



## **Main Investigation Report**

at

**Haydon Drive, Pinner, London Borough of Hillingdon HA5 2PW**

for

**Philip Pank Partnership LLP**

**Reference: 21724/MIR Rev1.0**

**April 2025**

## Control Document

### Project

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### Prepared by

Nikos Sidiropoulos BSc MSc CEng MIMMM RoGEP  
(ns@soilslimited.co.uk)



### First check by

Eur Ing R B Higginson BSc, PGDip, CEng, MICE, FGS.



### Second check by

S J Bevins BSc.(Hons) MSc. CEng CEnv MIMMM FGS MCortE RoGEP



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

This document comprises the Main Investigation Report (MIR) and incorporates the results, discussion, and conclusions to this intrusive works. General site data is recorded below:

<b>Commission Record</b>	
Client	Philip Pank Partnership LLP
Site Name	Haydon Drive, Pinner, London Borough of Hillingdon HA5 2PW
Grid Reference	TQ 104 894
Soils Limited Quotation Ref	Q29508, dated 4 <sup>th</sup> December 2024
Clients Purchase Order	Q29508, dated 4 <sup>th</sup> December 2024

The record of revision to this document is presented below:

<b>Record Of Revisions</b>		
<b>Revision</b>	<b>Date</b>	<b>Reason</b>
1.0	February 2025	Original
1.1	April 2025	Revision based on updated proposed development plan, supplied by Client on 24/04/25

**Note(s):** The latest revised document supersedes all previous revisions of the MIR produced by Soils Limited.

Documents associated with this development that must be referred to are given below.

<b>Record Of Associated Documents</b>			
<b>Reference</b>	<b>Type</b>	<b>Date</b>	<b>Creator</b>
21724/PIR Rev1.1	Desk Study	February 2025	Soils Limited
TH 4042	Tree Data Schedule	June 2023	Trevor Heaps

**Limitations and Disclaimers**

The report was prepared solely for the brief described in our quotation and Section 1.1 of this report. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of our engagement.

We have exercised 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.

This report is a snapshot of the site and conditions taken only at the time of our investigation works and described in our reporting. The ground is a product of continuing natural and artificial processes, and has variation by depth and location that cannot be determined absolutely. While a ground investigation will aim to understand and mitigate, risk cannot be eliminated.

Current regulations and good practice were used in the preparation of this report. Consideration of any subsequent changes to regulations or practice that may have occurred following issue of this report is the responsibility of the user.

If the term “competent person” is used in this report or any Soils Limited document, it means an engineering geologist or civil engineer with a minimum of three years post graduate experience in the understanding and application of the appropriate codes of practice.

Unless the site investigation works have been designed and specified in accordance with EC7, this report is not a Ground Investigation Report as defined by Eurocode 7.

Any reference to ground level relates to the site level at the time of the investigation, unless otherwise stated. Ground elevations and coordinates are only provided when this forms part of our engagement.

A survey of the possible presence or absence of invasive species including Japanese Knotweed is outside the scope of this investigation.

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## Section I      Introduction

### 1.1      Objective of Investigation

The Client commissioned Soils Limited 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 made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the exploratory holes.

Soil samples were to be 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: 21724/PIR, January 2025) and the Conceptual Site Model presented in Appendix E.1.

### 1.2      Site Description

The site was an irregular shaped plot of land that was occupied by residential terraced bungalows with four rows of east-west aligned bungalows in the centre of the site and two rows of residential garages.

The western area to the edge of the westernmost bungalows was flat and level, with the remaining site area noted to dip down towards the east at c.4°. The site covering was a mixture of tarmacadam roads and footpaths, concrete paving pathways to the bungalows and predominantly grass-covered soft landscaping. Semi-mature trees, small hedges and shrubs were noted across the site and several semi-mature trees along the northern site boundary.

The site location plan is given in Figure 1. An aerial photograph of the site and its close environs has been included in Figure 2.

### 1.3      Proposed Development

The proposed development consists of the demolition of the existing 16 properties, to create 21 new houses, comprising 15 four bedroom houses and six three bedroom houses, each with its own private garden. There will be a total of 31 car parking spaces and two cycle spaces for each dwelling.

The plans also include a new children's play area and a public open space as well as planting of new trees and shrubs.

In compiling this report reliance was placed on drawing M10029 APL006 revision A prepared by Hunters and dated March 2025. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be

applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the Client are presented in Appendix F.

#### **1.4 Anticipated Geology**

The 1:50,000 BGS Geology map showed the site to be situated on the Lambeth Group and the overlying London Clay Formation with no overlying superficial deposits.

The London Clay Formation is recorded at surface across the northwest section of the site.

##### **1.4.1 Lambeth Group**

The Lambeth Group (formerly the Woolwich and Reading Beds) occurs in the London and Hampshire Basins, where it directly overlies the Chalk or Thanet Sand Formation, and is succeeded by the Harwich and Lambeth Groups. Although generally less than 50 metres thick, its lithological variability and position beneath much of London has concerned tunnelling engineers since the early 19th century.

The relationship between the different depositional environments is seen in central and south-east London, where deposits of fine-grained sand, flint gravel beds, mottled clay, shell beds and altered beds form a complex interdigitating sequence, which is divided into three formations, the Woolwich and the Reading Formation, depending on the local succession, both overlying the Upnor Formation.

Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate.

The top of the Lambeth Group is marked by the eroded or interburrowed surface at the base of the overlying Thames Group. The uppermost part of the Lambeth Group can be the Reading Formation or the Woolwich Formation, depending on the local succession, or the Upnor Formation, depending on the depth of pre-Thames Group erosion. The Lambeth Group is overlain by sands, silts, clays or gravel beds of the Harwich Formation, depending on the local sequences, or gravelly sandy clays at the base of the Lambeth Group.

The base of the Lambeth Group is taken at the base of the Upnor Formation. In the Hampshire Basin and the west of the London Basin, the Lambeth Group overlies the Chalk Group. In the centre and east of the London Basin it overlies the Thanet Formation, and in Suffolk the Ormesby Clay Member of the Lista Formation.

##### **1.4.2 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.

The lower boundary is generally marked by a thin bed of well-rounded flint gravel and/or a glauconitic horizon. The formation overlies the Harwich Formation or where the Harwich Formation is absent the Lambeth Group.

In the north London area, the upper part of the London Clay Formation has been disturbed by periglacial action and may contain pockets of sand and gravel.

## Section 2      Site Works

### 2.1      Proposed Project Works

The intended investigation, as outlined within the Soils Limited quotation (Q29508, dated 4<sup>th</sup> December 2024), was to comprise the following items:

- Service clearance of proposed test hole locations;
- 4no. cable percussion borehole to 15.00 metres below existing ground level (bgl);
- Geotechnical laboratory testing;
- Chemical laboratory testing.

#### 2.1.1    Actual Project Works

The actual project site works were undertaken between 13<sup>th</sup> and 15<sup>th</sup> January 2025, with subsequent laboratory testing and reporting, and comprised:

- Service clearance of proposed test hole locations;
- 4no. cable percussion borehole to 15.00 metres below existing ground level (bgl);
- Geotechnical laboratory testing;
- Chemical laboratory testing.

### 2.2      Ground Conditions

On the 13<sup>th</sup> January 2025, service clearance of the proposed test hole locations prior to intrusive works was undertaken, using a Cable Avoidance Tool (CAT) and Genny.

Between the 13<sup>th</sup> and 15<sup>th</sup> January 2025, four cable percussion boreholes (BH1-BH4) were drilled to a depth of 15.00m bgl.

The exploratory hole locations are shown on Figure 3, their locations were agreed with the Client prior to works.

The exploratory hole locations were backfilled with arisings.

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

**Table 2.1 Final Depth of Exploratory Holes**

Exploratory Hole	Depth (m bgl)
BH1	15.00
BH2	15.00
BH3	15.00
BH4	15.00

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the exploratory 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 must be made to the detailed records given within Appendix B, but for the purposes of discussion, the succession of conditions encountered in the exploratory holes in descending order can be summarised as:

**Topsoil (MG)**  
**Weathered Lambeth Group (wLMBE)**  
**Lambeth Group (LMBE)**

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

**Table 2.2 Ground Conditions**

<b>Strata</b>	<b>Depth Encountered (m bgl)</b>		<b>Typical Thickness (m)</b>	<b>Typical Description</b>
	<b>Top</b>	<b>Bottom</b>		
TS	G.L.	0.30	0.30	Grass over brown sandy CLAY with roots.
wLMBE	0.30	2.00 – 4.00	2.60	Soft to firm brown mottled yellowish grey slightly silty slightly sandy CLAY, with occasional rootlets
LMBE	2.00 – 4.00	15.00 <sup>1,2</sup>	Not proven	Firm to very stiff brown slightly mottled light grey slightly sandy CLAY.

**Note(s):** <sup>1</sup> Final depth of exploratory hole. <sup>2</sup> Base of strata not encountered. The depths given in this table are taken from the ground level on-site at the time of investigation.

