



Main Investigation Report

at

**Samsons Gym, 237 Chamberlayne Road,
Eastleigh, Hampshire SO50 5JB**

for

Eastleigh Borough Council

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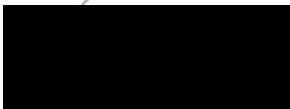
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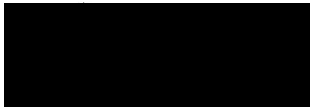
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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

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 Eastleigh Borough Council to undertake a Preliminary Investigation on Samsons Gym, 237 Chamberlayne Road, Eastleigh, Hampshire SO50 5JB. The scope of the investigation was outlined in the Soils Limited quotation reference Q24219 dated 26th February 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: 19192/PIR, dated May 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 22476-2&3:2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2002+A1:2013 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2004+A1:2013 - Geotechnical investigation and testing - Principles for a classification
- BS 10175:2011+A1:2013 - Investigation of potentially contaminated sites
- NHBC Standards 2021
- BS 1377:1990 Parts 1 to 8
- BRE Digest 240
- BRE 365: 2016

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.....	I
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	Superficial – River Terrace Deposits.....	2
1.5.2	Bedrock – London Clay Formation.....	2
1.6	Limitations and Disclaimers.....	2
Section 2	Site Works.....	5
2.1	Proposed Project Works.....	5
2.1.1	Actual Project Works.....	5
2.2	Ground Conditions.....	5
2.3	Ground Conditions Encountered in Trial Holes.....	7
2.3.1	Made Ground.....	7
2.3.2	River Terrace Deposits.....	8
2.3.3	London Clay Formation.....	8
2.4	Roots.....	9
2.5	Groundwater.....	9
Section 3	Discussion of Geotechnical In-Situ and Laboratory Testing.....	10
3.1	Standard Penetration Tests.....	10
3.2	Dynamic Probe Tests.....	10
3.3	Infiltration Tests.....	11
3.4	Quick Unconsolidated Undrained Triaxial Compression Tests.....	11
3.5	Atterberg Limit Tests.....	11
3.6	Particle Size Distribution Tests.....	12
3.7	Sulphate and pH Tests.....	12
Section 4	Foundation Design.....	13
4.1	General.....	13
4.1.1	Made Ground.....	13
4.1.2	River Terrace Deposits.....	13
4.1.3	London Clay Formation.....	14

4.1.4	Roots	15
4.1.5	Groundwater	15
4.2	Foundation Scheme General	15
4.2.1	Guidance on Shrinkable Soils	15
4.3	Foundation Scheme	17
4.3.1	Shallow Foundations into the granular River Terrace Deposits	17
4.3.2	Piled Foundations	18
4.3.3	Ground Floor Slab	19
4.4	Subsurface Concrete	19
4.5	Excavations	19
4.6	Soakaways	20
Section 5 Determination of Chemical Analysis		21
5.1	Site Characterisation and Revised Conceptual Site Model	21
5.2	Soil Sampling	21
5.3	Determination of Chemical Analysis	21
Section 6 Qualitative Risk Assessment		23
6.1	Assessment Criteria	23
6.2	Representative Contamination Criteria - Soil	23
6.2.1	Asbestos	24
6.3	Risk to Groundwater	24
6.4	Tier 1 Quantitative Risk Assessment	24
6.4.1	Soils	24
6.4.2	Groundwater	24
6.4.3	Soil Gas	25
6.5	Remedial Objective	25
6.6	Duty of Care	25
6.7	Excavated Material	25
6.8	Re-use of Excavated Material On-site	26
6.9	Imported Material	27
6.10	Discovery Strategy	27

List of Figures

Figure 1 – Site Location Map	29
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Figure 2 – Aerial Photograph	30
Figure 3 – Trial Hole Plan	31

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	7
Table 2.4 Final Depth of River Terrace Deposits	8
Table 2.5 Final Depth of London Clay Formation	8
Table 2.6 Depth of Root Penetration	9
Table 3.1 Infiltration Rates	11
Table 4.1 Allowable Bearing Capacities within the granular River Terrace Deposits	17
Table 5.1 Sampling Strategy	21
Table 5.2 Chemical Analysis Specification	22
Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance	23
Table B.1.1 SPT "N" Blow Count Cohesive Classification	
Table B.1.2 SPT "N" Blow Count Granular Classification	
Table B.1.3 Interpretation of SPT "N" Blow Counts in Chalk	
Table B.2.1 Interpretation of SPT Tests	
Table B.2.2 Interpretation of DPSH Blow Counts	
Table B.2.3 Interpretation of QUU Tests	
Table B.2.4 Interpretation of Atterberg Limit Tests	
Table B.2.5 Interpretation of PSD Tests	
Table D.1.1 CSM Revised Pre Testing	
Table D.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 Foundation Design

Appendix C.1 Preliminary Pile Design

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Appendix D.2 Chemical Laboratory Results

Appendix D.3 General Assessment Criteria

Appendix E Information Provided by the Client

Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Eastleigh Borough Council 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 mixed commercial and residential development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (Report ref: 19192, May 2021) and/or the Revised Conceptual Site Model presented in Appendix D.1.

I.2 Location

The site was located at Samsons Gym, 237 Chamberlayne Road, Eastleigh, Hampshire SO50 5JB and had an O.S Land Ranger Grid Reference of SU 451 184.

The site location plan is given in Figure 1.

I.3 Site Description

At the time of the investigation the site comprised a single storey building with a food bank operating out of the north east corner and a disused gym located in the north west corner of the site. The southern portion of the site was split in two by a fence and accessed from the roads east and west of the site. The southern portion of the site was covered in tarmacadam and served as a car park for the main building.

The site was relatively flat and level with no appreciable gradient. There was no vegetation excepting a self-set buddleia towards the rear of the food bank.

The area topography was also largely flat. The site was bounded by roads on the north, east and west sides. The south of the site was bounded by residential properties. A large mature deciduous tree was present alongside the road to the east of the site.

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

1.4 Proposed Development

The proposal comprised demolition of the existing building and the erection of a 3 storey building comprising residential apartments sitting above commercial units. No private or public soft landscaped areas were proposed. Hard landscaped car parking and access roads were proposed across the south of the site.

In compiling this report reliance was placed on the drawings included in Appendix E. 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 E.

1.5 Anticipated Geology

The 1:50,000 BGS Geology map showed the site to be situated on the London Clay Formation bedrock, with overlying superficial deposits of River Terrace Deposits.

1.5.1 Superficial – 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 Bedrock – 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 Reading Formation (Lambeth Group).

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at Samsons Gym, 237 Chamberlayne Road, Eastleigh, Hampshire, SO50 5JB and was prepared for the sole

benefit of Eastleigh Borough Council (The “Client”). The report was prepared solely for the brief described in Section 1.1 of this report.

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

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

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

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

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

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

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

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data 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.

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 mixed residential and commercial development. The intended investigation, as outlined within the Soils Limited quotation (Q24219 dated 26th February 2021), was to comprise the following items:

- 1No. 15m deep cable percussive borehole
- 1No. 10m deep monitoring well
- 1Day Windowless sampler boreholes and dynamic probes
- 3No. dual purpose soil gas and groundwater monitoring wells
- 1No. machine excavated trial pit infiltration test
- Geotechnical laboratory testing
- Geoenvironmental laboratory testing

2.1.1 Actual Project Works

The actual project works were undertaken between 22nd and 24th March 2021 with subsequent laboratory testing and comprised:

- 1No. 15m deep cable percussive borehole
- 3No. windowless sampler boreholes and dynamic probe tests
- 1No. machine excavated trial pit infiltration test
- 4No. well installations
- Geotechnical laboratory testing
- Geoenvironmental laboratory testing

Three windowless sampler boreholes and one cable percussive borehole were backfilled with gravel and bentonite following the installation of monitoring wells. One machine excavate trial pit was backfilled with arising's upon completion and mounded over to allow for future settlement.

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 23rd March 2021 three windowless sampler boreholes (WS1, WS2 and WS4) were

drilled, using an Archway Competitor type tracked windowless sampler drilling rig, to depths ranging 4.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

Three standpipes were installed within window sample borehole locations (WS1, WS2 and WS4) to allow for continued monitoring of both groundwater and soils gas, where present.

Three dynamic probes, super heavy, (DP1, DP2 and DP4) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 5.00 and 6.00m bgl. WS/DP3 was not carried out due to time constraints.

On the 23rd March 2021 one trial pit was machine excavated using a tracked mini digger to a depth of 1.60m bgl to allow for trial pit infiltration testing.

On 24th March 2021 a cable percussive borehole was drilled to a depth of 15.00m bgl using a Dando 4000 type drilling rig. Upon completion a 10.00m deep groundwater monitoring well was installed.

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)
BH1(w)	15.00	TPSA1	1.60
WS1(w)	4.00	DP1	6.00
WS2(w)	4.00	DP2	6.00
WS4(w)	4.00	DP4	6.00

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)
River Terrace Deposits (RTD)
London Clay Formation (LCF)

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

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Holocene	0.00	0.30 – 0.60	0.48	Soft dark brown CLAY with brick, concrete and flint.
RTD	Quaternary	0.30 – 0.60	4.60 – 5.90	4.60	Firm orangish brown CLAY overlying orangish brown sandy clayey GRAVEL.
LCF	Eocene	4.60 – 5.90	>15.00 ¹	Not proven ²	Firm to stiff, greenish grey silty sandy CLAY.

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 five trial holes from ground level to depths ranging between 0.30 and 0.60m bgl.

The Made Ground typically comprised soft dark brown slightly sandy, cobbly CLAY. Gravel and cobbles were flint, brick, concrete fragments. 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)
BH1	0.60
TPSA1	0.50
WS1	0.50
WS2	0.30
WS4	0.50
Note:	

2.3.2 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in each of the five trial holes and were inferred in each of the three dynamic probes to be present from immediately underlying the base of the Made Ground and were present to depths ranging between 4.60 and 5.90m bgl.

The River Terrace Deposits typically comprised firm, orangish brown CLAY to between 1.00 and 1.60m bgl, overlying orangish brown sandy, clayey GRAVEL.

The depth of River Terrace Deposits has been included in Table 2.4.

Table 2.4 Final Depth of River Terrace Deposits

Trial Hole	Depth (m bgl)
BH1	5.90
TPSA1	1.60 ¹
WS1	4.00 ¹
WS2	4.00 ¹
WS4	4.00 ¹
DPI	5.20
DP2	4.60
DP4	4.70

Note: ¹ Final depth of trial hole.

2.3.3 London Clay Formation

Soils described as the London Clay Formation were encountered in one out of the five trial holes and were inferred in each of the three dynamic probes from immediately underlying the River Terrace Deposits to the base of the investigation, 15.00m bgl.

The soils of the London Clay Formation were typically described as firm to stiff greenish grey silty sandy CLAY.

The depth of London Clay Formation has been included in Table 2.5.

Table 2.5 Final Depth of London Clay Formation

Trial Hole	Depth (m bgl)
BH1	15.00 ¹
TPSA1	Not encountered
WS1	Not encountered
WS2	Not encountered
WS4	Not encountered
DPI	6.00 ¹
DP2	6.00 ¹
DP4	6.00 ¹

Note: ¹ Final depth of trial hole.

2.4 Roots

Roots were encountered in four out of the five trial holes at depths ranging between 0.50 and 2.30m bgl with an average depth of 1.65m bgl. The depths of root penetration have been included in Table 2.6.

Table 2.6 Depth of Root Penetration

Trial Hole	Depth (m bgl)
BH1	None observed
TPSA1	0.50
WS1	1.70
WS2	2.30
WS4	2.10

Note:

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.

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

2.5 Groundwater

Groundwater was not encountered within any of the five trial holes, however it is possible that groundwater strikes within the cable percussive borehole were masked by the use of casing to support and advance the hole. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage.

The investigation was conducted in March 2021 when groundwater levels should be around their annual maximum (shallowest) elevation, which typically occurs around March before falling to the annual minimum (deepest) which typically occurs around September.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken in BH1. The results were interpreted based on the classifications outlined in Appendix B.1, Table B.1.1 to Table B.1.3.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig hammer 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 69%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The River Terrace Deposits recorded an SPT “N60” value of 26 within cohesive soils and between 38 and 41 within the granular soils. Classifying the cohesive soils as high strength with an inferred undrained cohesive strength of 130kPa. The granular soils were classified as dense relative density.

The London Clay Formation recorded SPT “N60” values between 25 and 38 within cohesive beds. The cohesive beds were classified as high to very high strength with an inferred undrained cohesive strength of between 125 and 190kPa, increasing with depth.

A full interpretation of the SPT results are outlined in Appendix B.2, Table B.2.1.

3.2 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at three locations adjacent and prior to the drilling of their respective windowless sampler boreholes to depths of 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.1.3.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig hammer 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 80.28%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The River Terrace Deposits recorded equivalent SPT “N60” values between 4 and 12 within cohesive beds and between 15 and >50 within the granular beds. Classifying the cohesive soils as low to medium strength and inferred undrained cohesive strength of 20kPa to 60kPa. The granular beds were classified as medium dense to very dense relative density.

The London Clay Formation recorded equivalent SPT “N60” values between 8 and 15

within cohesive beds. The cohesive beds were classified as medium strength with an inferred undrained cohesive strength of between 40 and 75kPa, increasing with depth.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.2.

3.3 Infiltration Tests

Infiltration testing was undertaken in TPSA1 within the River Terrace Deposits following the principles of BRE Digest 365 Soakaway design: 1991. BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test can only be ended once 75% of the water present has drained away.

A single test was attempted in TPSA1 however the test did not complete in the time available due to slow infiltration and therefore the test result was extrapolated, and the results outlined in Table 3.1.

