



Main Investigation Report

at

St Helens Close, Cowley, Middlesex UB8 3SZ

for

Philip Pank Partnership

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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 Philip Pank Partnership to undertake an intrusive ground investigation and prepare a Main Investigation Report on land at St Helens Close, Cowley, Middlesex UB8 3SZ. The scope of the investigation was outlined in the Soils Limited quotation reference Q21684, dated 25th July 2019.

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: 18255/PIR, dated November 2020.

Standards

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

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- 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
- Building Research Establishment Special Digest 1, 2005
- BSI Code of Practice for Foundations, BS 8004:2015
- NHBC Standards 2019
- BS 1377:1990 Parts 1 to 8
- BS EN 22476 Part 3
- SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014
- BRE *"Cover Systems For Land Regeneration, Thickness Design of Cover Systems for Contaminated Land, BRE, March 2004"*,

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.

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Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Philip Pank Partnership 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 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: 18255/PIR, November 2020) and/or the Revised Conceptual Site Model presented in Appendix C.1.

I.2 Location

The site was located at St Helens Close, Cowley, Middlesex UB8 3SZ and had an approximate O.S Land Ranger Grid Reference of TQ 05771 81528.

The site location plan is given in Figure 1.

I.3 Site Description

At the time of site attendance, the site was a disused and slightly overgrown area covered by concrete and tarmac hardstanding. Concrete bollards and a roughly 50cm high brick wall along the eastern boundary of the site prevented vehicular access from St Helen's Close.

Some weeds and shrubs were growing between the cracks in the concrete.

The site sloped at a gradient measured to around 2 degrees to the east according to Soils Limited's utility survey data.

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

I.4 Proposed Development

The proposal comprised the removal of the existing concrete and tarmac hardstanding,

and the brick wall and concrete bollards on the eastern boundary.

It was proposed to construct one detached and four semi-detached two storey domestic houses. Each of the proposed properties were to have their own private rear gardens and some also included green front public open spaces, each property would also have their own allocated parking spaces.

In compiling this report reliance was placed on drawings 1955 P-02:1955 P-07 dated December 2019 drawn by MEPK Architects. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

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

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be located on the London Clay Formation with overlying superficial deposits of the Lynch Hill Gravel Member with deposits of Langley Silt Member overlying the Lynch Hill Gravel Member.

1.5.1 Langley Silt Member

The Langley Silt Member, which was formerly known as Brickearth, comprises a geologically recent deposit of brown structureless sandy clay of limited thickness that is usually associated with the underlying River Terrace Gravels. Its former name is derived from its former use in the manufacture of bricks. The name Brickearth has been applied to sandy superficially deposited soils of differing origins covering soliflucted deposits, stratified estuarine deposits and colluvial sediments.

The name Langley Silt Member has been applied to the deposits that are thought to be in their original position.

1.5.2 Lynch Hill Gravel Member

The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Gravels. These terraces represent ancient floodplain deposits that became isolated as the river cut downwards to lower levels.

The Lynch Hill Gravel Member approximates to the third level terrace gravel. The composition of the River Terrace Gravel varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sand and gravel of roughly bedded flint or chert gravel commonly in a matrix of silt and clay.

1.5.3 London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. 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 upper boundary member of the London Clay Formation is known as the Claygate Member and marks the transition between the deep water, predominantly clay environment and succeeding shallow-water, sand environment of the Bagshot Formation.

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at St Helens Close, Cowley, Middlesex UB8 3SZ and was prepared for the sole benefit of Philip Pank Partnership (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, such as Japanese Knotweed, is outside of the scope of investigation.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

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

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q21684, dated 25th July 2019), was to comprise the following items:

- 4No 4m deep windowless sampler boreholes and dynamic probes
- 2No (up to) 15m deep CPTu Probes
- Falling head soakage testing
- Geotechnical Laboratory Testing
- Contamination Laboratory Testing

2.1.1 Actual Project Works

The actual project works were revised based upon encountered ground conditions, and were undertaken on 17th November 2020 and comprised:

- 4No windowless sampler boreholes to depths ranging between 2.00m and 4.00m bgl
- 4No dynamic probes to depths ranging between 4.00m and 6.00m bgl.
- 3No combined groundwater and gas well installations (WS1-WS3)
- Ground gas as and Groundwater Monitoring (Ongoing at the time of reporting)

Three windowless sampler boreholes (WS1-WS3) were backfilled with gravel and bentonite following the installation of monitoring wells, one borehole (WS4) was backfilled with bentonite.

Four dynamic probes, super heavy, (DP1 – DP4) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 4.00m and 6.00m bgl.

Three standpipes were installed within window sample borehole locations (WS1-WS3) to allow for continued monitoring of both groundwater and ground gas, where present.

All trial hole locations have been presented in Figure 3.

The CPTu testing was not undertaken as the thickness and density of the gravel encountered on site would have prevented the CPTu from reaching any significant depth. And the information gained from the windowless samples and dynamic

probes was deemed sufficient for the purposes of the investigation.

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 17th November 2020 four windowless sampler boreholes (WS1 – WS4) were drilled, using a Premier 110 windowless sampler drilling rig, to depths ranging between 2.00m and 4.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

Four super heavy dynamic probes, (DP1 – DP4) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 4.00m and 6.00m bgl.

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)
WS1	2.00 ^w	DPI	4.00
WS2	3.50 ^w	DP2	6.00
WS3	3.00 ^w	DP3	4.00
WS4	4.00	DP4	4.50

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)
Langley Silt Member (LASI)
Lynch Hill Gravel Member (LHGR)
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	Anthropocene	0.00	0.50-1.20	~1.00	Soft to firm yellowish brown slightly gravelly CLAY/SILT. Gravel is fine to coarse flint brick clinker and pottery, and metal.
LASI	Pleistocene	0.70-1.20	1.10-1.50	0.35	Soft to firm, yellowish brown slightly sandy silty CLAY.
LHGM	Pleistocene	1.00-1.50	2.00-4.00 ¹² [4.80m] ³	3.30 ⁴	Yellowish brown and dark grey, slightly clayey sandy GRAVEL.
LCF	Eocene	[4.80] ³	[6.00] ¹²³	>1.20	No sample recovered- interpreted from dynamic probe only

Note: ¹ Final depth of trial hole. ² Base of strata not encountered ³Based on Dynamic probe DP2 only strata not observed ⁴Confidently interpreted to be 3.30m thick in location DP2.

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 all four trial holes from ground level to depths ranging between 0.70m bgl (WS1) and 1.20m bgl (WS2).

The Made Ground typically comprised soft to firm yellowish brown slightly gravelly CLAY/SILT. Gravel is fine to coarse flint brick clinker and pottery, and metal.

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)
WS1/[DP1]	0.70
WS2/[DP2]	1.20
WS3/[DP3]	0.50
WS4/[DP4]	1.00
Note:	

2.3.2 Langley Silt Member

Soils described as Langley Silt Member were encountered in two out of the four trial holes from directly below the Made Ground to depths ranging between 1.00m and 1.50m bgl.

The Langley Silt Member was typically described as: soft to firm, yellowish brown slightly sandy silty CLAY. Occasional flint gravel.

The depth of Langley Silt Member has been included in Table 2.4.

Table 2.4 Final Depth of Langley Silt Member

Trial Hole	Depth (m bgl)
WS1/[DP1]	1.10
WS2/[DP2]	1.50
WS3/[DP3]	Not encountered
WS4/[DP4]	Not encountered
Note:	

2.3.3 Lynch Hill Gravel Member

Soils described as the Lynch Hill Gravel Member were encountered in all four trial holes from directly below the Langley Silt Member and/or Made Ground to the base of each windowless sampler. The Lynch Hill Gravel Member was typically described as: Yellowish brown and dark grey, slightly clayey sandy GRAVEL. And inferred to continue to deeper depths by interpretation of the dynamic probes.

The depth of Lynch Hill Gravel Member has been included in Table 2.5.

Table 2.5 Final Depth of Lynch Hill Gravel Member

Trial Hole	Depth (m bgl)
WS1/[DP1]	2.00 ¹ /[4.00] ¹
WS2/[DP2]	3.50 ¹ /[4.80] ²
WS3/[DP3]	3.00 ¹ /[4.00] ¹
WS4/[DP4]	4.00 ¹ /[4.30] ¹
Note: ¹ Final depth of trial hole. ² inferred change of strata based on DP blow count only	

2.3.4 London Clay Formation

The London Clay Formation was interpreted as being encountered within the deepest dynamic probe DP2 from 4.80m bgl to the final depth of 6.00m bgl.

2.4 Roots

Roots were encountered in three out of the four trial holes at depths ranging between 1.00-1.20m 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)
WS1	None encountered
WS2	1.20
WS3	1.00
WS4	1.00

Note: ¹ Final depth of trial hole.

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

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.

Deeper roots are deemed likely to be encountered on the west of the site proximal to the domestic gardens that were off site to the west.

2.5 Groundwater

Groundwater was not encountered within any trial hole. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2020), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

6No ground gas and groundwater monitoring visits were scheduled to be conducted within the standpipe's installed on site within WS1-WS3. Groundwater monitoring was ongoing at the time of reporting and a separate report will be supplied when the monitoring period is complete.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP1 to DP4) adjacent and prior to the drilling of WS1 to WS4 to depths ranging between 4.00m and 6.00m bgl. The results were converted to equivalent SPT "N60" values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1, Table B.1.1 to Table B.1.2.

The SPT "N60" values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the 'N' values should therefore not be necessary. The energy ratio of the drilling rig was 87.96%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The Langley Silt Member (where encountered) recorded equivalent SPT "N60" values between <4 and 13. Classifying the cohesive soils as extremely low to medium strength and inferred undrained cohesive strength of <10kPa to 65kPa.

The Lynch Hill Gravel Member recorded equivalent SPT "N60" values between 17 and 147 with classifying the soils as medium dense to very dense relative density, typically becoming dense or very dense relative density within the top 0.2m of being encountered.

The London Clay Formation was interpreted to have been encountered in one location DP2 and recorded equivalent SPT "N60" values between 13 and 21. Classifying the cohesive soils as medium to high strength with inferred undrained cohesive strengths of 65kPa to 105 kPa

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

3.2 Atterberg Limit Tests

Atterberg Limit tests were performed on two samples, one obtained from the Langley Silt Member at 0.80m in WS1 and the other from the Made Ground at 0.40m in WS4. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The cohesive parts of the Made Ground was classified as low volume change potential in accordance with BRE Digest 240 and had no volume change potential in accordance NHBC Standards Chapter 4.2.

The cohesive parts of the Langley Silt Member was classified as very high volume change potential in accordance with BRE Digest 240 and high in accordance NHBC Standards Chapter 4.2.

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

3.3 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on four samples from the Lynch Hill Gravel Member.

The PSD tests classified the granular beds of the Lynch Hill Gravel Member as having no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2. Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

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

3.4 Sulphate and pH Tests

One sample was taken from the Langley Silt Member (WS1:0.90m bgl), one from the Reworked Lynch Hill Gravel Member (WS4:1.70m) and one from the Lynch Hill Gravel Member two from the Lynch Hill Gravel Member (WS2:3.50m 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 tests recorded water soluble sulphate between <10mg/l and 75mg/l with pH values of 7.5 to 9.1. With the results from the chemical testing added the recorded water soluble sulphate ranged between <10mg/l and 134mg/l and pH values remained between 7.5-9.1.

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 all four trial holes from ground level to depths ranging between 0.70 (WS1) and 1.20m bgl (WS2). The Made Ground typically comprised Soft to firm yellowish brown slightly gravelly CLAY/SILT. Gravel is fine to coarse flint brick clinker and pottery, and metal. The depths of Made Ground have been included in Table 2.3.

Atterberg testing showed the Made Ground was classified as low volume change potential in accordance with BRE Digest 240 and had no volume change potential in accordance NHBC Standards Chapter 4.2.

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 Langley Silt Member

Soils described as Langley Silt Member were encountered in two out of the four trial holes from directly below the Made Ground to depths ranging between 1.00m and 1.50m bgl. The Langley Silt Member was typically described as: Soft to firm, yellowish brown slightly sandy silty CLAY. Occasional flint gravel. The depth of Langley Silt Member has been included in Table 2.4.

The results from DPSH testing inferred that the cohesive soils of the Langley Silt Member were **extremely low to medium strength**, with undrained cohesions of between **<10kPa and 65kPa**.

The results from Atterberg Limits tests confirmed that the soils of the Langley Silt Member had very high volume change potential in accordance with BRE Digest 240 and high in accordance NHBC Standards Chapter 4.2.

Soils of the Langley Silt Member are normally consolidated, predominantly cohesive and as such are expected to display very low bearing capacities with high settlement characteristics. The soils of the Langley Silt Member were not considered suitable for the proposed development due to very low bearing capacities with high anticipated settlements.

4.1.3 Lynch Hill Gravel Member

Soils described as the Lynch Hill Gravel Member were encountered in all four trial holes from directly below the Langley Silt Member and/or Made Ground to the base of each windowless sampler. And inferred to continue to deeper depths by interpretation of the dynamic probes. The depth of Lynch Hill Gravel Member has been included in Table 2.5.

The results from the dynamic probing inferred that the Lynch Hill Gravel Member was typically dense to very dense.

Four particle size distribution tests were conducted on the Lynch Hill Gravel Member which classified the granular beds as having no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The soils of the Lynch Hill Gravel Member were considered suitable for the proposed development due to high bearing capacities with low anticipated settlements.