## 2.3 Ground Conditions Encountered in Exploratory Holes

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

### 2.3.1 Topsoil

Soils described as Topsoil were encountered in each of the 4no. exploratory holes from ground level to a depth of 0.30m bgl comprising grass over brown sandy CLAY with roots.

The established depth of Topsoil found at each exploratory hole location have been included in Table 2.3.

**Table 2.3 Established Depth of Topsoil**

<b>Exploratory Hole</b>	<b>Depth (m bgl)</b>
BH1	0.30
BH2	0.30
BH3	0.30
BH4	0.30

**2.3.2 Weathered Lambeth Group**

Soils described on the logs as Weathered Lambeth Group were encountered in each of the 4no. exploratory hole locations directly beneath the Topsoil to proven depths ranging between 2.00m (BH1) and 4.00m (BH3).

The Weathered Lambeth Group comprised soft to firm brown mottled yellowish grey slightly silty slightly sandy CLAY, with occasional rootlets.

The established depth of Weathered Lambeth Group found at each exploratory hole location have been included in Table 2.4.

**Table 2.4 Established Depth of Weathered Lambeth Group**

<b>Exploratory Hole</b>	<b>Depth (m bgl)</b>
BH1	2.00
BH2	3.00
BH3	4.00
BH4	2.50

**2.3.3 Lambeth Group**

The soils of the Lambeth Group were found in each of the 4no. exploratory hole locations for their full depth of 15.00m bgl.

The soils of the Lambeth Group comprised firm to very stiff brown slightly mottled light grey CLAY with rare bands of sandy CLAY. Sand is fine. Occasional to rare cream calcareous inclusions with subangular, medium sized limestones. Occasional decayed root traces were noted. A band of soft brown slightly mottled grey sandy CLAY was recorded at circa 10.5m-11.0m bgl in BH2.

The established depth of Lambeth Group found at each exploratory hole location have been included in Table 2.5.

**Table 2.5 Established Depth of Lambeth Group**

<b>Exploratory Hole</b>	<b>Depth (m bgl)</b>
BH1	15.00 <sup>1</sup>
BH2	15.00 <sup>1</sup>
BH3	15.00 <sup>1</sup>
BH4	15.00 <sup>1</sup>

**Note(s):** <sup>1</sup> Final depth of exploratory hole.

## 2.4 Roots

Roots were encountered in each of the 4no. exploratory holes at depths ranging between 0.30m (BH1) and 1.20m bgl (BH4) with decayed traces of roots noted at a depth of 5.50m bgl in BH2.

The established depth of root penetration found at the exploratory hole locations has been included in Table 2.6.

**Table 2.6 Established Depth of Root Penetration**

Exploratory Hole	Depth (m bgl)
BH1	0.30
BH2	5.50 (decayed traces)
BH3	0.70
BH4	1.20

As discussed in Section 1.2, semi-mature trees, small hedges and shrubs were noted across the site and several semi-mature trees along the northern site boundary.

Based on information supplied by the Client (source: Tree Data Schedule, Ref: TH 4042, dated June 2023 by Trevor Heaps) 35no. trees were recorded scattered either on site, around or off site near the site perimeter; it must be mentioned that several the existing trees appeared to be located either in proximity or within the proposed development footprint, including trees of high water demand (Ash, Willow, Cypress).

Furthermore, Google Earth aerial photos between 1999 and 2013 did indicate the presence of what appeared to be semi-mature trees at and near the W boundary and scattered at the E/SE portion of the site, which were not noted during the investigation in January 2025.

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.

To establish if the soils are desiccated due to the presence of roots, historic maps must be checked to see when trees, shrubs or bushes were present or had been present within approximately the last 20 years.

## 2.5 Groundwater

Groundwater was only encountered in BH1 and BH4 as a strike (possibly perched) at 8.00m and 10.50m bgl respectively, during the intrusive investigation undertaken between the 13<sup>th</sup> and 15<sup>th</sup> January 2025 and have been presented in Table 2.7.

**Table 2.7 Groundwater Records**

<b>Exploratory Hole</b>	<b>Depth to Water (m bgl)</b>
	<b>13-15/01/25<sup>2</sup></b>
BH1	Strike at 8.00, rising to 7.80 <sup>1</sup>
BH2	Dry
BH3	Dry
BH4	Strike at 10.50, rising to 9.60 <sup>1</sup>

**Notes:** <sup>1</sup> After 20mins

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage.

The drilling was conducted in January, when groundwater levels are typically rising to the annual maximum (highest) which typically occurs around March, with their annual minimum (lowest) elevation, typically occurring around September.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made across the seasons, to capture the annual minimum and maximum elevations.

### Section 3 Geotechnical In-Situ and Laboratory Testing

#### 3.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken in BH1-BH4. The results were interpreted based on the classifications outlined in Appendix C.1, Table C.1.1.

**Table 3.1 SPT Hammer Efficiency**

SPT Hammer Ref	Energy Ratio Er (%)
SDA4	72

**Table 3.2 Standard Penetration Tests (SPT) Interpretation**

Strata	N <sub>60</sub> Range	Cohesive Soils	
		Classification	Inferred Cohesion (c <sub>u</sub> )
wLMBE	5 - 9	Low to medium	25kPa - 45kPa
LMBE	13 - 51	Medium to very high	65kPa - 255kPa

The Weathered Lambeth Group was of low to medium strength.

The Lambeth Group was of medium to very high strength, generally increasing with depth.

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

#### 3.2 Quick Unconsolidated Undrained Triaxial Compression Tests

Quick Unconsolidated Undrained Triaxial Compression Tests (QUU) were performed on five (5no.) samples, one (1no.) obtained from the Weathered Lambeth Group and the remaining four (4no.) from the Lambeth Group.

The strength interpretation was based on the classification outlined in Table C.2.2. An untypically low value of 13kPa was recorded at 10.5m bgl in BH2; based on the sample description it was the only sample submitted for QUU testing where sandy bands were noted within the clay structure, therefore it could be attributed clay softening due to water perched within the more permeable water-bearing sandy horizons. It must be mentioned that the above finding was in alignment with Section 2.3.3 based on which, a band of soft brown slightly mottled grey sandy CLAY was recorded at circa 10.5m-11.0m bgl in BH2.

**Table 3.3 Undrained Cohesion Results Classification**

Strata	Strata Depth (m bgl)	Cohesive Soils	
		Classification	Undrained Cohesion Range (C <sub>u</sub> )
wLMBE	1.50	Medium	43
LMBE	5.00 – 14.50	Very low to very high	13 - 223

A full interpretation of the QUU tests are outlined Table C.2.2, Appendix C.2 and the laboratory report in Appendix C.3.

### 3.3 Atterberg Limit Tests

Atterberg Limit tests were performed on four (4no.) samples, three (3no.) obtained from the Weathered Lambeth Group and the remaining one (1no.) from the Lambeth Group. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

**Table 3.4 Atterberg Limit Results Classification**

Strata	Depth (m bgl)	VCP Classification	
		NHBC	BRE 240
wLMBE	1.50 – 2.00	Medium to high	Medium to high
LMBE	14.50	Medium	Medium

A full interpretation of the Atterberg Limit tests, are outlined in Table C.2.3, Appendix C.2 and the laboratory report in Appendix C.3.

### 3.4 Sulphate and pH Tests

Water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

**Table 3.5 Sulphate and pH Test Results**

Strata	Depth (m bgl)	Sulphate Concentration (mg/l)	pH
wLMBE	1.00	<10	7.5
LMBE	7.00 - 15.00	82 - 282	8.0 - 8.6

The significance of the sulphate and pH test results are discussed in Section 5.2 and the laboratory report in Appendix C.3.

## Section 4      Engineering Appraisal

### 4.1      Established Ground Conditions

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 exploratory holes.

#### 4.1.1    Topsoil

Soils described as Topsoil were encountered in each of the 4no. exploratory holes from ground level to a depth of 0.30m bgl comprising grass over brown sandy CLAY with roots.

Foundations must not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design. Foundations must be taken through any Made Ground and/or Topsoil and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

#### 4.1.2    Weathered Lambeth Group

Soils described on the logs as Weathered Lambeth Group were encountered in each of the 4no. exploratory hole locations directly beneath the Topsoil to proven depths ranging between 2.00m (BH1) and 4.00m (BH3).

The soils of the Weathered Lambeth Group were not considered suitable for the proposed redevelopment given their lack of consistency in terms of thickness and due to their low bearing and high settlements characteristics, given the relatively low equivalent SPT “N<sub>60</sub>” values, classifying them predominantly as low strength, with derived undrained cohesions as low as 25kPa.

#### 4.1.3    Lambeth Group

The soils of the Lambeth Group were found in each of the 4no. exploratory hole locations for their full depth of 15.00m bgl.

The soils of the Lambeth Group are overconsolidated soils and are expected to display moderate bearing capacities and settlement characteristics and are suitable as a bearing stratum for the proposed redevelopment, using piled foundation given the thickness of the overlying soils of the Weathered Lambeth Group, in places reaching 4.00m bgl.