Table 3.1 Infiltration Rates

Trial Hole	Test No.	Infiltration Rate (m/s)	Note
TPSA1	I	1.604×10^{-6}	Estimated based on extrapolating the measured data
Notes:			

3.4 Quick Unconsolidated Undrained Triaxial Compression Tests

Quick Unconsolidated Undrained Triaxial Compression Tests (QUU) were performed on three samples obtained from the London Clay Formation. The strength interpretation was based on the classification outlined in Table B.2.3.

Soils of the London Clay Formation were of a medium becoming very high strength with undrained cohesions of between 42kPa and 166kPa, the cohesive strength was noted to increase with depth.

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

3.5 Atterberg Limit Tests

Atterberg Limit tests were performed on four samples, three obtained from the cohesive parts of the River Terrace Deposits and the remaining one sample from the London Clay Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The cohesive soils of the River Terrace Deposits was classified as low to medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

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

A full interpretation of the Atterberg Limit tests are outlined in Table B.2.4, Appendix B.2 and the laboratory report in Appendix B.3.

3.6 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on four samples from the River Terrace Deposits.

The PSD tests classified the granular beds of the River Terrace Deposits as having no volume change potential in accordance with either BRE Digest 240 or with NHBC Standards Chapter 4.2.

A full interpretation of the PSD tests are outlined in Table B.2.5, Appendix B.2 and the laboratory report in Appendix B.3.

3.7 Sulphate and pH Tests

Two samples were taken from the River Terrace Deposits (WS2:1.30m bgl and WS4:2.20m bgl) and one from the London Clay Formation (BH1:9.00m bgl) for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The BRE SD1 tests carried out in the River Terrace Deposits recorded water soluble sulphate between 19mg/l and 28mg/l with pH values of 7.8 to 8.2.

The BRE SD1 test carried out in the London Clay Formation recorded water soluble sulphate of 270mg/l with a pH value of 8.1.

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

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 five trial holes from ground level to depths ranging between 0.30 and 0.60m bgl. The Made Ground typically comprised soft dark brown slightly sandy, cobbly CLAY. Gravel and cobbles were flint, brick, concrete fragments.

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 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in each of the five trial holes and were inferred in each of the three dynamic probes to be present from immediately underlying the base of the Made Ground and were present to depths ranging between 4.60 and 5.90m bgl.

The River Terrace Deposits typically comprised firm, orangish brown CLAY to between 1.00 and 1.60m bgl, overlying orangish brown sandy, clayey GRAVEL.

The River Terrace Deposits recorded an SPT "N60" value of 26 within cohesive soils and between 38 and 41 within the granular soils. Classifying the cohesive

soils as high strength with an inferred undrained cohesive strength of 130kPa. The granular soils were classified as dense.

The River Terrace Deposits recorded equivalent SPT “N60” values between 4 and 12 within cohesive beds and between 15 and >50 within the granular beds. Classifying the cohesive soils as low to medium strength and inferred undrained cohesive strength of 20kPa to 60kPa. The granular beds were classified as medium dense to very dense.

The River Terrace Deposits was classified as low to 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 River Terrace Deposits as having no volume change potential in accordance with either BRE Digest 240 or with NHBC Standards Chapter 4.2.

Soils of the River Terrace Deposits are normally consolidated, predominantly cohesive soils to between 1.00 and 1.60m bgl, overlying granular soils and as such are expected to display low to moderate bearing capacities with moderate settlement characteristics. The soils of the River Terrace Deposits were considered suitable for the proposed development providing that adequate bearing and settlement characteristics could be proven.

4.1.3 London Clay Formation

Soils described as the London Clay Formation were encountered in one out of the five trial holes and were inferred in each of the three dynamic probes from immediately underlying the River Terrace Deposits to the base of the investigation, 15.00m bgl. The soils of the London Clay Formation were typically described as firm to stiff greenish grey silty sandy CLAY.

The London Clay Formation recorded SPT “N60” values between 25 and 38 within cohesive beds. The cohesive beds were classified as high to very high strength with an inferred undrained cohesive strength of between 125 and 190kPa, increasing with depth

The London Clay Formation recorded equivalent SPT “N60” values between 8 and 15 within cohesive beds. The cohesive beds were classified as medium strength with an inferred undrained cohesive strength of between 40 and 75kPa, increasing with depth.

Soils of the London Clay Formation were of a medium becoming very high strength with undrained cohesions of between 42kPa and 166kPa, cohesive strength was noted to increase with depth.

The London Clay Formation was classified as medium volume change potential in

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

The soils of the London Clay Formation are heavily overconsolidated, predominantly cohesive soils and were anticipated to provide moderate bearing and settlement characteristics. The soils of the London Clay Formation were considered to be a suitable bearing stratum providing that a deep piled foundation solution was adopted.

4.1.4 Roots

Roots were encountered in four out of the five trial holes at depths ranging between 0.50 and 2.30m bgl with an average depth of 1.65m 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.

4.1.5 Groundwater

Groundwater was not encountered within any of the five trial holes, however it is possible that groundwater strikes within the cable percussive borehole were masked by the use of casing to support and advance the hole. Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in March 2021 when groundwater levels should be around their annual maximum (shallowest) elevation, which typically occurs around March before falling to the annual minimum (deepest) which typically occurs around September.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells

4.2 Foundation Scheme General

The proposal comprised demolition of the existing building and the erection of a 3 storey building comprising residential apartments sitting above commercial units. No private or public soft landscaped areas were proposed. Hard landscaped car parking and access roads were proposed across the south of the site.

In compiling this report reliance was placed on the drawings included in Appendix E. 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 E.

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 River Terrace Deposits had **low to 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 cohesive parts of the River Terrace Deposits and or into the underlying London Clay Formation.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis 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 or 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 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 0.50 and 2.30m bgl with an average depth of 1.65m 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.

4.3.1 Shallow Foundations into the granular River Terrace Deposits

Based on a 5.00 by 1.00m strip foundation, using commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. The average depth of root penetration was 1.65m bgl and the granular River Terrace Deposits were not consistently present until below 1.60m bgl therefore bearing capacities were calculated from 300mm below this depth.

Table 4.1 Allowable Bearing Capacities within the granular River Terrace Deposits

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
2.00	5.00 x 1.00	130	<25
2.50		140	<25

Note:

The use of reinforced trench fill foundations would simplify construction and reduce the possibility of differential settlement affecting the foundations.

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

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

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

halved the anticipated settlement will halve.

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

If adopted the piled foundations must be taken through any Made Ground and River Terrace Deposits into suitable strength soils of the London Clay Formation.

The construction of a piled foundation is a specialist job with the actual pile working load depending on the particular type pile and installation method. Prior to finalising the foundation design the advice from a reputable contractor who is familiar with the ground and groundwater conditions present at the site should be sought.

The load capacities are provided for varying diameters and lengths of bored piles taken into the London Clay Formation, based on SPT "N60" values and must only be used for preliminary design purposes. A factor of safety of three was applied to both the shaft and base and depicted by the design line outlined in Appendix C.1.

An N_c value of 9 and an α value of 0.45 was adopted for the purposes of the preliminary design.

The bearing values given in Appendix C.1., are applicable to single piles. Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

From ground level the upper 5m of the pile shaft has been ignored in the preliminary pile design given.

To prevent necking of the green concrete, temporary casing may be required where the pile passes through the Made Ground or Cohesive River Terrace Deposits and below the groundwater table (if encountered). To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

No allowance has been made for negative skin friction that could be generated where piles pass through Made Ground deposits underlying the site. The negative skin friction must be applied to the pile working load and must not be factored.

4.3.3 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 root penetrated, medium volume change cohesive River Terrace Deposits underlying the Made Ground, which was present to a maximum depth of 0.60m bgl, it is recommended that suspended floor slabs are adopted.

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-1s**. The pH of the soils tested ranged between 7.8 and 8.2. The classification given was determined using the static groundwater case, in the view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, *‘Concrete in Aggressive Ground’* taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.5 Excavations

Shallow excavations in the Made Ground and River Terrace Deposits are likely to be marginally stable in the short term at best.

Deeper excavations taken into the River Terrace Deposits are likely to become unstable in the short term. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose before excavations are entered by personnel.

Excavations beneath the groundwater table are likely to be unstable and dewatering of

foundation trenches may be necessary.

4.6 Soakaways

The Trial Pit Soakage test carried out in TPSA1 did not complete in the time available due to slow infiltration and the extrapolated rate was 1.604×10^{-6} m/sec and therefore it is considered that alternative means of surface water disposal should be considered.

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: 19192/PIR dated May 2021) identified no risk of ground contamination from previous usage of the site or offsite sources.

The Main Investigation Report identified Made Ground to depths of up to 0.60m bgl and “organic / hydrocarbon” type odours were recorded during detailed logging within the River Terrace Deposits. The preliminary conceptual site model was updated to take these sources into account.

5.2 Soil Sampling

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

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

A targeted sampling strategy is appropriate when there is:

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

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

Table 5.1 Sampling Strategy

Sample	Strategy	Proposed Use
WS1:0.20	Targeted: Made Ground	Under proposed building
WS1:0.40	Targeted: Made Ground	
WS1:0.80	Targeted: Natural material	
WS2:0.40	Targeted: Natural material	Under proposed access road
WS2:3.30	Targeted: strong organic odour within natural material.	
WS4:0.70	Targeted: Natural material	Under proposed parking and amenity space.
WS4:1.20	Targeted: Natural material	
Note:		

5.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Preliminary Investigation Report and Main Investigation Report intrusive investigation.

Table 5.2 outlines the specification for each sample tested.

Table 5.2 Chemical Analysis Specification

Substance	Locations:Depths (m bgl)						
	WS1:0.20^s	WS1:0.40^s	WS1:0.80^s	WS2:0.40^s	WS2:3.30^s	WS4:0.70^s	WS4:1.20^s
Asbestos Screen	✓	✓	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓	✓	✓
pH	✓	✓	✓	✓	✓	✓	✓
Metals	✓	✓	✓	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓	✓	✓	✓
Organics	✓	✓	✓	✓	✓	✓	✓
PAHs	✓	✓	✓	✓	✓	✓	✓
TPH-CWG	✓	✓	✓	✓	✓	✓	✓
BTEX	✓	✓	✓	✓	✓	✓	✓

Notes: **Metals:** Cd, Cr, Pb, Hg, Ni, Se, Cu, Zn, Bo, V. **metalloids:** As. **organics:** USEPA 16 speciated PAH, TPH-CWG (speciated TPH), BTEX, VOC/SVOC **Asbestos screening** was undertaken in accordance with HSG 248. ^s = Soil sample. ^w = Water sample. ^L = Leachate.

Section 6 Qualitative Risk Assessment

6.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix D.3.

6.2 Representative Contamination Criteria - Soil

The proposal comprised demolition of the existing building and the erection of a 3 storey building comprising residential apartments sitting above commercial units. No private or public soft landscaped areas were proposed. Hard landscaped car parking and access roads were proposed across the south of the site.

In compiling this report reliance was placed on the drawings included in Appendix E. 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 'Commercial' 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 <0.1% and 1.3%. 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 determinants analysed.

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

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'Commercial' land-use scenario
None	
Asbestos locations where material found (no threshold just presence)	
None	

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

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for, Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed, SOM values of between <0.1% and 1.3%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

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

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

6.2.1 Asbestos

Whilst asbestos containing material was not identified in 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 production of a groundwater risk assessment was outside of the scope of this investigation, furthermore no groundwater was encountered during the course of the investigation.

6.4 Tier I Quantitative Risk Assessment

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

6.4.1 Soils

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

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

6.4.2 Groundwater

The production of a groundwater risk assessment was outside of the scope of this investigation, however it should be noted that no groundwater was encountered during the course of the investigation, which was carried in March when

groundwater levels should be at their highest elevation.

6.4.3 Soil Gas

The Preliminary Investigation Report identified no risk of soil gas from offsite sources and the intrusive investigation did not identify any significant sources of soil gas. Therefore, it is considered that there is no risk to the end user from soil gas.

6.5 Remedial Objective

The Tier 1 Quantitative Risk Assessment identified no risk to the human health receptor and therefore there is no remedial objective and no requirement for a remediation method statement, remedial works or subsequent validation works.

