



Main Investigation Report

at

**The Croft Medical Centre, Barnham Road, Eastergate,
West Sussex PO20 3RP**

for

PHP Primary Care Developments

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March 2021**

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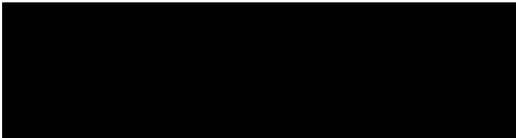
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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

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

Commission

Soils Limited was commissioned by PHP Primary Care Developments to undertake an intrusive ground investigation and prepare a Main Investigation Report on land at The Croft Medical Centre, Barnham Road, Eastergate, West Sussex PO20 3RP. The scope of the investigation was outlined in the Soils Limited quotation reference Q23812 rev.101, dated 14th January 2021.

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: 19023/PIR, dated January 2021.

Standards

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

- BS 5930:2015 and BS EN ISO 22476-3:2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7.
- BS EN ISO 14688-1:2018
- BS EN ISO 14688-2:2018
- BS 1377:1990 Parts 1 to 8
- BRE SD1: 2005: Concrete in Aggressive Ground
- BS 1377: 1990: Parts 1 to 8
- NHBC Standards 2020
- 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 Derwentside Environmental Testing Services (DETS) 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.

Contents

Section 1	Introduction	1
1.1	Objective of Investigation	1
1.2	Location	1
1.3	Site Description	1
1.4	Proposed Development	2
1.5	Anticipated Geology	2
1.5.1	River Terrace Deposits	2
1.5.2	Head	2
1.5.3	London Clay Formation	2
1.6	Limitations and Disclaimers	3
Section 2	Site Works.....	5
2.1	Proposed Project Works	5
2.1.1	Actual Project Works.....	5
2.2	Ground Conditions	6
2.3	Ground Conditions Encountered in Trial Holes	8
2.3.1	Made Ground.....	8
2.3.2	Brickearth.....	8
2.3.3	Head	9
2.4	Roots	9
2.5	Groundwater	9
Section 3	Discussion of Geotechnical In-Situ and Laboratory Testing.....	11
3.1	Dynamic Probe Tests.....	11
3.2	Dynamic Cone Penetrometer Tests	11
3.3	Infiltration Tests	11
3.4	Atterberg Limit Tests.....	12
3.5	Particle Size Distribution Tests	12
3.6	Sulphate and pH Tests	13
Section 4	Foundation Design.....	14
4.1	General	14
4.1.1	Made Ground and Topsoil	14
4.1.2	Brickearth.....	14
4.1.3	Head	15

4.1.4	Roots	16
4.1.5	Groundwater	16
4.2	Foundation Scheme General	16
4.2.1	Guidance on Shrinkable Soils	17
4.3	Foundation Scheme	18
4.3.1	Shallow Foundations into the Granular Head	18
4.3.2	Ground Floor Slab	19
4.4	Subsurface Concrete	20
4.5	Excavations	20
4.6	Pavements	20
4.7	Soakaways	21
Section 5	Determination of Chemical Analysis	22
5.1	Site Characterisation and Revised Conceptual Site Model	22
5.2	Soil Sampling	22
5.3	Determination of Chemical Analysis	22
Section 6	Qualitative Risk Assessment	24
6.1	Assessment Criteria	24
6.2	Representative Contamination Criteria - Soil	24
6.2.1	Asbestos	25
6.3	Risk to Groundwater	25
6.4	Risk Assessment	25
6.4.1	Soils	26
6.4.2	Groundwater	26
6.4.3	Soil Gas	26
6.5	Recommendations	26
6.6	Duty of Care	26
6.7	Excavated Material	27
6.8	Re-use of Excavated Material On-site	27
6.9	Imported Material	28
6.10	Discovery Strategy	28

List of Figures

Figure 1 – Site Location Map	31
Figure 2 – Aerial Photograph	32
Figure 3 – Trial Hole Plan	33

List of Tables

Table 2.1 Final Depth of Trial Holes	6
Table 2.2 Ground Conditions	7
Table 2.3 Final Depth of Made Ground	8
Table 2.4 Final Depth of Brickearth	9
Table 2.5 Depth of Root Penetration	9
Table 2.6 Groundwater Monitoring	10
Table 3.1 Indicative Infiltration Rates	12
Table 4.1 Allowable Bearing Capacities within the Granular Head	18
Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance	25
Table B.1.1 SPT "N" Blow Count Cohesive Classification	
Table B.1.2 SPT "N" Blow Count Granular Classification	
Table B.2.1 Interpretation of DPSH Blow Counts	
Table B.2.2 Interpretation of Atterberg Limit Tests	
Table B.2.3 Interpretation of PSD Tests	
Table C.1.1 CSM Revised Pre Testing	
Table C.1.2 CSM Revised Post Testing	

List of Appendices

Appendix A Field Work

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

Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by PHP Primary Care Developments to undertake an intrusive ground investigation and to prepare 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 commercial 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: 19023/PIR, March 2021) and/or the Revised Conceptual Site Model presented in Appendix C.1.

I.2 Location

The site was located at The Croft Medical Centre, Barnham Road, Eastergate, West Sussex PO20 3RP and had an approximate O.S Land Ranger Grid Reference of SU 94669 05694.

The site location plan is given in Figure 1.

I.3 Site Description

The site comprised an open field with no obvious usage. There were no structures present and the site was surfaced with rough grass and wood chippings. A small area of concrete (possible old floor slab) was recorded in the north.

The site appeared to have been recently cleared with evidence of tree felling (piles of branches and stumps located in the north). Mature trees were noted lining the eastern boundary. The site was generally flat-lying with a gentle slope (<0.1%) noted to the south in the wider area.

The surrounding area comprised residential land-use to the south and west, with open fields to the north and east.

An aerial photograph of the site and its environs has been included in Figure 2.

1.4 Proposed Development

The proposal comprised the construction of a two-storey medical centre comprising consultation and treatment rooms, waiting areas, office space and a pharmacy located on the ground floor.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the west. Areas of vehicle parking were located in the north and south with access to the plot off Barnham Road in the south. No private gardens or areas identified for the production of produce were shown on the drawings.

In compiling this report reliance was placed on drawings 9226.P004 - Proposed Site Plan and 9226.P005 - Proposed Floor Plans, dated June 2020 and were prepared by Simpson Hilder Associates Limited. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

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 directly upon bedrock of the London Clay Formation with overlying superficial deposits of River Terrace Deposits. Head deposits were also recorded along the western boundary and across the north western corner of the site.

1.5.1 River Terrace Deposits

The rivers Test and Itchen have deposited extensive spreads of River Terrace Deposits in the Southampton area, representative of ancient floodplains. In total, eleven terraces have been recorded. The River Terrace Deposits consist predominantly of gravels made up of subangular to subrounded flints with a significant sand component locally with lenses of silt, clay or peat.

The five highest terraces have appreciable clay content. Poorly sorted, clayey and sandy silts and silty clays overlie the 1st, 3rd, 5th and 6th terraces and locally at above terrace gravels.

1.5.2 Head

Head deposit are drifts produced by solifluxion, the downslope movement of debris outwash during the periglacial period, and characteristically comprise poorly sorted sands gravels and chalk of local derivation.

1.5.3 London Clay Formation

The London Clay Formation in the Hampshire 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 Lambeth Group.

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at The Croft Medical Centre, Barnham Road, Eastergate, West Sussex PO20 3RP and was prepared for the sole benefit of PHP Primary Care Developments (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

The contents, recommendations and advice given in the report are subject to the Terms and Conditions given in Quotation Q23812 rev. 101 dated 14th January 2021 accepted by the client in their Purchase Order TC/Croft, dated 18th January 2021.

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 prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior 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).

It should be noted that a detailed survey of the possible presence or absence of invasive species, such as Japanese Knotweed, is outside of the scope of investigation.

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 commercial development. The intended investigation, as outlined within the Soils Limited quotation (Q23812 rev.101, dated 14th January 2021), was to comprise the following items:

- 4No. up to 4m deep windowless sampler boreholes
- 4No. up to 6m deep dynamic probes
- 3No. gas and groundwater monitoring well installation
- Trial pits for infiltration testing and recovery of bulk samples suitable for geotechnical testing (if required)
- 2No. Infiltration tests to BRE DG365:2016
- In-situ CBR testing via handheld DCP-TRL probe
- Geotechnical laboratory testing
- Contamination laboratory testing
- 6No. gas and groundwater monitoring rounds
- Main Investigation Report

2.1.1 Actual Project Works

The actual project site works were undertaken on 27th January and 10th February 2021 with laboratory testing and report preparation thereafter, and comprised:

- 4No. windowless sampler boreholes (WS01 to WS04)
- 4No. dynamic probe holes (DP01 to DP04)
- 3No. monitoring well installations (WS01, WS02 and WS04)
- 5No. machine excavated trial pits (TP01 to TP05) with infiltration testing to BRE DG365:2016
- 10No. In-situ DCP-TRL probes (DCP01 to DCP10)
- Geotechnical laboratory testing
- Contamination laboratory testing
- 6No. gas and groundwater monitoring rounds (on-going)
- Main Investigation Report

Three windowless sampler boreholes (WS01, WS02 and WS04) were backfilled with gravel and bentonite following the installation of monitoring wells. The wells comprised 35mm ID HDPE pipe, slotted from 4.00m up to 1.00m bgl, surrounded

by non-calcareous gravel response zone, with plain pipe from just below ground level to 1.00m bgl, surrounded by bentonite. A gas tap was fitted to the top of the well and covered by a metal stopcock cover set in concrete.

One borehole (WS03) was backfilled with bentonite and gravel.

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 27th January 2021 four windowless sampler boreholes (WS01 to WS04) were drilled, using a Premier Compact 110 windowless sampler and dynamic probe rig, to a depth of 4.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client, and agreed with the Client's engineer.

Four super heavy dynamic probes, (DP01 to DP04), were driven prior and adjacent to their corresponding windowless sampler borehole to a depth of 6.00m bgl.

Three standpipes were installed within window sample borehole locations (WS01, WS02 and WS04) to allow for continued monitoring of both groundwater and soils gas.

On 10th February 2021, five trial pits were excavated using a JCB 3CX mechanical excavator to depths ranging between 0.91m and 2.50m bgl. Each pit was used to undertake infiltration testing in general accordance with BRE DG365:2016.

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 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)	Trial Hole	Depth (m bgl)
WS01 (w)	4.00	DP01	6.00
WS02 (w)	4.00	DP02	6.00
WS03	4.00	DP03	6.00
WS04 (w)	4.00	DP04	6.00
TP01	0.91	TP04	2.50
TP02	2.50	TP05	2.50
TP03	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 (MG)
Brickearth (BRK)
Head (HEAD)

The BGS mapping showed the majority of the site to be underlain by River Terrace Deposits with Head noted along the western boundary and across the north-western corner of the site. Based on the investigations findings it is thought the Head is glacial outwash, overlain by more recent fluvial River Terrace Deposits, which are predominately cohesive, so referred to as Brickearth within this report.

The underlying bedrock of the London Clay Formation was not encountered or inferred from the dynamic probes. A nearby borehole on the BGS website (ref: SU90NW76) suggests it would be encountered at a depth of approximately 8m bgl.

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		
MG	Anthropocene	G.L.	0.30–0.60	0.40	Soft brown and grey slightly sandy slightly gravelly silty CLAY / clayey SILT with occasional fragments of concrete, brick, clinker and fine ash.
BRK	Holocene	0.30–0.60	0.91 ¹ –2.00	1.50	Soft and firm orangish brown and light brown slightly sandy slightly gravelly CLAY. Locally coarsening towards base. Gravel is angular fine to coarse flint.

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
HEAD	Holocene	1.50–2.00	2.50 ¹ –4.00 (6.00)	Not proven ²	Off-white light brown clayey silty sandy GRAVEL / very gravelly SILT. Gravel is angular fine to coarse flint and chalk.
Note: ¹ Final depth of trial hole. ² Base of strata not encountered					

2.3 Ground Conditions Encountered in Trial Holes

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

2.3.1 Made Ground

Soils described as Made Ground were encountered in each of the nine trial pits from ground level to depths ranging between 0.30m and 0.60m bgl.

The Made Ground typically comprised soft brown and grey slightly sandy slightly gravelly silty CLAY / clayey SILT with occasional fragments of concrete, brick, clinker and fine ash.

The depths of Made Ground have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
WS/DP01	0.45	TP02	0.40
WS/DP02	0.35	TP03	0.60
WS/DP03	0.30	TP04	0.40
WS/DP04	0.35	TP05	0.30
TP01	0.50		

2.3.2 Brickearth

The Brickearth was encountered directly underlying the Made Ground in each of the trial holes and recorded to depths ranging between 0.91m and 2.20m bgl. Both of the shallow trial pits (TP01 and TP03) terminated within the Brickearth, so its full depth was not established in these locations.

The Brickearth typically comprised soft and firm orangish brown and light brown slightly sandy slightly gravelly CLAY. Locally coarsening towards its base, typically within the lower 0.30m – 0.40m of the unit, where present. Gravel is angular fine to coarse flint.

The depth of Brickearth has been included in Table 2.4.

Table 2.4 Final Depth of Brickearth

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
W/DPS01	2.20	TP02	2.00
WS/DP02	1.90	TP03	1.00 ¹
WS/DP03	1.95	TP04	1.50
WS/DP04	1.80	TP05	1.10
TP01	0.91 ¹		

Note: ¹ Final depth of trial hole.

2.3.3 Head

The Head deposits were encountered directly underlying the Brickearth in seven of the nine trial holes being recorded to the full investigatory depth of 4.00m bgl. The Head was also inferred to the base of dynamic probes at 6.00m bgl.

The Head typically comprised off-white light brown clayey silty sandy GRAVEL / very gravelly SILT. Gravel is angular fine to coarse flint and chalk.

2.4 Roots

Roots were encountered in each of the nine trial holes at depths ranging between 0.40m and 2.20m bgl. The depths of root penetration have been included in Table 2.5.

Table 2.5 Depth of Root Penetration

Trial Hole	Depth (m bgl)
WS01	2.20
WS02	1.20
WS03	1.60
WS04	1.80
TP01	0.50
TP02	0.50
TP03	0.60
TP04	0.40
TP05	0.40

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that may have been removed both within the site and its close environs. The site appeared to have been recently cleared with evidence of tree felling (piles of branches and stumps located in the north). Mature trees were noted lining the eastern boundary.

2.5 Groundwater

Groundwater was encountered within three of the four boreholes (WS01 to WS03) at depths ranging between 3.30m and 3.80m bgl. No rises were observed. Groundwater was not encountered in any of the trial pits, which were excavated to a maximum depth of 2.50m bgl.

Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in January and February (2021), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September, to the annual maximum (highest) which typically occurs around March.

Further groundwater monitoring was conducted within the standpipes installed on site following completion of site works and has been presented in Table 2.6.