#### 4.1.4    Guidance on Shrinkable Soils

The ground conditions were established as Topsoil, with a typical thickness of 0.30m, overlying a 2.60m thick band of Weathered Lambeth Group, over the bedrock of the Lambeth Group at depth.

The volume change potential for each stratum was established and presented in Table 4.1.

**Table 4.1 Established Volume Change Potential by Strata**

Strata	Volume Change Potential		Established Lower Boundary (m bgl)
	BRE	NHBC	
wLMBE	High	High	4.00
LMBE	Medium	Medium	15.00+

The soils of the Weathered Lambeth Group were of high volume change potential with the underlying soils of the Lambeth Group noted to display medium volume change potential.

#### **4.1.5 Groundwater**

Groundwater was only encountered in BH1 and BH4 as a strike at 8.00m and 10.50m bgl respectively, during the intrusive investigation undertaken between the 13<sup>th</sup> and 15<sup>th</sup> January 2025.

Given the predominantly cohesive, thus low-permeable nature of the underlying soils, groundwater was considered unlikely to have a significant impact and/or cause instability during the construction of foundation trenches – if shallow foundations were to be adopted.

## Section 5 Foundation Scheme

### 5.1 Foundation Recommendations

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

A shallow foundation scheme would be problematic for the proposed development, due to the following reasons:

- The presence of unsuitable soils of the Weathered Lambeth Group possessing low bearing and high settlements characteristics to an excessive depth in places reaching 4.00m bgl;
- The high volume change potential of the soils of the Weathered Lambeth Group;
- The presence of roots in each of the boreholes;
- The former and current existence of trees across the site, several of which appeared to be located either in proximity or within the proposed development footprint, including trees of high water demand (Ash, Willow, Cypress), as detailed in Section 2.4.

#### 5.1.1 Piled Foundations

As discussed above, shallow foundations **must** be avoided, thus a piled foundation solution was considered the most suitable with the foundations taken through any Made Ground or Topsoil, beneath the soils of the Weathered Lambeth Group and into the Lambeth Group, such that adequate bearing capacity was achieved.

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

The vertical load capacities are provided for varying diameters and lengths of bored piles taken into the Lambeth Group, based on geotechnical laboratory testing and in-situ testing and must only be used for preliminary design purposes.

A factor of safety of 3 was applied to the characteristic line derived from testing undertaken, for both the shaft and base load capacities.

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

From ground level the upper 4m of the pile shaft has been ignored in the preliminary pile design given.

An adhesion value ( $\alpha$ ) of 0.45 was used to calculate the skin friction and a bearing capacity factor ( $N_c$ ) of 9 was adopted for the cohesive bands of the Lambeth Group.

The skin friction values are pile type and installation sensitive and the adoption of CFA piles may well result in an increased adhesion value and consequential increase in capacity of the pile.

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

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

Guidance on the design of a working platform for piling rigs can be provided by Soils Limited in accordance with the BRE "Working platform for tracked plant, 2004" documentation.

If a piled foundation scheme is to be adopted for the proposed development, to prevent any downward migration of contaminants into the underlying groundwater/aquifers or create preferential vertical pathways between aquifers, specific piling techniques should be employed in accordance with The National Groundwater and Contaminated Land Centre Report NC/99/73: Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention published by the EA, which presents guidance on piling on contaminated sites.

Therefore, the proposed piling method might need to be agreed and approved by the EA before piling works would commence on site.

## 5.2 Subsurface Concrete

The sulphate and pH tests carried out in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground', established the site concrete classifications for each stratum as presented in Table 5.1.

**Table 5.1 Concrete Classification**

Stratum	Design Sulphate Class	ACEC Class
wLMBE	DS-I	AC-I
LMBE	DS-I	AC-I

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.

### **5.3 Excavations**

Shallow excavations in the Topsoil, or Weathered Lambeth Group are likely to be marginally stable in the short term at best.

Deeper excavations taken into the Weathered Lambeth Group are likely to be unstable and require support. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions must therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose.

**Section 6 Pavements****6.1 Pavements**

Any soft spots at formation level, within the Topsoil or the underlying Weathered Lambeth Group, must be dug out and replaced with a suitably compacted granular fill. Prior to construction the formation level should be proof rolled.

Cohesive soils of the Weathered Lambeth Group were noted to have plasticity index >20%, therefore and in accordance with Road Research Laboratory LR90, are expected to be **non-frost-susceptible**.

## Section 7 Determination of Chemical Analysis

### 7.1 Site Characterisation and Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (report ref: 21724/PIR Rev 1.1 dated February 2025) identified a very low to low risk of ground contamination from current usages of the site (residential garages and parked cars) and off-site source (farm).

The intrusive investigation identified Topsoil in each of the 4no. exploratory holes from ground level to a depth of 0.30m bgl comprising grass over brown sandy CLAY with roots.

There were no significant visual or olfactory indicators of contamination noted.

The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).

The conceptual site model did not require revisions i.e. to take account of any additional potential contamination sources (e.g. Made Ground) and is presented in Appendix E.1.

### 7.2 Soil Sampling

Exploratory hole locations were established to provide an overview of ground conditions across the site in relation to the proposed construction, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

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

Unless otherwise stated, analytical testing was based initially on a screening suite of commonly identified inorganic and organic contaminants, taking into account the prevailing site conditions and the findings of the initial conceptual site model.

### 7.3 Determination of Chemical Analysis

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

The chemical analyses were carried out on 3no. samples of Topsoil and 1no. sample of the underlying Weathered Lambeth Group. The nature of the analyses is detailed in Table 7.1.

**Table 7.1 Chemical Analyses Suites - Soil**

<b>Determinants</b>	<b>No. Tested</b>	
	<b>TS</b>	<b>wLMBe</b>
Metal suites: Arsenic, Boron (Water Soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc	3	1
Organic Matter	3	1
pH	3	1
Polycyclic aromatic hydrocarbons (PAH) – (EPA 16)	3	1
Phenols – total monohydric	3	1
Extractable petroleum hydrocarbons (EPH) – Texas banding	3	1
Asbestos screening	3	1

The soil testing was carried out in compliance with the MCERTS performance standard, and the results are shown in Appendix E.2, test report 25-00549.

## Section 8 Qualitative Risk Assessment

### 8.1 Assessment Criteria

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

### 8.2 Representative Contamination Criteria - Soil

The proposed development consists of the demolition of the existing 16 properties, to create 21 new houses, comprising 15 four bedroom houses and six three bedroom houses, each with its own private garden. There will be a total of 31 car parking spaces and two cycle spaces for each dwelling.

The plans also include a new children's play area and a public open space as well as planting of new trees and shrubs.

In compiling this report reliance was placed on drawing M10029 APL006 revision A prepared by Hunters and dated March 2025. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic assessment criteria (GAC) 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, GACs 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 2.3% and 3.4%. For each soil sample tested, the resultant SOM allowed for the correct comparison to be made with the appropriate guideline value for each organic determinant analysed.

### 8.3 Risk Assessment – Topsoil

Table 8.1. outlines the samples chemically tested and if they have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix E.2.

**Table 8.1 Summary of GAC Exceedances – Topsoil**

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level
BH1	0.10	None	-	-
BH2	0.10-0.30	None	-	-
BH3	0.10-0.30	None	-	-

The risk assessment has not established a pollutant linkage in relation to human health from any elevated contaminant concentration within the Topsoil across the site.

#### **8.4 Risk Assessment – Weathered Lambeth Group**

Table 8.2 outlines the sample chemically tested and if it has exceeded its relevant assessment criteria. The full laboratory report is presented in Appendix E.2.

**Table 8.2 Summary of GAC Exceedances – Weathered Lambeth Group**

<b>Location</b>	<b>Depth (m bgl)</b>	<b>Contaminant</b>	<b>Concentration</b>	<b>Guidance Level</b>
BH4	0.10-0.50	None	-	-

**Note(s):** Units mg/kg

The risk assessment has not established a pollutant linkage in relation to human health from any elevated contaminant concentration within the Weathered Lambeth Group.

#### **8.5 Asbestos**

The test certificate for each sample submitted for contamination analysis during this investigation includes the results of an Asbestos Screen.

In each case 'Not detected' was reported.

This finding does not obviate the risk of asbestos being present on the site and the Client must seek advice from qualified and competent asbestos specialist during and prior to undertaking works to ensure compliance with appropriate legislation and guidance.

#### **8.6 Risk to Groundwater**

The intrusive investigation confirmed the ground conditions to typically comprise Topsoil over the Weathered Lambeth Group and the Lambeth Group.

The site is located on a Secondary A aquifer (Lambeth Group) and there were no groundwater abstractions within 1km of the site. The site was within a Total Catchment (Zone 3) Source Protection Zone, although this relates to the underlying Chalk at depth, beneath the Lambeth Group, and potentially the underlying Thanet Sand Formation.

Therefore, given the absence of any contamination sources, the low-permeable soils of the Weathered Lambeth Group and the Lambeth Group that would act as a barrier for any leaching of potential contaminants and the deep groundwater recorded at circa 8m bgl, there was **negligible** risk to the groundwater receptors.