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	29
Figure 2 – Aerial Photograph	30
Figure 3 – Trial Hole Plan	31

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 Foundation Design

Appendix C.1 Preliminary Pile Design

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Appendix D.2 Chemical Laboratory Results

Appendix D.3 General Assessment Criteria

Appendix E Information Provided by the Client

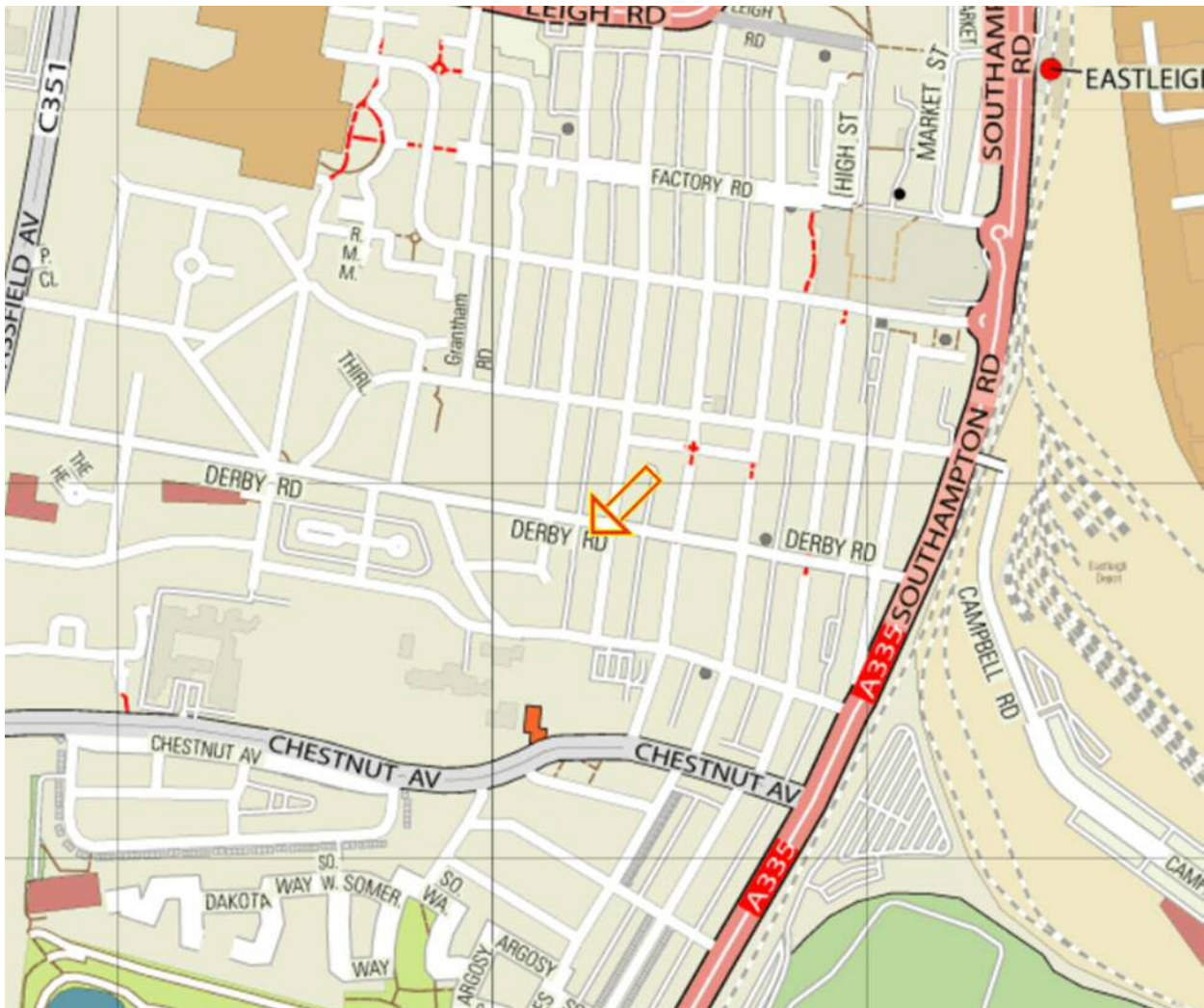


Figure I – Site Location Map

Job Number

19192

Project

Samsons Gym, 237 Chamberlayne Road, Eastleigh,
Hampshire, SO50 5JB

Client

Eastleigh Borough Council

Date

May 2021



Figure 2 – Aerial Photograph

Project

Samsons Gym, 237 Chamberlayne
Road, Eastleigh, Hampshire, SO50
5JB

Client

Eastleigh Borough Council

Date

May 2021

Job Number

19192

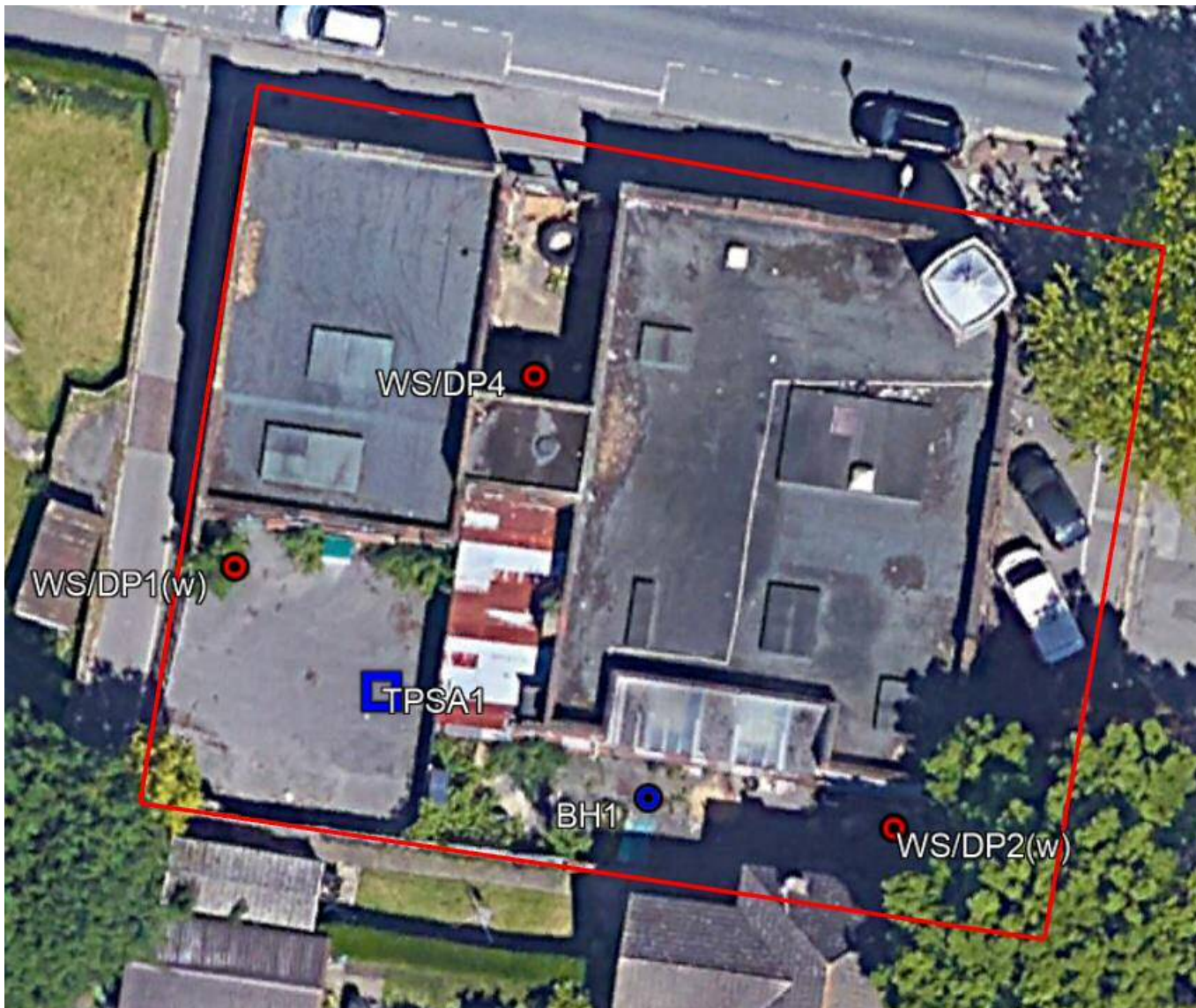


Figure 3 – Trial Hole Plan

Project

Samsons Gym, 237 Chamberlayne Road, Eastleigh, Hampshire, SO50 5JB

Client

Eastleigh Borough Council

Date

May 2021

Job Number

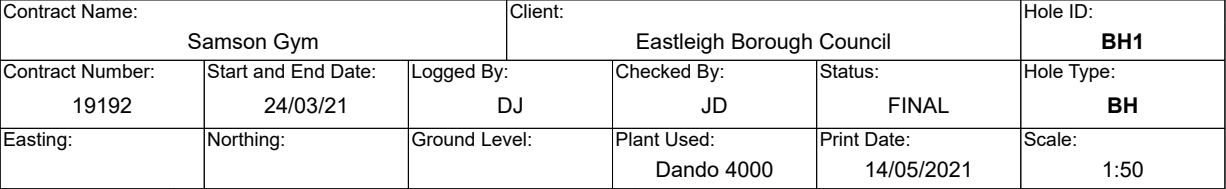
19192



Appendix A Field Work

Appendix A.1 Engineers Logs

				Contract Name: Samson Gym				Client: Eastleigh Borough Council				Hole ID: BH1			
				Contract Number: 19192		Start and End Date: 24/03/21		Logged By: DJ		Checked By: JD		Status: FINAL		Hole Type: BH	
				Easting:		Northing:		Ground Level:		Plant Used: Dando 4000		Print Date: 14/05/2021		Scale: 1:50	
Weather:				Termination:				SPT Hammer: N/R, Energy Ratio: N/R				Sheet 1 of 2			
Samples & In Situ Testing				Strata Details								Groundwater			
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation		
0.25	D			0.05		Tarmac. MADE GROUND									
0.50 - 0.70	B			0.30		Soft, orangish brown silty sandy CLAY. Sand is fine. Rare angular fine gravels of chalk. MADE GROUND									
				(0.30)		Firm yellow brown clay and chalk fill. MADE GROUND.									
				0.60		Firm orange brown silty CLAY. RIVER TERRACE DEPOSITS									
1.00	D			(0.85)								1			
1.20 - 1.60	U														
1.60 - 2.10	D			1.45		Firm brown slightly sandy gravelly CLAY. Sand is fine, Gravel is angular fine to coarse flint. RIVER TERRACE DEPOSITS									
2.10	SPT B	N=23 (6,9/6,5,5,7)		(1.45)								2			
3.00	SPT B	N=34 (7,9/7,8,9,10)		2.90		Orangish brown sandy GRAVEL. Gravel is angular to rounded fine to coarse flint. RIVER TERRACE DEPOSITS						3			
4.00	SPT B	N=33 (7,9/8,7,8,10)		(3.00)								4			
5.00	SPT B	N=36 (5,6/8,9,10,9)										5			
5.90 - 6.40	B			5.90		Firm stiff greenish grey silty sandy CLAY. Partially laminated pockets of clay. Becoming increasingly sandy with depth. LONDON CLAY FORMATION						6			
6.50	SPT D	N=22 (2,2/4,5,5,8)										7			
7.50	D														
8.00	SPT D	N=23 (2,3/4,6,6,7)		(5.40)								8			
9.00	D											9			
9.50 - 9.90	U														
9.90	D											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)	
24-03-2021	15:00	15.00	11.50	14.80											
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.															



Weather:	Termination:	SPT Hammer: N/R, Energy Ratio: N/R	Sheet 2 of 2
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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				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.					

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk			Trial Pit Log		Trial Pit No. TPSA1 Sheet 1 of 1	
Project Name: Samson Gym				Project No.: 19192		Method: Machine Excavated		Hole Type TP
Location: Eastleigh						Plant: JCB		
Client: Eastleigh Borough Council				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 22/03/2021				Level:		Co-ords:		Logged By CF
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
				0.05			Tarmac. MADE GROUND	
				0.10			Pinkish grey fine to medium limestone GRAVEL. MADE GROUND.	
	0.30	D					Dark brown slightly sandy cobbley gravelly CLAY. Gravel is angular to sub rounded, fine to coarse, flint, brick, concrete and breeze block. Cobble is angular to sub rounded, breeze block and concrete. Occasional rootlets. MADE GROUND	
	0.60	D		0.50			Dark orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse flint. RIVER TERRACE DEPOSITS	
	0.90	D						
	1.50	D		1.60			End of Pit at 1.600m	
General Remarks:								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks: No groundwater encountered								

	Contract Name: Samson Gym				Client: Eastleigh Borough Council				Hole ID: WS1					
	Contract Number: 19192		Start and End Date: 23/03/21		Logged By: CF		Checked By: JD		Status: FINAL		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Archway		Print Date: 14/05/2021		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	
0.20	D			0.10		Tarmac. MADE GROUND						1		
ES				0.35		Red angular to sub rounded, fine to coarse, brick GRAVEL. MADE GROUND.								
D				0.50		Soft, dark greyish brown slightly sandy, slightly gravelly CLAY. Gravel is sub angular to sub rounded, fine, flint and occasional brick. Frequent black staining. MADE GROUND.								
ES				(0.50)		Soft orangish brown slightly sandy, slightly gravelly CLAY. Gravel is sub angular to sub rounded, fine to medium, flint. Occasional rootlets. RIVER TERRACE DEPOSITS								
0.80	D			1.00		Orangish brown slightly sandy, very clayey GRAVEL. Gravel is sub angular to sub rounded fine to coarse flint. Occasional rootlets. RIVER TERRACE DEPOSITS								
ES				(0.70)										
1.30	D			1.70		Yellowish brown slightly clayey, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse, flint. RIVER TERRACE DEPOSITS								
ES				(2.30)										
1.80	D			2.70										
D				3.20										
2.20	D	3.70												
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)						
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
					0.00	1.00	PLAIN	50				0	0.00	No groundwater encountered
					1.00	3.70	SLOTTED	50						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

				Contract Name: Samson Gym				Client: Eastleigh Borough Council				Hole ID: WS2				
				Contract Number: 19192		Start and End Date: 23/03/21		Logged By: CF		Checked By: JD		Status: FINAL		Hole Type: WS		
				Easting:		Northing:		Ground Level:		Plant Used: Archway		Print Date: 14/05/2021		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		
0.40	D ES			0.10		Tarmac. MADE GROUND										
				0.30		Red angular to sub rounded, fine to coarse, brick GRAVEL. MADE GROUND.										
0.80	D ES			(1.30)		Soft to firm, orangish brown slightly sandy, slightly gravelly CLAY. Gravel is sub angular to sub rounded, fine to medium, flint. Occasional rootlets. RIVER TERRACE DEPOSITS							1			
1.30	D ES															
1.70	D ES			1.60		Orangish brown slightly sandy, very clayey GRAVEL. Gravel is sub angular to sub rounded, fine to coarse flint, Occasional rootlets. Strong organic odour. RIVER TERRACE DEPOSITS							2			
2.30	D ES			(0.70)												
2.70	D ES			2.30		Yellowish brown slightly clayey, sandy, sub angular to sub rounded, fine to coarse, flint GRAVEL. Strong organic odour. RIVER TERRACE DEPOSITS							3			
3.30	D ES			(1.70)												
3.70	D ES			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)								
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		
					0.00	1.00	PLAIN	50				0	0.00	No groundwater encountered		
					1.00	3.90	SLOTTED	50								
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.																