4.1.4 Roots

Roots were encountered in three out of the four trial holes at depths ranging between 1.00-1.20m bgl. The depths of root penetration have been included in Table 2.6. 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.

Deeper roots are deemed likely to be encountered on the west of the site proximal to the domestic gardens that were off site to the west.

4.1.5 Groundwater

Groundwater was not encountered within any trial hole. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2020), when groundwater

levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

6No ground gas and groundwater monitoring visits were scheduled to be conducted within the standpipe's installed on site within WS1-WS3, Groundwater monitoring was ongoing at the time of reporting and a separate report will be supplied when the monitoring period is complete.

4.2 Foundation Scheme General

The proposal comprised the removal of the existing concrete and tarmac hardstanding, and the brick wall and concrete bollards on the eastern boundary. It was proposed to construct one detached and four semi-detached two storey domestic houses. Each of the proposed properties were to have their own private rear gardens and some also included green front public open spaces, each property would also have their own allocated parking spaces.

In compiling this report reliance was placed on drawings 1955 P-02:1955 P-07 dated December 2019 drawn by MEPK Architects. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

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

4.2.1 Guidance on Shrinkable Soils

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

The results from Atterberg Limits tests showed that the soils of the Langley Silt Member had **very high volume change potential** in accordance with BRE Digest 240 and **high volume change potential** in accordance NHBC Standards Chapter 4.2.

High volume change potential must therefore be adopted where foundations are constructed into, onto, or pass through the Langley Silt Member in accordance with NHBC Standards Chapter 4.2.

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 on any trees, bushes or shrubs removed prior to or following the site survey.

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

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

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

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage."

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

4.3 Foundation Scheme

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

Roots were encountered in three out of the four trial holes at depths ranging between 1.00-1.20m bgl. If roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution was considered the most suitable. Therefore, the foundation design must be undertaken using NHBC Standards Chapter 4.2.

4.3.1 Shallow Foundations into the Lynch Hill Gravel Member

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. The average thickness of Made Ground was about 1.0m with the maximum encountered depth of Made Ground/Langley Silt Member was 1.50m bgl, bearing capacities were calculated at 1.50m bgl.

Table 4.1 Allowable Bearing Capacities within the Lynch Hill Gravel Member

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.50	5.00 x 0.75	200 ¹	<5

Note: ¹Higher bearing capacities could be provided but value provided was considered appropriate for the proposed developments

The use of reinforced trench fill foundations would reduce the possibility of differential settlement affecting the foundations. Higher bearing values than those provided could be permissible, however the bearing capacity provided should be more than sufficient for the current proposed development.

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 is total settlement of which initial settlement is likely to be the largest component.

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.

There is the potential for deeper Made ground to be found, particularly along the eastern boundary of the site where a former railway cutting has been backfilled historically. Foundations must be extended deeper if such deposits are encountered. If the made ground is found to extend beyond 2.5m bgl and/onto the

London Clay Formation, then a deeper cable percussive borehole will be required in order to provide a design for a piled foundation solution for the affected plots.

It has been assumed that the foundations to any existing structures have been grubbed out. And that the concrete slabs on that currently cover the site will be 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.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class **DS-1** of the BRE Special Digest 1 2005, '*Concrete in Aggressive Ground*'. Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1**. The pH of the soils tested ranged between 7.5 and 9.1. The classification given was determined using the mobile groundwater case, in the view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

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

4.5 Excavations

Shallow excavations in the Made Ground/Topsoil and Langley Silt Member are likely to be marginally stable in the short term.

Deeper excavations taken into the Lynch Hill Gravel Member are likely to be less stable in the short term, depending on the thickness of overlying Langley Silt Member.

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.

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: 18255/PIR dated November 2020) identified a low to moderate risk of ground contamination from previous usage of the site and offsite sources.

The Main Investigation Report identified Made Ground to depths between 0.50m and 1.20m bgl. The Made Ground typically comprised soft to firm yellowish brown slightly gravelly CLAY/SILT. Gravel is fine to coarse flint brick clinker and pottery, and metal.

No Groundwater was encountered within the drilling works, however shallow groundwater was anticipated within the Lynch Hill Gravel Member encountered on site and groundwater monitoring was scheduled at the time of reporting. The shallow groundwater receptor was therefore retained within the updated conceptual site model presented in Appendix C.1.

5.2 Soil Sampling

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

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

A targeted sampling strategy is appropriate when there is:

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

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

Table 5.1 Sampling Strategy

Sample	Strategy	Proposed Use
WS1:0.40	Made Ground	Near plot 5 front garden areas and formerly backfilled railway cutting
WS2:0.40	Made Ground	Private garden for plot 4
WS3:0.60	Made Ground	Midday beneath the foundation of Plots 1 and 2
WS4:0.90	Made Ground	Private garden for plot 3

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)			
	WS1:0.40 ^s	WS2:0.40 ^s	WS3:0.60 ^s	WS4:0.90 ^s
Asbestos Screen	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓
pH	✓	✓	✓	✓
Metals	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓
Organics	✓	✓	✓	✓
PAHs	✓	✓	✓	✓
EPH-Texas			✓	
TPH-CWG	✓	✓		✓
BTEX/ MTBE	✓	✓		✓
PCBs	✓	✓		✓
WAC			✓	

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 C.3.

6.2 Representative Contamination Criteria - Soil

The proposal comprised the removal of the existing concrete and tarmac hardstanding, and the brick wall and concrete bollards on the eastern boundary. It was proposed to construct one detached and four semi-detached two storey domestic houses. Each of the proposed properties were to have their own private rear gardens and some also included green front public open spaces, each property would also have their own allocated parking spaces.

In compiling this report reliance was placed on drawings 1955 P-02:1955 P-07 dated December 2019 drawn by MEPK Architects. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes. Development plans provided by the client are presented in Appendix D.

Based on the proposed development, the results of the chemical analysis have been compared against generic guidance values for a '**Residential with home grown produce**' 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 0.9% and 2.7%. For each soil sample tested, the resultant Soil Organic Matter allowed for the correct comparison to be made with the appropriate guideline value for each organic determinant analysed.

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

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the ' Residential with homegrown produce ' land-use scenario
Lead	231 mg/kg against 200mg/kg- VS2:0.40m bgl (S4UL)

Asbestos locations where material found (no threshold just presence)

None recorded

The guideline values are assessed against the "Residential with homegrown produce" 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 0.9% and 2.7%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

In summary, one of the samples tested showed concentrations in excess of the relevant C4SL for a residential land-use scenario. In WS2 at 0.40m bgl lead was recorded at a concentration of 231mg/kg against the residential end-use C4SL of 200mg/kg.

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

6.2.1 Asbestos

No Asbestos Containing Material (ACM) was detected within the samples tested. However, 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

Groundwater conditions had not yet been established on the site, a total of 6 combined groundwater and ground gas monitoring visits were scheduled to be completed.

The Lynch Hill Gravel was classes as a Principal Aquifer and could support shallow groundwater. The London Clay Formation bedrock was classified as an unproductive stratum and would act as an aquiclude to the deeper groundwater receptors. The Langley Silt Member although laterally discontinuous was classed as an unproductive stratum and would act to limit vertical groundwater migration.

The only exceedance recorded on the site as a part of this Main Investigation Report was Lead recorded at 231mg/kg against the residential with home-grown end-use scenario of C4SL of 200mg/kg. As lead is highly immobile it is deemed unlikely to present a risk to groundwater.

6.4 Ground Gas Risk

At the time of writing a total of 6 combined groundwater and ground gas monitoring visits were scheduled to be completed. A separate ground gas risk assessment report will be provided at the end of the monitoring period as an addendum to this report.

6.5 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 C.1. The full laboratory chemical report is presented in Appendix C.2.

6.5.1 Soils

One of the samples tested showed concentrations in excess of the relevant C4SL for a residential land-use scenario. In WS2 at 0.40m bgl lead was recorded at a concentration of 231mg/kg against the residential end-use C4SL of 200mg/kg.

The Tier 1 Quantitative risk assessment therefore established that there was **a risk to the human health receptors** of construction workers or future end-users.

6.5.2 Groundwater

The only exceedance recorded on the site as a part of this Main Investigation Report was Lead recorded at 231mg/kg against the residential with home-grown end-use scenario of C4SL of 200mg/kg. As lead is highly immobile it is deemed unlikely to present a risk to groundwater.

6.5.3 Ground Gas

The Preliminary Investigation Report identified a moderate/low risk of ground gas associated with an infilled railway immediately east of the site and the former sewage works near the site.

A total of 6No combined groundwater and ground gas monitoring visits had been scheduled at the time of writing and a separate Ground Gas Risk Assessment will be supplied at the end of the monitoring period.

6.6 Development of Soil Remediation Strategy

Production of a remediation strategy report was not part of the brief for this Main Investigation Report Intrusive Investigation. A number of examples remedial options are outlined below.

6.6.1 Further Chemical Testing and Human Health Risk Assessment

It is **recommended** that further testing is undertaken within the proposed private garden areas and public open spaces once the site strip has been completed. Leaching testing would also be undertaken at this stage. Leachate testing would be undertaken at this stage if considered to be required.

6.6.2 Adoption of Cover System in Soft Landscaped Areas

The BRE "*Cover Systems For Land Regeneration, Thickness Design of Cover Systems for Contaminated Land, BRE, March 2004*", allows for the design of cover systems to impacted soils where the concentration of substances within the ground does not exceed any of the respective SGV, C4SL or S4UL by more than six times. In such a situation, a maximum cover thickness of 600mm is given. However, the concentration of substances within the certified clean soil/topsoil, which comprises the cover system, determines the overall thickness of the system and can reduce the required thickness markedly below 600mm.

Where the concentration of substances within the ground does exceed any of the respective SGV, C4SL or S4UL by more than six then an engineered capping system would be required.

The concentrations of elevated contaminants outlined in Table 6.1 did not show any substances, which were greater than six times their respective guideline value.

6.6.3 Excavation of Impacted Soil

It could be proposed to excavate and stockpile the impacted material on the site in preparation for classification and subsequent disposal off-site to a suitable licensed facility.

The initial excavations should be centred on the trial-holes with impacted soil and then extended in all directions, so that the impacted soils can be 'chased' out. Once excavation has been completed validation would be required to prove all impacted soil has been removed. Validation would involve taking a representative number of samples from the sides and base of any excavation and then sent off for appropriate chemical analysis.

The stockpiled soils must be placed on an impermeable liner with raised edges. During periods of rainfall, the stockpile must be covered over to minimise leaching and run-off into the underlying soils. Covering of the stockpile may be required to prevent fumes impacting receptors off-site.

The remedial works must be inspected and independently validated by a suitable person.

On completion of the development, a Validation and Closure Report must be supplied to both the Local Authority and the NHBC detailing the remediation works undertaken on the site.

Any voids resulting from the removal of impacted soil must be backfilled with a suitable certified clean granular soil.

The developer/groundworker must be made aware of the need to address the risk from asbestos identified in this report; former use of the site and for the potential for

additional sources of contamination not identified in the Preliminary Investigation Report or the Main Investigation Report Intrusive Investigation to be found within the site both during demolition and the excavation of trenches for services and foundations.

6.6.4 Excavation of All Made Ground

Made Ground was encountered across the site to depths between 0.50m and 1.20m bgl, Given the extent of the Made Ground encountered this opinion would be very expensive and require excavations to be supported.

6.6.5 Hard Landscape Entire Site

Hard landscaping the entire site could eliminate exposure pathways to contaminated soils for:

- Direct soil and dust ingestion,
- Consumption of home-grown produce,
- Dermal contact,
- Inhalation of dust (indoor and outdoor),
- Migration through permeable soils (direct precipitation, overland flow and through flow).

6.6.6 Engineering Capping System

If an engineering capping system was required it should comprise a geotextile and/or mesh underlying a 200mm thick layer of lightly compacted gap graded crushed concrete, or the like (5-75mm), with geotextile upper cover underlying 450mm thickness of clean certified.

6.7 Duty of Care

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

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

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

6.8 Excavated Material

Excavated material 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.