## 8.7 Risk from Ground Gas Ingression

Potential sources of ground gas on site, however of very low risk were identified within the CSM and comprised:

- Parked cars
- Residential garages

Based on the findings of the intrusive investigation and as concluded in the Preliminary Investigation Report undertaken by Soils Limited, the ground-gas risk remained as “Very Low”, considering the reasons below:

- the lack of any additional potential sources of ground-gas generation i.e. Made Ground;
- the relatively low levels of Soil Organic Matter (SOM) ranging between of 2.3% and 3.4% within the soil samples of the Topsoil and the Weathered Lambeth Group tested.

### 8.7.1 Radon

The site **was not situated** within an area where protection or risk assessment against the ingress of radon was required.

Radon protection measures **will not be required** within the proposed new development.

## 8.8 Generic Quantitative Risk Assessment

A quantitative risk assessment is undertaken for soil. The CSM has been updated to take account of the assessments below and presented in Appendix E.1. The full laboratory chemical report is presented in Appendix E.2.

### 8.8.1 Soils

None of the samples tested showed concentrations in excess of the relevant GAC for a “Residential with home grown produce” land-use scenario. The Tier 1 Quantitative risk assessment therefore established that there was **no risk to the human health receptors** of construction workers or future end-users due to soil contamination.

### 8.8.2 Groundwater

As discussed in Section 8.6, there was **no** merit in undertaking any remedial action for the protection of groundwater.

### 8.8.3 Ground Gas

As discussed in Section 8.7, there was **no** requirement for any precautionary measures against the ingress of ground gas.

## 8.9 Recommendations

**The generic quantitative risk assessment established that there was no risk to the active receptors and no soil remedial measures would be required based on the sampling undertaken.** However, a discovery strategy is put in place in case of

unexpected contamination being encountered during construction.

#### **8.10 Protection of Services**

Contamination of the ground may pose a risk to human health by permeating potable water supply pipes. To fulfil their statutory obligations, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from contaminants specified in UKWIR Report 10/WM/03/21 Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (UKWIR, 2010), or that the proposed remedial strategy will mitigate any existing risk.

#### **8.11 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.

#### **8.12 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 must always be sought.

#### **8.13 HazWasteOnline**

Further consideration of results using HazWasteOnlineTM can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

#### **8.14 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.

#### **8.15 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 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.

**8.16 Discovery Strategy**

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

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### **Appendix C Geotechnical In-Situ and Laboratory Testing**

Appendix C.1 Classification

Appendix C.2 Interpretation

Appendix C.3 Geotechnical In-Situ and Laboratory Results

### **Appendix D Foundation Design**

Appendix D.1 Preliminary Pile Design

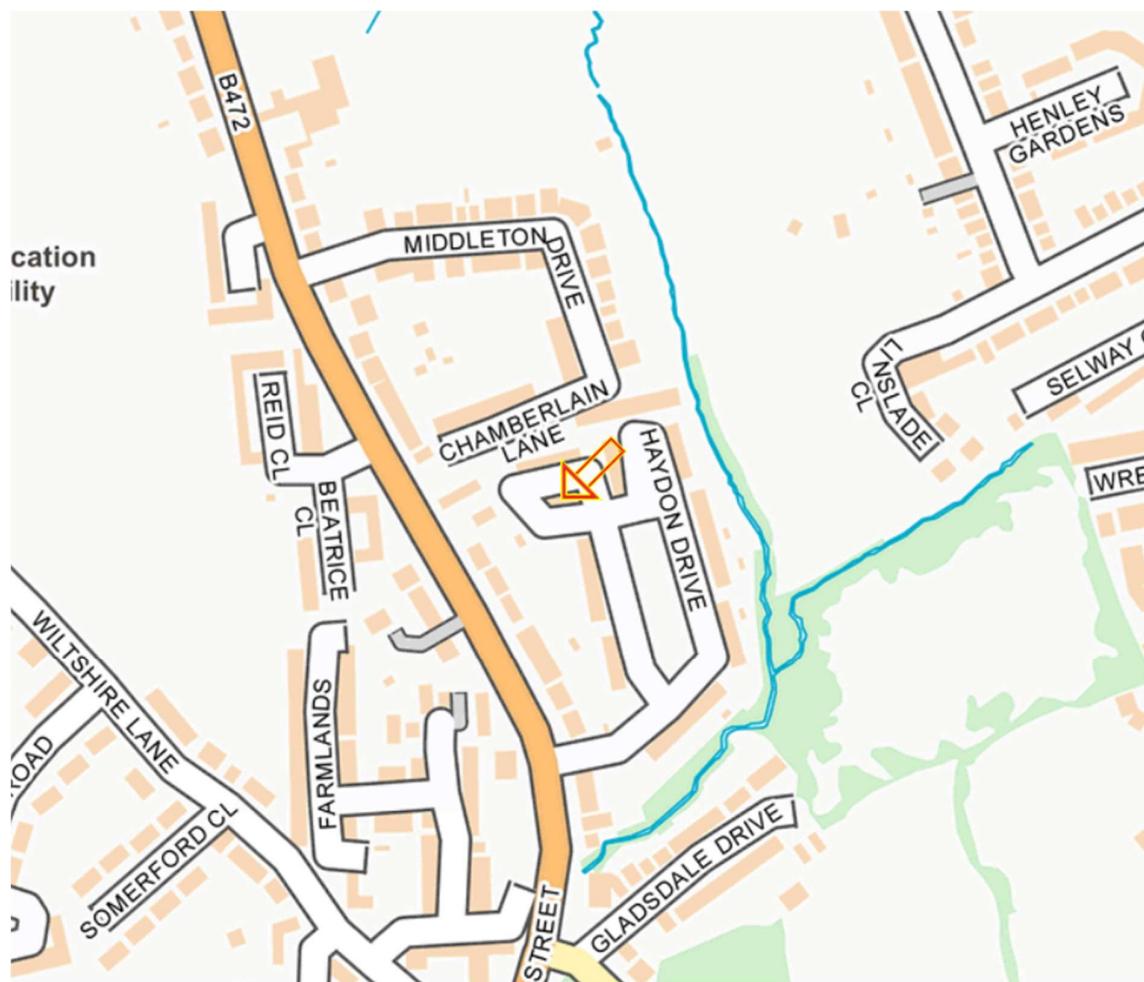
### **Appendix E Chemical Laboratory Analyses**

Appendix E.1 Conceptual Site Model

Appendix E.2 Chemical Laboratory Results

Appendix E.3 General Assessment Criteria

### **Appendix F Information Provided by the Client**



**Figure 1 – Site Location Map**



<b>Job Number</b>	<b>Project</b>
21724	Haydon Drive, Pinner, London Borough of Hillingdon HA5 2PW
<b>Client</b>	<b>Date</b>
Philip Pank Partnership LLP	April 2025