	Contract Name: Samson Gym				Client: Eastleigh Borough Council				Hole ID: WS4					
	Contract Number: 19192		Start and End Date: 23/03/21		Logged By: CF		Checked By: JD		Status: FINAL		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Archway		Print Date: 14/05/2021		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	
0.40	D ES			0.20		Concrete slab. MADE GROUND								
				(0.30)		Loosely cemented CONCRETE. MADE GROUND.								
0.70	D ES			0.50		Soft to firm, orangish brown slightly sandy, slightly gravelly CLAY. Gravel is sub angular to sub rounded, fine to medium, flint. Occasional rootlets. RIVER TERRACE DEPOSITS						1		
1.20	D ES			(0.90)										
1.70	D ES			1.40		Orangish brown slightly sandy, very clayey, GRAVEL. Gravel is sub angular to sub rounded, fine to coarse flint. Occasional rootlets. RIVER TERRACE DEPOSITS						2		
2.20	D			(0.70)										
2.70	D			2.10		Yellowish brown slightly clayey, sandy, sub angular to sub rounded, fine to coarse, flint GRAVEL. Slight organic odour. RIVER TERRACE DEPOSITS						3		
3.20	D ES			(1.90)										
3.70	D ES			4.00								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)						
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
					0.00	1.00	PLAIN	50				0	0.00	No groundwater encountered
					1.00	3.80	SLOTTED	50						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT “N” values:

The inferred undrained strength of the cohesive soils was based on the SPT “N” blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, “The Standard Penetration Test – its application and interpretation”, Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT “N” Blow Count Cohesive Classification

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

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

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

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

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

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

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

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

Chalk'. In the absence of a standardised correlation between SPT "N" values and chalk grade for the most recent chalk classification (CIRIA C574) a broad indication of the in-situ chalk grade can be assessed using a paper by T.R.M. Wakeling from a site in Mundford, Norfolk, which compares SPT "N" values to the old Spink & Norbury chalk classification. From the Spink & Norbury classification it is possible to infer a basic CIRIA Grade (structureless or structured), as outlined in Table B.1.3.

Table B.1.3 Interpretation of SPT "N" Blow Counts in Chalk

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

Note:

Appendix B.2 Interpretation

Table B.2.1 Interpretation of SPT Tests

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
BHI	RTD 0.60 – 2.90 CLAY	26	High (Cu = 130kPa)
	RTD 2.90 – 5.90 GRAVEL	38 – 41	Dense
	LCF 5.90 – 15.00 CLAY	25 – 38	High to very high (Cu = 125 – 190kPa)

Note:

Table B.2.2 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DPI	RTD 0.65 – 1.10 CLAY	4 – 8	Low (Cu = 20 – 40kPa)
	RTD 1.10 – 3.10 GRAVEL	19 – 35	Medium dense to dense
	RTD ¹ 3.10 – 5.20 GRAVEL	39 – >50	Dense to very dense
	LCF ¹ 5.20 – 6.00 CLAY	8 – 15	Medium (Cu = 40 – 75kPa)
DP2	RTD 0.50 – 1.50 CLAY	4 – 8	Low (Cu = 20 – 40kPa)
	RTD 1.50 – 2.10 SAND	15 – 23	Medium dense
	RTD 2.10 – 3.40 GRAVEL	23 – 50	Medium dense to dense
	RTD 3.40 – 3.70 CLAY	4 – 8	Low (Cu = 20 – 40kPa)
	RTD ¹ 3.70 – 4.60 GRAVEL	27 – 42	Medium dense to dense

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP4	LCF ¹ 4.60 – 6.00 CLAY	8 – 15	Medium (Cu = 40 – 75kPa)
	RTD 0.60 – 1.50 CLAY	4 – 8	Low (Cu = 20 – 40kPa)
	RTD 1.50 – 2.10 SAND	15 – 19	Medium dense
	RTD 2.10 – 3.40 GRAVEL	27 – 46	Medium dense to dense
	RTD 3.40 – 3.70 CLAY	4 – 12	Low to medium (Cu = 20 – 60kPa)
	RTD ¹ 3.70 – 4.70 GRAVEL	27 – 42	Medium dense to dense
	LCF ¹ 4.70 – 6.00 CLAY	8 – 12	Medium (Cu = 40 – 60kPa)

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

Table B.2.3 Interpretation of QUU Tests

Location	Stratum	Sample Depth (m bgl)	Moisture Content (%)	Soil Strength	Shear Strength (kPa)
BHI	LCF	9.50 – 9.95	24	Medium	42
BHI	LCF	12.50 – 12.85	26	High	125
BHI	LCF	14.00 – 14.35	23	Very high	166

Note:

Table B.2.4 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
RTD	15 – 22	21 – 24	72 – 100	17 – 23	CI	Low to medium	Low to medium
LCF	29	35	100	35	CH	Medium	Medium

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.2.5 Interpretation of PSD Tests

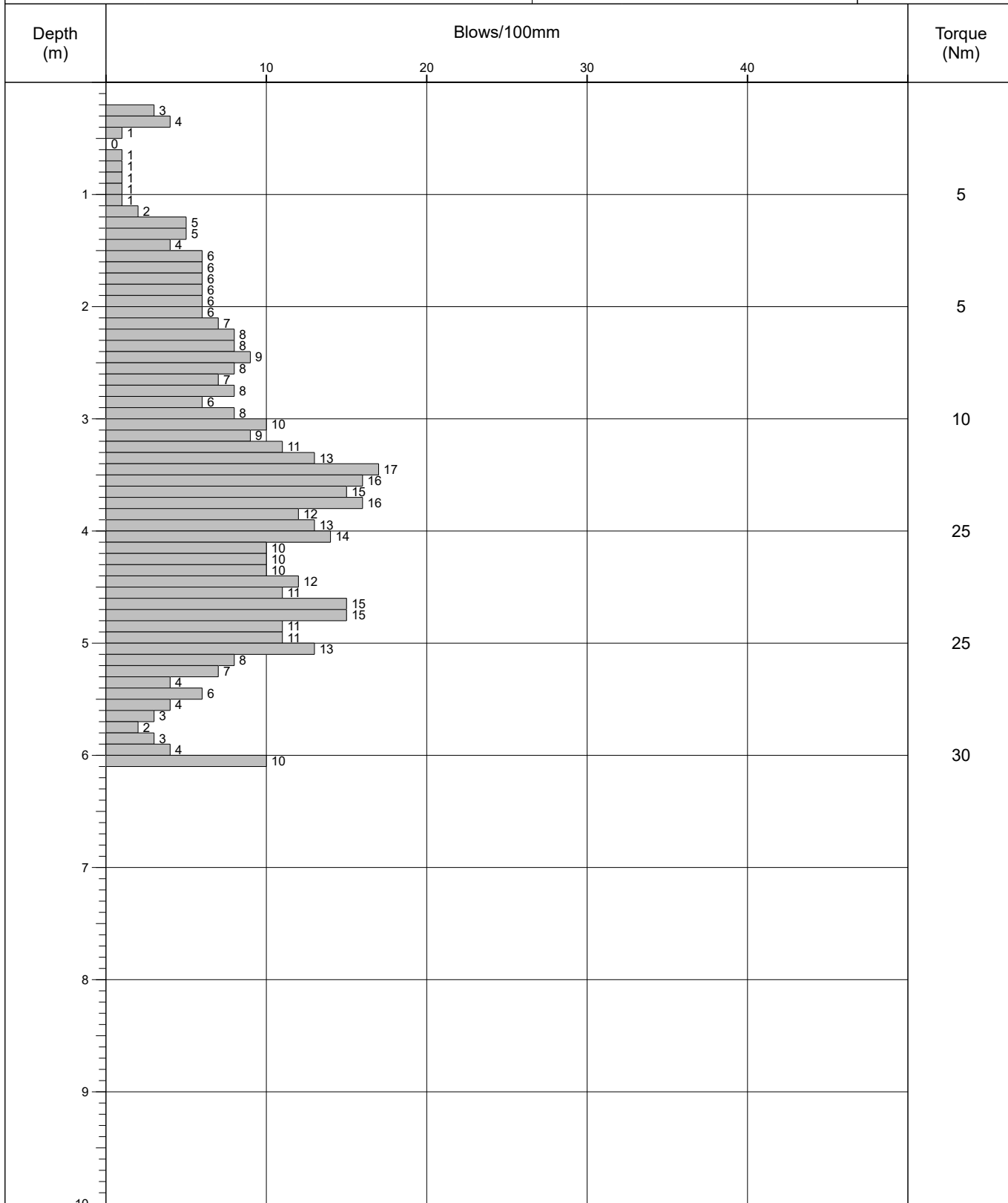
Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS1	1.30	Dark brown clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	13
WS2	2.30	Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	6
WS4	1.70	Dark brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	9
BH1	3.00	Light brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	8

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

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

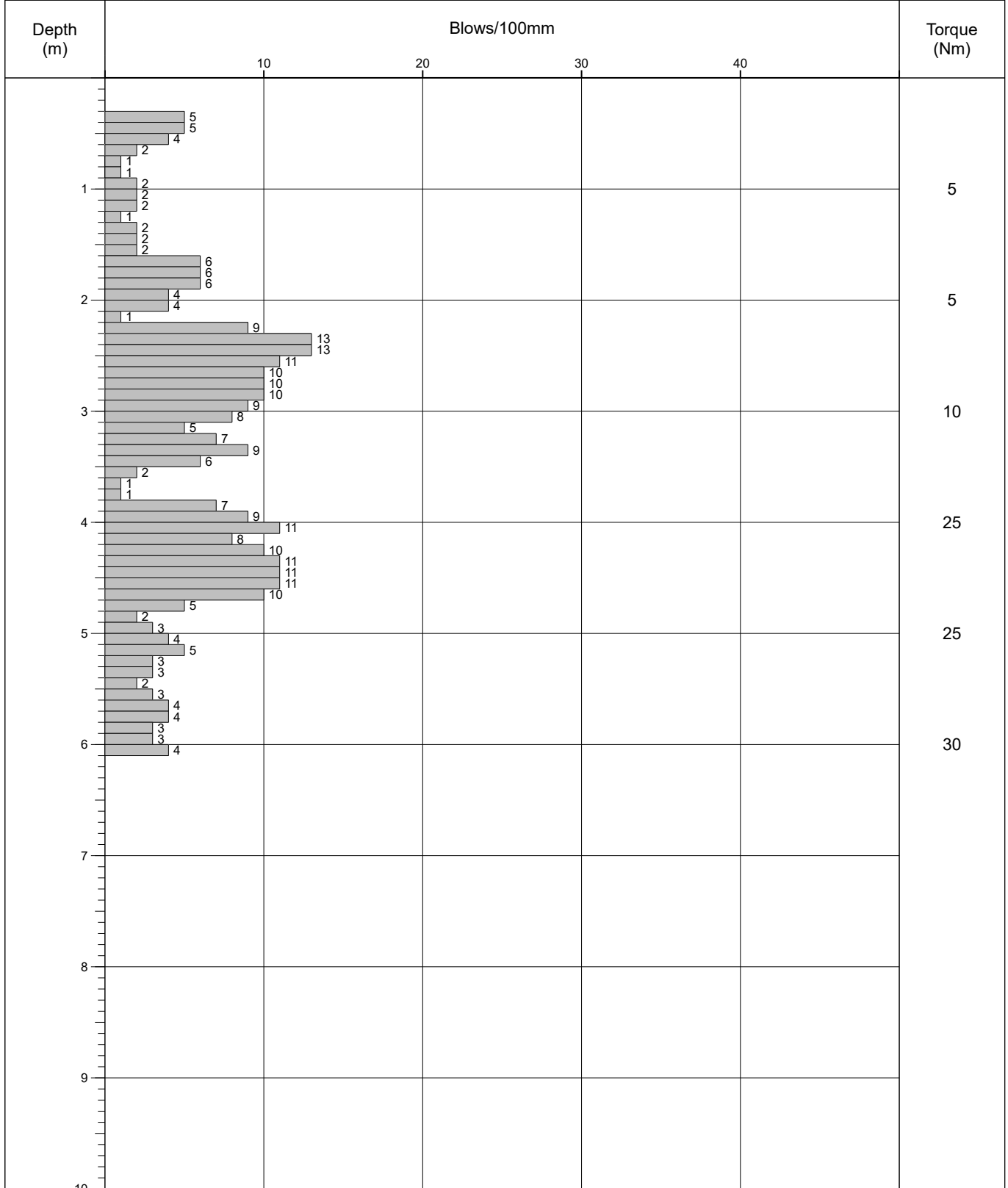
Appendix B.3 Geotechnical In-Situ and Laboratory Results

Project Name:	Samson Gym	Project No.	19192	Co-ords:		Hole Type	DP
Location:	Eastleigh	Level:	m AOD	Scale	1:50	Logged By	CF
Client:	Eastleigh Borough Council	Dates:	23/03/2021				



Remarks	Fall Height	760mm	Cone Base Diameter	5.3mm	
	Hammer Weight	63.5kg	Final Depth	6m	
	Probe Type		Energy Ratio (Er)	80.28%	

Project Name:	Samson Gym	Project No.	19192	Co-ords:		Hole Type	DP
Location:	Eastleigh	Level:	m AOD			Scale	1:50
Client:	Eastleigh Borough Council	Dates:	23/03/2021			Logged By	CF



Remarks	Fall Height	760mm	Cone Base Diameter	5.3mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type		Energy Ratio (Er)	80.28%

Project Name:	Samson Gym	Project No.	19192	Co-ords:		Hole Type	DP
Location:	Eastleigh	Level:	m AOD			Scale	1:50
Client:	Eastleigh Borough Council	Dates:	23/03/2021			Logged By	CF