Table 2.6 Groundwater Monitoring

Trial Hole	Well Depth (m bgl)	Depth to Water (m bgl)	
		10/02/21	25/02/21
WS01	4.00	2.70	3.16
WS02	4.00	2.53	3.03
WS04	4.00	2.37	2.87

Groundwater levels were noted to be falling across the two monitoring visits to date, which is contrary to the trend anticipated. It is likely the levels reflect the amount of precipitation in the preceding days and suggests the groundwater table is responsive to localised inputs.

Groundwater monitoring was ongoing at the time of reporting and will be updated when complete.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP01 to DP04) adjacent and prior to the drilling of their respective windowless sampler borehole to a depth 6.00m 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.1.2.

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. The energy ratio of the drilling rig was 72.45%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The Brickearth recorded equivalent SPT “N60” values between 0 and 10 within cohesive beds and 7 to 17 in granular beds. The cohesive beds were classified as extremely low to medium strength with an inferred undrained cohesive strength ranging between <10kPa and 50kPa. The granular beds were classified as loose to medium dense relative density.

The Head recorded equivalent SPT “N60” values between 3 and 17 within cohesive beds and 10 to >50 in granular beds. The cohesive beds were classified as very low to high strength with an inferred undrained cohesive strength ranging between 15kPa and 85kPa. The granular beds were classified as medium dense to very dense relative density.

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) were undertaken at ten locations (DCP01 to DCP10). The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 3% and 54% for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts or Made Ground inclusions struck during the test.

The DCP results are presented in Appendix B.3.

3.3 Infiltration Tests

Infiltration testing was undertaken in TP01 to TP05 within the Brickearth and Head following the principles of BRE Digest 365 Soakaway design: 2016. 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.

A single test was carried in TP01 and TP03, ending once 75% of the water had drained away. The tests in TP02, TP04 and TP05 did not drain sufficiently during the monitoring period to allow infiltration rates to be calculated.

BRE software BRESOAK was used to calculate the infiltration rates in TP01 and TP03 and the results outlined in Table 3.1. In addition, data for TP02 was extrapolated to provide an indicative rate. This must be used with caution.

Table 3.1 Indicative Infiltration Rates

Trial Hole	Test No.	Indicative Rate (m/s)	Notes
TP01	I	2.16E-05	One cycle of test
TP02	I	3.19E-06 ¹	Extrapolated from limited data
TP03	I	1.82E-05	One cycle of test

Notes: ¹ Extrapolated, must be used with caution.

3.4 Atterberg Limit Tests

Atterberg Limit tests were performed on three samples, two obtained from the Brickearth and one from the Head. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The Brickearth was classified as medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The Head was classified as low volume change potential in accordance with BRE Digest 240 and no volume change potential in accordance with 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 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on four samples, two taken from the Brickearth and two taken from the Head Deposits.

The PSD tests classified the granular beds of the Brickearth as having a volume change potential in one of two samples in accordance BRE Digest 240. The results from grading analysis confirmed that neither of the two samples tested had a volume change potential in accordance with NHBC Standards Chapter 4.2.

The PSD tests classified the granular beds of the Head as having a volume change potential in accordance BRE Digest 240. The results from grading analysis showed that none of the two samples tested had a volume change potential in accordance with NHBC Standards Chapter 4.2.

Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests are outlined in Table B.2.3, Appendix B.2 and the laboratory report in Appendix B.3.

3.6 Sulphate and pH Tests

One sample was taken from the Brickearth and one from the Head for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'. A further two samples of Made Ground were tested for water soluble sulphate to assess the aggressivity of the material.

The tests recorded water soluble sulphate of <10mg/l with pH values of 7.8 to 8.5.

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 (non-engineered fill)* 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 8004:2015, Clause 4.1.2.2 states, *'Spread foundations should not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design.'*

Soils described as Made Ground were encountered in each of the nine trial pits from ground level to depths ranging between 0.30m and 0.60m bgl. The Made Ground typically comprised soft brown and grey slightly sandy slightly gravelly silty CLAY / clayey SILT with occasional fragments of concrete, brick, clinker and fine ash.

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 Brickearth

The Brickearth was encountered directly underlying the Made Ground in each of the trial holes and recorded to depths ranging between 0.91m and 2.20m bgl. Both of the shallow trial pits (TP01 and TP03) terminated within the Brickearth, so its full depth was not established in these locations. The Brickearth typically comprised soft and firm orangish brown and light brown slightly sandy slightly gravelly CLAY. Locally coarsening towards base. Gravel is angular fine to coarse flint.

The results from DPSH testing inferred that the cohesive beds of the Brickearth were of **extremely low to medium strength** with an inferred undrained cohesive strength ranging between **<10kPa and 50kPa**. The granular beds were classified as **loose to medium dense** relative density.

The results from Atterberg Limits tests confirmed that the soils of the Brickearth had **medium volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The PSD tests classified the granular beds of the Brickearth as having a volume change potential in one of two samples in accordance BRE Digest 240. The results from grading analysis confirmed that none of the two samples tested had a volume change potential in accordance with NHBC Standards Chapter 4.2.

Brickearth comprises normally consolidated predominately cohesive upper beds of the River Terrace Deposits and as such are expected to display low to moderate bearing capacities with moderate to high settlement characteristics. The soils of the Brickearth were not considered a suitable bearing stratum for the proposed development due to likely variations both in composition and depositional thickness.

4.1.3 Head

The Head deposits were encountered directly underlying the Brickearth in seven of the nine trial holes being recorded to the full investigatory depth of 4.00m bgl. The Head was also inferred to the base of dynamic probes at 6.00m bgl. The Head typically comprised off-white light brown clayey silty sandy GRAVEL / very gravelly SILT. Gravel is angular fine to coarse flint and chalk.

The results from the dynamic probing inferred that the cohesive beds of the Head were classified as **very low to high strength** with an inferred undrained cohesive strength ranging between **15kPa and 85kPa**. The granular beds were classified as medium dense to very dense relative density.

The results from Atterberg Limits tests confirmed that the cohesive soils of the Head had **low volume change potential** in accordance with BRE Digest 240 and **no volume change potential** in accordance with NHBC Standards Chapter 4.2.

The PSD tests classified the granular beds of the Head as having a volume change potential in accordance BRE Digest 240. The results from grading analysis confirmed that none of the two samples tested had a volume change potential in accordance with NHBC Standards Chapter 4.2.

Based on the above results and typical granular content (75% – 83%), the Head is considered to have no volume change potential.

The Head deposits encountered were predominately granular glacial outwash, albeit with cohesive horizons, and as such are expected to display moderate bearing capacities with moderate to high settlement characteristics, depending on the fines content. The soils of the Head were considered a suitable bearing stratum for the proposed development, subject to sufficient bearing capacity being available.

4.1.4 Roots

Roots were encountered in each of the nine trial holes at depths ranging between 0.40m and 2.20m 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.

The site appeared to have been recently cleared with evidence of tree felling (piles of branches and stumps located in the north). Mature trees were noted lining the eastern boundary.

4.1.5 Groundwater

Groundwater was encountered within three of the four boreholes (WS01 to WS03) at depths ranging between 3.30m and 3.80m bgl. No rises were observed.

Groundwater was not encountered in any of the trial pits, which were excavated to a maximum depth of 2.50m bgl.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in January and February (2021), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September, to the annual maximum (highest) which typically occurs around March.

Groundwater levels were noted to be falling across the two monitoring visits to date, which is contrary to the trend anticipated. It is likely the levels reflect the amount of precipitation in the preceding days, and suggests the groundwater table is responsive to localised inputs.

4.2 Foundation Scheme General

The proposal comprised the construction of a two-storey medical centre consisting consultation and treatment rooms, waiting areas, office space and a pharmacy located on the ground floor.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the west. Areas of vehicle parking were located in the north and south with access to the plot off Barnham Road in the south. No private gardens or areas identified for the production of produce were shown on the drawings.

In compiling this report reliance was placed on drawings 9226.P004 - Proposed Site Plan and 9226.P005 - Proposed Floor Plans, dated June 2020 and were prepared by Simpson Hilder Associates Limited. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

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 Brickearth had **medium volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Medium volume change potential must therefore be adopted where foundations pass through the Brickearth.

The Head was classified as low volume change potential in accordance with BRE Digest 240 and no volume change potential in accordance with NHBC Standards Chapter 4.2. Based on the testing undertaken, the Soils of the Head have no volume change potential.

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 to establish an appropriate founding depth prior to the construction of foundations. This must take account of trees, substantial bushes and hedgerows that are to remain, those that have already been removed or are to be removed or those that are to be planted as part of the site landscaping.

When trees are felled it can take up to twenty years for desiccation caused by roots to recover. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

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 and Brickearth due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in four out of the five trial holes at depths ranging between 0.40m bgl and 2.20m 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, a shallow foundation solution was considered the most suitable. These must be taken into the granular soils of the Head.

Although not strictly applicable to non-residential structures, the proposed development is likely to be both light and brittle. It is therefore considered that foundation design can consider NHBC Standards Chapter 4.2.

4.3.1 Shallow Foundations into the Granular Head

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. The granular soils of Head were generally encountered at depths of around 2.00m bgl, and roots were noted as deep as 2.20m, so foundations must be deepened accordingly within any cohesive soils.

Table 4.1 Allowable Bearing Capacities within the Granular Head

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
2.00	5.00 x 0.75	120	<10

Reinforced trench fill foundations are required as they would 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.. 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 results in increased settlements. It has been assumed that the foundations to the existing structures have been grubbed out. Foundations must not be cast over such hard points without this being considered in the foundation design. Where foundations have been grubbed out the new foundation must be taken through the backfill material into the natural ground.

4.3.2 Ground Floor Slab

NHBC Standards 2019 states ground floors should be constructed as suspended floors where:

- *“the foundation depth dictated by the NHBC Standards 2019, Chapter 4.2.10 would exceed 1.5m bgl;”*
- *“ground floor construction is undertaken when the surface soils are seasonally desiccated;”*
- *“the depth of fill exceeds 600mm;”*
- *“there is shrinkable soil that could be subject to movement, expansive material or other unstable soils;”*
- *“the ground has been subject to vibratory improvement;” or*
- *“ground or fill is not suitable to support ground-bearing slabs.”*

Given the presence of cohesive Brickearth with medium volume change potential, the presence of roots and the evidence of vegetation removal on site, suspended ground floor slabs must be adopted.

Ground beams must be designed with appropriate collapsible void formers and compressible layers to accommodate both vertical and lateral movements resulting from recovery of desiccation following removal of trees.

Slabs must be suspended and have a suitable underfloor void to accommodate ground heave.

Design must comply with the recommended practices of BRE Digest 240 with regard to potential heave. NHBC Standards 4.2. gives recommendations for the thickness of compressible layers and voids for high volume change potential soils.

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 7.8 and 8.5. The classification given was determined using the mobile groundwater case, in 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 Made Ground and Brickearth are likely to be stable in the short term.

Deeper excavations taken into the Head are likely to be marginally stable in the short term, depending on the thickness of overlying Brickearth. 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 necessary in this case.

4.6 Pavements

The Transport Research Laboratory (TRL) Dynamic Cone Penetrometer (DCP) was undertaken at ten locations on site (DCP01 to DCP10). The results from dynamic cone penetrometer tests indicated **CBR values of between 3% and 54%** for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts or Made Ground inclusions struck during the test.

When removing 400mm of either Made Ground or Brickearth, CBR values of between 4% and 9% were recorded. Values of 5% or greater are generally considered suitable for design purposes. During the interpretation two areas were highlighted as potentially problematic, in the area around DCP06 and DCP10, where the worst case CBR value was recorded as 4%.

As CBR values were 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, as identified in the areas around DCP04 and DCP10, should be dug out and replaced with a suitably compacted granular fill. Prior to construction the formation level should be proof rolled.

Cohesive soils of the Brickearth are regarded as non-frost-susceptible, given their plasticity index was >20% (see Section 3.4) .

None of the other soils noted during this investigation are likely to be encountered at road formation level.

4.7 Soakaways

Infiltration testing was undertaken in TP01 to TP05 within the Brickearth and Head following the principles of BRE Digest 365 Soakaway design: 2016. A single test was carried in TP01 and TP03, ending once 75% of the water had drained away. The tests in TP02, TP04 and TP05 did not drain sufficiently during the monitoring period to allow infiltration rates to be calculated.

Indicative Infiltration rates in TP01 and TP03 were recorded between 1.82×10^{-5} and 2.16×10^{-5} m/s. Data for TP02 was extrapolated to provide an indicative rate of 3.19×10^{-6} m/s. This must be used with caution.

In light of the above results, and discussions with the local authority, additional infiltration testing has been commissioned to provide full compliance with BRE DG365:2016.

In line with current guidance (BRE Digest 365, NHBC and CIRIA C574) soakaways should be located remote from the proposed foundations, at least 5m away from the face of any existing or proposed footing.

Consultation with the Environment Agency must be sought regarding any use which may have an impact on groundwater resources. The Local Authority may also require long-term groundwater monitoring data to determine groundwater conditions in relation to the use of soakaways at the site.

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: 19023/PIR dated March 2021) identified a low to moderate risk of ground contamination from previous usage of the site and offsite sources.

The Main Investigation Report identified Made Ground to depths between 0.30m and 0.60m bgl. The Made Ground typically comprised soft brown and grey slightly sandy slightly gravelly silty CLAY / clayey SILT with occasional fragments of concrete, brick, clinker and fine ash.

Aside from the secondary constituents noted, no visual or olfactory indicators of contamination were noted.

Superficial deposits of Brickearth were encountered underlying the Made Ground, with Head underlying those. Shallow groundwater was encountered within the granular Head. The conceptual site model was updated to take account of the investigation findings and presented in Appendix C.1.

5.2 Soil Sampling

Trial hole locations were set out to provide an overview of ground conditions across the site, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the trial holes at depths of between 0.10m and 0.50m to allow a representation of the materials encountered, with additional samples to be obtained if necessary where there was visual or olfactory evidence of contamination.

The analytical testing was based on a suite of commonly occurring inorganic and organic contaminants, considering the Conceptual Site Model and the ground conditions encountered.

5.3 Determination of Chemical Analysis

The suite of chemical analyses has been based upon the findings of the Preliminary Investigation Report (PIR) and this investigation, to examine the potential sources of contamination identified in the conceptual site model. The chemical analyses were carried out on four samples prepared from the Made Ground (3No.) and Brickearth (1No.) from across the site. The nature of the analyses is detailed below:

- 4 No. Metal suites: Arsenic, Boron, Cadmium, Chromium (trivalent & hexavalent), Copper, Lead, Mercury, Nickel, Vanadium, Selenium, Zinc

- 4 No. pH values
- 4 No. Polycyclic aromatic hydrocarbons (PAH) – USEPA 16 suite
- 4 No. Organic matter contents
- 4 No. Asbestos screens
- 4 No. Monohydric Phenols
- 4 No. Texas banded Total Petroleum Hydrocarbons
- 2 No. 2:1 water soluble sulphate
- 1 No. Waste Acceptance Criteria

The soil testing was carried out in accordance with the MCERTS performance standard, and the results are shown in Appendix C.2, Test Report 21-01476.