6.9 Re-use of Excavated Material On-site

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

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

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within

areas and levels defined in planning applications and permissions for the development. An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

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

6.10 Imported Material

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

6.11 Discovery Strategy

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

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

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third party

Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

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

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Appendix A Field Work

Appendix A.1 Engineers Logs

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Appendix B.2 Interpretation

Appendix B.3 Geotechnical In-Situ and Laboratory Results

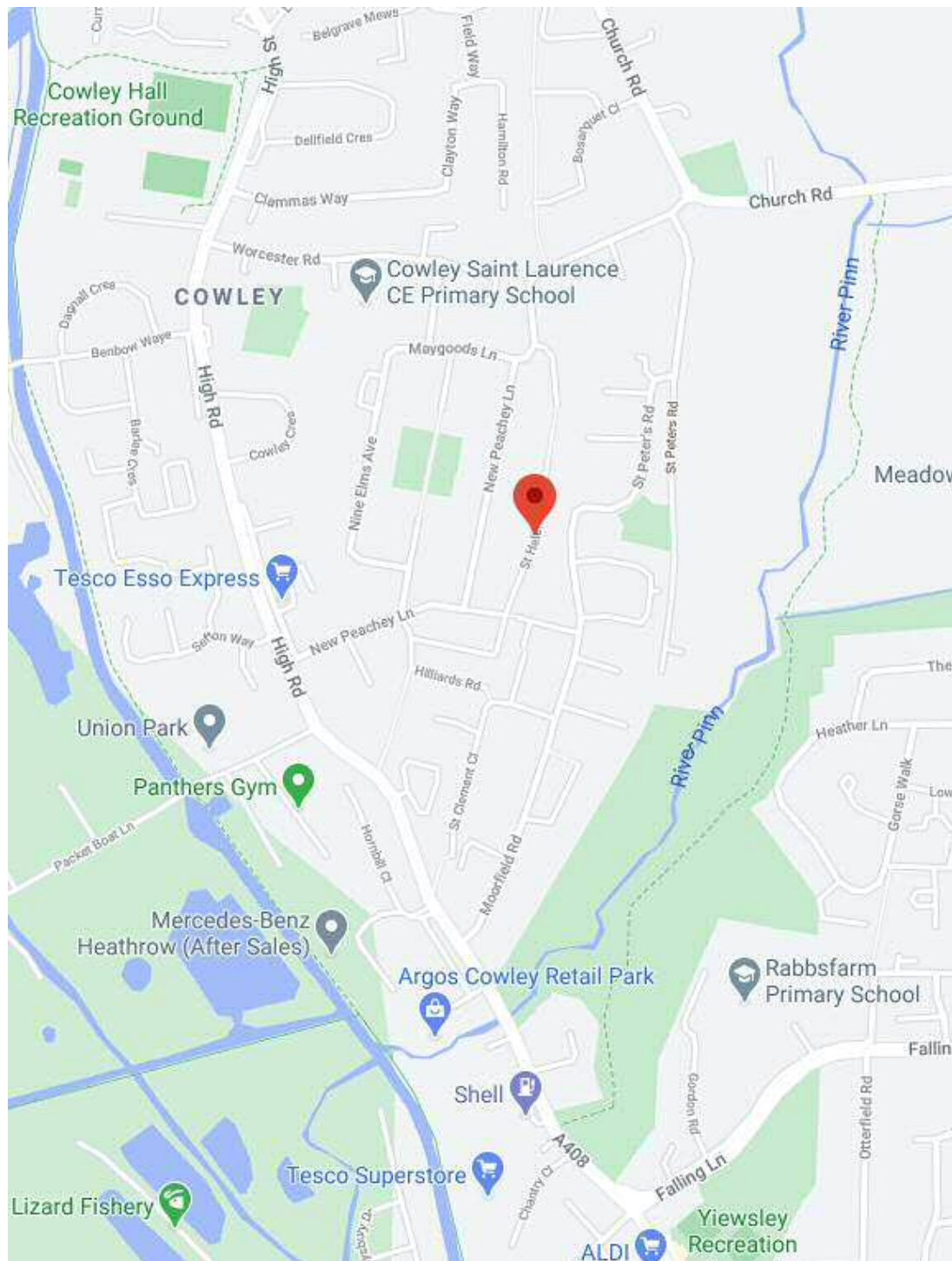
Appendix C Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Appendix C.2 Chemical Laboratory Results

Appendix C.3 General Assessment Criteria

Appendix D Information Provided by the Client

**Figure 1 – Site Location Map**

Job Number
18255

Project
St Helens Close, Cowley, Middlesex UB8 3SZ

Client
Philip Pank Partnership

Date
December 2020



Figure 2 – Aerial Photograph

Project

St Helens Close, Cowley,
Middlesex UB8 3SZ

Client

Philip Pank Partnership

Date

December 2020

Job Number

18255

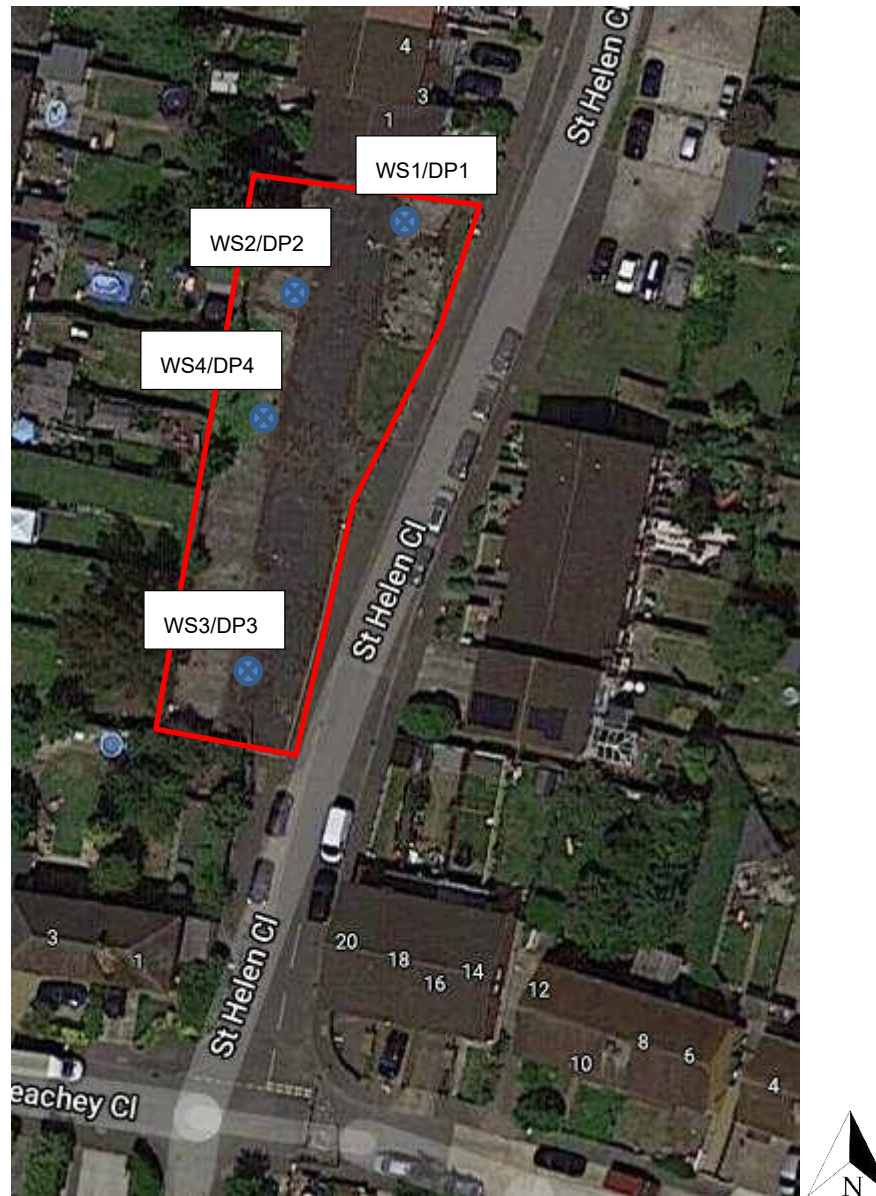


Figure 3 – Trial Hole Plan

Project

St Helens Close, Cowley,
Middlesex UB8 3SZ

Client

Philip Pank Partnership

Date

December 2020

Job Number

18255

Appendix A Field Work

Appendix A.1 Engineers Logs

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)						
										No rootlets encountered.				
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

**Soils Limited**

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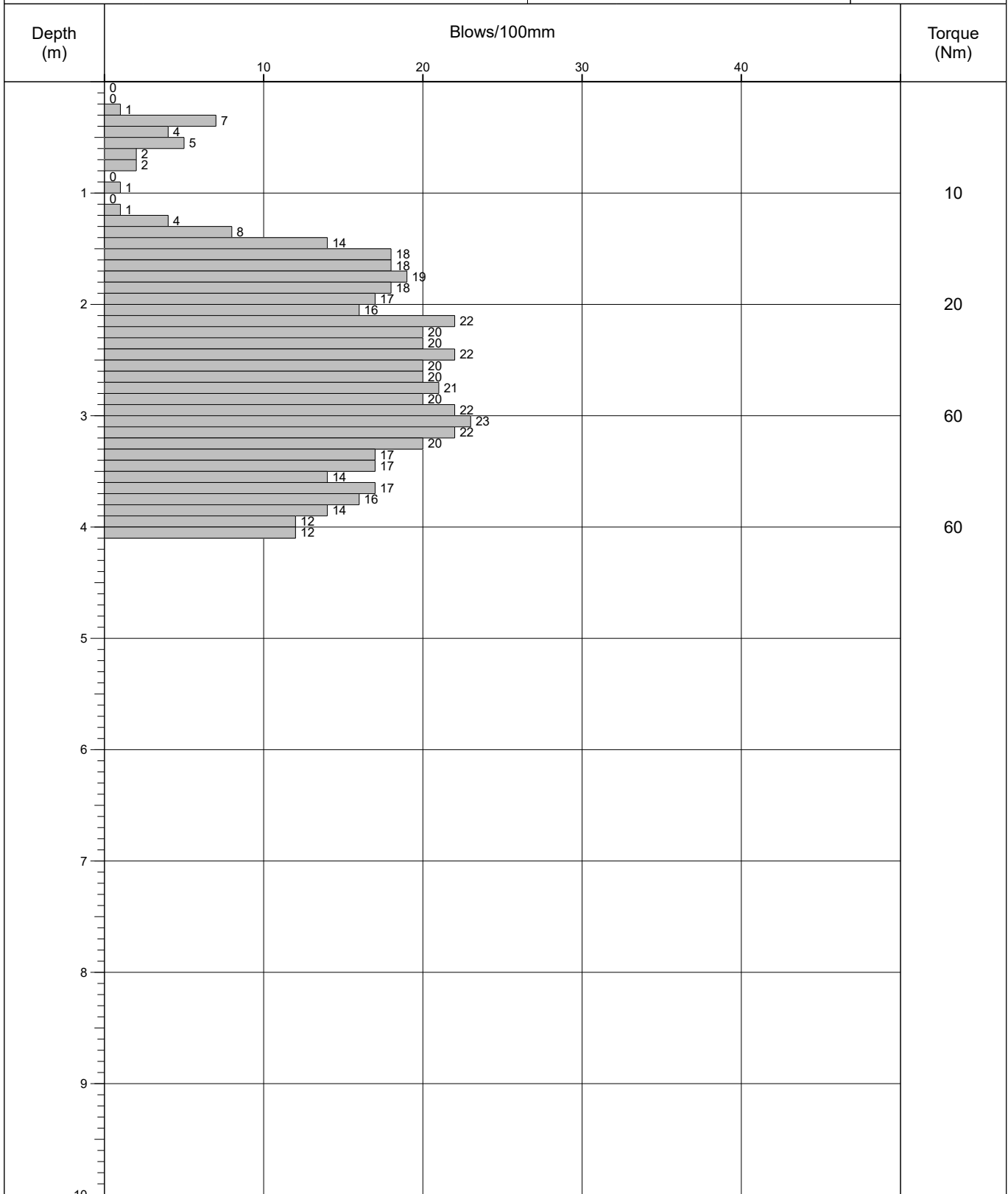
Probe Log

Probe No.

DP1

Sheet 1 of 1

Project Name:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Project No.	18255	Co-ords:		Hole Type	DP
Location:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Level:	m AOD			Scale	1:50
Client:	Phillip Pank Partnership	Dates:	17/11/2020			Logged By	



Remarks	Fall Height 0.76mm	Cone Base Diameter 0.052mm	
	Hammer Weight 63.5kg	Final Depth 4m	
	Probe Type DPSH-B	Energy Ratio (Er) 87.96%	

	Contract Name: St Helen's Close, Cowley, Middlesex UB8 5SZ				Client: Phillip Pank Partnership				Hole ID: WS2					
	Contract Number: 18255		Start and End Date: 17/11/20		Logged By: JD		Checked By: TS		Status: FINAL		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier		Print Date: 18/12/2020		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/ES			0.15		Concrete. MADE GROUND.							1	
0.30	D/ES				Black gravelly SAND. Gravel is fine to coarse angular brick and flint. MADE GROUND									
0.40	D/ES				Brown and black mottled, slightly sandy silty CLAY. Common fine to coarse angular brick. Common fine to medium clinker, Frequent rootlets. MADE GROUND									
0.60	D/ES				Brown, slightly sandy silty CLAY. Common fine medium clinker, Frequent rootlets. MADE GROUND									
0.70				(0.60)										
1.30	D/ES			1.20		Brown grading down to black, slightly sandy gravelly CLAY. Gravel is fine to coarse, sub angular to angular flint. LANGLEY SILT MEMBER.							2	
1.60	D			1.50		Yellowish brown, slightly clayey sandy GRAVEL, Gravel is fine to coarse sub angular to angular flint. LYNCH HILL GRAVEL MEMBER.								
2.10	D			(2.00)									3	
2.60	D												4	
3.10	D												5	
3.50	D			3.50									6	
						End of Borehole at 3.50m						7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets to 1.20m bgl.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
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**Probe Log**

Probe No.