Depth (m)	Blows/100mm					Torque (Nm)
	10	20	30	40		
0.0	4					5
0.1	4					
0.2	5					
0.3	3					
0.4	2					
0.5	1					
0.6	1					
0.7	2					
0.8	2					
0.9	1					
1.0	1					
1.1	2					
1.2	5					
1.3	6					
1.4	5					
1.5	5					
1.6	4					
1.7	3					
1.8	7					
1.9	10					
2.0	12					
2.1	12					
2.2	10					
2.3	9					
2.4	10					
2.5	9					
2.6	7					
2.7	6					
2.8	7					
2.9	9					
3.0	7					
3.1	3					
3.2	2					
3.3	1					
3.4	6					
3.5	7					
3.6	10					
3.7	9					
3.8	8					
3.9	12					
4.0	11					
4.1	10					
4.2	11					
4.3	8					
4.4	2					
4.5	3					
4.6	3					
4.7	4					
4.8	4					
4.9	3					
5.0	3					
5.1	2					
5.2	3					
5.3	4					
5.4	4					
5.5	4					
5.6	4					
5.7	3					
5.8						
5.9						
6.0						
6.1						
6.2						
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6.6						
6.7						
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8.1						
8.2						
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8.4						
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8.6						
8.7						
8.8						
8.9						
9.0						
9.1						
9.2						
9.3						
9.4						
9.5						
9.6						
9.7						
9.8						
9.9						
10.0						

Remarks	Fall Height	760mm	Cone Base Diameter	5.3mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type		Energy Ratio (Er)	%

Soakaway Calculations

Soakaway Test No.	TPSA1 Test 1
Contract:	Samsons Gym
Contract No.	19192

Field Test

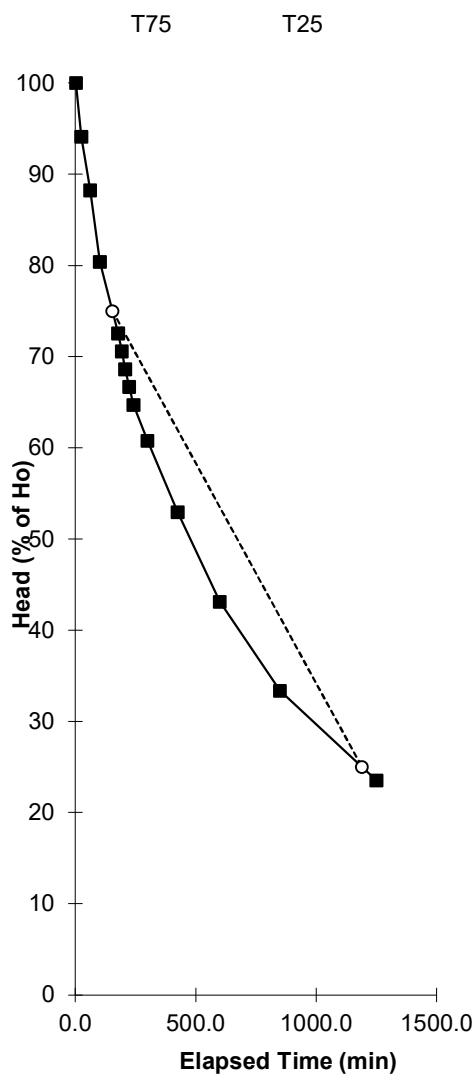
Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.57 m
Width of Pit	0.45 m
Length of Pit	1.20 m
Depth of Pit Soaked	0.51 m
ap50	1.3815 m2
Vp75-25	0.1377 m3
t75-25	1035.5 min
water used	0.2754 m3
f	1.604E-06 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
1.06	0	100	0.51
1.06	2.4	100	0.51
1.09	24.7	94	0.48
1.12	61.8	88	0.45
1.16	102.1	80	0.41
1.20	178.2	73	0.37
1.21	193.0	71	0.36
1.22	206.7	69	0.35
1.23	223.5	67	0.34
1.24	241.2	65	0.33
1.26	300.0	61	0.31
1.30	425.0	53	0.27
1.35	600.0	43	0.22
1.40	850.0	33	0.17
1.45	1250.0	24	0.12
T75	154.458	75	
T25	1190.000	25	
T75-25	1035.542	Derived from Best Fit	



Comments

extrapolated after 241.2 minutes.

SOILS LIMITED

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

Telephone: 01737 814 221

Facsimile: 01737 812 557



Contract Number: 53405

Client Ref: **19192**

Report Date: **26-04-2021**

Client PO:

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

Contract Title: **19192 - Samsons Gym**
For the attention of: **Tom Rees-Blanchard**

Date Received: **15-04-2021**

Date Completed: **26-04-2021**

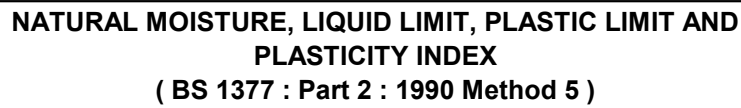
Test Description	Qty
Samples Received - @ Non Accredited Test	11
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	4
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	4
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	4
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) BS 1377:1990 - Part 7 : 8 - * UKAS	3
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)



53405

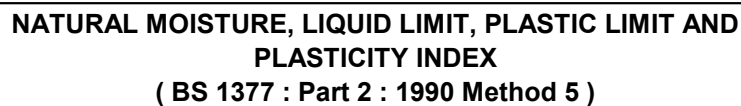
19192 - Samsons Gym

23/04/2021

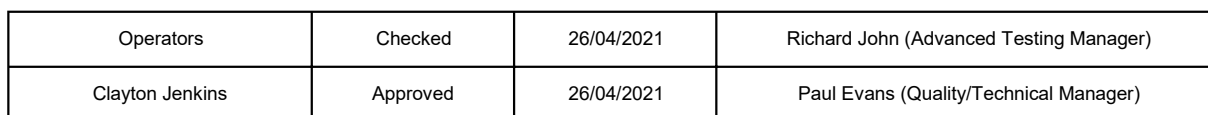
DESCRIPTIONS

Operators	Checked	26/04/2021	Richard John (Advanced Testing Manager)
Clayton Jenkins	Approved	26/04/2021	Paul Evans (Quality/Technical Manager)



[illegible]

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





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

Contract Number **53405**

Borehole/Pit No. **WS1**

Site Name **19192 - Samsons Gym**

Sample No.

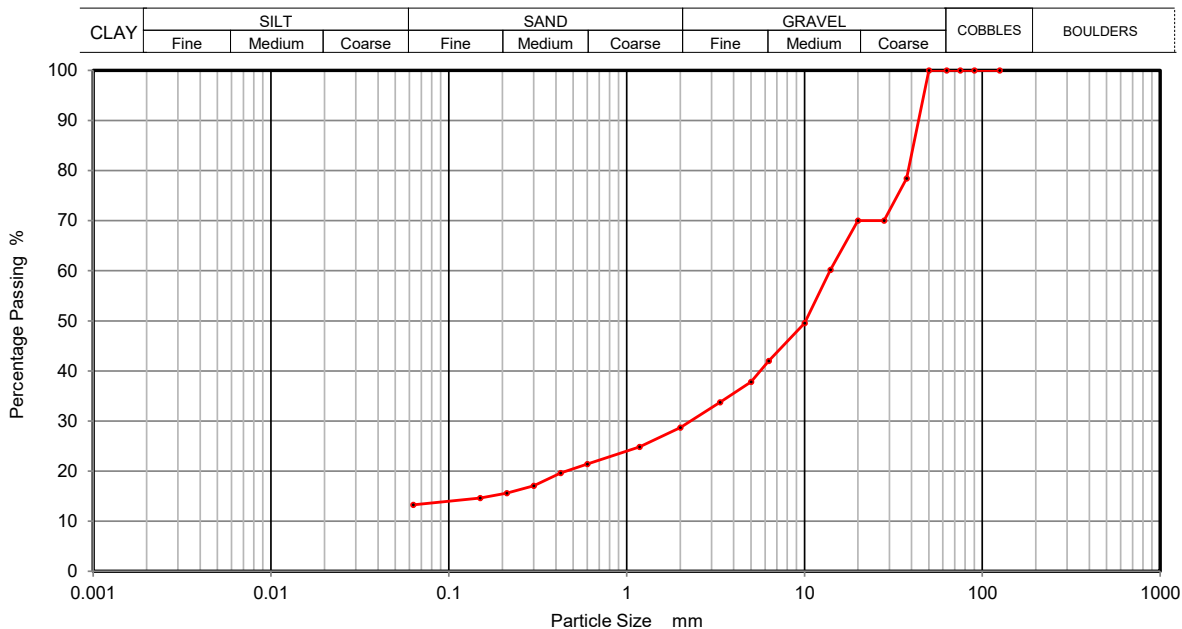
Soil Description **Dark brown clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **1.30**

Depth Base

Date Tested **23/04/2021**

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	78		
28	70		
20	70		
14	60		
10	50		
6.3	42		
5	38		
3.35	34		
2	29		
1.18	25		
0.6	21		
0.425	20		
0.3	17		
0.212	16		
0.15	15		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	16
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	25/04/2021	Richard John	
David	Approved	26/04/2021	Paul Evans	





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

Contract Number **53405**

Borehole/Pit No. **WS2**

Site Name **19192 - Samsons Gym**

Sample No.

Soil Description

Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL

Depth Top

2.30

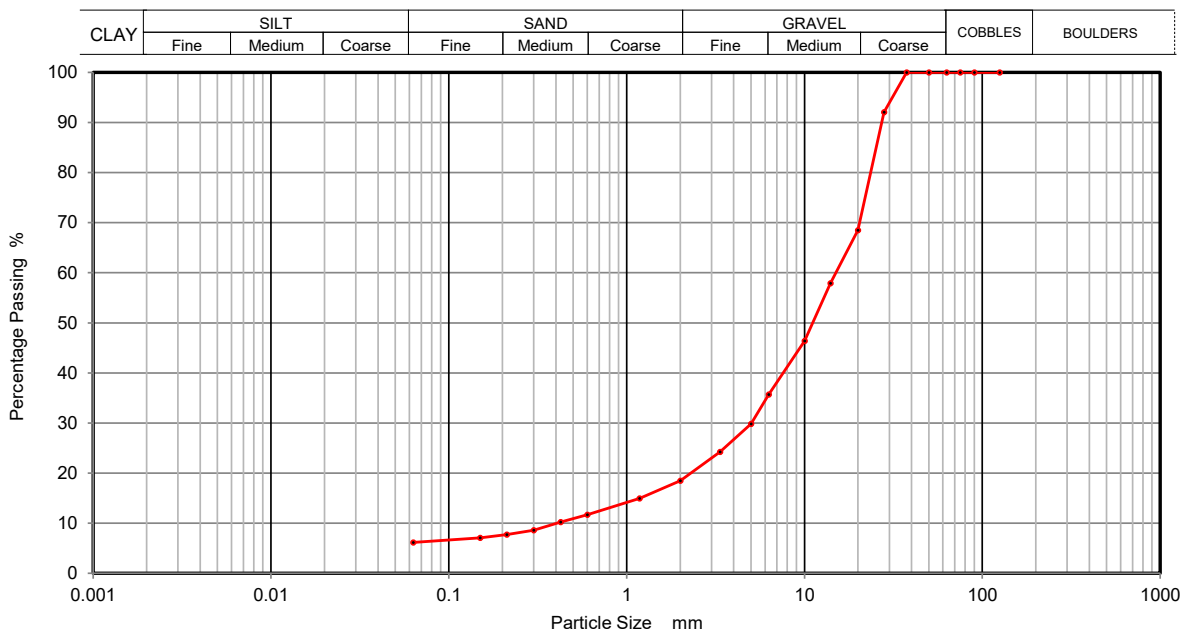
Depth Base

Date Tested

23/04/2021

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	92		
20	68		
14	58		
10	46		
6.3	36		
5	30		
3.35	24		
2	18		
1.18	15		
0.6	12		
0.425	10		
0.3	9		
0.212	8		
0.15	7		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	12
Silt and Clay	6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	25/04/2021	Richard John	
David	Approved	26/04/2021	Paul Evans	





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

Contract Number **53405**

Borehole/Pit No. **WS4**

Site Name **19192 - Samsons Gym**

Sample No.

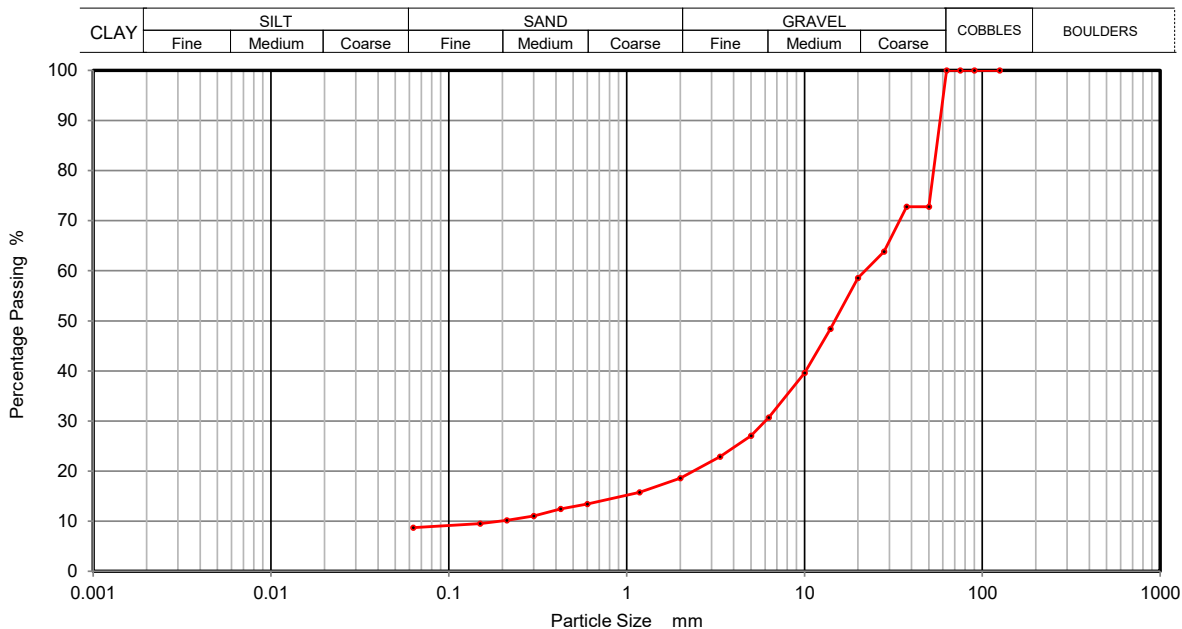
Soil Description **Dark brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **1.70**

Depth Base

Date Tested **23/04/2021**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	73		
37.5	73		
28	64		
20	59		
14	48		
10	40		
6.3	31		
5	27		
3.35	23		
2	19		
1.18	16		
0.6	13		
0.425	12		
0.3	11		
0.212	10		
0.15	10		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	81
Sand	10
Silt and Clay	9

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	25/04/2021	Richard John	
David	Approved	26/04/2021	Paul Evans	





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

Contract Number **53405**

Borehole/Pit No. **BH1**

Site Name **19192 - Samsons Gym**

Sample No.