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 proposal comprised the construction of a two storey medical centre consisting consultation and treatment rooms, waiting areas, office space and a pharmacy located on the ground floor.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the west. Areas of vehicle parking were located in the north and south with access to the plot off Barnham Road in the south. No private gardens or areas identified for the production of produce were shown on the drawings.

In compiling this report reliance was placed on drawings 9226.P004 - Proposed Site Plan and 9226.P005 - Proposed Floor Plans, dated June 2020 and were prepared by Simpson Hilder Associates Limited. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic guidance values for a '**Public Open Space**' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, generic screening values derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded, SOM values of between 1.1% and 3.5%. For each soil sample tested, the resultant Soil Organic Matter allowed for the correct comparison to be made with the appropriate guideline value for each organic determinant analysed.

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, CASL or S4UL adopted were exceeded for the 'Public Open Space' land-use scenario
None Recorded	
<i>Asbestos locations where material found (no threshold just presence)</i>	
None Recorded	

The guideline values are assessed against the "Public Open Space" land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed redevelopment.

In summary, none of the substances tested recorded concentrations above the Public Open Space end-use screening values.

6.2.1 Asbestos

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

It is possible that asbestos is present in other areas of the site. If encountered, care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

6.3 Risk to Groundwater

The site is underlain by superficial deposits that are classified as a Secondary A Aquifer, which are in turn underlain by the London Clay Formation, which is an Unproductive Strata with very low permeability.

The site is not located within a Source Protection Zone (SPZ). The nearest surface water body is an inland river, located 292m west of the site. As such, a low sensitivity with respect to hydrogeology and hydrology is considered to be present.

The shallow soils analysis did not identify any elevated concentrations, even when compared to a residential without homegrown produce end-use.

Based on the above factors, the risk to groundwater is considered to be negligible, and no further assessment is deemed necessary.

6.4 Risk Assessment

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 substances tested recorded concentrations above the Public Open Space end-use screening values. Asbestos Containing Material (ACM) was not detected within any of the samples tested.

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

Based on the hydrogeological and hydrological sensitivity of the site and the findings of this investigation, the risk to groundwater is considered to be negligible, and no further assessment is deemed necessary.

6.4.3 Soil Gas

The Preliminary Investigation Report (report ref: 19023/PIR dated March 2021) identified a low risk of soil gas associated with previous uses on site and in the surrounding area.

Monitoring of the wells installed within WS01, WS02 and WS04 has been undertaken on two occasions, including targeting periods of low and falling pressure. At the time of reporting, four more visits were scheduled and therefore the results of the soil gas risk assessment will be provided in an addendum once the regime is completed.

6.5 Recommendations

No elevated substance concentrations for the proposed end-use were identified in the chemical analysis of shallow soils and the risk to groundwater was considered to be negligible.

Soil gas monitoring works are on-going with a risk assessment to follow. Otherwise, no further works are deemed necessary, subject to approval from the local authority, which should be sought at the earliest opportunity.

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.

List of Figures

Figure 1 – Site Location Map	31
Figure 2 – Aerial Photograph	32
Figure 3 – Trial Hole Plan	33

List of Appendices

Appendix A **Field Work**

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
19023

Project
The Croft Medical Centre, Barnham Road,
Eastergate, West Sussex PO20 3RP

Client
PHP Primary Care Developments

Date
March 2021



Figure 2 – Aerial Photograph

Project

The Croft Medical Centre,
Barnham Road, Eastergate, West
Sussex PO20 3RP

Client

PHP Primary Care Developments

Date

March 2021

Job Number

19023



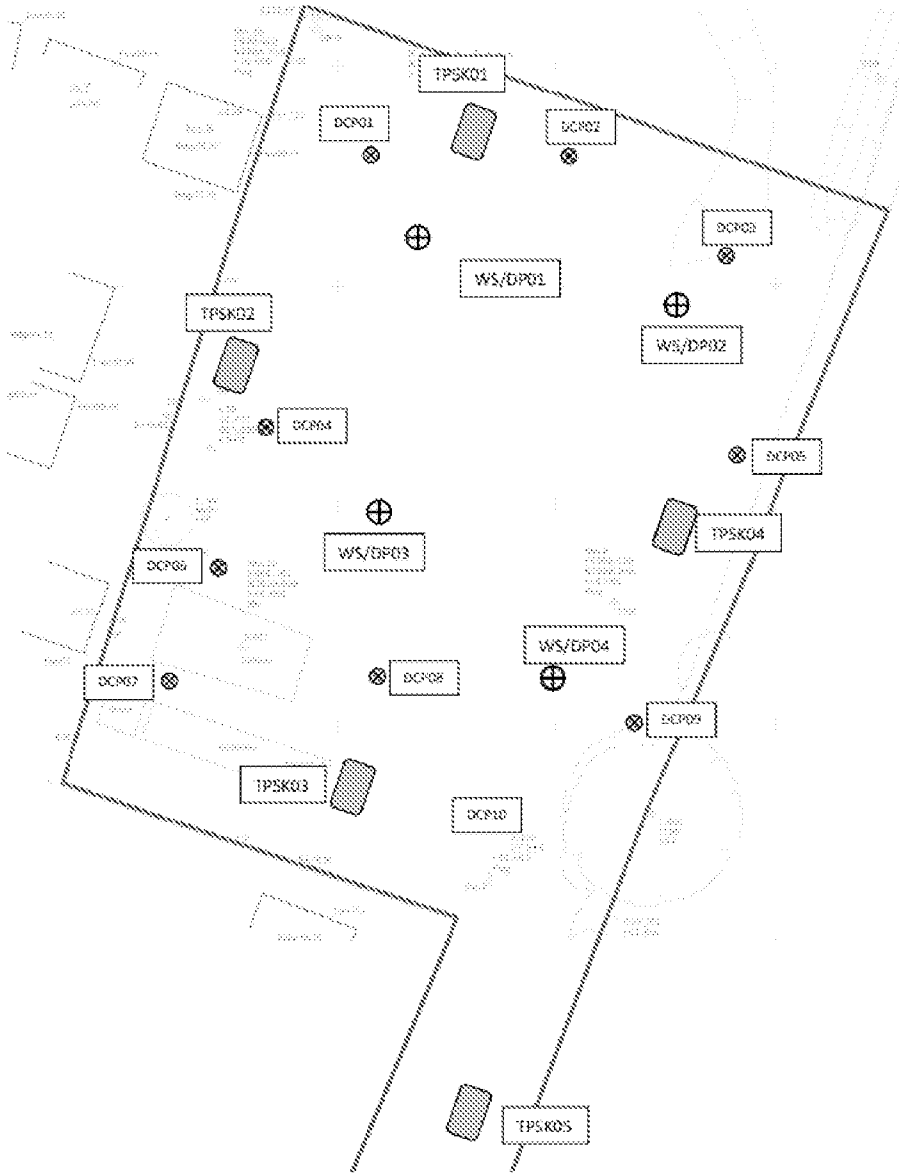


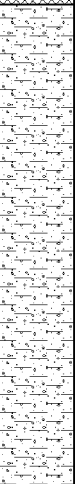
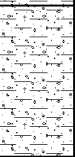
Figure 3 – Trial Hole Plan

Project
The Croft Medical Centre, Barnham Road, Eastergate, West Sussex PO20 3RP
Client
PHP Primary Care Developments
Date
March 2021
Job Number
19023

Appendix A

Field Work

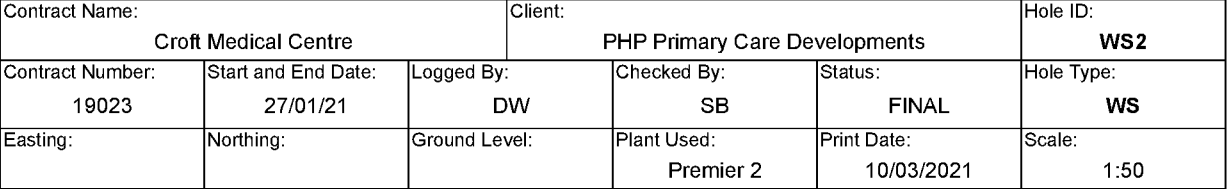
Appendix A.I Engineers Logs

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. TP02 Sheet 1 of 1	
Project Name: Croft Medical Centre				Project No.: 19023		Method:		Hole Type TP
Location: West Sussex, PO20 3RP						Plant:		
Client: PHP Primary Care Developments				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 10/02/2021				Level:		Co-ords:		Logged By
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	D		0.40			Grass over light brown sandy slightly clayey, slightly gravelly SILT. Gravel is sub-angular fine to coarse flint. Frequent fragments of clinker and fine ash. Frequent roots and rootlets. MADE GROUND	
	0.50	D					Light brown slightly sandy, slightly gravelly CLAY. Gravel is sub-angular fine to coarse flint. BRICKEARTH	
	1.00	D		2.00			1	
	1.50	B						
	2.00	B						
	2.50	B		2.50			2	
							3	
							4	
							5	
General Remarks: Undertaken using JCB 3CX mechanical excavator, primarily for BRE 365 infiltration testing. Groundwater not encountered. Roots encountered to 0.50m bgl.								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR			Trial Pit Log		Trial Pit No. TP04 Sheet 1 of 1	
Project Name: Croft Medical Centre				Project No.: 19023		Method:		Hole Type TP
Location: West Sussex, PO20 3RP						Plant:		
Client: PHP Primary Care Developments				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 10/02/2021				Level:		Co-ords:		Logged By
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	D		0.40			Grass over light brown sandy slightly clayey, slightly gravelly SILT. Gravel is sub-angular fine to coarse flint. Frequent fragments of clinker and fine ash. Frequent roots and rootlets. MADE GROUND	
	0.50	D					Light brown slightly sandy, slightly gravelly CLAY. Gravel is sub-angular fine to coarse flint. BRICKEARTH	
	1.00	D						
	1.50	B		1.50			Off white, silty sandy GRAVEL. Gravel is angular and sub-angular fine to coarse and cobbles of flint and chalk. HEAD	
	2.00	B						
	2.50	B						
	End of Pit at 2.500m							
General Remarks: Undertaken using JCB 3CX mechanical excavator, primarily for BRE 365 infiltration testing. Groundwater not encountered. Roots encountered to 0.40m bgl.								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:								

		Soils Limited 		Trial Pit Log		Trial Pit No. TP05 Sheet 1 of 1	
Project Name: Croft Medical Centre			Project No.: 19023		Method:		Hole Type TP
Location: West Sussex, PO20 3RP					Plant:		
Client: PHP Primary Care Developments			Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 10/02/2021		Level:		Co-ords:		Logged By	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description
	Depth	Type	Results				
				0.10			Tarmacadam.
	0.20	D		0.30			Light brown sandy slightly clayey, slightly gravelly SILT. Gravel is sub-angular fine to coarse flint. Frequent fragments of clinker and fine ash. Frequent roots and rootlets. MADE GROUND
	0.50	D					Light brown slightly sandy, slightly gravelly CLAY. Gravel is sub-angular fine to coarse flint. BRICKEARTH
	1.00	D		1.10			Off white, silty sandy GRAVEL. Gravel is angular and sub-angular fine to coarse and cobbles of flint and chalk. HEAD
	1.50	B					
	2.00	B					
	2.50	B		2.50			End of Pit at 2.500m
General Remarks: Undertaken using JCB 3CX mechanical excavator, primarily for BRE 365 infiltration testing. Groundwater not encountered. Roots encountered to 0.40m bgl.							Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:							

	Contract Name: Croft Medical Centre				Client: PHP Primary Care Developments				Hole ID: WS1					
	Contract Number: 19023		Start and End Date: 27/01/21		Logged By: DW		Checked By: SB		Status: FINAL	Hole Type: WS				
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 10/03/2021	Scale: 1:50				
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing				Strata Details							Groundwater			
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description					Water Strike	Backfill/Installation		
0.10	D					Firm to very stiff dark brown and reddish brown mottled, greyish brown, slightly sandy, slightly gravelly SILT. Gravel is angular to sub-angular, fine to coarse concrete, flint, brick, and clinker. Sand is fine to medium. Frequent rootlets. MADE GROUND.								
0.30	ES			(0.45)		Woody root 15mm diameter at 0.1m bgl. Angular broken concrete cobble at 0.2m bgl.								
	D			0.45										
	ES			0.60		Firm dark brown mottled and black speckled brown, slightly sandy, silty CLAY. Sand is fine to medium. Occasional angular, fine to medium flint gravel. Occasional rootlets and desiccated roots. Reworked material. MADE GROUND								
0.70	D													
	ES					Firm brown, slightly sandy, silty CLAY. Sand is fine to medium. Very rare angular fine flint gravel. Occasional rootlets. BRICKEARTH								
1.00	D					Occasional angular, fine to coarse flint gravel from 1.7m bgl.								
1.40	D			(1.35)										
2.00	D			1.95		Firm greyish brown, slightly sandy, very gravelly CLAY. Gravel is angular, fine to coarse flint. Sand is fine to medium. Rare roots. BRICKEARTH								
				2.20		Light brown and off-white mottled, slightly sandy, silty GRAVEL. Gravel is angular fine to coarse flint and chalk. Frequent coarse sand sized chalk. HEAD								
2.50	D					LOW RECOVERY PL DOWN								
2.90	D			(1.30)										
3.50 - 4.00	D			3.50		Yellowish brown, slightly sandy, clayey GRAVEL. Gravel is angular fine to coarse flint. HEAD								
				(0.50)		LOW RECOVERY PL DOWN								
				4.00		End of Borehole at 4.00m								
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Roots observed to 2.2m bgl.					
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.30			0	0.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														
ARUN DISTRICT COUNCIL BN/62/21/PL														



Weather:	Termination:		Sheet 1 of 1
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Samples & In Situ Testing			Strata Details					Groundwater			
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation		
0.20	D			(0.35)		Firm dark brown, slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub-angular, fine to medium flint, and very rare brick and clinker. Frequent rootlets and roots. High organic content. MADE GROUND	1				
0.50	D			0.35		Firm greyish brown mottled, brown, slightly sandy, silty CLAY. Sand is fine to medium. Very rare angular medium to coarse flint gravel. Occasional black speckling. Occasional rootlets. Rare coarse sand sized chalk. BRICKEARTH					
0.90	D			(1.15)		Very soft at base of stratum					
1.40	D			1.50		Firm greyish brown, slightly sandy, gravelly CLAY. Gravel is angular, fine to coarse flint. Sand is fine to medium. BRICKEARTH					
1.60	D			(0.40)	1.90		Light brown and off-white mottled, slightly sandy, silty GRAVEL/slightly sandy very gravelly SILT. Gravel is angular fine to coarse flint and chalk. Frequent coarse sand sized chalk. HEAD			2	
2.10	D			(1.10)	3.00		Greyish brown mottled, yellowish brown, slightly sandy, clayey GRAVEL. Gravel is angular fine to coarse flint. HEAD			3	
3.20	D			(1.00)	4.00	End of Borehole at 4.00m				4	
3.70	D										5
											6
											7
							8				
							9				
							10				