DP2

Sheet 1 of 1

Project Name:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Project No.	18255	Co-ords:		Hole Type	DP
Location:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Level:	m AOD			Scale	1:50
Client:	Phillip Pank Partnership	Dates:	17/11/2020			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
0.1					
0.2					
0.3					
0.4					
0.5					
0.6					
0.7					
0.8					
0.9					
1					5
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2					60
2.1					
2.2					
2.3					
2.4					
2.5					
2.6					
2.7					
2.8					
2.9					
3					40
3.1					
3.2					
3.3					
3.4					
3.5					
3.6					
3.7					
3.8					
3.9					
4					90
4.1					
4.2					
4.3					
4.4					
4.5					
4.6					
4.7					
4.8					
4.9					
5					100
5.1					
5.2					
5.3					
5.4					
5.5					
5.6					
5.7					
5.8					
5.9					
6					100
6.1					
6.2					
6.3					
6.4					
6.5					
6.6					
6.7					
6.8					
6.9					
7					
7.1					
7.2					
7.3					
7.4					
7.5					
7.6					
7.7					
7.8					
7.9					
8					
8.1					
8.2					
8.3					
8.4					
8.5					
8.6					
8.7					
8.8					
8.9					
9					
9.1					
9.2					
9.3					
9.4					
9.5					
9.6					
9.7					
9.8					
9.9					
10					
Remarks	Fall Height 0.76mm		Cone Base Diameter 0.052mm		
	Hammer Weight 63.5kg		Final Depth 6m		
	Probe Type DPSH-B		Energy Ratio (Er) 87.96%		

				Contract Name: St Helen's Close, Cowley, Middlesex UB8 5SZ				Client: Phillip Pank Partnership				Hole ID: WS3			
				Contract Number: 18255		Start and End Date: 17/11/20		Logged By: JD		Checked By: TS		Status: FINAL		Hole Type: WS	
				Easting:		Northing:		Ground Level:		Plant Used: Premier		Print Date: 18/12/2020		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/ES			0.15		Concrete. MADE GROUND.							1		
0.35	D			0.30		Yellowish brown and black mottled gravelly SAND. Gravel is fine to coarse angular flint. MADE GROUND.									
0.40	ES			0.50		Soft, brown and black mottled, slightly sandy silty CLAY. Common fine angular brick and clinker. Occasional rootlets. MADE GROUND.									
0.60	D/ES			(0.50)		Firm, brown slightly sandy silty CLAY. Rare clinker to 0.70m bgl. Rare rootlets, 2cm thick root at 0.70m. MADE GROUND.									
1.10	D/ES			1.00		Light yellowish brown, slightly clayey sandy GRAVEL. Gravel is fine to coarse sub angular to angular flint. LYNCH HILL GRAVEL MEMBER.									
1.60	D			(1.60)									2		
2.10	D			2.60											
2.50	D			(0.40)											
2.60	D			3.00		Yellowish brown, slightly clayey sandy GRAVEL. Gravel is fine to coarse sub angular to angular flint. LYNCH HILL GRAVEL MEMBER.							3		
2.70	D			End of Borehole at 3.00m											
											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)	Rootlets to 1.00m bgl.						
Chiselling					Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.															

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Probe Log

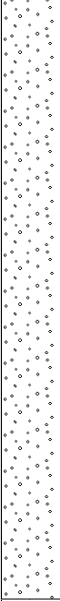
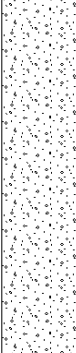
Probe No.

DP3

Sheet 1 of 1

Project Name:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Project No.	18255	Co-ords:		Hole Type	DP
Location:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Level:	m AOD			Scale	1:50
Client:	Phillip Pank Partnership	Dates:	17/11/2020			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
0.1	1				
0.2	3				
0.3	3				
0.4	5				
0.5	3				
0.6	2				
0.7	2				
0.8	1				
0.9	1				5
1.0	7				
1.1	11				
1.2	13				
1.3	14				
1.4	15				
1.5	17				
1.6	19				
1.7	22				
1.8	22				
1.9	19				30
2.0	24				
2.1	24				
2.2	22				
2.3	21				
2.4	23				
2.5	26				
2.6	29				
2.7	28				
2.8	24				
2.9	21				45
3.0	26				
3.1	19				
3.2	20				
3.3	19				
3.4	18				
3.5	16				
3.6	19				
3.7	18				
3.8	16				100
3.9	15				
4.0					
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					
Remarks	Fall Height 0.76mm		Cone Base Diameter 0.052mm		
	Hammer Weight 63.5kg		Final Depth 4m		
	Probe Type DPSH-B		Energy Ratio (Er) 87.96%		

	Contract Name: St Helen's Close, Cowley, Middlesex UB8 5SZ				Client: Phillip Pank Partnership				Hole ID: WS4					
	Contract Number: 18255		Start and End Date: 17/11/20		Logged By: JD		Checked By: TS		Status: FINAL		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier		Print Date: 18/12/2020		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/ES			0.15		Concrete. MADE GROUND.						1		
0.40	D/ES			0.35		Black slightly clayey gravelly SAND. Gravel is fine to coarse angular brick and flint. MADE GROUND.								
				(0.65)		Firm grading down to soft, brown slightly sandy silty CLAY. Common fine angular brick and clinker. Occasional rootlets. MADE GROUND								
0.90	D/ES			1.00		Light yellowish brown, slightly clayey gravelly SAND, Gravel is fine to coarse sub angular to angular flint. Sandy lense at 2.60 to 2.70m bgl. LYNCH HILL GRAVEL MEMBER.						2		
1.00	D/ES											3		
1.70	D											4		
2.20	D/ES			(2.40)								5		
2.70	D/ES					Dark brown, slightly clayey slightly sandy GRAVEL, Gravel is fine to coarse sub angular to angular flint. LYNCH HILL GRAVEL MEMBER.						6		
3.20	D			3.40								7		
3.60	D			(0.60)								8		
				4.00	End of Borehole at 4.00m						9			
											10			
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets to 1.00m bgl.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

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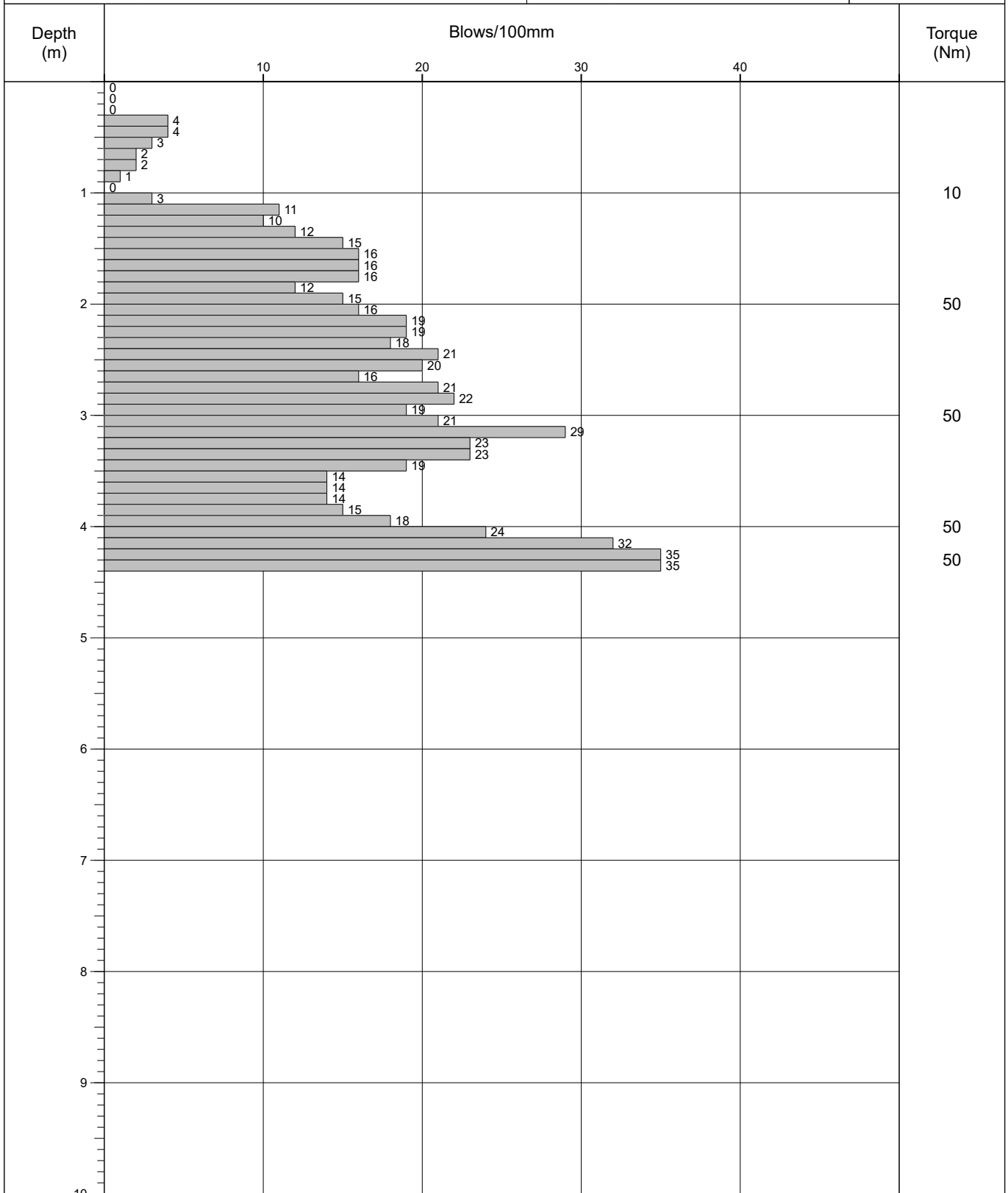
Probe Log

Probe No.

DP4

Sheet 1 of 1

Project Name:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Project No.	18255	Co-ords:		Hole Type	DP
Location:	St Helen's Close, Cowley, Middlesex UB8 5SZ	Level:	m AOD			Scale	1:50
Client:	Phillip Pank Partnership	Dates:	17/11/2020			Logged By	



Remarks	Fall Height 0.76mm	Cone Base Diameter 0.052mm	
	Hammer Weight 63.5kg	Final Depth 4.3m	
	Probe Type DPSH-B	Energy Ratio (Er) 87.96%	

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)

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP1	LASI 0.70 – 1.10 CLAY	0 - 8	Extremely low to low ($C_u = <10 - 40\text{kPa}$)
	LHGR 1.10 – 4.00 ¹ GRAVEL	17 - 96	Medium dense to very dense
DP2	LASI 1.20 – 1.50 Gravelly CLAY	13 – 63	Medium to Extremely High ($C_u = 65\text{kPa} - 315\text{kPa}$)
	LHGR 1.50 – 4.80 ¹ Gravel	50 - 113	Very Dense
	LCF 4.80-6.00 ¹ CLAY	13-21	Medium to High ($C_u = 65\text{kPa} - 105\text{kPa}$)
DP3	LHGR 1.00-4.00 ¹ GRAVEL	29-122	Medium dense to very dense
DP4	LHGR 1.10 -4.00 ¹ Gravelly SAND	42-147	Dense to very dense

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

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
LASI	17	71	100	71	CV	Very High	High
MG	16	10	88	9	CL	Low	N/A

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)

NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2

Soils Classification based on British Soil Classification System

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

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

Table B.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS1	1.20	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	11
WS2	2.10	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	5
WS3	2.60	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	5
WS4	2.70	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL.	No	No	5

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



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 51469

Client Ref: **18255**

Report Date: **10-12-2020**

Client PO: **18255**

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

Contract Title: **St Helen's Close**
For the attention of: **Timothy Stempt**

Date Received: **25-11-2020**

Date Completed: **10-12-2020**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	2
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	2
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	4
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:

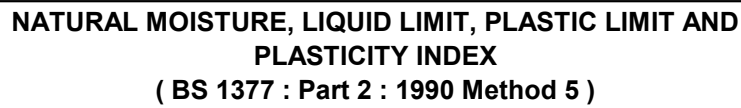
Emma Sharp (Office Manager/Director) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)

Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

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

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

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

Contract Number **51469**

Borehole/Pit No. **WS1**

Site Name **St Helen's Close**

Sample No. **2**

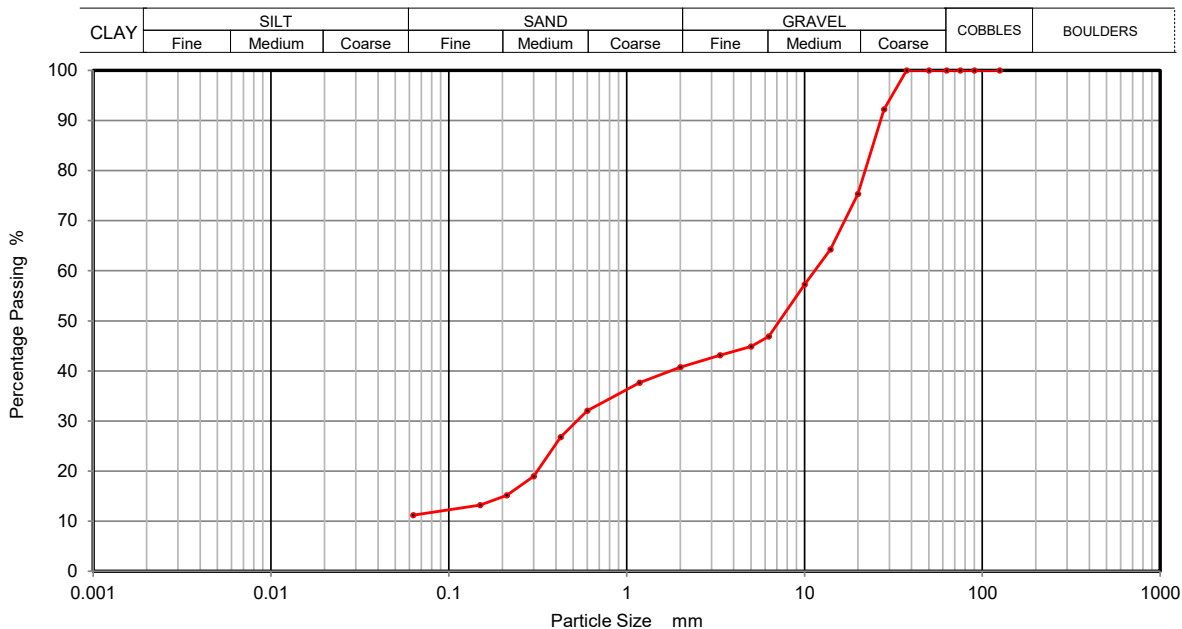
Soil Description **Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **1.20**