**Figure 2 – Aerial Photograph**



**Project**

Haydon Drive, Pinner, London  
Borough of Hillingdon HA5 2PW

**Client**

Philip Pank Partnership LLP

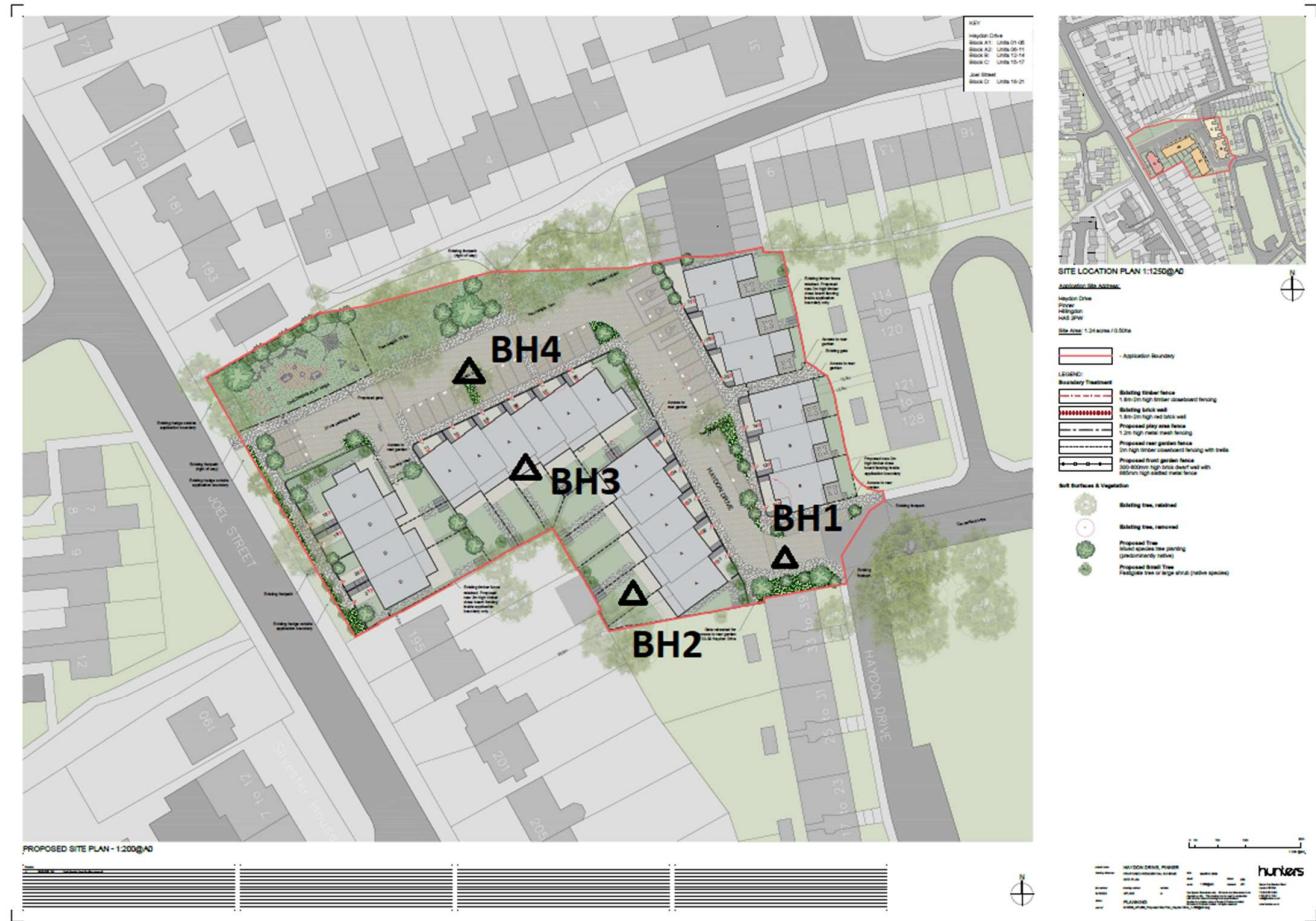
**Date**

April 2025

**Job Number**

21724

**Figure 3 – Exploratory Hole Plan**



**Project**

Haydon Drive, Pinner, London  
Borough of Hillingdon HA5 2PW

**Client**

Philip Pank Partnership LLP

**Date**

April 2025

**Job Number**

21724

## Appendix A Standards and Resources

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

- BS 5930:2015 and BS EN ISO 22476-3:2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2018 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2018 - Geotechnical investigation and testing - Principles for a classification
- BS 10175:2011+A2:2017 - Investigation of potentially contaminated sites
- LCRM 2021 Environment Agency
- BS 8004:2015 – Code of practice for foundations
- BS 1377:1990 Parts 1 to 8
- BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2
- BRE Special Digest 1, 2005, ‘Concrete in Aggressive Ground’
- 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.
- N.E. Simons, B.K. Menzies, “A Short Course in Foundation Engineering”
- NHBC Standards Chapter 4.2, January 2025.
- SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014
- CIRIA C733, Asbestos in soil and made ground: a guide to understanding and managing risks and CAR2012 regulations.
- Google Earth
- British Geological Survey Website & iGeology App

## **Appendix B    Field Work**

### **Appendix B.I    Engineers Logs**





Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH1</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather: Termination: SPT Hammer: SDA1 Energy Ratio: 76% Sheet 2 of 2



Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH2</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather:			Termination:			SPT Hammer: SDA4 Energy Ratio: 72%		Sheet 1 of 2		
Samples & In Situ Testing			Strata Details					Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
0.10 - 0.30	B			(0.30)		Grass over brown sandy CLAY with roots. TOPSOIL				
0.50 - 1.20	B			0.30		Soft to firm brown mottled yellowish brown slightly silty CLAY. Occasional rootlets. WEATHERED LAMBETH GROUP				
1.20 - 1.65	U	Ublow = 22		(1.70)					1	
1.75	D									
2.00	SPT D	N=5 (1,1/1,1,2,1)		2.00		Firm brown slightly mottled light grey slightly silty CLAY. WEATHERED LAMBETH GROUP			2	
				(1.00)						
3.00	D			3.00					3	
3.00 - 3.45	U	Ublow = 34				Stiff orangish brown mottled grey CLAY. Occasional rootlets. LAMBETH GROUP				
3.50	D									
4.00	SPT D	N=15 (1,2/3,3,4,5)		(2.50)					4	
5.00	D									
5.00 - 5.45	U	Ublow = 42							5	
5.50	D			5.50		Stiff to very stiff brown slightly mottled grey CLAY. Occasional angular medium limestone fragments and calcareous nodules. LAMBETH GROUP				
6.00	SPT D	N=21 (2,3/4,5,5,7)							6	
7.00	D									
7.50 - 7.95	U	Ublow = 72		(3.50)					7	
8.00	D									
9.00	SPT	N=28 (3,4/6,7,7,8)		9.00		Stiff to very stiff mottled grey and cream CLAY. Occasional cream calcareous inclusions. LAMBETH GROUP			9	
				(2.00)						
10.00	D								10	

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Decayed roots to 5.50m bgl. No water recorded					
					3.00	150	3.00	150						
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)			0	0.00	No groundwater encountered.	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														



Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH2</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather: Termination: SPT Hammer: SDA4 Energy Ratio: 72% Sheet 2 of 2

Samples & In Situ Testing					Strata Details			Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
10.50 - 10.95	U	Ublow = 80				Stiff to very stiff mottled grey and cream CLAY. Occasional cream calcareous inclusions. LAMBETH GROUP				
11.00	D			11.00		Soft to firm brown slightly mottled grey sandy CLAY . Sand is fine. LAMBETH GROUP		11		
12.00	SPT D	N=31 (4,5/6,8,8,9)						12		
13.00	D			(4.00)				13		
13.50 - 13.95	U	Ublow = 64						14		
14.00	D							15		
15.00	SPT D	N=36 (5,7/8,9,9,10)		15.00		End of Borehole at 15.00m		16		
								17		
								18		
								19		
								20		



Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH3</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather: Termination: SPT Hammer: SDA4 Energy Ratio: 72% Sheet 1 of 2

Samples & In Situ Testing				Strata Details				Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
0.10 - 0.30	B	N=5 (1,2/1,2,1,1) Ublow = 21 N=5 (1,1/1,1,2,1) Ublow = 28 N=11 (2,2/3,3,2,3) Ublow = 52 Ublow = 72	(0.30) 0.30 (0.40) 0.70 (3.30) 4.00 4.00 - 4.45 5.00 6.00 6.50 7.00 8.00 9.00 9.00 - 9.45 9.50 10.00	(0.30) 0.30 (0.40) 0.70 (3.30) 4.00 4.00 - 4.45 5.00 6.00 6.50 7.00 8.00 9.00 9.00 - 9.45 9.50 10.00		Grass over brown sandy CLAY with roots. TOPSOIL				
0.70 - 1.20						Soft dark brown slightly sandy, slightly silty CLAY. Sand is fine .Frequent rootlets. WEATHERED LAMBETH GROUP				
1.20						Firm light yellowish brown and brown slightly mottled light grey slightly silty CLAY. WEATHERED LAMBETH GROUP				
2.00										
2.00 - 2.45										
3.00										
4.00										
4.00 - 4.45										
5.00										
6.00										
6.00 - 6.45										
6.50										
7.00										
8.00										
9.00										
9.00 - 9.45										
9.50										
10.00										



Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH3</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather: Termination: SPT Hammer: SDA4 Energy Ratio: 72% Sheet 2 of 2



Contract Name: Haydon Drive		Client: London Borough of Hillingdon c/o Philip Pank			Hole ID: <b>BH4</b>
Contract Number: 21724	Start and End Date: 15-01-25	Logged By: SDA	Checked By:	Status: DRAFT	Hole Type: <b>BH</b>
Easting:	Northing:	Ground Level:	Plant Used: Dando 2000	Print Date: 13-02-2025	Scale: 1:50

Weather: Termination: SPT Hammer: SDA4 Energy Ratio: 72% Sheet 1 of 2

Samples & In Situ Testing			Strata Details					Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/Installation
0.10 - 0.50	B			(0.30)		Grass over brown sandy CLAY with roots. TOPSOIL				
0.70 - 1.20	B			0.30		Soft dark brown slightly sandy, slightly silty CLAY. Sand is fine. Frequent rootlets. WEATHERED LAMBETH GROUP				
1.20	SPT	N=4 (1,0/1,1,1,1)		(0.40)		Soft orangish brown mottled light grey slightly sandy CLAY . Occasional rootlets. WEATHERED LAMBETH GROUP		1		
2.00	SPT D	N=8 (1,2/1,2,2,3)		(0.50)		Firm light grey mottled greyish brown slightly silty CLAY. WEATHERED LAMBETH GROUP				
3.00	SPT D	N=12 (2,3/2,3,3,4)		1.20		Stiff orangish brown mottled light grey CLAY. LAMBETH GROUP				
4.00	SPT D	N=15 (2,3/4,3,4,4)		(1.30)		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
5.00	SPT D	N=17 (2,3/4,4,5,4)		2.50		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
6.00	SPT D	N=19 (3,4/5,4,5,5)		3.50		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
7.00	D			6.00		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
7.50	SPT	N=32 (4,6/7,8,8,9)		7.00		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
8.00	D			(4.00)		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
9.00	SPT D	N=35 (4,6/8,8,9,10)		8.00		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				
10.00	D			10.00		Stiff to very stiff dark brown slightly mottled grey CLAY . Rare cream calcareous inclusions. LAMBETH GROUP				

Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Roots to 1.20m bgl. Groundwater strike at 10.50m rising at 7.8m after 20mins					
					3.00	150	3.00	150						
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)	10.50	3.00		20	9.60		
													Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.	