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	
Chiselling					Installation				
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	
									Strike (m) 3.50 Casing (m) Sealed (m) Time (mins) 0 Rose to (m) 0.00 Remarks
RUN DISTRICT COUNCIL BN/62/21/PL									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

	Contract Name: Croft Medical Centre				Client: PHP Primary Care Developments				Hole ID: WS3					
	Contract Number: 19023		Start and End Date: 27/01/21		Logged By: DW		Checked By: SB		Status: FINAL		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 10/03/2021		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.10	D			(0.30)		Soft to firm dark brown to greyish brown with depth, slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub-angular, fine to coarse flint, concrete, brick, and clinker. Sand is fine to medium. Frequent rootlets. MADE GROUND.						1		
0.40	D			0.30										
	ES			(0.90)		Very soft to soft, black speckled and greyish brown mottled, brown, slightly sandy, silty CLAY. Occasional rootlets. Rare angular to sub-angular, coarse sand to fine gravel sized flint and chalk. BRICKEARTH <i>Compressed in liner from 1.0m bgl.</i>								
0.90	D													
1.10	ES			1.20		Greyish brown, slightly sandy very clayey GRAVEL. Gravel is angular, fine to coarse flint. Frequent coarse sand sized chalk. Rare rootlets. BRICKEARTH <i>Compressed in liner.</i>								
1.50	D			(0.75)										
				1.95		Firm, yellowish brown and brown mottled, off-white, slightly sandy silty GRAVEL. Gravel is angular fine to coarse flint and chalk. Frequent coarse sand sized chalk. Occasional clay lenses. HEAD <i>Compressed in liner, no sample from 2.0 - 2.5m bgl.</i>						2		
2.10	D													
2.60	D			(1.15)										
				3.10										
3.20	D			(0.40)		Brown mottled, light greyish brown, slightly sandy, very clayey GRAVEL. Gravel is angular fine to coarse flint. HEAD <i>Clay lens at top of stratum.</i>								
3.60	D			3.50										
3.80	D			3.70		Very soft black speckled, yellowish brown, slightly sandy, silty CLAY. Sand is fine. Rare angular fine flint gravel. HEAD						3		
				(0.30)										
				4.00		Greyish brown mottled, yellowish brown, slightly sandy, very clayey GRAVEL. Gravel is angular fine to coarse flint. HEAD						4		
						End of Borehole at 4.00m								
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.6m bgl.					
Chiselling					Installation		Water Strikes							
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.80			0	0.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Croft Medical Centre				Client: PHP Primary Care Developments				Hole ID: WS4							
	Contract Number: 19023		Start and End Date: 27/01/21		Logged By: DW		Checked By: SB		Status: FINAL		Hole Type: WS					
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 10/03/2021		Scale: 1:50					
Weather:			Termination:					Sheet 1 of 1								
Samples & In Situ Testing				Strata Details								Groundwater				
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation			
0.10	D			(0.35)		Soft to firm dark brown to greyish brown with depth, slightly sandy, silty CLAY. Frequent rootlets and roots. Occasional angular to sub-angular, fine to coarse flint, and rare fine clinker and brick gravel. MADE GROUND						1				
0.50	D			0.35		Woody root 5mm diameter at 0.15m bgl. Firm, black speckled, brown, slightly sandy, silty CLAY. Occasional rootlets. Occasional angular to sub-angular, coarse sand to fine gravel-sized flint and chalk. BRICKEARTH										
0.80	D			(0.95)		Greyish brown, slightly sandy very clayey GRAVEL. Gravel is angular, fine to coarse flint. Frequent coarse sand sized chalk. Rare rootlets. BRICKEARTH										
	ES															
1.40	D			1.30	(0.50)		Firm to soft, yellowish brown and brown mottled, off-white, slightly sandy very gravelly SILT/slightly sandy silty GRAVEL. Gravel is angular fine to coarse flint and chalk. Frequent coarse sand sized chalk. Occasional clay lenses. HEAD							2		
1.90	D			1.80												
2.30	D			(1.40)		Greyish brown mottled, yellowish brown, slightly sandy, very clayey GRAVEL. Gravel is angular fine to coarse flint. Frequent clay pockets and lenses. HEAD								3		
2.80	D															3.20
3.30	D			(0.80)		Odourless black organic mottling at 3.4m bgl.								4		
3.80	D															4.00
						End of Borehole at 4.00m						4				
												5				
												6				
												7				
												8				
												9				
												10				
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:							
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Desiccated rootlets observed to 1.8m bgl.							
Chiselling					Installation				Water Strikes							
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks		
												0	0.00			
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.																

ARUN DISTRICT COUNCIL BN/62/21/PL

Project Name:	Croft Medical Centre	Project No.	19023	Co-ords:		Hole Type	DP
Location:	West Sussex, PO20 3RP	Level:	m AOD			Scale	1:50
Client:	PHP Primary Care Developments	Dates:	27/01/2021			Logged By	JO

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0	4	4			0
1	1	1			
2	3	2			20
3	15	6			40
4	14	5			50
5	1	2			60
6	5	6			80
7					
8					
9					
10					
Remarks		Fall Height	0.76mm	Cone Base Diameter	0.052mm
		Hammer Weight	63.5kg	Final Depth	6m
		Probe Type		Energy Ratio (Er)	72.45%

Project Name:	Croft Medical Centre	Project No.	19023	Co-ords:		Hole Type	DP
Location:	West Sussex, PO20 3RP	Level:	m AOD	Scale	1:50	Logged By	JO
Client:	PHP Primary Care Developments	Dates:	27/01/2021				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0	1				0
1	1				
2	1				
3	1				
4	1				
5	1				
6	1				
7	1				
8	1				
9	1				
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329	1				



Soils Limited

Newton House, Cross Road, Tadworth KT20 5SR

Probe Log

Probe No.

DP3

Sheet 1 of 1

Project Name:	Croft Medical Centre	Project No.	19023	Co-ords:		Hole Type	DP
Location:	West Sussex, PO20 3RP	Level:	m AOD	Scale	1:50	Logged By	JO
Client:	PHP Primary Care Developments	Dates:	27/01/2021				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0	5 7 5 2 2 1 1 1 1 1 2 3 2 2 1 1				0
1	2 3 2 2 1 1 2 2 3 4 4 5 5 5 3 3 4 3 3 6 8 10 9 14 1 2				30
2	6 6 6 6 6 5 5 3 4 3 3 6 11 13 12 7 7 13 12 11 11 9				30
3	5 1 2 4 5 6 7 6 7 7 7				60
4					45
5					80
6					
7					
8					
9					
10					
Remarks	Fall Height	0.76mm	Cone Base Diameter	0.052mm	
	Hammer Weight	63.5kg	Final Depth	6m	
	Probe Type		Energy Ratio (Er)	72.45%	



Soils Limited

Newton House, Cross Road, Tadworth KT20 5SR

Probe Log

Probe No.

DP4

Sheet 1 of 1

Project Name:	Croft Medical Centre	Project No.	19023	Co-ords:		Hole Type	DP
Location:	West Sussex, PO20 3RP	Level:	m AOD	Scale	1:50	Logged By	JO
Client:	PHP Primary Care Developments	Dates:	27/01/2021				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0	1 2 0 1 0 1 0				0
1	1 1 1 1 1 1 5 2 3 3 4 4 7 8 10 7 5 5 5 5 5 5				10
2	3 5 6 8 11 11 11 7 4 5 3 3 5 4 6 9 6 3 2 2 2 3 3 7 8 9 8 9 9 8 8				15
3					30
4					80
5					80
6					
7					
8					
9					
10					
Remarks					
Fall Height		0.76mm		Cone Base Diameter 0.052mm	
Hammer Weight		63.5kg		Final Depth 6m	
Probe Type				Energy Ratio (Er) 72.45%	
					

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)

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:

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP01	BRK 0.60 – 2.20 Sandy gravelly CLAY	3 – 10	Very low to medium (Cu = 15kPa to 50kPa)
	HEAD 2.20 – 4.80 Clayey sandy GRAVEL ¹	10 – 24	Medium dense
	HEAD 4.80 – 5.80 Gravelly CLAY ¹	3 – 7	Very low to low (Cu = 15kPa to 35kPa)
	HEAD 5.80 – 6.00 Clayey GRAVEL ¹	17 – 21	Medium dense
DP02	BRK 0.50 – 2.00 Sandy gravelly CLAY	0 – 10	Extremely low to medium (Cu = <10kPa to 50kPa)
	HEAD 2.00 – 4.20 Clayey sandy GRAVEL ¹	10 – >50	Medium dense to very dense
	HEAD 4.20 – 5.60 Gravelly CLAY ¹	7 – 17	Low to high (Cu = 35kPa to 85kPa)
	HEAD 5.60 – 6.00 Clayey GRAVEL ¹	21 – 31	Medium dense to dense
DP03	BRK 0.50 – 2.00 Gravelly CLAY / clayey GRAVEL	3 – 10	Very low to medium / very loose to loose (Cu = 15kPa to 50kPa)
	HEAD 2.00 – 3.50 Gravelly SILT / clayey GRAVEL	10 – 35	Medium dense to dense
	HEAD 3.50 – 3.70 Silty sandy CLAY	3 – 7	Very low to low (Cu = 15kPa to 35kPa)
	HEAD 3.70 – 4.90 Clayey GRAVEL ¹	17 – 45	Medium dense to dense
	HEAD 4.90 – 5.20 Sandy CLAY ¹	3 – 7	Very low to low (Cu = 15kPa to 35kPa)
	HEAD 5.20 – 6.00 Clayey GRAVEL ¹	14 – 24	Medium dense
DP04	BRK 0.50 – 1.40 Silty sandy CLAY	0 – 3	Extremely low to very low (Cu = <10kPa to 15kPa)

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
	BRK 1.40 – 1.80 Clayey sandy GRAVEL	7 – 17	Loose to medium dense
	HEAD 1.80 – 4.60 Silty sandy GRAVEL ¹	10 – 38	Medium dense to dense
	HEAD 4.60 – 5.20 Gravelly CLAY ¹	7 – 10	Low to medium (Cu = 35kPa to 50kPa)
	HEAD 5.20 – 6.00 Clayey GRAVEL ¹	24 – 31	Medium dense to dense

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
BRK	22 – 23	24 – 27	100	24 – 27	CI	Medium	Medium
HEAD	9	24	35	8.4	CI	Low	None

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)

Table B.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)	Passing 2µm Sieve (%)
			BRE	NHBC		
WS01	2.50	Off white fine to coarse sandy clayey/silty chalky fine to coarse GRAVEL	Yes	No	25	-
WS02	2.10	Off white silty/clayey fine to coarse sandy fine to coarse GRAVEL	Yes	No	24	-
WS03	1.50	Brown slightly fine to coarse sandy silty/clayey fine to coarse GRAVEL	Yes	No	17	-
WS04	1.40	Brown silty fine to coarse sandy clayey fine to coarse GRAVEL	No	No	23	13

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)	Passing 2µm Sieve (%)
			BRE	NHBC		

Note: BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. In most cases, only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.

(The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Appendix B.3 Geotechnical In-Situ and Laboratory Results

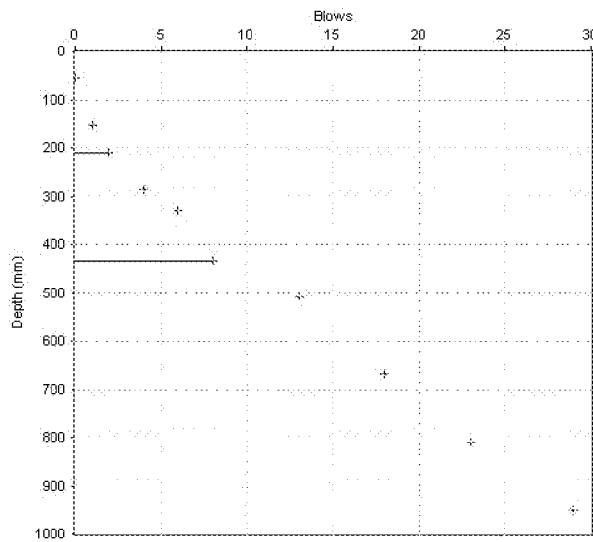
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

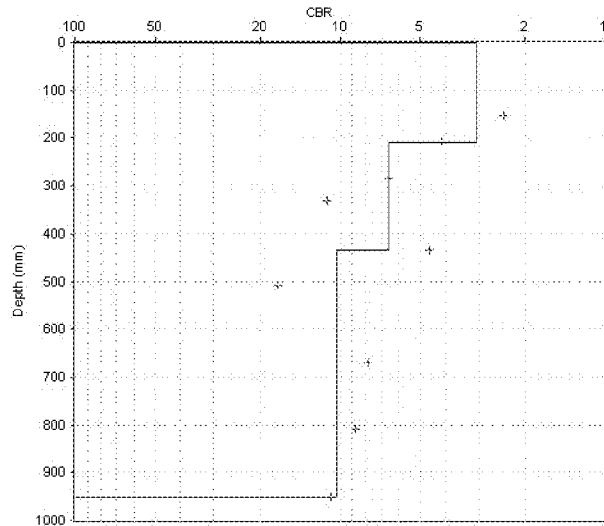
Chainage (km): 1.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	77.50	3	210	210
2	37.50	7	225	435
3	24.52	10	515	950

CBR Relationship:

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

Report produced by

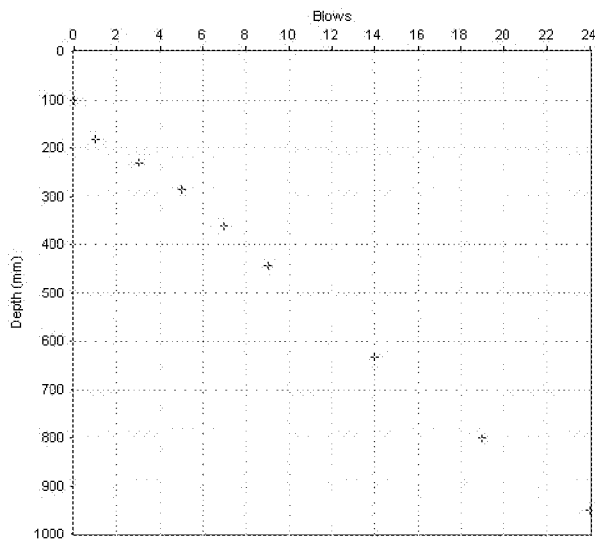
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