Depth Base **1.70**

Date Tested **30/11/2020**

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	75		
14	64		
10	57		
6.3	47		
5	45		
3.35	43		
2	41		
1.18	38		
0.6	32		
0.425	27		
0.3	19		
0.212	15		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	59
Sand	30
Silt and Clay	11

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	09/12/2020	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	10/12/2020	Paul Evans	<i>DP Evans</i>





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

Contract Number **51469**

Borehole/Pit No. **WS2**

Site Name **St Helen's Close**

Sample No. **2**

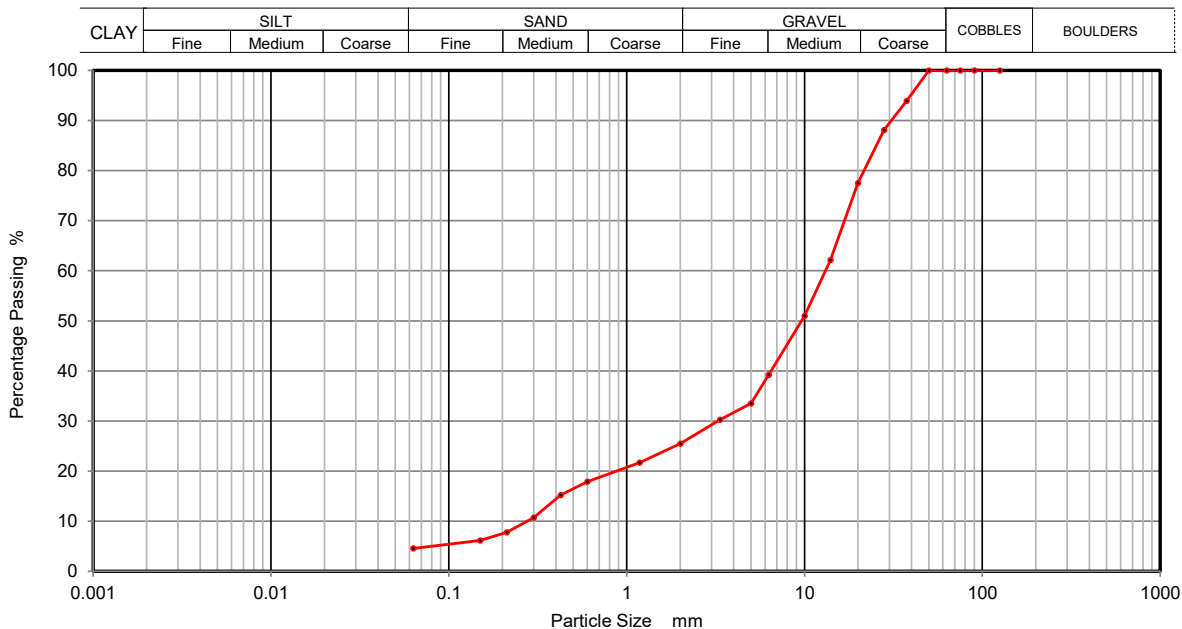
Soil Description **Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **2.10**

Depth Base **2.60**

Date Tested **30/11/2020**

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	94		
28	88		
20	77		
14	62		
10	51		
6.3	39		
5	34		
3.35	30		
2	25		
1.18	22		
0.6	18		
0.425	15		
0.3	11		
0.212	8		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	20
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	09/12/2020	Wayne Honey	W. Honey
RO/MH	Approved	10/12/2020	Paul Evans	P. Evans





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

Contract Number **51469**

Borehole/Pit No. **WS3**

Site Name **St Helen's Close**

Sample No. **2**

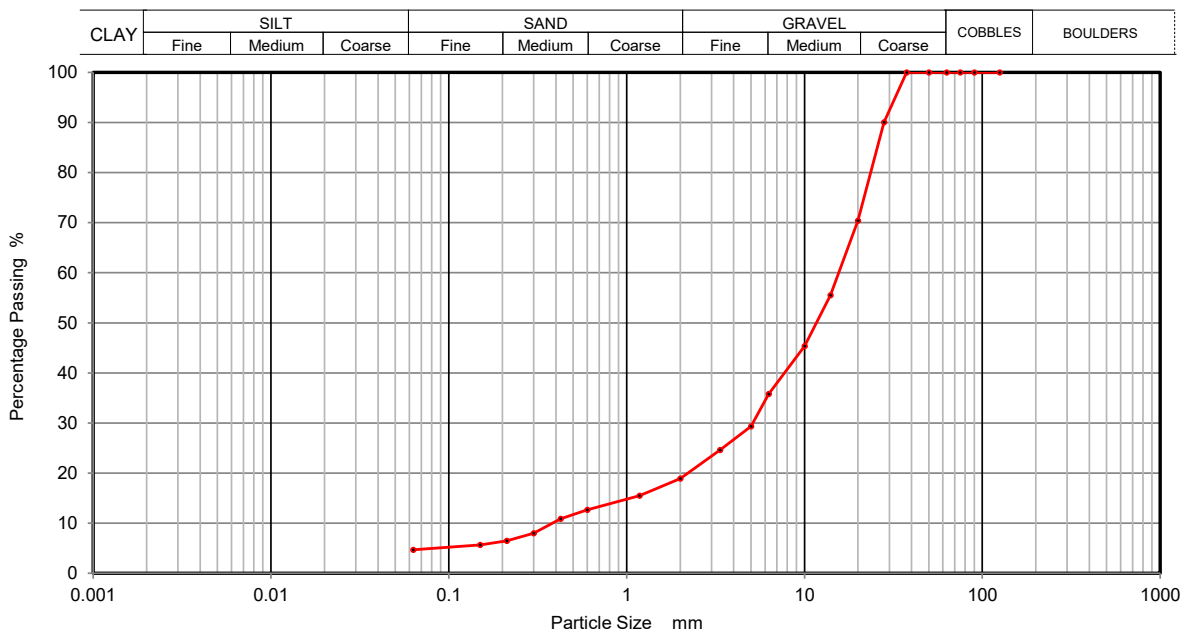
Soil Description **Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **2.60**

Depth Base **2.70**

Date Tested **30/11/2020**

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	90		
20	70		
14	55		
10	45		
6.3	36		
5	29		
3.35	25		
2	19		
1.18	15		
0.6	13		
0.425	11		
0.3	8		
0.212	6		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	0
Gravel	81
Sand	14
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	09/12/2020	Wayne Honey	W. Honey
RO/MH	Approved	10/12/2020	Paul Evans	P. Evans





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

Contract Number **51469**

Borehole/Pit No. **WS4**

Site Name **St Helen's Close**

Sample No. **2**

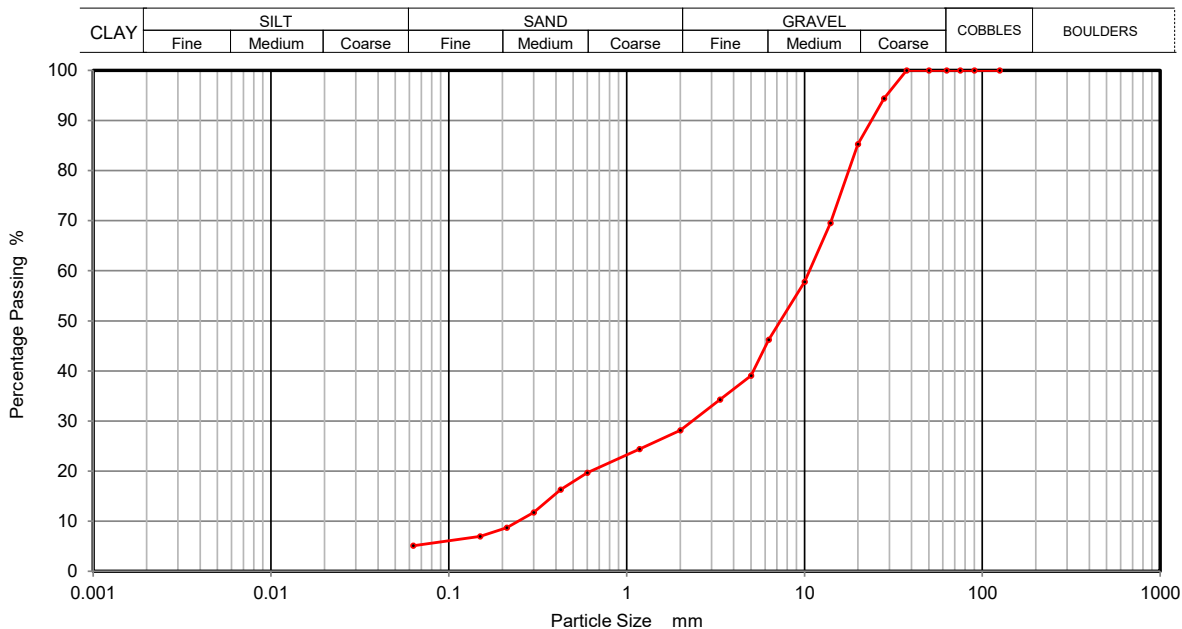
Soil Description **Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **2.70**

Depth Base **3.20**

Date Tested **30/11/2020**

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	94		
20	85		
14	70		
10	58		
6.3	46		
5	39		
3.35	34		
2	28		
1.18	24		
0.6	20		
0.425	16		
0.3	12		
0.212	9		
0.15	7		
0.063	5		

Sample Proportions	% dry mass
Cobbles	0
Gravel	72
Sand	23
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	09/12/2020	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	10/12/2020	Paul Evans	<i>P. Evans</i>



Appendix C Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Table C.I.I CSM Revised Pre Testing

Source (See Table 7.2 and Table 7.3)	Potential Contaminant (See Error! Reference source not found.)	Exposure Pathway (See Error! Reference source not found.)	Receptor (See Error! Reference source not found.)	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Backfill of former railway cutting/ Made Ground On-site historic and current site usage.	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Medium	Low	Moderate/Low	Site located on superficial deposits of the Lynch Hill Gravel Member, which is classified as a principal aquifer, The bedrock of the London Clay Formation was classified as unproductive strata and would act as an aquiclude to the deeper groundwater receptors.	Main ground investigation to confirm the ground conditions present and chemical testing prior to undertaking a generic quantitative risk assessment.
			End Users	Medium	Low	Moderate/Low		
			Off-site Users	Medium	Unlikely	Low		
	TPHs, Ground Gas	Inhalation of Vapour/gases	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Minor	Unlikely	Very low		
			Off-site Users	Medium	Unlikely	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Unlikely	Low	Surface water run-off is only anticipated in areas of hardstanding. Permeable deposits of the Lynch Hill Gravel Member create a pathway for the migration of ground gases.	
			End Users	Medium	Low	Moderate/Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Medium	Unlikely	Low		
			Migration in solution via groundwater	Surface Water	Medium	Unlikely		
		Shallow Aquifer	Medium	Low	Moderate/Low			
		Deep Aquifer	-	-	-			
		Direct contact with construction material	Buried structures	Mild	Low	Low		
	Buried Services							
	TPHs, Ground Gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Moderate/Low		
			End Users					
			Off-site Users	Medium	Low	Moderate/Low		
			Building and confined spaces					
Former Sewage works (Off site historical source)	TPHs, Ground Gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Moderate/Low	Site located on superficial deposits of the Lynch Hill Gravel Member, which is classified as a principal aquifer, The bedrock of the London Clay Formation was classified as unproductive strata and would act as an aquiclude to the deeper groundwater receptors.	Main ground investigation to confirm the ground conditions present and chemical testing prior to undertaking a generic quantitative risk assessment.
			End Users					
			Off-site Users	Medium	Low	Moderate/Low		
			Building and confined spaces					