Contract Name: Haydon Drive				Client: London Borough of Hillingdon c/o Philip Pank				Hole ID: <b>BH4</b>
Contract Number: 21724		Start and End Date: 15-01-25		Logged By: SDA		Checked By: 		Status: <b>DRAFT</b>
Easting: 		Northing: 		Ground Level: 		Plant Used: Dando 2000		Print Date: 13-02-2025

Weather: Termination: SPT Hammer: SDA4 Energy Ratio: 72% Sheet 2 of 2

Samples & In Situ Testing			Strata Details						Groundwater					
Depth	Type	Results	Level (mAO)	Depth (m) (Thickness)	Legend	Strata Description					Water Strike	Backfill/ Installation		
10.50	SPT	N=24 (3,4/5,5,6,8)				Stiff grey and brown CLAY . Frequent brown sand lenses within the clay and also as a covering layer on top of the clay. LAMBETH GROUP								
11.00	D										11			
12.00	SPT D	N=28 (4,5/6,7,7,8)		(5.00)							12			
13.00	D										13			
14.00	D										14			
15.00	D			15.00		End of Borehole at 15.00m					15			
											16			
											17			
											18			
											19			
											20			

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)	Remarks:
					3.00	150	3.00	150	Roots to 1.20m bgl. Groundwater strike at 10.50m rising at 7.8m after 20mins

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
								10.50	3.00		20	9.60	

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

## Appendix C Geotechnical In-Situ and Laboratory Testing

### Appendix C.I 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 C.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 C.I.1 SPT "N" Blow Count Cohesive Classification**

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

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

## Appendix C.2 Interpretation

**Table C.2.1 Interpretation of SPT Tests**

<b>BH</b>	<b>Strata</b>	<b>SPT <math>N_{60}</math> Blow Counts</b>	<b>Inferred Cohesive Strength</b>
BH1	LMBE 2.00 – 15.00 Silty CLAY	15 – 46	Medium to very high ( $Cu = 75 – 230\text{kPa}$ )
	wLMBE 0.30 – 3.00 Silty CLAY	6	Low ( $Cu = 30\text{kPa}$ )
	LMBE 3.00 – 15.00 Silty CLAY	18 – 43	High to very high ( $Cu = 90 – 215\text{kPa}$ )
BH2	wLMBE 0.30 – 4.00 Silty CLAY	6	Low ( $Cu = 30\text{kPa}$ )
	LMBE 4.00 – 15.00 Silty CLAY	13 - 51	Medium to very high ( $Cu = 65 – 255\text{kPa}$ )
	wLMBE 0.30 – 2.50 Silty CLAY	5 - 9	Low to medium ( $Cu = 25 – 45\text{kPa}$ )
BH3	LMBE 2.50 – 15.00 Silty CLAY	14 - 42	Medium to very high ( $Cu = 70 – 210\text{kPa}$ )
BH4			

**Note(s):** Energy Ratio = 72%, SPT  $N_{60}$  =  $N^*1.2$

**Table C.2.2 Interpretation of QUU Tests**

<b>Location</b>	<b>Stratum</b>	<b>Sample Depth (m bgl)</b>	<b>Moisture Content (%)</b>	<b>Soil Strength</b>	<b>Shear Strength (kPa)</b>
BH1	wLMBE	1.50	25	Medium	43
BH1	LMBE	14.50	19	High	115
BH2	LMBE	5.00	25	High	82
BH2	LMBE	10.50	27	Very low	13
BH3	LMBE	12.00	15	Very high	223

**Table C.2.3 Interpretation of Atterberg Limit Tests**

<b>Stratum</b>	<b>M/C (%)</b>	<b>PI (%)</b>	<b>&gt;425<math>\mu\text{m}</math> (%)</b>	<b>Mod PI (%)</b>	<b>Class</b>	<b>VCP</b>	<b>NHBC</b>
						<b>BRE</b>	
wLMBE	26 - 38	39 - 54	100	39 - 54	CH - CV	High	High
LMBE	19	26	100	100	CI	Medium	Medium

**Note(s):** BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results). VCP=Volume Change Potential  
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2  
Soils Classification based on British Soil Classification System  
The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5

**Appendix C.3 Geotechnical In-Situ and Laboratory Results**



2788

# Laboratory Report



## Contract Number: 76728

Client Ref: **21724**

Client PO: **21724**

Date Received: **24-01-2025**

Date Completed: **05-02-2025**

Report Date: **05-02-2025**

Client: **Soils Limited**

This report has been checked and approved by:

**Brendan Evans**  
Office Administrator

Description	Qty
<b>Moisture Content</b> BS 1377:1990 - Part 2 : 3.2 - * UKAS	4
<b>1 Point Liquid &amp; Plastic Limit</b> BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	4
<b>Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter)</b> BS 1377:1990 - Part 7 : 8 - * UKAS	5

**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

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### Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)



# **NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX ( BS 1377:1990 - Part 2 : 4.4 & 5.3 )**

Contract Number	76728	
Project Name	Haydon Drive	
Date Tested	27/01/2025	
<b>DESCRIPTIONS</b>		

## Operator

Aaron Hodge



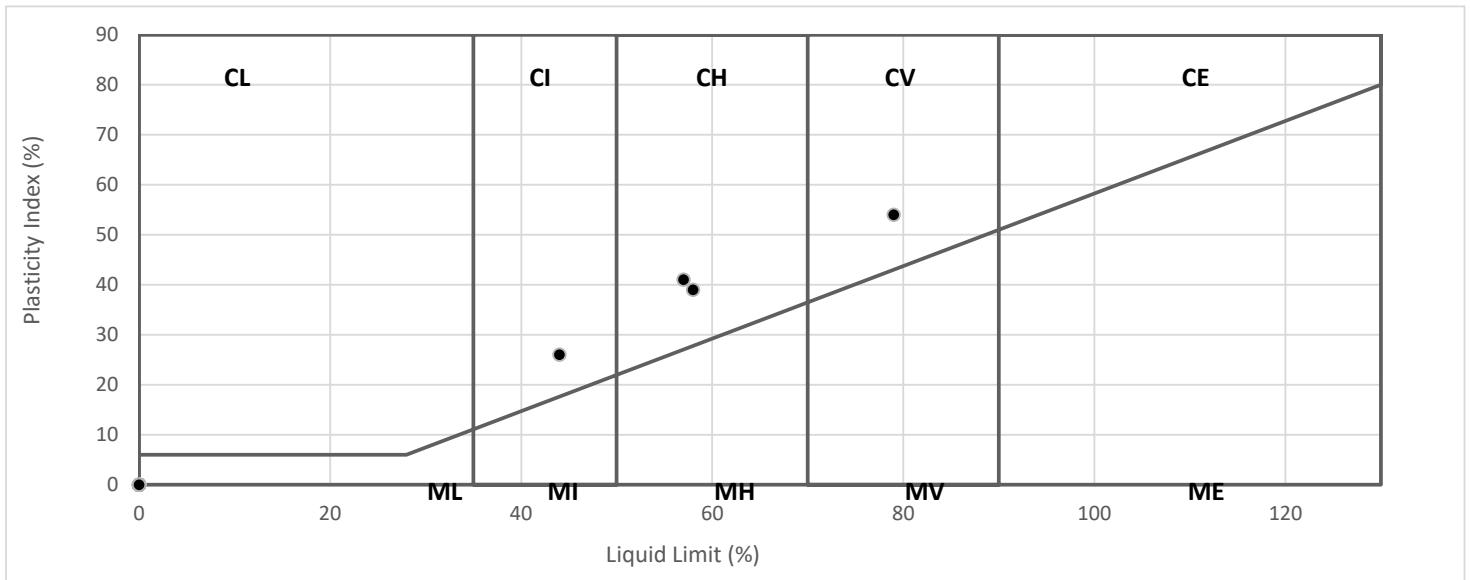
Contract Number	76728	
Project Name	Haydon Drive	
Date Tested	27/01/2025	

Symbols: NP : Non Plastic

# : Liquid Limit and Plastic Limit Wet Sieved

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION

## BS 5930:2015+A1:2020



Operator  
Aaron Hodge



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

Contract Number 76728

Borehole/Pit No. BH1

Project Name Haydon Drive

Sample No.