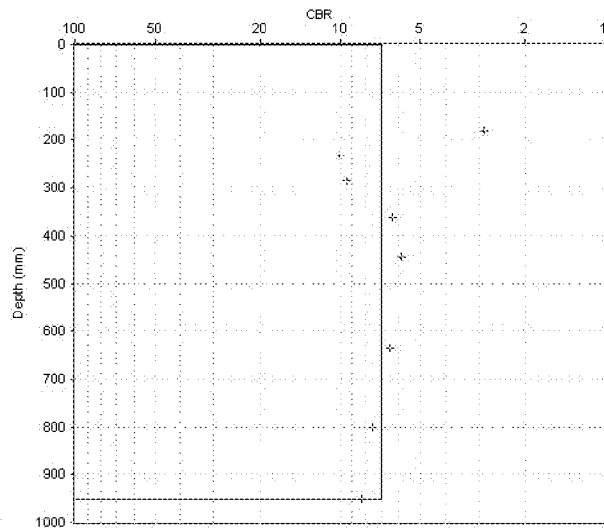
Chainage (km): 2.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	35.42	7	950	950

CBR Relationship:

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

Report produced by

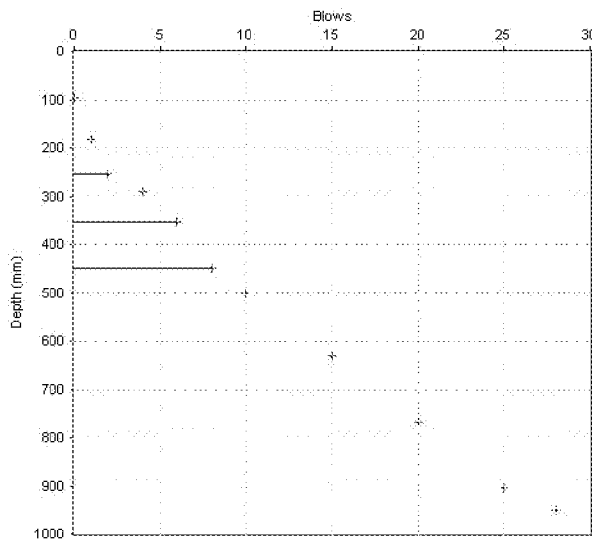
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

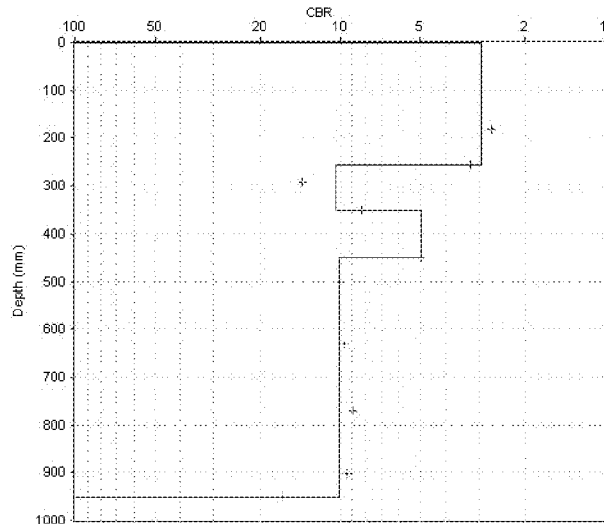
Chainage (km): 3.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 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)
1	80.00	3	255	255
2	24.25	10	97	352
3	49.00	5	98	450
4	25.00	10	500	950

CBR Relationship:

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

Report produced by

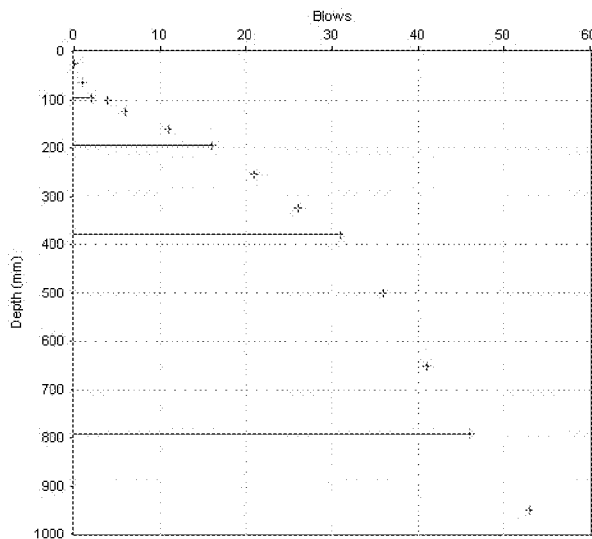
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

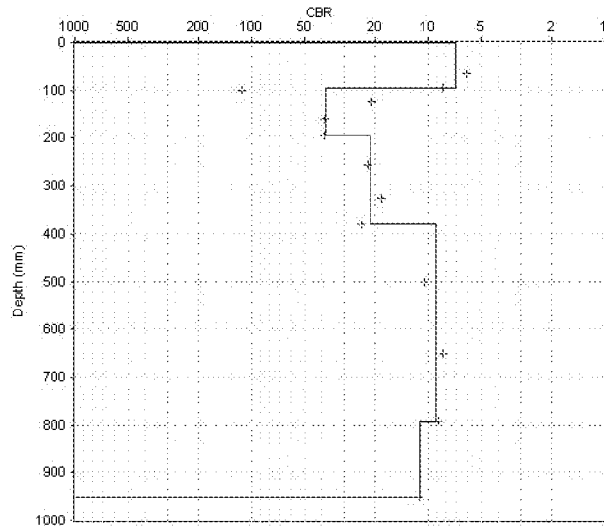
Chainage (km): 4.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	35.00	7	95	95
2	7.14	38	100	195
3	12.33	21	185	380
4	27.47	9	412	792
5	22.57	11	158	950

CBR Relationship:

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

Report produced by

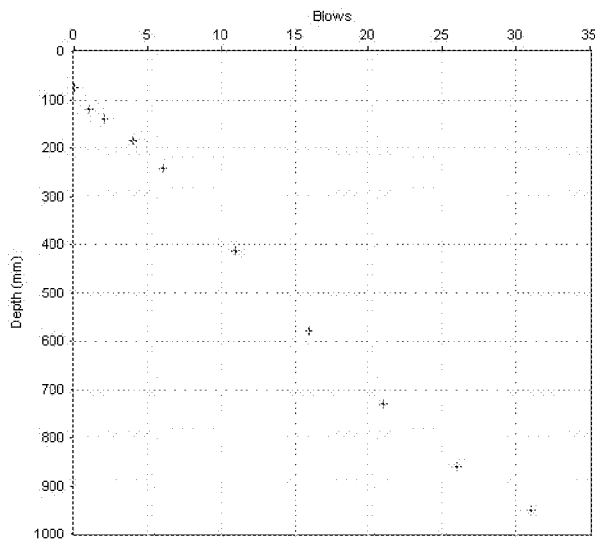
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

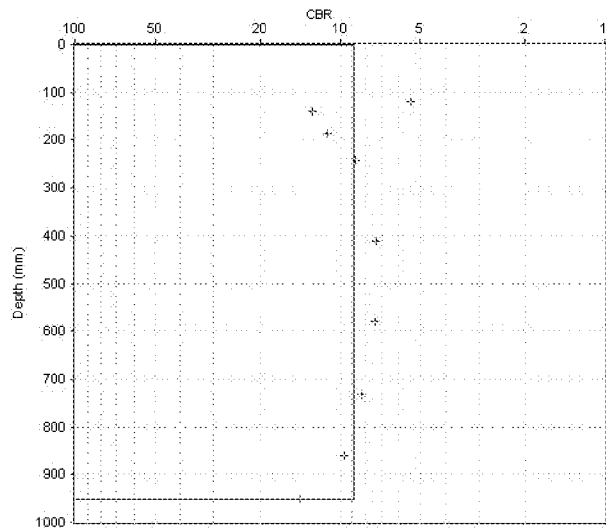
Chainage (km): 5.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	28.23	9	950	950

CBR Relationship:

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

Report produced by

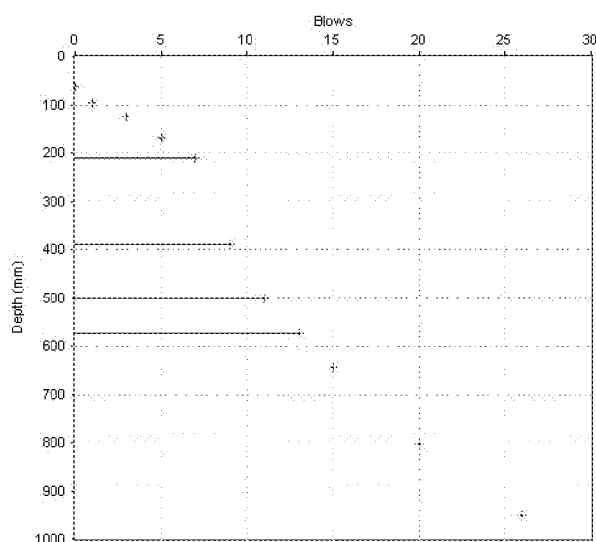
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

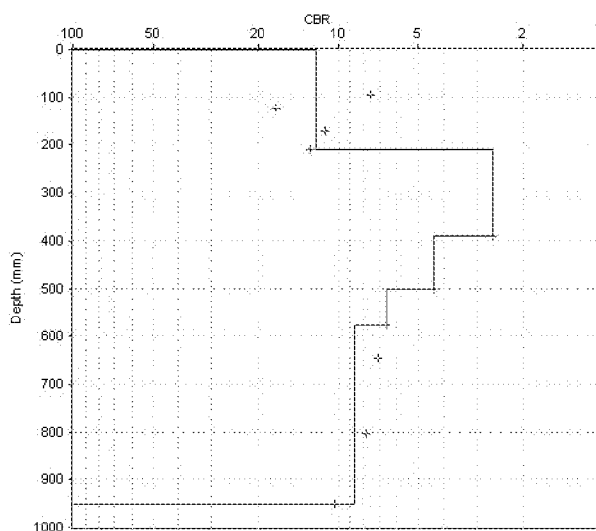
Chainage (km): 6.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	21.14	12	210	210
2	90.00	3	180	390
3	55.00	4	110	500
4	37.50	7	75	575
5	28.85	9	375	950

CBR Relationship:

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

Report produced by

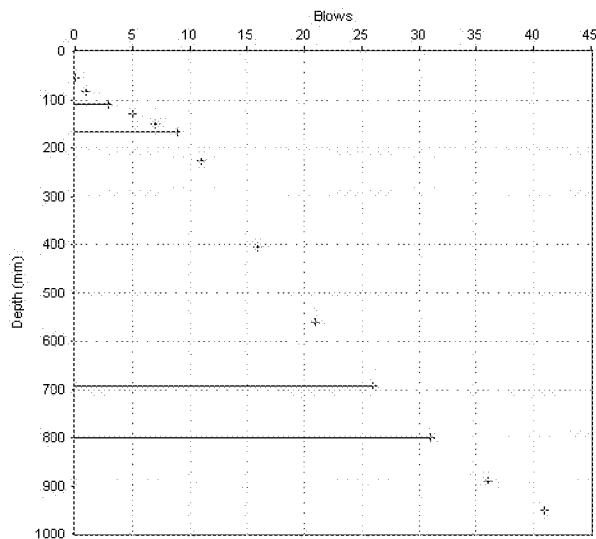
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

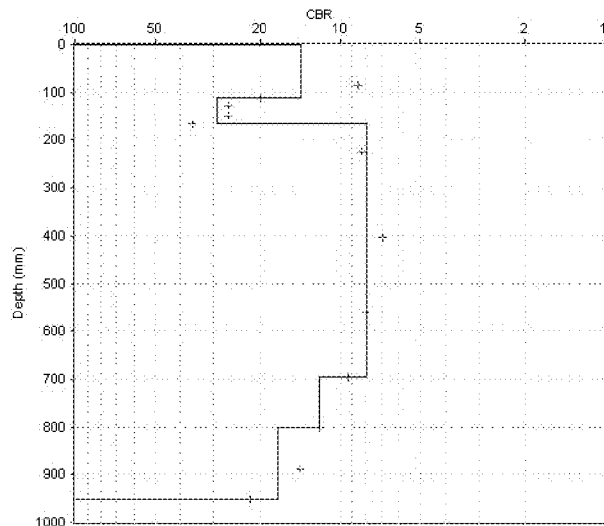
Chainage (km): 7.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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)
1	18.33	14	110	110
2	9.17	29	55	165
3	31.12	8	529	694
4	21.20	12	106	800
5	15.00	17	150	950

CBR Relationship:

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

Report produced by

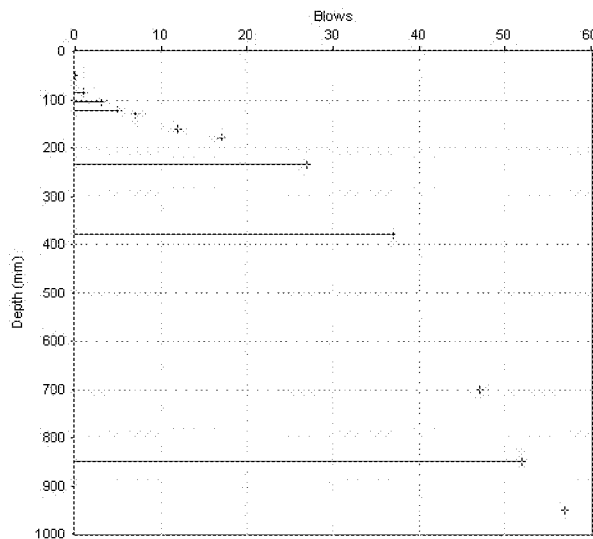
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

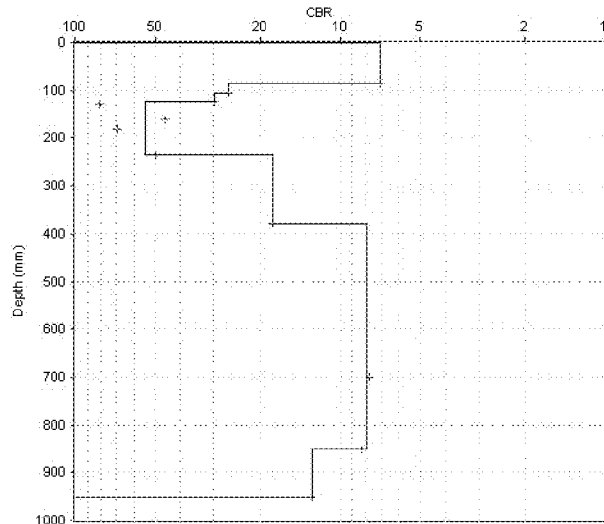
Chainage (km): 8.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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

Layer Boundaries: Chainage 8.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	35.00	7	85	85
2	10.00	26	20	105
3	9.00	30	18	123
4	5.09	54	112	235
5	14.50	18	145	380
6	31.33	8	470	850
7	20.00	13	100	950

CBR Relationship:

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

Report produced by

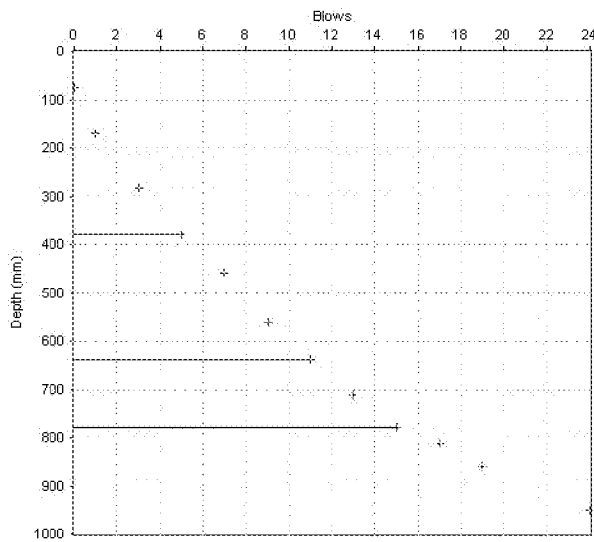
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

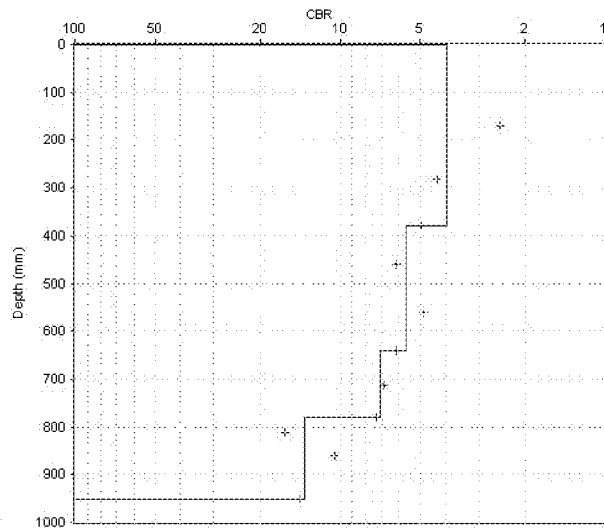
Chainage (km): 9.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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

Layer Boundaries: Chainage 9.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	60.80	4	380	380
2	43.33	6	260	640
3	35.00	7	140	780
4	18.89	14	170	950

CBR Relationship:

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

Report produced by

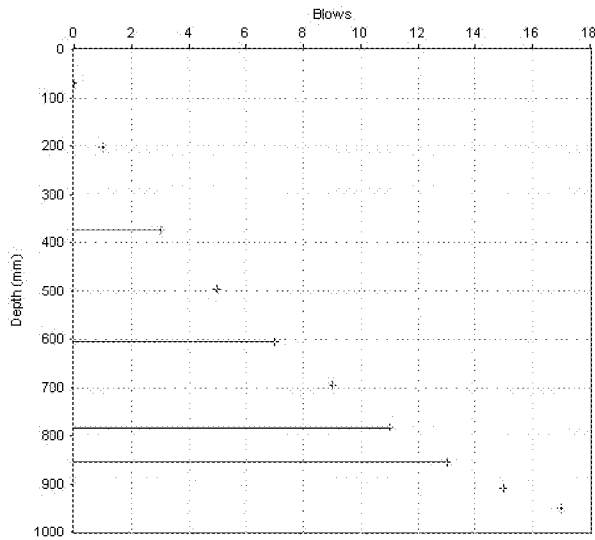
DCP Layer Strength Analysis Report

Project Name: 19023 DCP Results

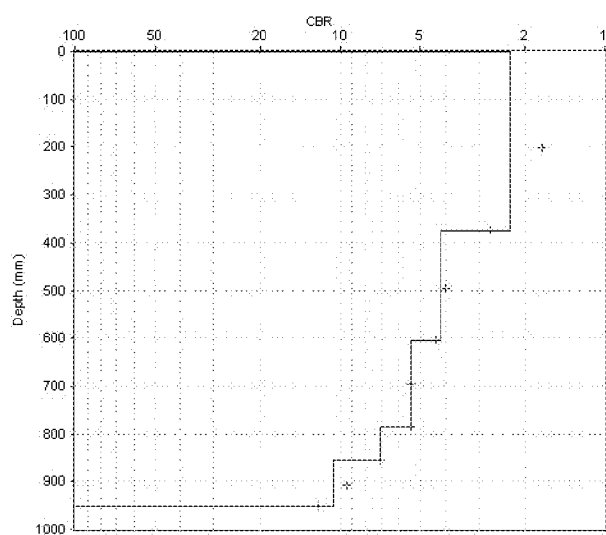
Chainage (km): 10.000
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 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 08/03/2021

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

Layer Boundaries: Chainage 10.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	101.67	2	375	375
2	57.50	4	230	605
3	45.00	5	180	785
4	35.00	7	70	855
5	23.75	11	95	950

CBR Relationship:

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

Report produced by



Laboratory Report



Contract Number: 52536

Client Ref: **19023**
Client PO: **19023/SB**

Report Date: **22-02-2021**

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

Contract Title: **The Croft**
For the attention of: **Sam Bevins**

Date Received: **10-02-2021**
Date Completed: **22-02-2021**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	3
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	3
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	4
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	1
Samples Received - @ Non Accredited Test	7
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

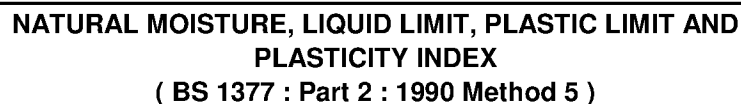
This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of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

Approved Signatories:

Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

[illegible]



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **52536**

Borehole/Pit No. **WS01**

Site Name **The Croft**

Sample No.

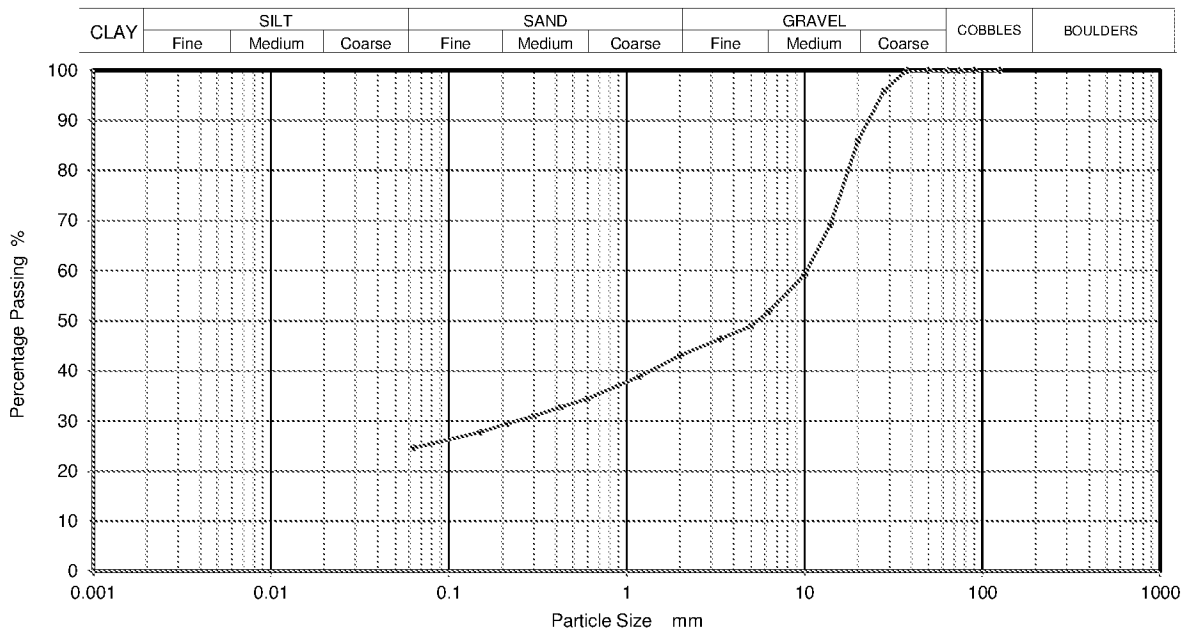
Soil Description **Off white fine to coarse sandy clayey/silty chalky fine to coarse GRAVEL**

Depth Top **2.50**

Depth Base

Date Tested **15/02/2021**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	86		
14	69		
10	59		
6.3	52		
5	49		
3.35	46		
2	43		
1.18	39		
0.6	34		
0.425	33		
0.3	31		
0.212	29		
0.15	28		
0.063	25		

Sample Proportions	% dry mass
Cobbles	0
Gravel	57
Sand	18
Silt and Clay	25

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	21/02/2021	Wayne Honey
RO/MH	Approved	22/02/2021	Paul Evans



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **52536**

Borehole/Pit No. **WS02**

Site Name **The Croft**

Sample No.

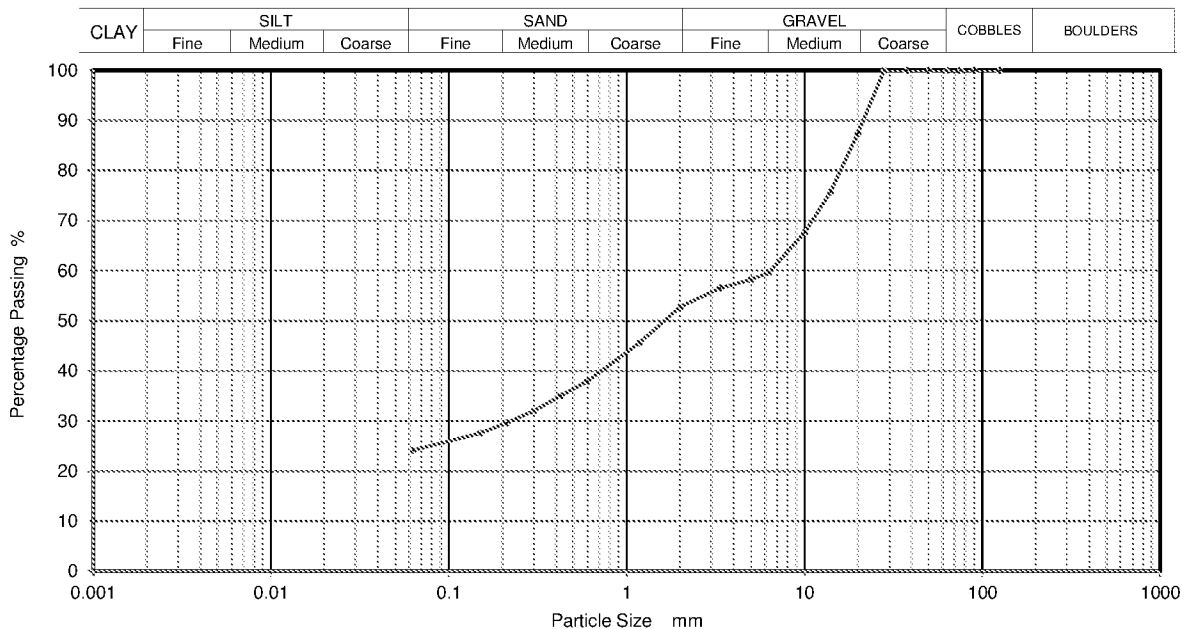
Soil Description **Off white silty/clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **2.10**

Depth Base

Date Tested **15/02/2021**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	87		
14	76		
10	68		
6.3	60		
5	58		
3.35	57		
2	53		
1.18	46		
0.6	38		
0.425	35		
0.3	32		
0.212	30		
0.15	28		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	47
Sand	29
Silt and Clay	24

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	21/02/2021	Wayne Honey
RO/MH	Approved	22/02/2021	Paul Evans





**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number **52536**

Borehole/Pit No. **WS03**

Site Name **The Croft**

Sample No.

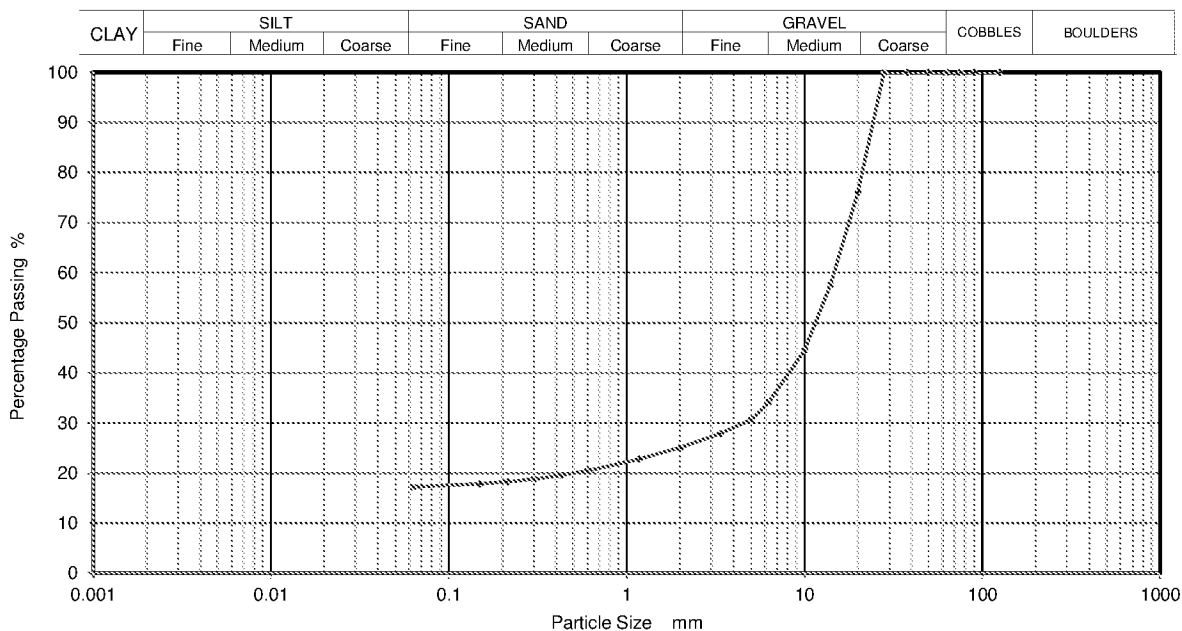
Soil Description **Brown slightly fine to coarse sandy silty/clayey fine to coarse GRAVEL**

Depth Top **1.50**

Depth Base

Date Tested **15/02/2021**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	76		
14	58		
10	45		
6.3	34		
5	31		
3.35	28		
2	25		
1.18	23		
0.6	20		
0.425	20		
0.3	19		
0.212	18		
0.15	18		
0.063	17		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	8
Silt and Clay	17

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	21/02/2021	Wayne Honey
RO/MH	Approved	22/02/2021	Paul Evans