Table C.I.2 CSM Revised Post Testing

Source (See Table 7.2 and Table 7.3)	Potential Contaminant (See Error! Reference source not found.)	Exposure Pathway (See Error! Reference source not found.)	Receptor (See Error! Reference source not found.)	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation	
				Severity	Probability	Risk			
Backfill of former railway cutting/ Made Ground On-site historic and current site usage.	Metals	Inhalation of dust	Site Workers/Site Maintenance	Medium	Low	Moderate/Low	Site located on superficial deposits of the Lynch Hill Gravel Member, which is classified as a principal aquifer, The bedrock of the London Clay Formation was classified as unproductive strata and would act as an aquiclude to the deeper groundwater receptors.	Groundwater and Ground Gas Monitoring being undertaken. A separate Soil Gas Risk assessment will be undertaken once the monitoring period is completed.	
			End Users	Medium	Low	Moderate/Low			
			Off-site Users	Medium	Unlikely	Low			
	TPHs, Ground Gas	Inhalation of Vapour/gases	Site Workers/Site Maintenance	Mild	Low	Low			
			End Users						
			Off-site Users	Minor	Unlikely	Very low			
	Metals	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Low	Moderate/Low			Surface water run-off is only anticipated in areas of hardstanding. Permeable deposits of the Lynch Hill Gravel Member create a pathway for the migration of ground gases.
			End Users	Medium	Low	Moderate/Low			
	Metals	Migration via surface runoff	Surface Water	Mild	Unlikely	Very Low			
		Migration in solution via groundwater	Surface Water	Mild	Unlikely	Very Low			
			Shallow Aquifer	Mild	Unlikely	Very Low			
			Deep Aquifer	-	-	-			
		Direct contact with construction material	Buried structures	Mild	Low	Low			
	Buried Services								
	TPHs, Ground Gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Moderate/Low			
			End Users						
			Off-site Users	Medium	Low	Moderate/Low			
			Building and confined spaces						
Former Sewage works (Off site historical source)	TPHs, Ground Gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Moderate/Low	Site located on superficial deposits of the Lynch Hill Gravel Member, which is classified as a principal aquifer, The bedrock of the London Clay Formation was classified as unproductive strata and would act as an aquiclude to the deeper groundwater receptors.	Groundwater and Ground Gas Monitoring being undertaken. A separate Soil Gas Risk assessment will be undertaken once the monitoring period is completed	
			End Users						
			Off-site Users	Medium	Low	Moderate/Low			
			Building and confined spaces						

Appendix C.2 Chemical Laboratory Results



Timothy Stempt
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: 20-13980

Site Reference: St Helens Close

Project / Job Ref: 18255

Order No: 18255/TS

Sample Receipt Date: 26/11/2020

Sample Scheduled Date: 26/11/2020

Report Issue Number: 1

Reporting Date: 02/12/2020

Authorised by:

A handwritten signature in black ink, appearing to read "Kevin Old".

Kevin Old
General 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.



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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 20-13980	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: St Helens Close	TP / BH No	WS1	WS2	WS3	WS4	
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 18255/TS	Depth (m)	0.40	0.40	0.60	0.90	
Reporting Date: 02/12/2020	DETS Sample No	513083	513084	513085	513086	

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.8	7.8	7.7	7.9
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	113	25		134
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.11	0.03		0.13
Organic Matter	%	< 0.1	MCERTS	2	2.7	1.5	0.9
Arsenic (As)	mg/kg	< 2	MCERTS	14	22	13	13
W/S Boron	mg/kg	< 1	NONE	2.1	1.1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.2	0.3	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	21	23	17	16
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	48	90	34	24
Lead (Pb)	mg/kg	< 3	MCERTS	137	231	102	73
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	17	19	14	13
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	34	38	28	26
Zinc (Zn)	mg/kg	< 3	MCERTS	97	115	64	53
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions 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: 20-13980	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: St Helens Close	TP / BH No	WS1	WS2	WS3	WS4	
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 18255/TS	Depth (m)	0.40	0.40	0.60	0.90	
Reporting Date: 02/12/2020	DETS Sample No	513083	513084	513085	513086	

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.20	0.73	0.49	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.17	0.17	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.37	1	0.89	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.34	0.84	0.79	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.41	0.66	0.73	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.36	0.58	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.18	0.40	0.78	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.31	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.19	0.57	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	0.39	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	4.6	5.8	< 1.6



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 20-13980	Date Sampled	None Supplied				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: St Helens Close	TP / BH No	WS3				
Project / Job Ref: 18255	Additional Refs	None Supplied				
Order No: 18255/TS	Depth (m)	0.60				
Reporting Date: 02/12/2020	DETS Sample No	513085				

Determinand	Unit	RL	Accreditation				
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05			
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1			
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1			
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	1			
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	5			
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	11			
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	17			



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 20-13980	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: St Helens Close	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 18255/TS	Depth (m)	0.40	0.40	0.90		
Reporting Date: 02/12/2020	DETS Sample No	513083	513084	513086		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	4	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42		



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 20-13980	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: St Helens Close	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 18255/TS	Depth (m)	0.40	0.40	0.90		
Reporting Date: 02/12/2020	DETS Sample No	513083	513084	513086		

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



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Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 20-13980	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: St Helens Close	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 18255/TS	Depth (m)	0.40	0.40	0.90		
Reporting Date: 02/12/2020	DETS Sample No	513083	513084	513086		

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 52	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008		
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2																																							
DETS Report No: 20-13980		Date Sampled	None Supplied		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </tbody> </table>					Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
--	--	10%																																					
6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Soils Ltd		Time Sampled	None Supplied																																				
Site Reference: St Helens Close		TP / BH No	WS3																																				
Project / Job Ref: 18255		Additional Refs	None Supplied																																				
Order No: 18255/TS		Depth (m)	0.60																																				
Reporting Date: 02/12/2020		DETS Sample No	513085																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	0.9																																				
Loss on Ignition	%	< 0.01	2.80																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	5.8																																				
pH ^{MU}	pH Units	N/a	7.7																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U		< 0.01			< 0.1	0.5	2	25																															
Barium ^U		< 0.02			< 0.2	20	100	300																															
Cadmium ^U		< 0.0005			< 0.005	0.04	1	5																															
Chromium ^U		< 0.005			< 0.05	0.5	10	70																															
Copper ^U		0.02			0.2	2	50	100																															
Mercury ^U		< 0.0005			< 0.005	0.01	0.2	2																															
Molybdenum ^U		0.008			0.08	0.5	10	30																															
Nickel ^U		< 0.007			< 0.07	0.4	10	40																															
Lead ^U		< 0.005			< 0.05	0.5	10	50																															
Antimony ^U		< 0.005			< 0.05	0.06	0.7	5																															
Selenium ^U		< 0.005			< 0.05	0.1	0.5	7																															
Zinc ^U		< 0.005			< 0.05	4	50	200																															
Chloride ^U		5.6			56	800	15000	25000																															
Fluoride ^U		0.6			6	10	150	500																															
Sulphate ^U		13.9			139	1000	20000	50000																															
TDS		94			940	4000	60000	100000																															
Phenol Index		< 0.01			< 0.1	1	-	-																															
DOC		9.1			91.4	500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)			0.10																																				
Dry Matter (%)			86.4																																				
Moisture (%)			15.8																																				
Stage 1																																							
Volume Eluate L10 (litres)			0.89																																				

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



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 20-13980	
Soils Ltd	
Site Reference: St Helens Close	
Project / Job Ref: 18255	
Order No: 18255/TS	
Reporting Date: 02/12/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 513083	WS1	None Supplied	0.40	14.3	Brown loamy sand
^ 513084	WS2	None Supplied	0.40	16.9	Brown loamy sand with brick
^ 513085	WS3	None Supplied	0.60	13.7	Brown loamy sand
^ 513086	WS4	None Supplied	0.90	15.5	Brown loamy sand with chalk

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

Insufficient Sample ^{1/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: 20-13980

Soils Ltd

Site Reference: St Helens Close

Project / Job Ref: 18255

Order No: 18255/TS

Reporting Date: 02/12/2020

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 diphencylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (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

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



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t: 01622 850410

DETS Report No: 20-13981

Site Reference: St Helens Close

Project / Job Ref: 18255

Order No: 18255/TS

Sample Receipt Date: 26/11/2020

Sample Scheduled Date: 26/11/2020

Report Issue Number: 1

Reporting Date: 02/12/2020

Authorised by:

A handwritten signature in black ink, appearing to read "Kevin Old".

Kevin Old
General 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.



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Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 20-13981	Date Sampled	20/11/20	20/11/20	20/11/20		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: St Helens Close	TP / BH No	WS1	WS4	WS2		
Project / Job Ref: 18255	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 18255/TS	Depth (m)	0.90	1.70	3.50		
Reporting Date: 02/12/2020	DETS Sample No	513087	513088	513089		

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.5	7.7	9.1	
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	430	< 200	230	
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.04	< 0.02	0.02	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	75	< 10	30	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.07	< 0.01	0.03	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	
Ammonium as NH ₄	mg/kg	< 0.5	NONE	0.8	< 0.5	< 0.5	
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.08	< 0.05	< 0.05	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	18	7	13	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	8.8	3.7	6.7	
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	36	< 3	< 3	
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	17.9	< 1.5	< 1.5	
W/S Magnesium	mg/l	< 0.1	NONE	1.9	0.3	0.4	

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



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 20-13981	
Soils Ltd	
Site Reference: St Helens Close	
Project / Job Ref: 18255	
Order No: 18255/TS	
Reporting Date: 02/12/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
513087	WS1	None Supplied	0.90	13.2	Brown sandy clay
513088	WS4	None Supplied	1.70	1.8	Light brown sandy gravel with stones
513089	WS2	None Supplied	3.50	4.3	Light brown sandy gravel with stones

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-13981

Soils Ltd

Site Reference: St Helens Close

Project / Job Ref: 18255

Order No: 18255/TS

Reporting Date: 02/12/2020

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 diphencylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix C.3 General Assessment Criteria

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

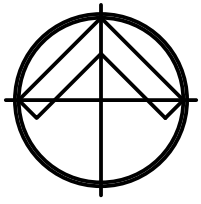
- 1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.
- 1.2 Environment Act 1995, Section 57, DoE 1995.
- 1.3 CLR 11, '*Model Procedures for the Management of Contaminated Land*', DEFRA and Environment Agency, 2004.
- 1.4 Environment Agency Science Report SC050021/SR2 'Human health 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.

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			With home-grown produce			Without home-grown produce			Allotments			Commercial			Residential			Park						
Type	Contaminants	Species	Year	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		
Metals	Antimony		2010							550						7500						EIC/AGS/ CL:AIRE	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						200			310			80			2330			630		1300	C4SL	DEFRA	2014
	Mercury	Elemental	2012				1.0			1.0			26			26						SGV	DEFRA	2012
			2015				1.2			1.2			21			58			16		30	S4UL	LQM/CIEH	2015
		Inorganic	2012				170			170			80			36000						SGV	DEFRA	2012
			2015				40			56			19			1100			120		240	S4UL	LQM/CIEH	2015
		Methyl	2012				11			11			8			410						SGV	DEFRA	2012
			2015				11			15			6			320			40		68	S4UL	LQM/CIEH	2015
	Nickel		2012				130			130			230			1800						SGV	DEFRA	2012
			2015				130			180			53			980			230		800	S4UL	LQM/CIEH	2015
	Selenium		2012				350			350			120			13000						SGV	DEFRA	2012
			2015				250			430			88			12000			1100		1800	S4UL	LQM/CIEH	2015
	Vanadium		2015				410			1200			91			9000			2000		5000	S4UL	LQM/CIEH	2015
	Zinc		2015				3700			40000			620			730000			81000		170000	S4UL	LQM/CIEH	2015
BTEX & MTBE	Benzene		2012				0.33		0.33			0.07			95						SGV	DEFRA	2012	
			2014				0.87		3.3			0.18			98			140		230	C4SL	DEFRA	2014	
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015
	Toluene		2012				610		610			120			4400						SGV	DEFRA	2012	
			2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Ethylbenzene		2012				350		350			90			2800						SGV	DEFRA	2012	
			2015	47	110	260	83	190	440	16	39	91	4700	13000	27000	24000	24000	25000	17000	22000	27000	S4UL	LQM/CIEH	2015
	Xylenes	o-xylene	2012				250		250			160			2600						SGV	DEFRA	2012	
			2015	60	140	330	88	210	480	28	67	160	6600	15000	33000	41000	42000	43000	17000	24000	33000	S4UL	LQM/CIEH	2015
		m-xylene	2012				240		240			180			3500						SGV	DEFRA	2012	
			2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000	S4UL	LQM/CIEH	2015
		p-xylene	2012				230		230			160			3200						SGV	DEFRA	2012	
		2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000	S4UL	LQM/CIEH	2015	
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	600000	610000	620000	150000	220000	320000	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	65000	92000	140000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015	

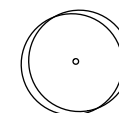
Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)											Name	Authority	Date
			With			Without			Allotments			Commercial			Residential			Park							
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6				
Type	Contaminants	Species	Year																						
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015	
	Aliphatic + Aromatic >C44 - C70			1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015	
Polycyclic Aromatic Hydrocarbons (PAH' s) (mg/kg)	Acenaphthene		2015	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015	
	Acenaphthylene		2015	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015	
	Anthracene		2015	2400	5400	11000	31000	35000	37000	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015	
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015	
	Benzo(a)pyrene		2014			5			5.3			5.7			76			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	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015	
	Fluoranthene		2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015	
	Fluorene		2015	170	400	860	2800	3800	4500	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015	
	Indeno(1,2,3-cd)pyrene		2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015	
	Naphthalene		2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190	460	1100	4900	4900	4900	1200	1900	3000	S4UL	LQM/CIEH	2015	
	Phenanthrene		2015	95	220	440	1300	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015	
	Pyrene		2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015	
	Coal Tar(Bap as surrogate matter)		2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015	
Chloroalkanes & alkenes	1,2 Dichloroethane		2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015	
	1,1,1 Trichloroethane		2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000	76000	100000	S4UL	LQM/CIEH	2015	
	1,1,2,2 Tetrachloroethane		2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015	
	1,1,1,2 Tetrachloroethane		2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015	
	Tetrachloroethene		2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810	1100	1500	S4UL	LQM/CIEH	2015	
	Tetrachloromethane (Carbon Tetrachloride)		2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015	
	Trichloroethene		2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015	
	Trichloromethane		2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015	
Explosives	Vinyl Chloride (chloroethene)		2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015	
	2,4,6 Trinitrotoluene		2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015	
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)		2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015	
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)		2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000	23000	24000	S4UL	LQM/CIEH	2015	
Pesticides	Aldrin		2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015	
	Dieldrin		2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015	
	Atrazine		2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015	
	Dichlorvos		2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015	
	Alpha - Endosulfan		2015	7.4	18	41	160	280	410	1.2	2.9	6.8	5600	7400	8400	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015	
	Beta - Endosulfan		2015	7	17	39	190	320	440	1.1	2.7	6.4	6300	7800	8700	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015	
	Alpha -Hexachlorocyclohexanes		2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015	
	Beta -Hexachlorocyclohexanes		2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015	
Chlorobenzenes	Gamma -Hexachlorocyclohexanes		2015	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	
	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															