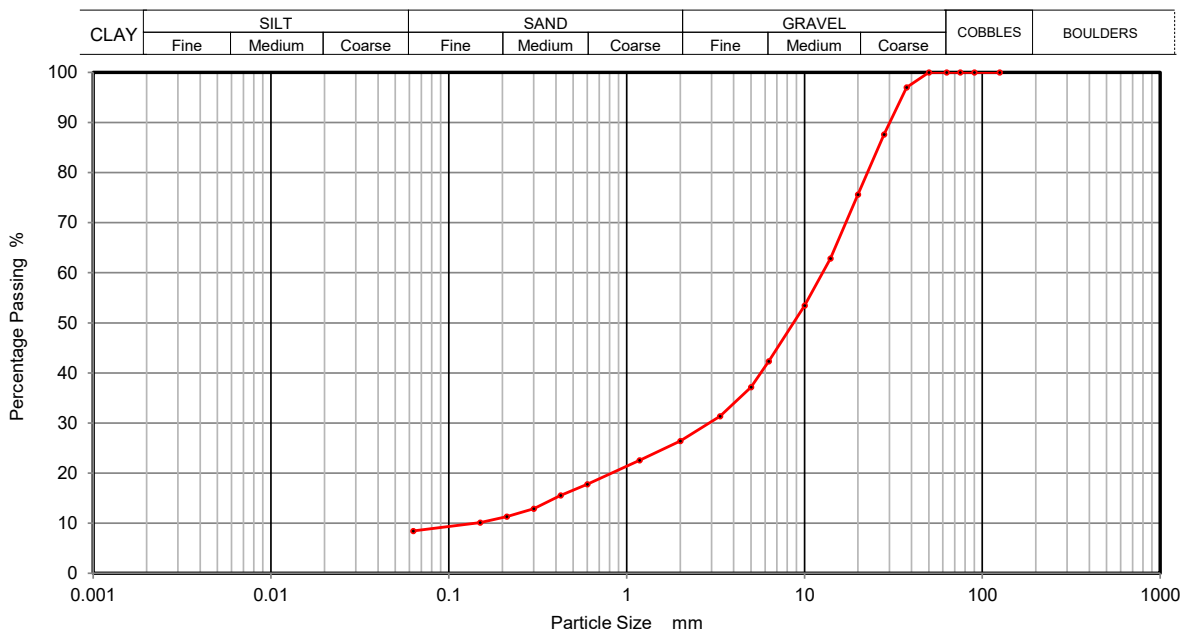
Soil Description **Light brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **3.00**

Depth Base

Date Tested **23/04/2021**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	88		
20	76		
14	63		
10	53		
6.3	42		
5	37		
3.35	31		
2	26		
1.18	23		
0.6	18		
0.425	16		
0.3	13		
0.212	11		
0.15	10		
0.063	8		

Sample Proportions	% dry mass
Cobbles	0
Gravel	74
Sand	18
Silt and Clay	8

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	25/04/2021	Richard John	
David	Approved	26/04/2021	Paul Evans	

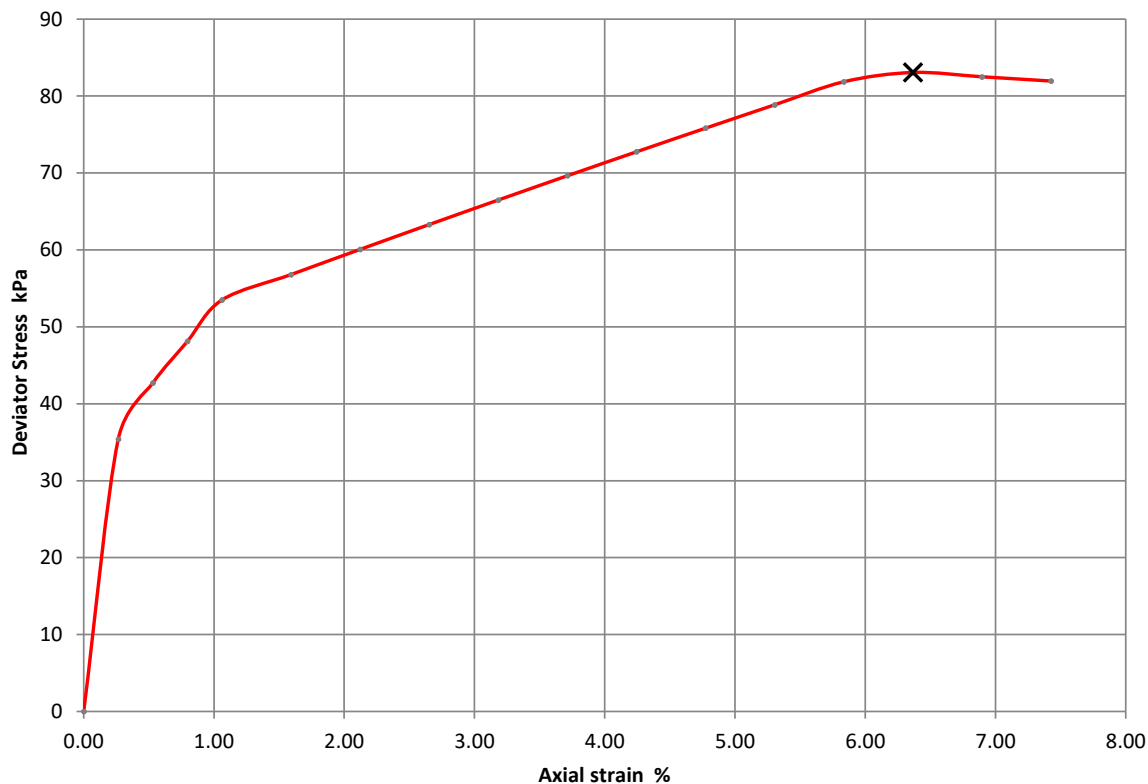


2788



Single Stage Unconsolidated-Undrained Triaxial Test
BS 1377 : 1990 Part 7 : 8

	Single Stage Unconsolidated-Undrained Triaxial Test BS 1377 : 1990 Part 7 : 8	Contract Number	53405
		Borehole/Pit No.	BH1
Site Name	19192 - Samsons Gym	Sample No.	
Soil Description	Grey sandy silty CLAY	Depth Top (m)	9.50
		Depth Base (m)	9.95
Date Tested	22/04/2021	Sample Type	U
		Technician	Daniel



Moisture Content (%)	24
Bulk Density (Mg/m ³)	1.94
Dry Density (Mg/m ³)	1.57
Specimen Length (mm)	188.5
Specimen Diameter (mm)	105.1
Cell Pressure (kPa)	170
Deviator Stress (kPa)	83
Undrained Shear Strength (kPa)	42
Failure Strain (%)	6
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.59

Specimen Post Test



Sample Split



Checked	25/04/2021	Richard John	
Approved	26/04/2021	Paul Evans	





**Single Stage Unconsolidated-Undrained Triaxial
Test
BS 1377 : 1990 Part 7 : 8**

Contract Number 53405

Borehole/Pit No. BH1

Site Name 19192 - Samsons Gym

Sample No.

Soil Description Grey sandy silty CLAY

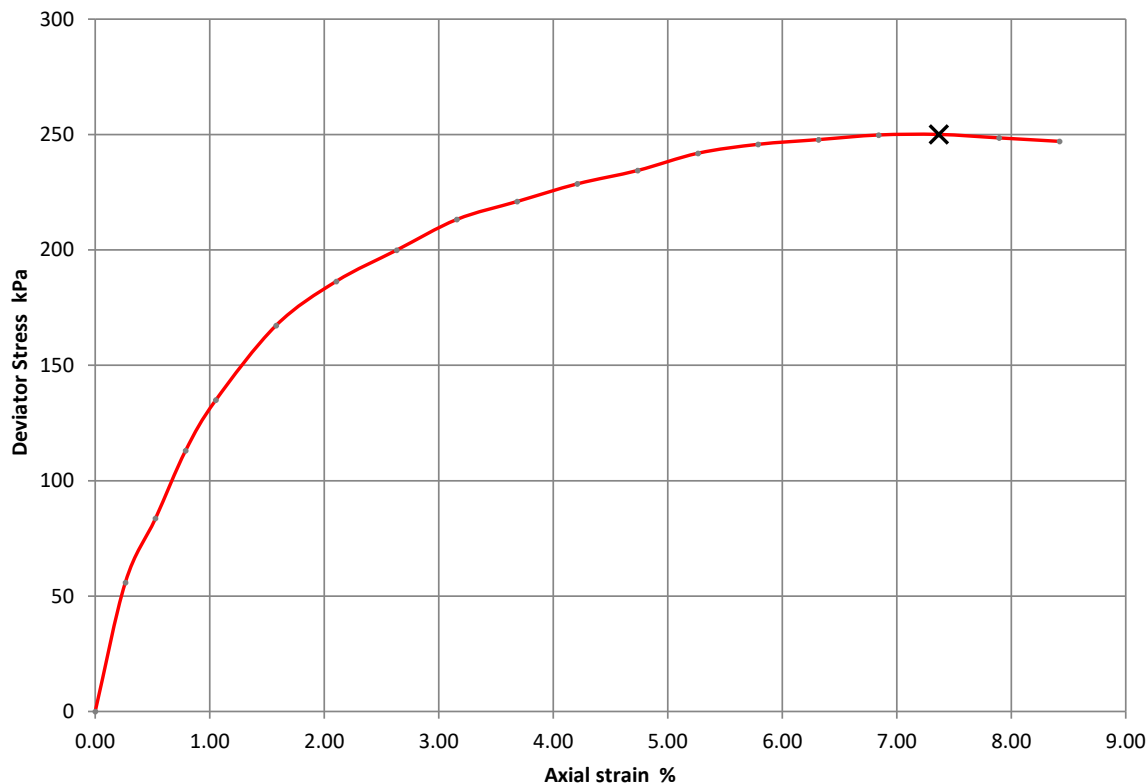
Depth Top (m) 12.50

Depth Base (m) 12.85

Date Tested 22/04/2021

Sample Type U

Technician Daniel



Moisture Content (%)	26
Bulk Density (Mg/m ³)	1.92
Dry Density (Mg/m ³)	1.53
Specimen Length (mm)	190
Specimen Diameter (mm)	105.1
Cell Pressure (kPa)	225
Deviator Stress (kPa)	250
Undrained Shear Strength (kPa)	125
Failure Strain (%)	7
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.58

Specimen Post Test



Sample Split



Checked	25/04/2021	Richard John	
Approved	26/04/2021	Paul Evans	





**Single Stage Unconsolidated-Undrained Triaxial
Test**
BS 1377 : 1990 Part 7 : 8

Contract Number 53405

Borehole/Pit No. BH1

Site Name 19192 - Samsons Gym

Sample No.