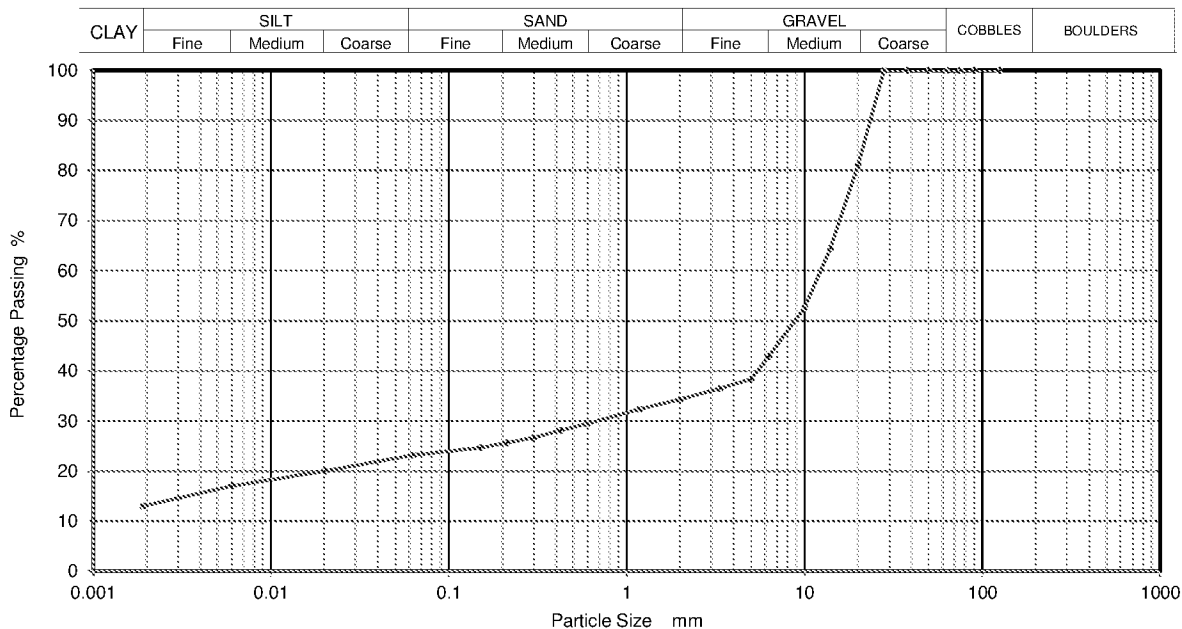




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	52536
Borehole/Pit No.	WS04
Sample No.	
Depth Top	1.40
Depth Base	
Sample Type	D

Site Name	The Croft
Soil Description	Brown silty fine to coarse sandy clayey fine to coarse GRAVEL
Date Tested	15/02/2021



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	20
90	100	0.0060	17
75	100	0.0020	13
63	100		
50	100		
37.5	100		
28	100		
20	81		
14	64		
10	53		
6.3	43		
5	38		
3.35	36		
2	34		
1.18	32		
0.6	29		
0.425	28		
0.3	27		
0.212	26		
0.15	25		
0.063	23		

Sample Proportions	% dry mass
Cobbles	0
Gravel	66
Sand	11
Silt	10
Clay	13

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	21/02/2021	Wayne Honey
RO/MH	Approved	22/02/2021	Paul Evans



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	Further Works
				Severity	Probability	Risk		
Onsite demolition of buildings, construction materials and storage, previous farming usage.	Metals, Semi-metals and non-metals, PAHs, TPHs, pH, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Mild	Low	Low	Limited Made Ground recorded on site, with underlying cohesive Brickearth.	Chemical testing prior to undertaking a generic quantitative risk assessment as required.
			End Users	Mild	Low	Low		
			Off-site Users	Mild	Unlikely	Very Low		
	PAHs, TPHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Low	Low	London Clay Formation would act as an aquiclude to underlying deep groundwater regimes.	Soil gas monitoring on-going. Risk assessment to follow.
			End Users	Mild	Low	Low		
			Off-site Users	Mild	Unlikely	Very Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH, herbicides and pesticides	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Mild	Low	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH,	Migration via surface runoff	Surface Water	-	-	-		
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	Mild	Low	Low		
			Deep Aquifer	Mild	Unlikely	Very Low		
		Direct contact with construction material	Buried structures	Mild	Low	Low		
			Buried Services	Mild	Low	Low		
	PAHs, TPHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		
Vehicle breakers yard/ waste management facility/ waste disposal centre		Inhalation of dust	Site Workers/Site Maintenance	-	-	-	Limited Made Ground recorded on site, with underlying cohesive Brickearth.	Chemical testing prior to undertaking a generic quantitative risk assessment as required.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	Soil gas (PAH/TPH)	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Unlikely	Very Low	London Clay Formation would act as an aquiclude to underlying deep groundwater regimes.	Soil gas monitoring on-going. Risk assessment to follow.
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
		Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
		Migration via surface runoff	Surface Water	-	-	-		
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
		Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	-	-	-		
	Soil gas (PAH/TPH)	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		

Table C.I.2 CSM Revised Post Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Further Works
				Severity	Probability	Risk		
Onsite demolition of buildings, construction materials and storage, previous farming usage.	None	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	Limited Made Ground recorded on site, with underlying cohesive Brickearth.	No further works required in respect of shallow soils or groundwater.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	Soil gas	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Low	Low	No exceedances recorded when compared against screening values for the proposed end-use. No elevated levels of PAH or TPH.	Soil gas monitoring on-going. Risk assessment to follow.
			End Users	Mild	Low	Low		
			Off-site Users	Mild	Unlikely	Very Low		
	None	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-	London Clay Formation would act as an aquiclude to underlying deep groundwater regimes.	
			End Users	-	-	-		
	None	Migration via surface runoff	Surface Water	-	-	-		
			Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
		Migration in solution via groundwater	Deep Aquifer	-	-	-		
			Buried structures	-	-	-		
			Buried Services	-	-	-		
	Soil gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		
Vehicle breakers yard/ waste management facility/ waste disposal centre		Inhalation of dust	Site Workers/Site Maintenance	-	-	-	Limited Made Ground recorded on site, with underlying cohesive Brickearth.	No further works required in respect of shallow soils or groundwater.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	Soil gas	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Unlikely	Very Low	No exceedances recorded when compared against screening values for the proposed end-use. No elevated levels of PAH or TPH.	Soil gas monitoring on-going. Risk assessment to follow.
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
		Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-	London Clay Formation would act as an aquiclude to underlying deep groundwater regimes.	
			End Users	-	-	-		
		Migration via surface runoff	Surface Water	-	-	-		
			Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
		Migration in solution via groundwater	Deep Aquifer	-	-	-		
			Buried structures	-	-	-		
			Buried Services	-	-	-		
	Soil gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		

Appendix C.2 Chemical Laboratory Results



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Newton House
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Tadworth
Surrey
KT20 5SR

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

DETS Report No: 21-01476

Site Reference: The Croft

Project / Job Ref: 19023

Order No: 19023/SB

Sample Receipt Date: 08/02/2021

Sample Scheduled Date: 08/02/2021

Report Issue Number: 1

Reporting Date: 15/02/2021



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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

For Topsoil and WAC analysis the expanded uncertainty measurement should be considered while evaluating results against compliance values.



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Soil Analysis Certificate						
DETS Report No: 21-01476	Date Sampled	04/02/21	04/02/21	04/02/21	04/02/21	04/02/21
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: The Croft	TP / BH No	WS01	WS02	WS03	WS04	WS02
Project / Job Ref: 19023	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 19023/SB	Depth (m)	0.30	0.50	0.20	0.10	0.90
Reporting Date: 15/02/2021	DETS Sample No	524496	524497	524498	524499	524500

Determinand	Unit	RL	Accreditation					
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO 17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.0	7.9	7.9	7.8	8.3
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS					< 200
Total Sulphate as SO ₄	%	< 0.02	MCERTS					< 0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10			< 10	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01			< 0.01	< 0.01
Total Sulphur	%	< 0.02	NONE					< 0.02
Organic Matter	%	< 0.1	MCERTS	1.5	1.1	2.8	3.5	
Ammonium as NH ₄	mg/kg	< 0.5	NONE					3.4
Ammonium as NH ₄	mg/l	< 0.05	NONE					0.34
W/S Chloride (2:1)	mg/kg	< 1	MCERTS					10
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS					5
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS					< 3
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS					< 1.5
Arsenic (As)	mg/kg	< 2	MCERTS	10	10	9	9	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	NONE	0.3	< 0.2	0.2	0.3	
Chromium (Cr)	mg/kg	< 2	MCERTS	14	19	16	15	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	12	12	13	17	
Lead (Pb)	mg/kg	< 3	MCERTS	30	12	44	201	
W/S Magnesium	mg/l	< 0.1	NONE					0.9
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	11	14	12	12	
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 1	MCERTS	21	27	23	20	
Zinc (Zn)	mg/kg	< 3	MCERTS	62	47	72	100	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (5)



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Soil Analysis Certificate

DETS Report No: 21-01476	Date Sampled	04/02/21				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: The Croft	TP / BH No	WS03				
Project / Job Ref: 19023	Additional Refs	None Supplied				
Order No: 19023/SB	Depth (m)	2.60				
Reporting Date: 15/02/2021	DETS Sample No	524501				

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO 17025				
pH	pH Units	N/a	MCERTS	8.5			
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	351			
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.04			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01			
Total Sulphur	%	< 0.02	NONE	< 0.02			
Organic Matter	%	< 0.1	MCERTS				
Ammonium as NH ₄	mg/kg	< 0.5	NONE	< 0.5			
Ammonium as NH ₄	mg/l	< 0.05	NONE	< 0.05			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	7			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	3.3			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	< 3			
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	< 1.5			
Arsenic (As)	mg/kg	< 2	MCERTS				
W/S Boron	mg/kg	< 1	NONE				
Cadmium (Cd)	mg/kg	< 0.2	NONE				
Chromium (Cr)	mg/kg	< 2	MCERTS				
Chromium (hexavalent)	mg/kg	< 2	NONE				
Copper (Cu)	mg/kg	< 4	MCERTS				
Lead (Pb)	mg/kg	< 3	MCERTS				
W/S Magnesium	mg/l	< 0.1	NONE	0.7			
Mercury (Hg)	mg/kg	< 1	MCERTS				
Nickel (Ni)	mg/kg	< 3	MCERTS				
Selenium (Se)	mg/kg	< 2	MCERTS				
Vanadium (V)	mg/kg	< 1	MCERTS				
Zinc (Zn)	mg/kg	< 3	MCERTS				
Total Phenols (monohydric)	mg/kg	< 2	NONE				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Maidstone
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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-01476	Date Sampled	04/02/21	04/02/21	04/02/21	04/02/21	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: The Croft	TP / BH No	WS01	WS02	WS03	WS04	
Project / Job Ref: 19023	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 19023/SB	Depth (m)	0.30	0.50	0.20	0.10	
Reporting Date: 15/02/2021	DETS Sample No	524496	524497	524498	524499	

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.12	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.71	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1	0.35	
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.80	0.30	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.69	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.32	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.71	0.48	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.19	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.57	0.35	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.60	0.48	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.19	< 0.1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	5.9	2	



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 21-01476	Date Sampled	04/02/21	04/02/21	04/02/21	04/02/21	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: The Croft	TP / BH No	WS01	WS02	WS03	WS04	
Project / Job Ref: 19023	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 19023/SB	Depth (m)	0.30	0.50	0.20	0.10	
Reporting Date: 15/02/2021	DETS Sample No	524496	524497	524498	524499	

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	4	< 1	
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	< 6	< 6	31	< 6	
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	< 6	< 6	34	< 6	



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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2

DETS Report No: 21-01476		Date Sampled	04/02/21		Landfill Waste Acceptance Criteria Limits			
Soils Ltd		Time Sampled	None Supplied					
Site Reference: The Croft		TP / BH No	WS03					
Project / Job Ref: 19023		Additional Refs	None Supplied					
Order No: 19023/SB		Depth (m)	0.20					
Reporting Date: 15/02/2021		DETS Sample No	524498					
Determinand	Unit	MDL			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	
TOC ^{MU}	%	< 0.1	1.6		3%	5%	6%	
Loss on Ignition	%	< 0.01	3		--	--	10%	
BTEX ^{MU}	mg/kg	< 0.05	< 0.05		6	--	--	
Sum of PCBs	mg/kg	< 0.1	< 0.1		1	--	--	
Mineral Oil ^{MU}	mg/kg	< 10	< 10		500	--	--	
Total PAH ^{MU}	mg/kg	< 1.7	5.9		100	--	--	
pH ^{MU}	pH Units	N/a	7.9		--	>6	--	
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	1		--	To be evaluated	To be evaluated	
Eluate Analysis			10:1 mg/l		Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic ^U		< 0.01			< 0.1	0.5	2	25
Barium ^U		< 0.02			< 0.2	20	100	300
Cadmium ^U		< 0.0005			< 0.005	0.04	1	5
Chromium ^U		< 0.005			< 0.05	0.5	10	70
Copper ^U		< 0.01			< 0.1	2	50	100
Mercury ^U		< 0.0005			< 0.005	0.01	0.2	2
Molybdenum ^U		< 0.001			< 0.01	0.5	10	30
Nickel ^U		< 0.007			< 0.07	0.4	10	40
Lead ^U		< 0.005			< 0.05	0.5	10	50
Antimony ^U		< 0.005			< 0.05	0.06	0.7	5
Selenium ^U		< 0.005			< 0.05	0.1	0.5	7
Zinc ^U		< 0.005			< 0.05	4	50	200
Chloride ^U		14.8			148	800	15000	25000
Fluoride ^U		< 0.5			< 5	10	150	500
Sulphate ^U		13.1			131	1000	20000	50000
TDS		111			1110	4000	60000	100000
Phenol Index		< 0.01			< 0.1	1	-	-
DOC		20.6			206	500	800	1000
Leach Test Information								
Sample Mass (kg)		0.10						
Dry Matter (%)		86.5						
Moisture (%)		15.8						
Stage 1								
Volume Eluate L10 (litres)		0.89						

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test



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



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-01476

Soils Ltd

Site Reference: The Croft

Project / Job Ref: 19023

Order No: 19023/SB

Reporting Date: 15/02/2021

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
524496	WS01	None Supplied	0.30	16	Brown sandy clay
524497	WS02	None Supplied	0.50	15.6	Brown sandy clay
524498	WS03	None Supplied	0.20	13.6	Brown sandy clay with stones
524499	WS04	None Supplied	0.10	20.5	Brown sandy clay with stones
524500	WS02	None Supplied	0.90	15.7	Light brown sandy clay
524501	WS03	None Supplied	2.60	10.4	Light brown sandy clay with stones and chalk

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{4/5}



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Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-01476

Soils Ltd

Site Reference: The Croft

Project / Job Ref: 19023

Order No: 19023/SB

Reporting Date: 15/02/2021

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 diphénylcarbazine 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	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
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

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Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Parameter	Matrix Type	Suite Reference	Expanded Uncertainty Measurement	Unit
TOC	Soil	BS EN 12457	13.49	%
Loss on Ignition	Soil	BS EN 12457	17	%
BTEX	Soil	BS EN 12457	14	%
Sum of PCBs	Soil	BS EN 12457	23	%
Mineral Oil	Soil	BS EN 12457	9	%
Total PAH	Soil	BS EN 12457	20	%
pH	Soil	BS EN 12457	0.399	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18	%
Arsenic	Leachate	BS EN 12457	16.63	%
Barium	Leachate	BS EN 12457	14.29	%
Cadmium	Leachate	BS EN 12457	14.44	%
Chromium	Leachate	BS EN 12457	18.06	%
Copper	Leachate	BS EN 12457	21.27	%
Mercury	Leachate	BS EN 12457	24.13	%
Molybdenum	Leachate	BS EN 12457	12.55	%
Nickel	Leachate	BS EN 12457	20.08	%
Lead	Leachate	BS EN 12457	13.43	%
Antimony	Leachate	BS EN 12457	18.85	%
Selenium	Leachate	BS EN 12457	18.91	%
Zinc	Leachate	BS EN 12457	13.71	%
Chloride	Leachate	BS EN 12457	16	%
Fluoride	Leachate	BS EN 12457	19.4	%
Sulphate	Leachate	BS EN 12457	19.63	%
TDS	Leachate	BS EN 12457	12	%
Phenol Index	Leachate	BS EN 12457	14	%
DOC	Leachate	BS EN 12457	10	%
Clay Content	Soil	BS 3882: 2015	15	%
Silt Content	Soil	BS 3882: 2015	14	%
Sand Content	Soil	BS 3882: 2015	13	%
Loss on Ignition	Soil	BS 3882: 2015	17	%
pH	Soil	BS 3882: 2015	0.399	Units
Carbonate	Soil	BS 3882: 2015	16	%
Total Nitrogen	Soil	BS 3882: 2015	12	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24	%
Potassium (Extractable)	Soil	BS 3882: 2015	20	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26	%
Zinc	Soil	BS 3882: 2015	14.9	%
Copper	Soil	BS 3882: 2015	16	%
Nickel	Soil	BS 3882: 2015	17.7	%
Available Sodium	Soil	BS 3882: 2015	23	%
Available Calcium	Soil	BS 3882: 2015	23	%
Electrical Conductivity	Soil	BS 3882: 2015	10	%

Appendix C.3 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

Introduction

The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2;

‘Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) pollution of controlled waters is being, or is likely to be, caused.’