NOTE	
Priority	Guideline (mg kg ⁻¹)
1	Site Specific Assessment Criteria (SSAC) (Soils Limited)
2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)
4	2015: Suitable 4 Use Level (S4UL) (Nathanail <i>et al</i> , 2015)
For Generic Risk Assessment, the values in Bold have priority	
Table reviewed February 2020	

Appendix D Information Provided by the Client



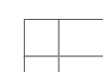
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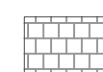
New tree



Hedgerow



Precast slabs



Precast setts



Shrubs



Grass

DRAFT

rev date

Planning

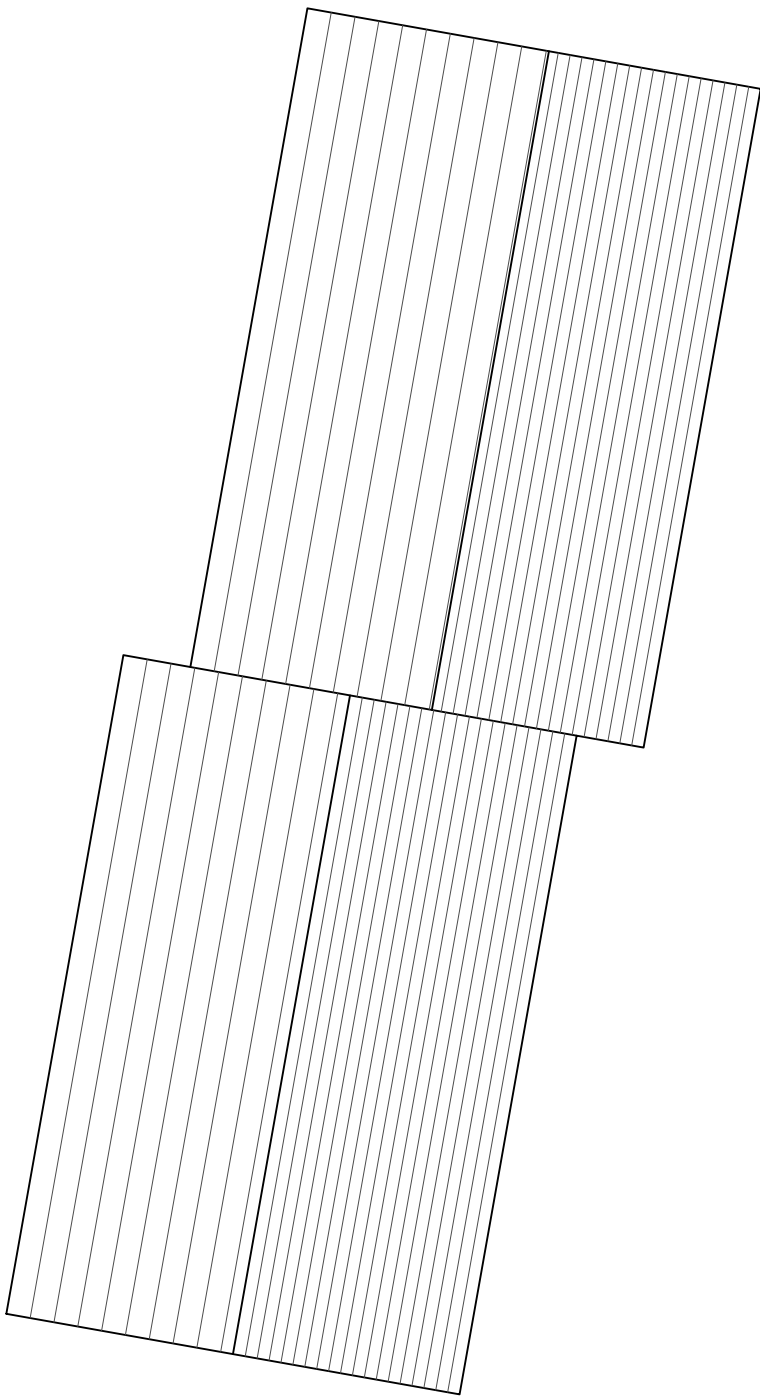
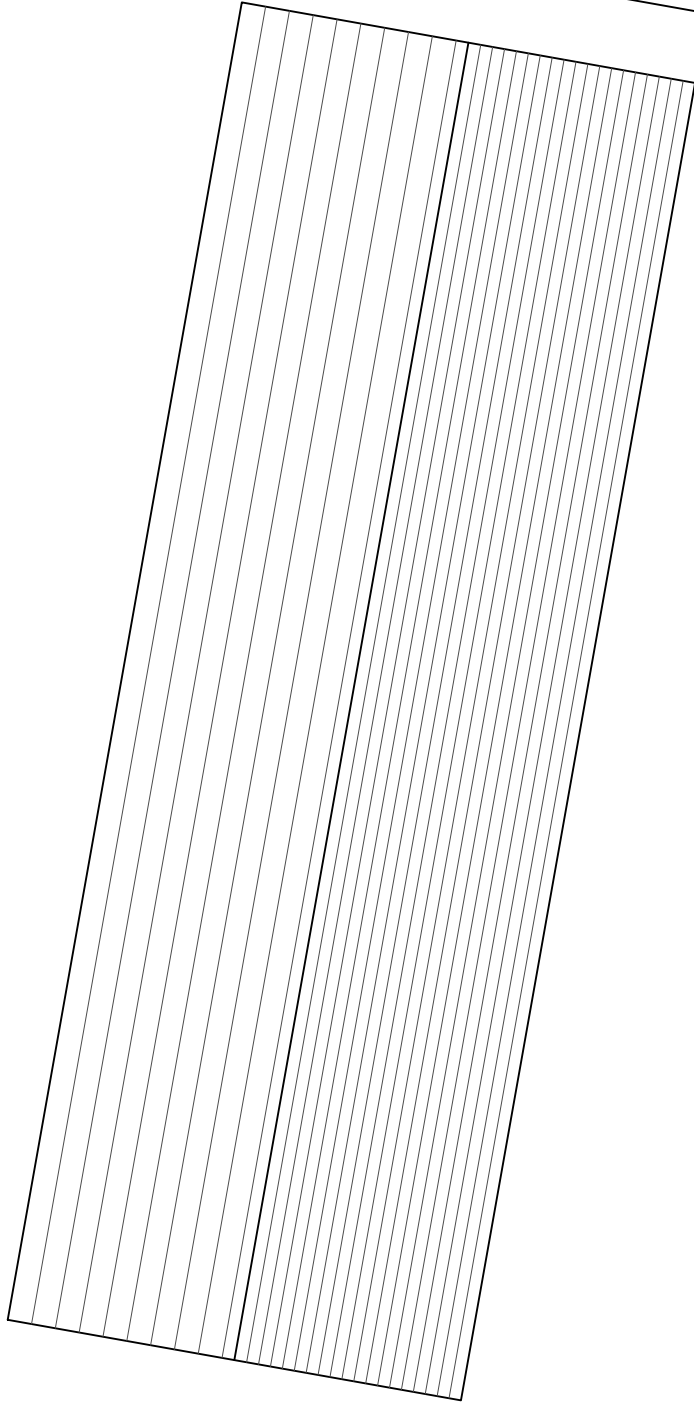
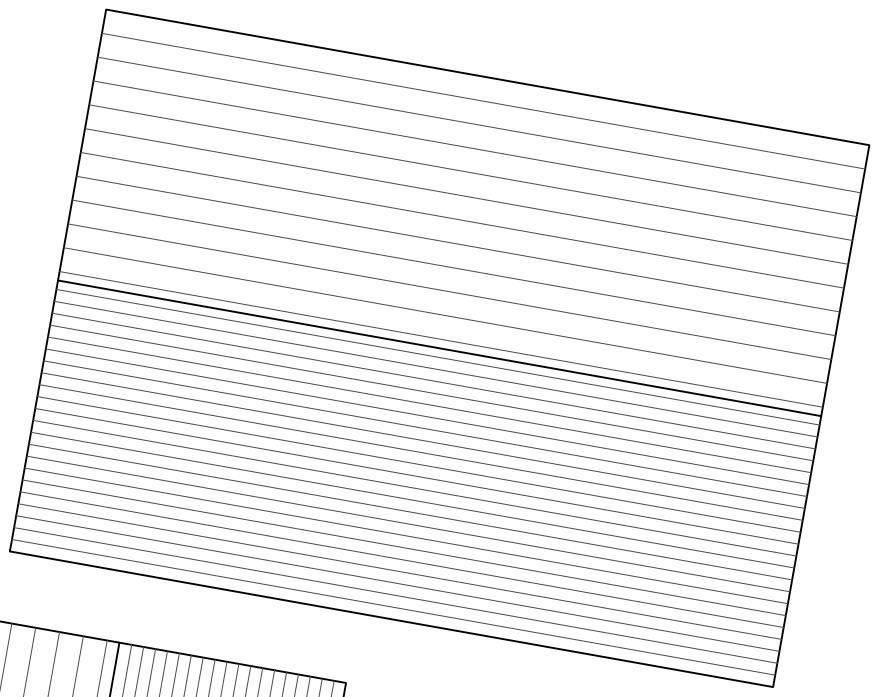
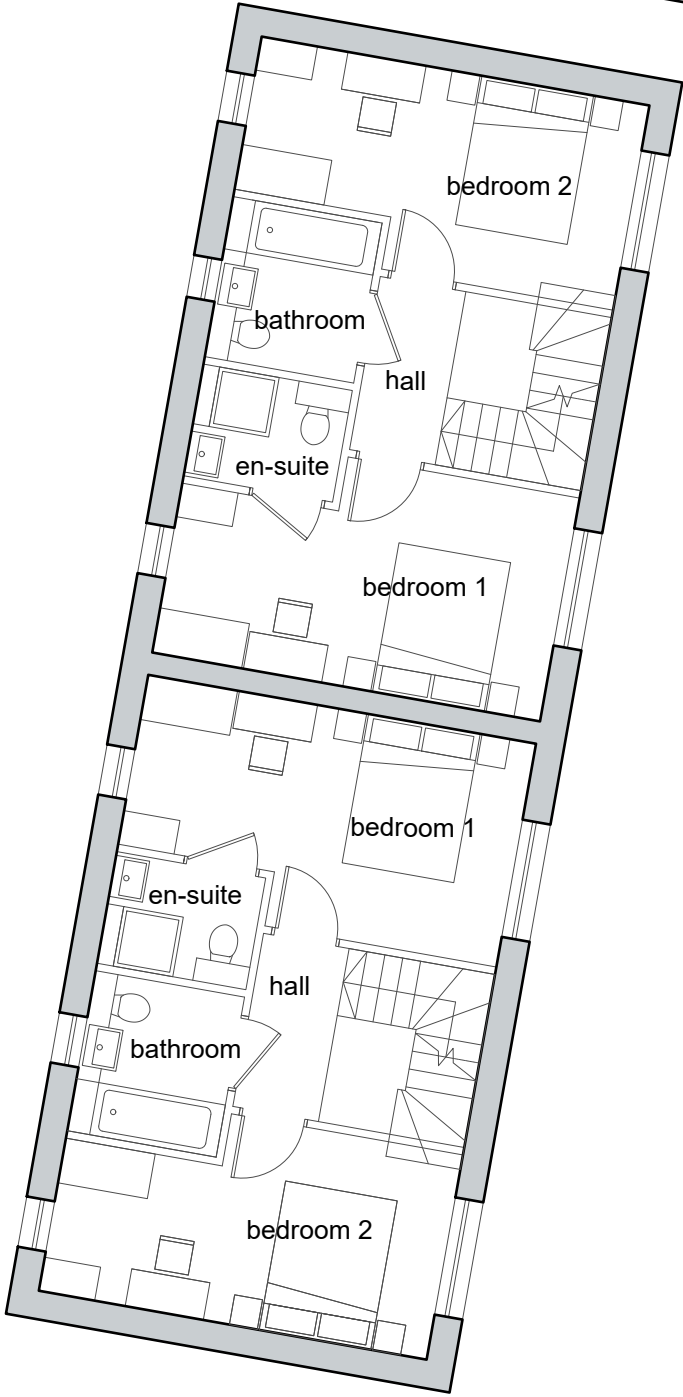
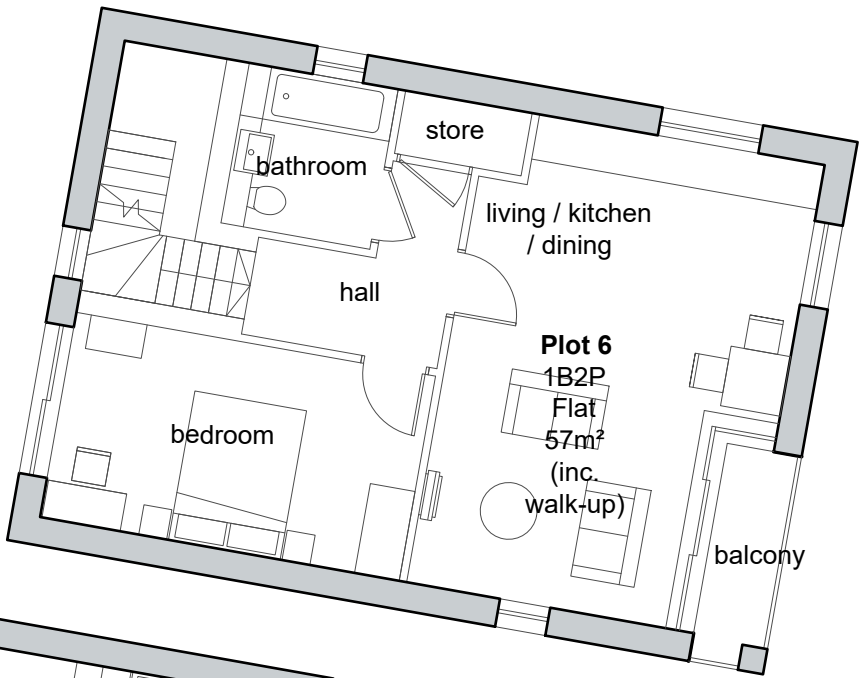
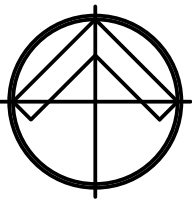
St Helen Close, Cowley UB8
Site layout and ground floor plan