Soil Description Grey sandy silty CLAY

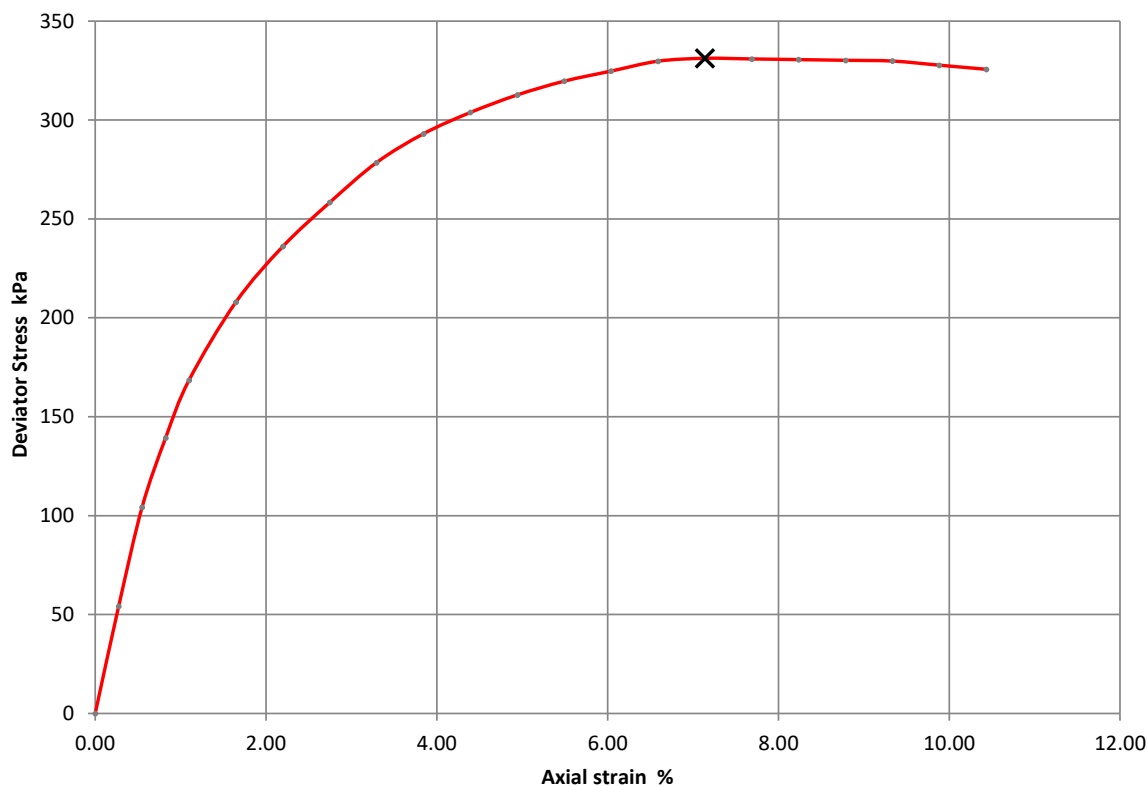
Depth Top (m) 14.00

Depth Base (m) 14.35

Date Tested 22/04/2021

Sample Type U

Technician Daniel



Moisture Content (%)	23
Bulk Density (Mg/m ³)	1.94
Dry Density (Mg/m ³)	1.58
Specimen Length (mm)	182.1
Specimen Diameter (mm)	105
Cell Pressure (kPa)	250
Deviator Stress (kPa)	331
Undrained Shear Strength (kPa)	166
Failure Strain (%)	7
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.65

Specimen Post Test



Sample Split



Checked	25/04/2021	Richard John	
Approved	26/04/2021	Paul Evans	





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

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 21-04414

Site Reference: Samson's Gym

Project / Job Ref: 19192

Order No: 19192

Sample Receipt Date: 07/04/2021

Sample Scheduled Date: 07/04/2021

Report Issue Number: 1

Reporting Date: 19/04/2021

Authorised by:

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.



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



Soil Analysis Certificate						
DETS Report No: 21-04414	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Samson's Gym	TP / BH No	WS2	WS4	BH1		
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 19192	Depth (m)	1.30	2.20	9.00		
Reporting Date: 19/04/2021	DETS Sample No	535992	535993	535994		

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.8	8.2	8.1	
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	< 200	302	408	
Total Sulphate as SO ₄	%	< 0.02	MCERTS	< 0.02	0.03	0.04	
W/S Sulphate as SO ₄ (2:1) ^(S)	mg/l	< 10	MCERTS	28	19	270	
W/S Sulphate as SO ₄ (2:1) ^(S)	g/l	< 0.01	MCERTS	0.03	0.02	0.27	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	0.23	
Ammonium as NH ₄	mg/kg	< 0.5	NONE	0.7	0.9	4.5	
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.07	0.09	0.45	
W/S Chloride (2:1) ^(S)	mg/kg	< 1	MCERTS	8	22	28	
W/S Chloride (2:1) ^(S)	mg/l	< 0.5	MCERTS	3.8	11	14	
Water Soluble Nitrate (2:1) as NO ₃ ^(S)	mg/kg	< 3	MCERTS	14	< 3	38	
Water Soluble Nitrate (2:1) as NO ₃ ^(S)	mg/l	< 1.5	MCERTS	7.2	< 1.5	19	
W/S Magnesium	mg/l	< 0.1	NONE	0.8	0.9	2.1	

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)



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



Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 21-04414	
Soils Ltd	
Site Reference: Samson's Gym	
Project / Job Ref: 19192	
Order No: 19192	
Reporting Date: 19/04/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 535992	WS2	None Supplied	1.30	12.1	Light brown sandy clay with stones
^ 535993	WS4	None Supplied	2.20	8.3	Light brown sandy gravel with stones
^ 535994	BH1	None Supplied	9.00	18.3	Grey sandy clay

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-04414

Soils Ltd

Site Reference: Samson's Gym

Project / Job Ref: 19192

Order No: 19192

Reporting Date: 19/04/2021

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 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	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

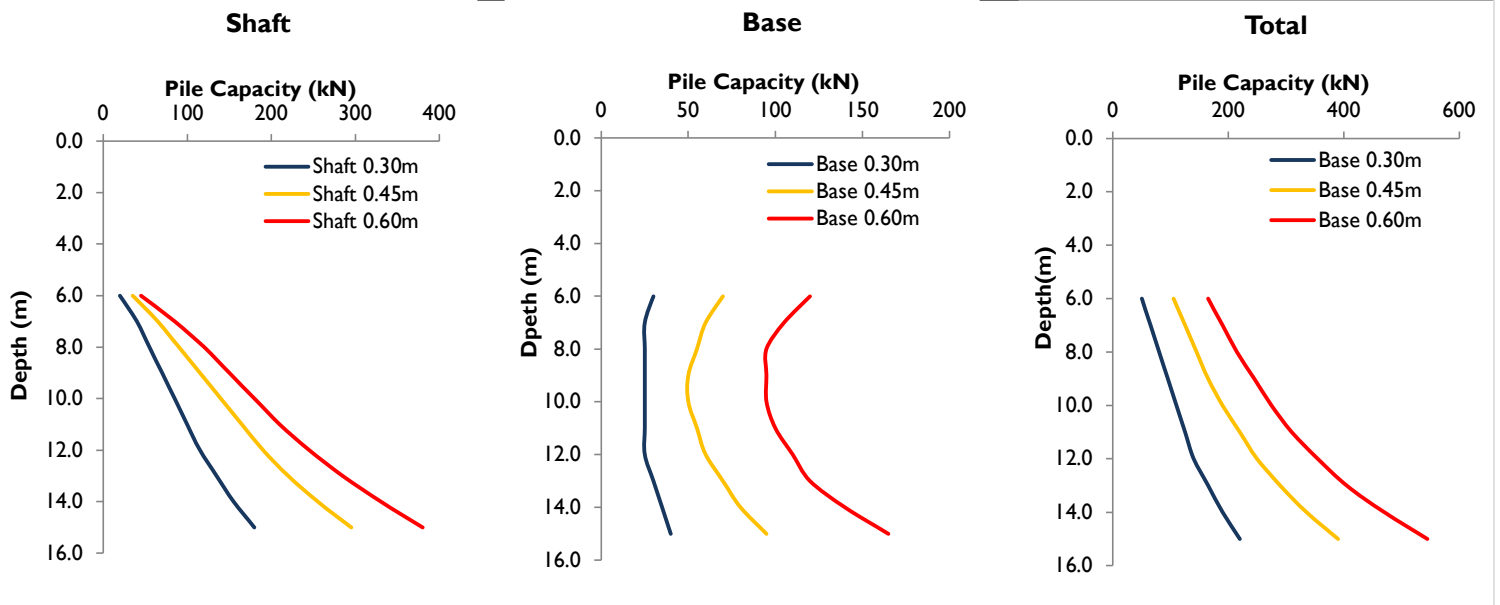
D Dried
AR As Received

Appendix C Foundation Design

Appendix C.1 Preliminary Pile Design

Preliminary Pile Working Loads
Single Vertically Loaded Pile (kN)

Name:	TRB	N_C value	9	Pile Start Depth:	5	FOS	
Job No:	19192	α value:	0.45	Pile Final Depth:	15	Shaft	Base
Date:	1.5.21			Pile Increment:	1	3	3



Pile Diameter (m):									
0.30			0.45			0.60			
Pile Depths	Shaft	Base	Total	Shaft	Base	Total	Shaft	Base	Total
(m bgl)									
5.0									
6.0	20	30	50	35	70	105	45	120	165
7.0	40	25	65	65	60	125	85	105	190
8.0	55	25	80	90	55	145	120	95	215
9.0	70	25	95	115	50	165	150	95	245
10.0	85	25	110	140	50	190	180	95	275
11.0	100	25	125	165	55	220	210	100	310
12.0	115	25	140	190	60	250	245	110	355
13.0	135	30	165	220	70	290	285	120	405
14.0	155	35	190	255	80	335	330	140	470
15.0	180	40	220	295	95	390	380	165	545

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Table D.I.I CSM Revised Pre Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Made Ground	Asbestos, Metals and semi-metals	Inhalation of dust	Site Workers/Site Maintenance	Medium	Low	Moderate	Made Ground is present onsite including brick and concrete fragments which are indicators of demolition waste which often contain metals, semi-metals and asbestos in either fibre form or in the form of asbestos containing materials.	Laboratory testing of soil samples.
			End Users	Medium	Low	Moderate		
			Off-site Users	Medium	Low	Moderate		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	Asbestos, Metals and semi-metals	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Low	Moderate		
			End Users	Medium	Low	Moderate		
	Metals and semi-metals	Migration via surface runoff	Surface Water	Mild	Low	Low		
			Surface Water	Mild	Low	Low		
		Migration in solution via groundwater	Shallow Aquifer	Mild	Low	Low		
			Deep Aquifer	-	-	-		
			Buried structures	Minor	Low	Very low		
			Buried Services	Minor	Low	Very low		
	-	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
Organic/hydrocarbon type odours within the Granular River Terrace Deposits.	PAH, TPH	Inhalation of dust	Site Workers/Site Maintenance	Medium	Low	Moderate	Light end hydrocarbon/organic odours were noted during logging, however no staining was observed suggesting that low levels of hydrocarbon contamination may be present.	Laboratory testing of soil samples.
			End Users	Medium	Low	Moderate		
			Off-site Users	Medium	Low	Moderate		
	PAH, TPH	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Medium	Low	Moderate		
			End Users	Medium	Low	Moderate		
			Off-site Users	Medium	Low	Moderate		
	PAH, TPH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Low	Moderate		
			End Users	Medium	Low	Moderate		
	PAH, TPH	Migration via surface runoff	Surface Water	Mild	Low	Low		
			Surface Water	Mild	Low	Low		
		Migration in solution via groundwater	Shallow Aquifer	Mild	Low	Low		
			Deep Aquifer	-	-	-		
			Buried structures	Mild	Low	Low		
			Buried Services	Mild	Low	Low		
	PAH, TPH	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Moderate		
			End Users	Medium	Low	Moderate		
			Off-site Users	Medium	Low	Moderate		
			Building and confined spaces	Medium	Low	Moderate		

Table D.I.2 CSM Revised Post Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Made Ground	Asbestos, Metals and semi-metals	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	No contaminants identified above the relevant screening criteria.	No further action required.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	Asbestos, Metals and semi-metals	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
	Metals and semi-metals	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	-	-	-		
		Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
Organic/hydrocarbon type odours within the Granular River Terrace Deposits.	PAH, TPH	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	No contaminants identified above the relevant screening criteria.	No further action required.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAH, TPH	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAH, TPH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
	PAH, TPH	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	-	-	-		
	PAH, TPH	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		

Appendix D.2 Chemical Laboratory Results



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

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t: 01622 850410

DETS Report No: 21-04413

Site Reference: Samson's Gym

Project / Job Ref: 19192

Order No: 19192

Sample Receipt Date: 07/04/2021

Sample Scheduled Date: 07/04/2021

Report Issue Number: 1

Reporting Date: 13/04/2021

Authorised by:

Dave Ashworth
Technical Manager

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

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Soil Analysis Certificate						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Samson's Gym	TP / BH No	WS1	WS1	WS1	WS2	WS2
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 19192	Depth (m)	0.20	0.40	0.80	0.40	3.30
Reporting Date: 13/04/2021	DETS Sample No	535985	535986	535987	535988	535989

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.6	8.1	8.0	7.9	8.1
Organic Matter	%	< 0.1	MCERTS	1	1.3	< 0.1	0.8	0.1
Arsenic (As)	mg/kg	< 2	MCERTS	2	6	5	5	< 2
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	5	13	21	19	4
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	4	12	9	7	< 4
Lead (Pb)	mg/kg	< 3	MCERTS	43	33	11	11	< 3
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	< 3	10	16	14	< 3
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	4	19	29	27	4
Zinc (Zn)	mg/kg	< 3	MCERTS	43	41	38	40	5
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

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



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Soil Analysis Certificate						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Samson's Gym	TP / BH No	WS4	WS4			
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied			
Order No: 19192	Depth (m)	0.70	1.20			
Reporting Date: 13/04/2021	DETS Sample No	535990	535991			

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	8.1	8.0			
Organic Matter	%	< 0.1	MCERTS	0.2	0.6			
Arsenic (As)	mg/kg	< 2	MCERTS	5	7			
W/S Boron	mg/kg	< 1	NONE	< 1	< 1			
Cadmium (Cd)	mg/kg	< 0.2	NONE	< 0.2	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	21	23			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	9	11			
Lead (Pb)	mg/kg	< 3	MCERTS	10	12			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	17	26			
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3			
Vanadium (V)	mg/kg	< 1	MCERTS	28	31			
Zinc (Zn)	mg/kg	< 3	MCERTS	38	45			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 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 (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Samson's Gym	TP / BH No	WS1	WS1	WS1	WS2	WS2
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 19192	Depth (m)	0.20	0.40	0.80	0.40	3.30
Reporting Date: 13/04/2021	DETS Sample No	535985	535986	535987	535988	535989

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.32	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.18	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.19	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Samson's Gym	TP / BH No	WS4	WS4			
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied			
Order No: 19192	Depth (m)	0.70	1.20			
Reporting Date: 13/04/2021	DETS Sample No	535990	535991			

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



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Samson's Gym	TP / BH No	WS1	WS1	WS1	WS2	WS2
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 19192	Depth (m)	0.20	0.40	0.80	0.40	3.30
Reporting Date: 13/04/2021	DETS Sample No	535985	535986	535987	535988	535989

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	2
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	5
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	6
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	12	< 6	< 6	< 6	16
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	12	< 6	< 6	< 6	29



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 21-04413	Date Sampled	None Supplied	None Supplied			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Samson's Gym	TP / BH No	WS4	WS4			
Project / Job Ref: 19192	Additional Refs	None Supplied	None Supplied			
Order No: 19192	Depth (m)	0.70	1.20			
Reporting Date: 13/04/2021	DETS Sample No	535990	535991			

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



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-04413	
Soils Ltd	
Site Reference: Samson's Gym	
Project / Job Ref: 19192	
Order No: 19192	
Reporting Date: 13/04/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 535985	WS1	None Supplied	0.20	15.3	Red sandy clay with brick
^ 535986	WS1	None Supplied	0.40	16.3	Brown sandy clay
^ 535987	WS1	None Supplied	0.80	15.6	Light brown sandy clay
^ 535988	WS2	None Supplied	0.40	14.2	Light brown sandy clay
^ 535989	WS2	None Supplied	3.30	5.2	Brown sandy clay with stones
^ 535990	WS4	None Supplied	0.70	13.2	Light brown sandy clay
^ 535991	WS4	None Supplied	1.20	13.9	Light brown sandy clay with stones

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-04413

Soils Ltd

Site Reference: Samson's Gym

Project / Job Ref: 19192

Order No: 19192

Reporting Date: 13/04/2021

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 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	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

D Dried
AR As Received

Appendix D.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.