The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 1.3 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 1.4 and SR3, ref. 1.5.

In establishing whether a site fulfils the statutory definition of ‘contaminated land’ it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A ‘pollutant linkage’ may be defined as the link between a contaminant ‘source’ and a ‘receptor’ by means of a ‘pathway’.

Assessment Methodology

The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

Stages 1 and 2 develop a '*conceptual model*' based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 1.6. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 1.7. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. Specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to specific industrial processes.

If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref 1.8. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

All site works should be in general accordance with the British Standards BS 10175:2011, ref. 1.9. and BS 5930:2015, ref. 1.10.

The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.

The end-use may be defined as one of the following ref. 1.15;

- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetables may be grown for home consumption
- Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
- Allotments – specific areas where vegetables are grown for home consumption.
- Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.
- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children's play area, sports grounds and dog walking.
- Commercial – industrial premises where there is limited exposure to soil.

Standard Land-use Scenarios

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

Residential with homegrown produce

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

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

A sub-set of the Residential land-use is **Residential without Homegrown produce**. The generic scenario assumes low density housing with communal landscaped gardens where the consumption of home grown vegetables will not occur.

Allotments

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

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

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

Commercial

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

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

Public Open Space within Residential Area

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

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

Public Open Space Park

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

-
- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
 - Female child age classes 1-6
 - Soil ingestion rate of 50 mg.day⁻¹
 - Occupancy period outdoors = 2 hours.day⁻¹
 - Exposure frequency of 170 days.year⁻¹ for age classes 2-18 and 85 days.year⁻¹ for age class 1
 - Outdoor exposure pathways only (no tracking back).
-

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

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

In 2014, the publication of Category 4 Screening Levels (C4SL) ref 1.15, 1.16, as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3) ref 1.5 used in the generation of SGVs. C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010 ref 1.16. Where a C4SL has been published, Soils Limited has adopted them as GAC for these six substances.

For all other substances the soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM ref. 1.12, which were developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants.

Where no S4UL or C4SL is available, the assessment criteria (AC) may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.13. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 1.6, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 1.17, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 1.18 and for contaminants not considered in this

document the fate and transport data used in previous versions of the CLEA model has been used.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 1.14. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

References

- 1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.
- 1.2 Environment Act 1995, Section 57, DoE 1995.
- 1.3 CLR 11, '*Model Procedures for the Management of Contaminated Land*', DEFRA and Environment Agency, 2004.
- 1.4 Environment Agency Science Report SC050021/SR2 'Human health toxicological assessment of contaminants in soil'.
- 1.5 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008
- 1.6 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.
- 1.7 CLR 3 '*Documentary Research on Industrial Sites*', Report by RPS Consultants Ltd., DOE, 1994
- 1.8 CLR 4, '*Sampling strategies for contaminated land*', Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994
- 1.9 BS 10175: 2011 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2011
- 1.10 BS 5930: 2015 '*Code of practice for ground investigations*', British Standards Institute, 2015
- 1.11 Science Report SC050021 '*Contaminants in Soil: Updated Collation of Toxicological Data and Intake Values for Humans*', Environment Agency, 2009
- 1.12 The LQM/S4ULs for Human Health Risk Assessment, Nathanail P, McCaffery C, Gillett A, Ogden R, and Nathanail J, Land Quality Press, Nottingham, published 2015.
- 1.13 CLEA '*Software Version 1.071*' (downloaded from the Environment Agency website, <http://www.environment-agency.gov.uk>)
- 1.14 CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*', Chartered Institute of Environmental Health (CIEH) and Contaminated Land: Applications in Real Environments (CL:AIRE), May 2008.
- 1.15 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.
- 1.16 Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). '*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*', Revision 2, DEFRA research project SP1010.
- 1.17 Generic Assessment Criteria for Human Health Risk Assessment, Nathanail CP, McCaffery C, Ashmore M, Cheng Y, Gillett A, Hooker P and Ogden RC
- 1.18 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

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																		
			1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6				
Type	Contaminants	Species	Year																					
Metals	Antimony		2010	550									7500									EC/AGS/CLAIRE	EC/AGS/CLAIRE	2010
	Arsenic		2014	37			40			49			640			79			160			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
	Chromium	III	2014	26			149			4.9			410			220			680			C4SL	DEFRA	2014
			2015	910			910			18000			8600			1500			33000			S4UL	LQM/CIEH	2015
			VI	2014	21			21			170			49			23			250			C4SL	DEFRA
	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 & PTX	Benzene	2012	0.33			0.33			0.07			95									SGV	DEFRA	2012	
		2014	0.87			3.3			0.18			98			140			230			C4SL	DEFRA	2014	
		2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015	
	Toluene	2012	610			610			120			4400									SGV	DEFRA	2012	
		2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015	
	Ethylbenzene	2012	350			350			90			2800									SGV	DEFRA	2012	
		2015	47	110	260	83	190	440	16	39	91	4700	13000	27000	24000	24000	25000	17000	22000	27000	S4UL	LQM/CIEH	2015	
	Xylenes	o-xylene	2012	250			250			160			2600									SGV	DEFRA	2012
			2015	60	140	330	88	210	480	28	67	160	6600	15000	33000	41000	42000	43000	17000	24000	33000	S4UL	LQM/CIEH	2015
		m-xylene	2012	240			240			180			3500									SGV	DEFRA	2012
			2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000	S4UL	LQM/CIEH	2015
		p-xylene	2012	230			230			160			3200									SGV	DEFRA	2012
			2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >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
	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

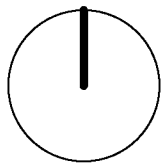
Land Use			Residential With or Without Plant Uptake									Allotments			Commercial			Public Open Space (POS)									Name	Authority	Date
			With home-grown produce			Without home-grown produce			Residential									Park											
			SQM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6								
Type	Contaminants	Species	Year																										
	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 (PAH's) (mg/kg)	Acenaphthene		2015	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015					
	Acenaphthylene		2015	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015					
	Anthracene		2015	2400	5400	11000	31000	35000	37000	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015					
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015					
	Benzo(a)pyrene		2014			5			5.3			5.7			76			16		21	C48L	DEFRA	2014						
			2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015					
	Benzo(b)fluoranthene		2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015					
	Benzo(ghi)perylene		2015	320	340	350	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					
Explosives	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					
	2,4,6 Trinitrotoluene		2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015					
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)		2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015					
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)		2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000	23000	24000	S4UL	LQM/CIEH	2015					
Pesticides	Aldrin		2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015					
	Dieldrin		2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015					
	Atrazine		2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015					
	Dichlorvos		2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015					
	Alpha - Endosulfan		2015	7.4	18	41	160	280	410	1.2	2.9	6.8	5600	7400	8400	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015					
	Beta - Endosulfan		2015	7	17	39	190	320	440	1.1	2.7	6.4	6300	7800	8700	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015					
	Alpha -Hexachlorocyclohexanes		2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015					
	Beta -Hexachlorocyclohexanes		2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015					
Chlorobenzenes	Gamma -Hexachlorocyclohexanes		2015																										

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			With			Without			Allotments			Commercial			Residential			Park						
			home-grown produce	home-grown produce																				
Type	Contaminants	Species	Year	SQM	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		
Phenols & Chlorophenols	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
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 (CLARE), 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 2020	

Appendix D Information Provided by the Client



NOTES:

OTHER THAN FOR THE PURPOSES OF PLANNING, DO NOT SCALE THESE DRAWINGS.
USE WRITTEN DIMENSIONS ONLY. ALL DIMENSIONS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORK.

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ITEMS CLOUDED WITH A DASHED LINE ARE TO BE CONFIRMED, SUBJECT TO DETAIL DESIGN AND CAN BE EXPECTED TO CHANGE.



REVISION CLOUD

Parking:

08 Accessible spaces
38 Public spaces
24 Staff space
70 Total Parking Spaces

*Allowance for ambulance space

Notes:

Drawing is based on information on information by others provided by Hampshire Land Survey Ltd Ref. HLS 1142_08_04_01.

Boundary line is indicative and subject to confirmation.

This drawing is indicative with regards to site landscaping and is subject to design development. The proposals indicated are for planning purposes only & are subject to all relevant statutory approvals, including building regulations.

Rev	Date	Description	By	Chk
-----	------	-------------	----	-----

Drawing Status

PRELIMINARY

Client

Principal contractor

Design Consultant



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Project Title

THE CROFT MEDICAL CENTRE
BARNHAM ROAD
EASTERGATE
WEST SUSSEX PO20 3RP

Drawing Title

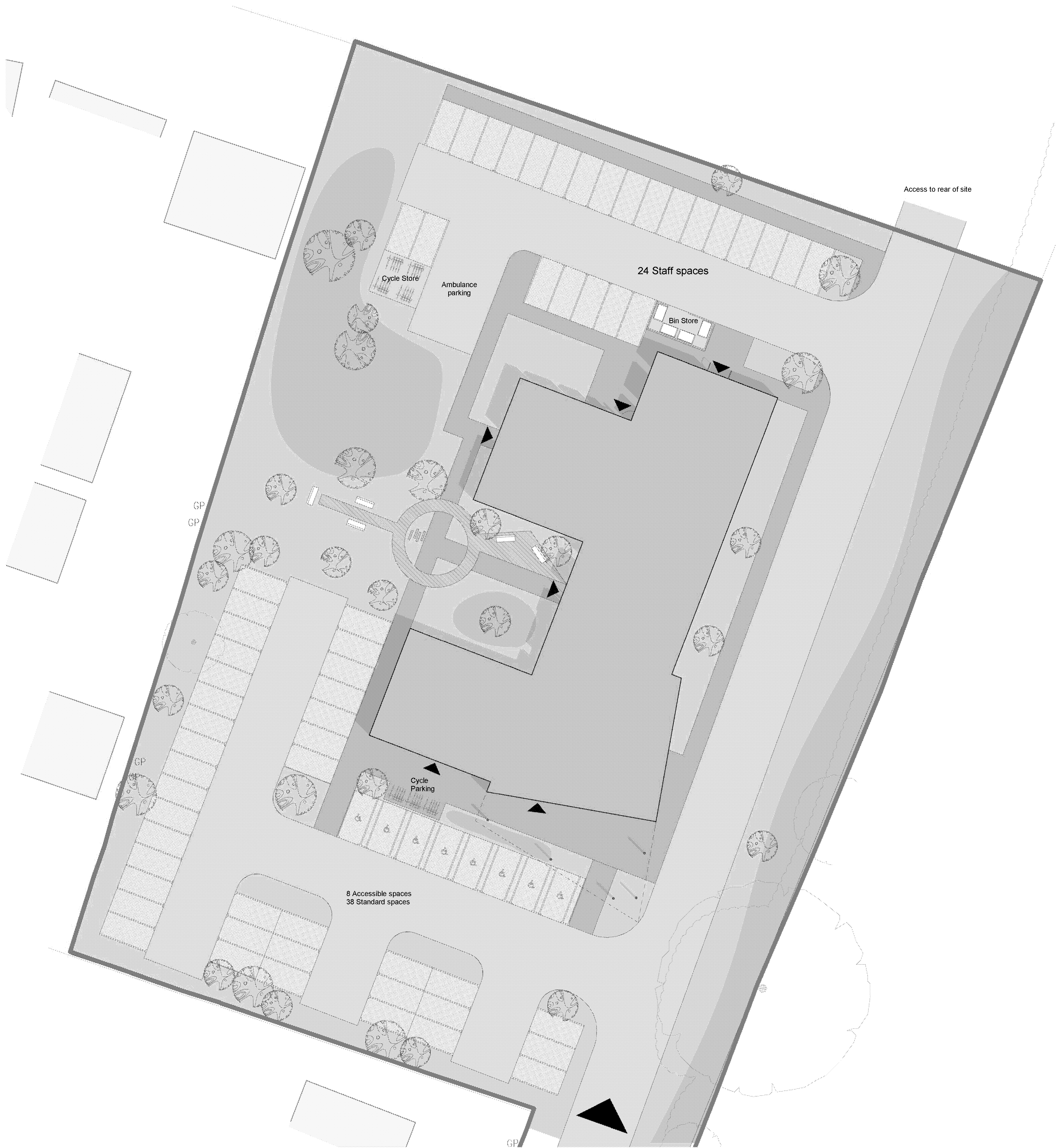
PROPOSED SITE PLAN

Scale (if A1 SIZE)

1 : 200

Drawn: JTW Date: JUNE 2020 Checked: MR Date: JUNE 2020

Drawing No. 9226-P004 Revision:



Proposed Site Plan
1 : 200

0 50 100 150 200
SCALE 1:5 mm

0 100 200 300 400
SCALE 1:10 mm

0 200 400 600 800
SCALE 1:20 mm

0 0.5 1 1.5 2
SCALE 1:50 m

0 1 2 3 4
SCALE 1:100 m

0 2 4 6 8
SCALE 1:200 m

0 5 10 15 20
SCALE 1:500 m

0 10 20 30 40 50
SCALE 1:1250 m

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