Soil Description Brown slightly gravelly sandy silty CLAY

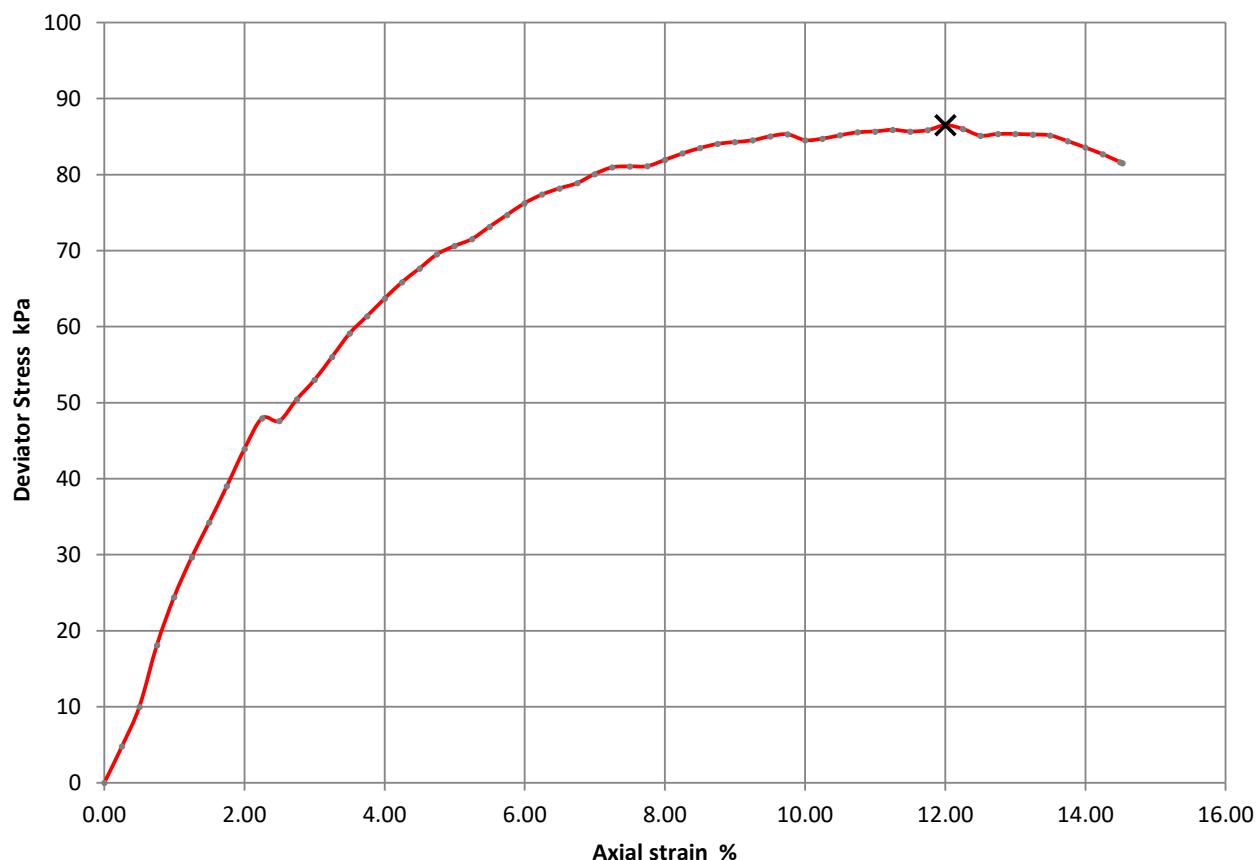
Depth Top (m) 1.50

Depth Base (m)

Date Tested 28/01/2025

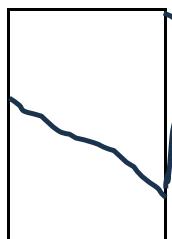
Sample Type U

Operator David Edwards



Moisture Content (%)	25
Bulk Density (Mg/m <sup>3</sup> )	1.88
Dry Density (Mg/m <sup>3</sup> )	1.50
Specimen Length (mm)	207.2
Specimen Diameter (mm)	104.2
Cell Pressure (kPa)	30
Deviator Stress (kPa)	87
Undrained Shear Strength (kPa)	43
Failure Strain (%)	12
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.4mm
Rate of Strain (%/min)	1.33

Notes.

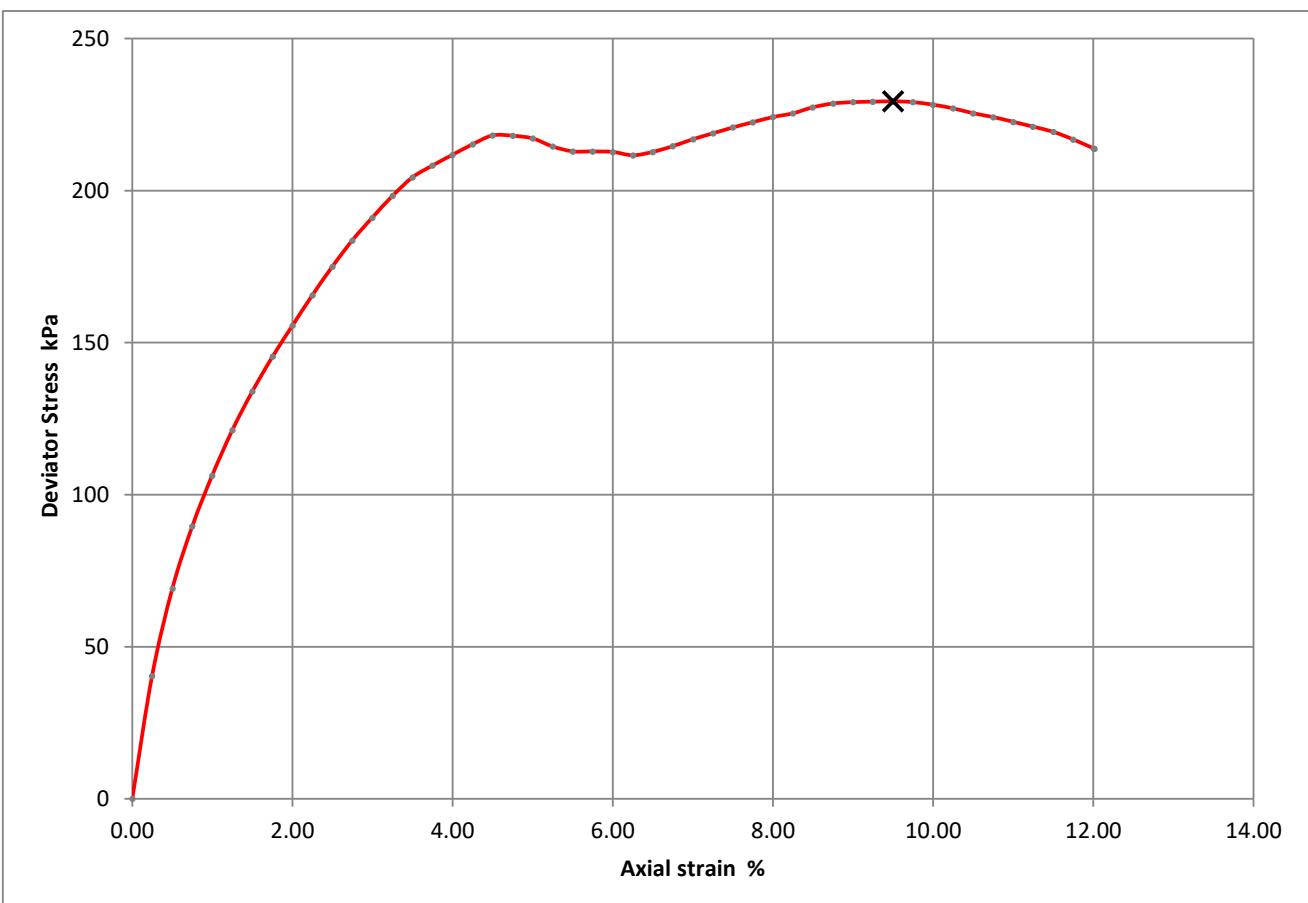


Failure Sketch.



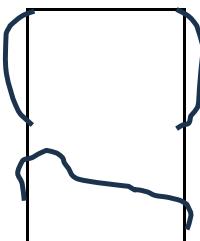
**Single Stage Unconsolidated-Undrained Triaxial Test  
BS 1377 : 1990 Part 7 : 8**

Project Name	Haydon Drive	Sample No.	
Soil Description	Grey/brown silty CLAY	Depth Top (m)	14.50
Date Tested	28/01/2025	Depth Base (m)	
		Sample Type	U
		Operator	David Edwards



Moisture Content (%)	19
Bulk Density (Mg/m <sup>3</sup> )	2.06
Dry Density (Mg/m <sup>3</sup> )	1.73
Specimen Length (mm)	209.3
Specimen Diameter (mm)	104.3
Cell Pressure (kPa)	290
Deviator Stress (kPa)	229
Undrained Shear Strength (kPa)	115
Failure Strain (%)	10
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.4mm
Rate of Strain (%/min)	1.31

Notes.