-
- 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.

			Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park						
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																					
Metals	Antimony		2010				550						7500									EIC/AGS/	CL:AIRE	2010
	Arsenic		2014	37			40			49			640			79			168			C4SL	DEFRA	2014
			2015	37			40			40			640			79			170			S4UL	LQM/CIEH	2015
	Beryllium		2015	1.7			1.7			35			12			2.2			63			S4UL	LQM/CIEH	2015
	Boron		2015	290			11000			45			240000			21000			46000			S4UL	LQM/CIEH	2015
	Cadmium		2015	11			85			1.9			190			120			532			S4UL	LQM/CIEH	2015
			2014	26			149			4.9			410			220			880			C4SL	DEFRA	2014
	Chromium	III	2015	910			910			18000			8600			1500			33000			S4UL	LQM/CIEH	2015
		VI	2014	21			21			170			49			23			250			C4SL	DEFRA	2014
		VI	2015	6			6			1.8			33			7.7			220			S4UL	LQM/CIEH	2015
	Copper		2015	2400			7100			520			68000			12000			44000			S4UL	LQM/CIEH	2015
	Lead		2014	200			310			80			2330			630			1300			C4SL	DEFRA	2014
	Mercury	Elemental	2015	1.2			1.2			21			58			16			30			S4UL	LQM/CIEH	2015
		Inorganic	2015	40			56			19			1100			120			240			S4UL	LQM/CIEH	2015
		Methyl	2015	11			15			6			320			40			68			S4UL	LQM/CIEH	2015
	Nickel		2015	130			180			53			980			230			800			S4UL	LQM/CIEH	2015
	Selenium		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
	Benzene		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		2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Ethylbenzene		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	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	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	2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	600000	610000	620000	150000	220000	320000	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	65000	92000	140000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
	Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70		2015	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH' s) (mg/kg)	Acenaphthene		2015	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene		2015	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene		2015	2400	5400	11000	31000	35000	37000	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene		2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
			2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene		2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene		2015	320	340	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</																				

			Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park						
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																					
	Fluoranthene		2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene		2015	170	400	860	2800	3800	4500	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene		2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene		2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190	460	1100	4900	4900	4900	1200	1900	3000	S4UL	LQM/CIEH	2015
	Phenanthrene		2015	95	220	440	1300	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene		2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)		2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane		2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane		2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000	76000	100000	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane		2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane		2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene		2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810	1100	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)		2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene		2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane		2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (chloroethene)		2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
Explosives	2,4,6 Trinitrotoluene		2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)		2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)		2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000	23000	24000	S4UL	LQM/CIEH	2015
Pesticides	Aldrin		2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin		2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine		2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos		2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan		2015	7.4	18	41	160	280	410	1.2	2.9	6.8	5600	7400	8400	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan		2015	7	17	39	190	320	440	1.1	2.7	6.4	6300	7800	8700	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes		2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes		2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes		2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene		2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300	2000	2900	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene		2015	23	55	130	24	57	130	94	230	540	2000	4800	11000	90000	95000	98000	24000	36000	51000	S4UL	LQM/CIEH	2015
	1,3-Dichlorobenzene		2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene		2015	61	150	350	61	150	350	15	37	88	4400	10000	25000	17000	17000	1700	36000	36000	36000	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene		2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770	1100	1600	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene		2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700	2600	4000	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene		2015	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380	580	860	S4UL	LQM/CIEH	2015
	1,2,3,4,-Tetrachlorobenzene		2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	830	1500	1600	1600	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49	120	240	78	79	79	110	120	130	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42	72	96	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
	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 & Chlorophenols																								
	Phenols		2015	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
Others																								
	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene		2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015

NOTE

Priority	Guideline (mg kg ⁻¹)
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				Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park		
SOM				1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
Type	Contaminants	Species	Year																		
	1	Site Specific Assessment Criteria (SSAC) (Soils Limited)																			
	2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)																			
	3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)																			
	4	2015: Suitable 4 Use Level (S4UL) (Nathanail <i>et al</i> , 2015)																			
				For Generic Risk Assessment, the values in Bold have priority																	
				Table reviewed February 2020																	

Appendix E Information Provided by the Client

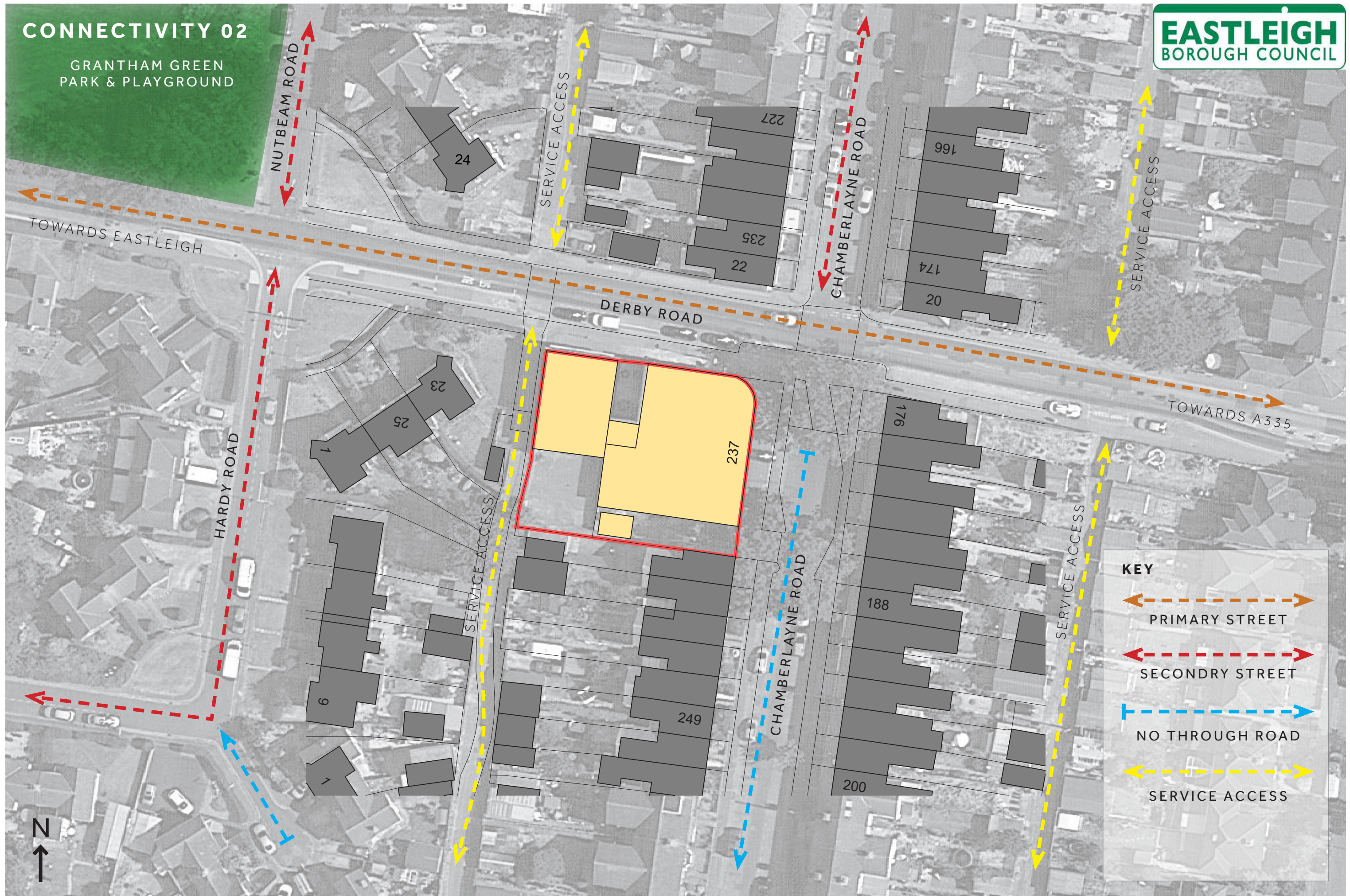




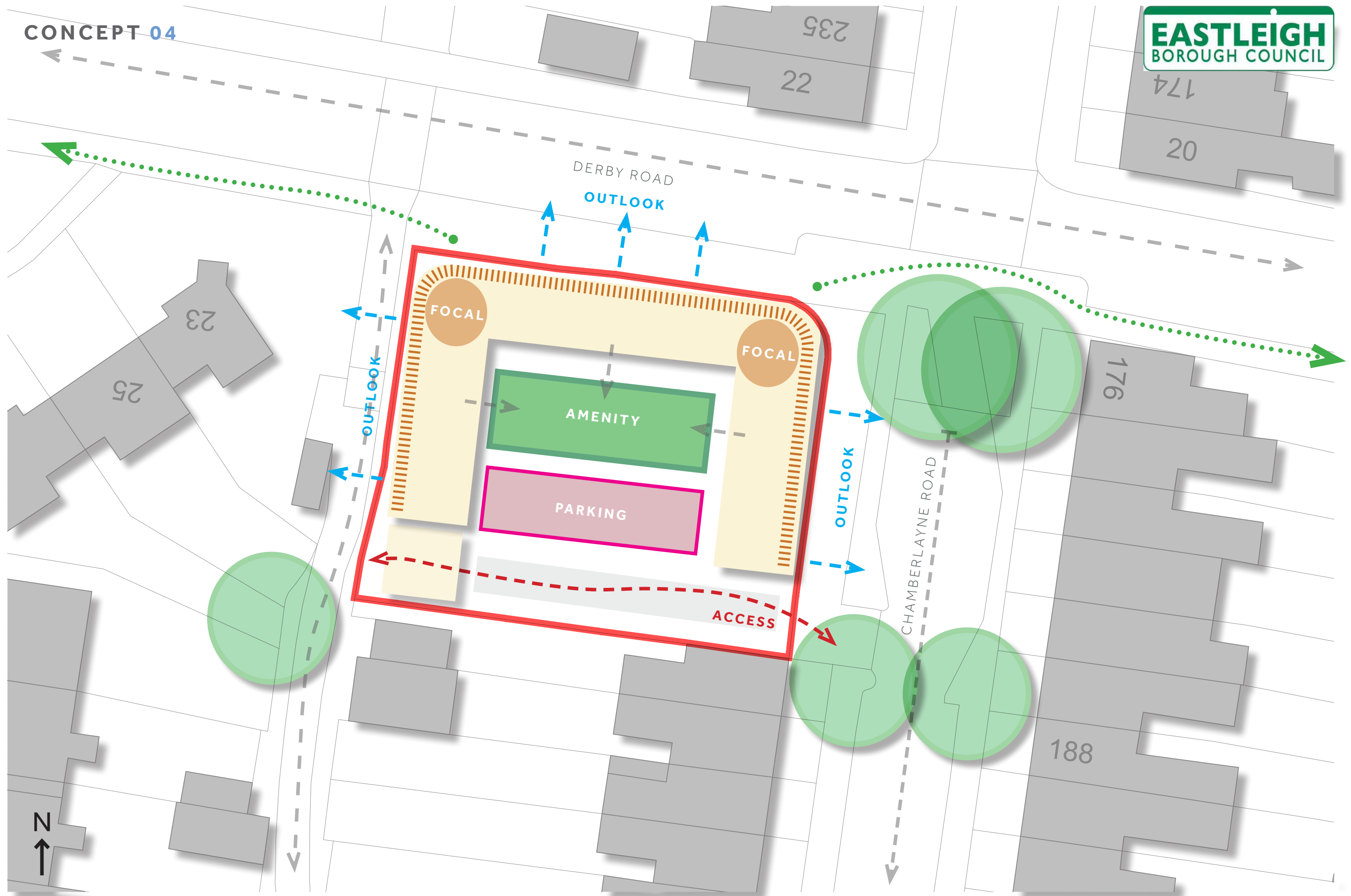
CONNECTIVITY 02

GRANTHAM GREEN PARK & PLAYGROUND

NUTBEAM
PO









Ground Floor



First Floor



Second Floor

- Option 02c - 3 Storey**
19 Units - Car Club Parking Only
- 1 Bed Unit @ 51.3m² - 10No
 - 2 Bed Unit @ 78.2m²- 9No
 - 2 Parking Spaces for Car Club

OPTION 2C VIEW 1



OPTION 2C VIEW 2



DERBY ROAD ELEVATION



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