drawn checked

drawing number	revision	scale @ A2	date	drawn	checked
1955 P-02	-	1:100	12.12.19	JS	SC

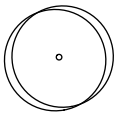
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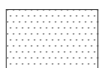
New tree



Shrubs



Hedgerow



Grass



Precast slabs



Precast setts

rev date

drawn checked

Planning

St Helen Close, Cowley UB8
First floor and roof plans

drawing number	revision	scale @ A2	date	drawn	checked
1955 P-03	-	1:100	12.12.19	JS	SC

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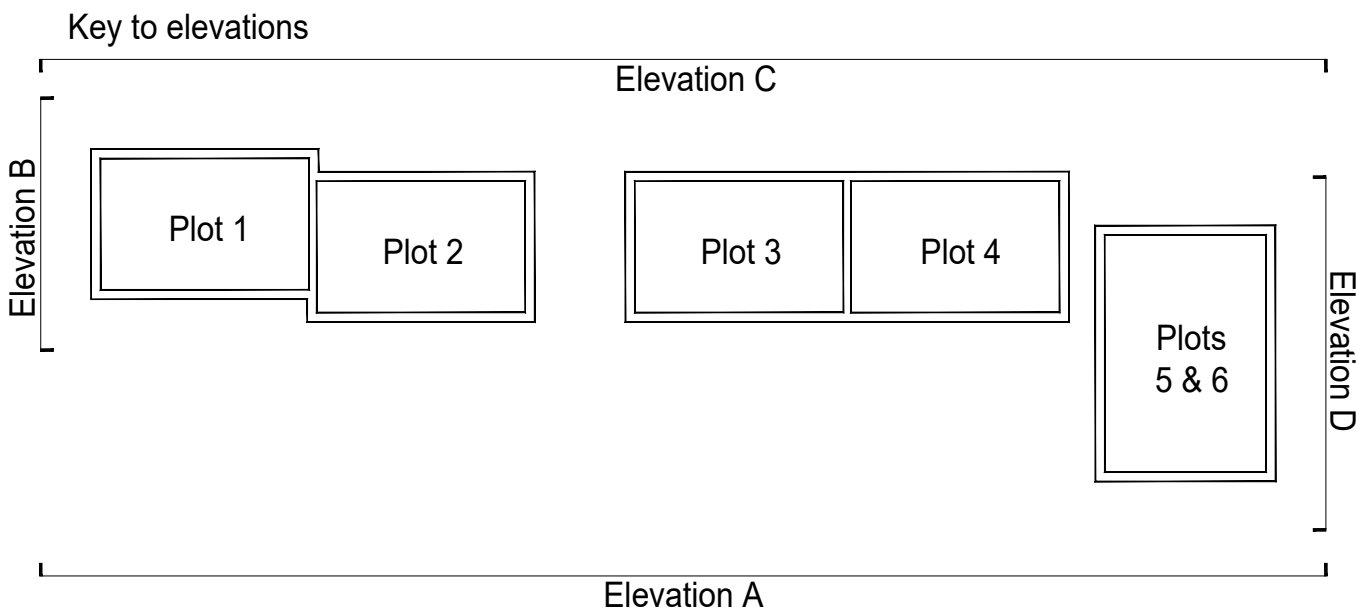




East Elevation (A)



West Elevation (C)



0 1 2 3 4 5 6 7 8 9 10m
Scale @ 1:100

Material Schedule

External walls:

- Chalky / buff multi stock brick

Roofs:

- Concrete tiles
- Dark grey PPC aluminium rainwater pipes and gutters to match windows
- Zinc Dormers
- Dark grey PPC faced canopy over flat block entrances

Windows and doors:

- Dark grey PPC aluminium generally
- Front entrance door timber composite - colour TBC

Balconies

- Dark PPC mild steel metalwork

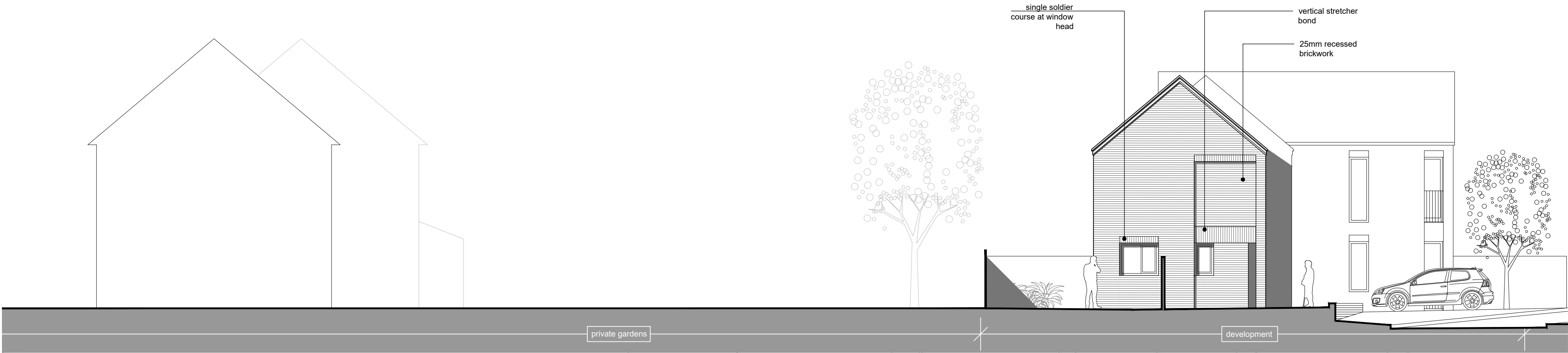
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Planning
St Helen Close, Cowley UB8
Elevations
Sheet 1

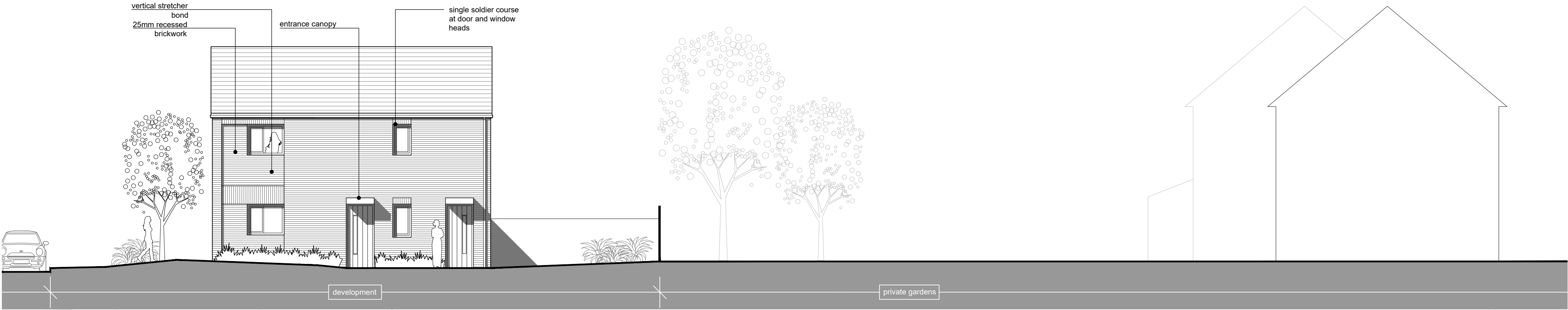
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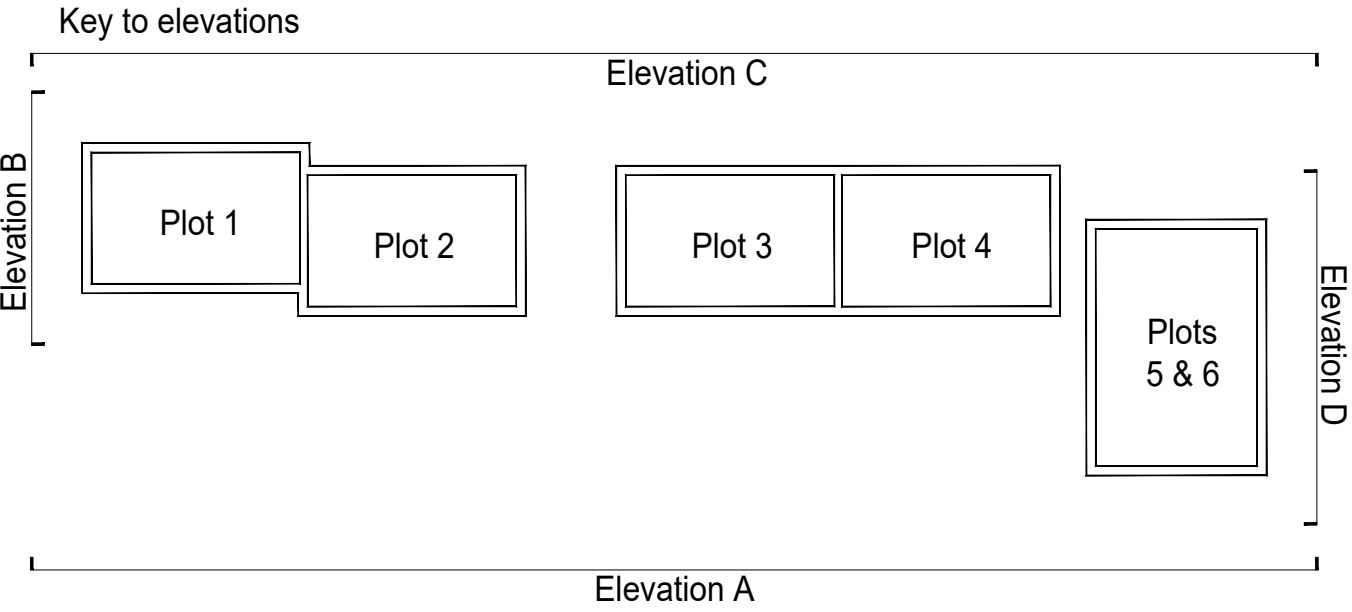




South Elevation (B)



North Elevation (D)



0 1 2 3 4 5 6 7 8 9 10m
Scale @ 1:100

Material Schedule

- External walls:
- Chalky / buff multi stock brick

- Roofs:
- Concrete tiles
 - Dark grey PPC aluminium rainwater pipes and gutters to match windows
 - Zinc Dormers
 - Dark grey PPC faced canopy over flat block entrances

- Windows and doors:
- Dark grey PPC aluminium generally
 - Front entrance door timber composite - colour TBC

- Balconies
- Dark PPC mild steel metalwork

rev	date	description	drawn	checked
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Planning
St Helen Close, Cowley UB8
Elevations
Sheet 2

drawing number	revision	scale @ A2	date	drawn	checked
1955 P-05	-	1:100	18.01.20	JS	SC

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Aerial view looking north-west



View looking north-west

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rev date description drawn checked

Planning

St Helen Close, Cowley UB8

3D Impressions

Sheet 1

drawing number	revision	scale @ A3	date	drawn	checked
1955 P-06	-	NTS	23.01.20	JS	SC

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View looking south-west



Aerial view looking south-east

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rev	date	description	drawn	checked
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Planning

St Helen Close, Cowley UB8

3D Impressions

Sheet 2

drawing number	revision	scale @ A3	date	drawn	checked
1955 P-07	-	NTS	12.12.19	JS	SC

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