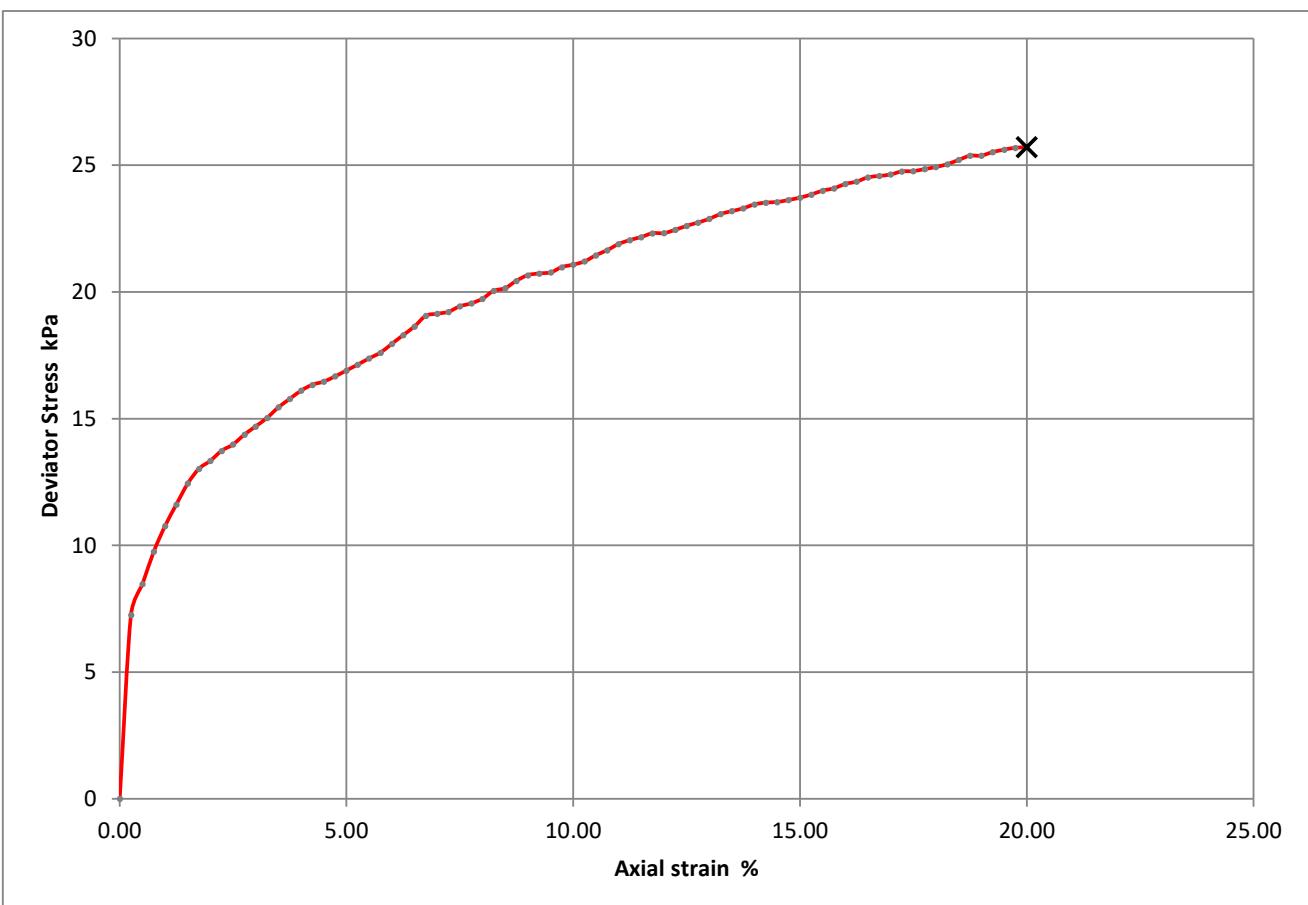


Failure Sketch.



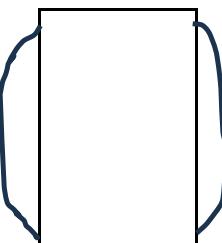
**Single Stage Unconsolidated-Undrained Triaxial Test  
BS 1377 : 1990 Part 7 : 8**

Project Name	Haydon Drive	Sample No.	
Soil Description	Brown silty sandy CLAY	Depth Top (m)	10.50
		Depth Base (m)	
Date Tested	28/01/2025	Sample Type	U
		Operator	David Edwards



Moisture Content (%)	27
Bulk Density (Mg/m <sup>3</sup> )	1.92
Dry Density (Mg/m <sup>3</sup> )	1.51
Specimen Length (mm)	204.3
Specimen Diameter (mm)	102.3
Cell Pressure (kPa)	210
Deviator Stress (kPa)	26
Undrained Shear Strength (kPa)	13
Failure Strain (%)	20
Mode Of Failure	Plastic
Membrane Used/Thickness	Rubber/0.4mm
Rate of Strain (%/min)	1.35

Notes.

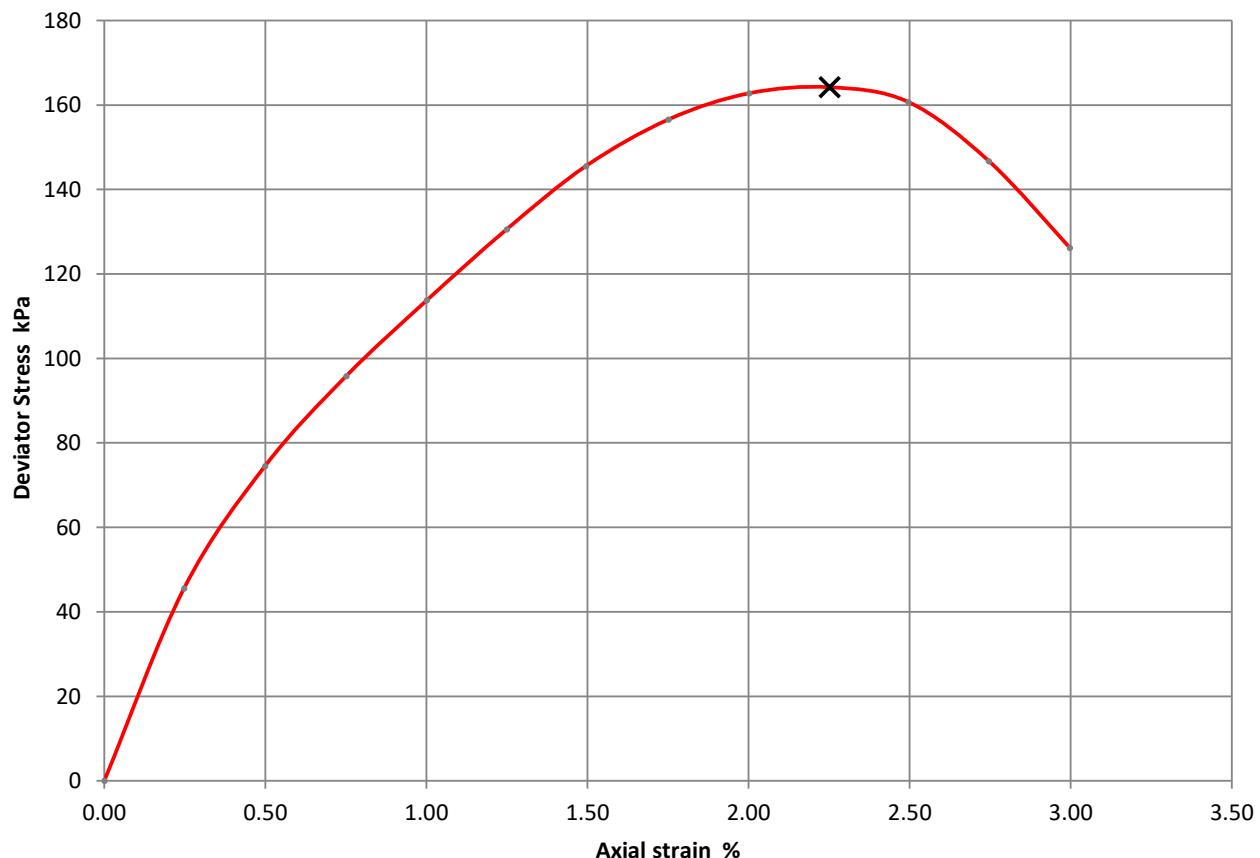


Failure Sketch.



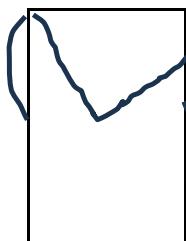
**Single Stage Unconsolidated-Undrained Triaxial  
Test  
BS 1377 : 1990 Part 7 : 8**

Contract Number	76728
Borehole/Pit No.	<u>BH2</u>
Project Name	Haydon Drive
Soil Description	Grey/brown silty CLAY
Date Tested	28/01/2025
Sample Type	U
Operator	David Edwards



Moisture Content (%)	25
Bulk Density (Mg/m <sup>3</sup> )	2.01
Dry Density (Mg/m <sup>3</sup> )	1.61
Specimen Length (mm)	208.3
Specimen Diameter (mm)	104.3
Cell Pressure (kPa)	100
Deviator Stress (kPa)	164
Undrained Shear Strength (kPa)	82
Failure Strain (%)	2
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.4mm
Rate of Strain (%/min)	1.32

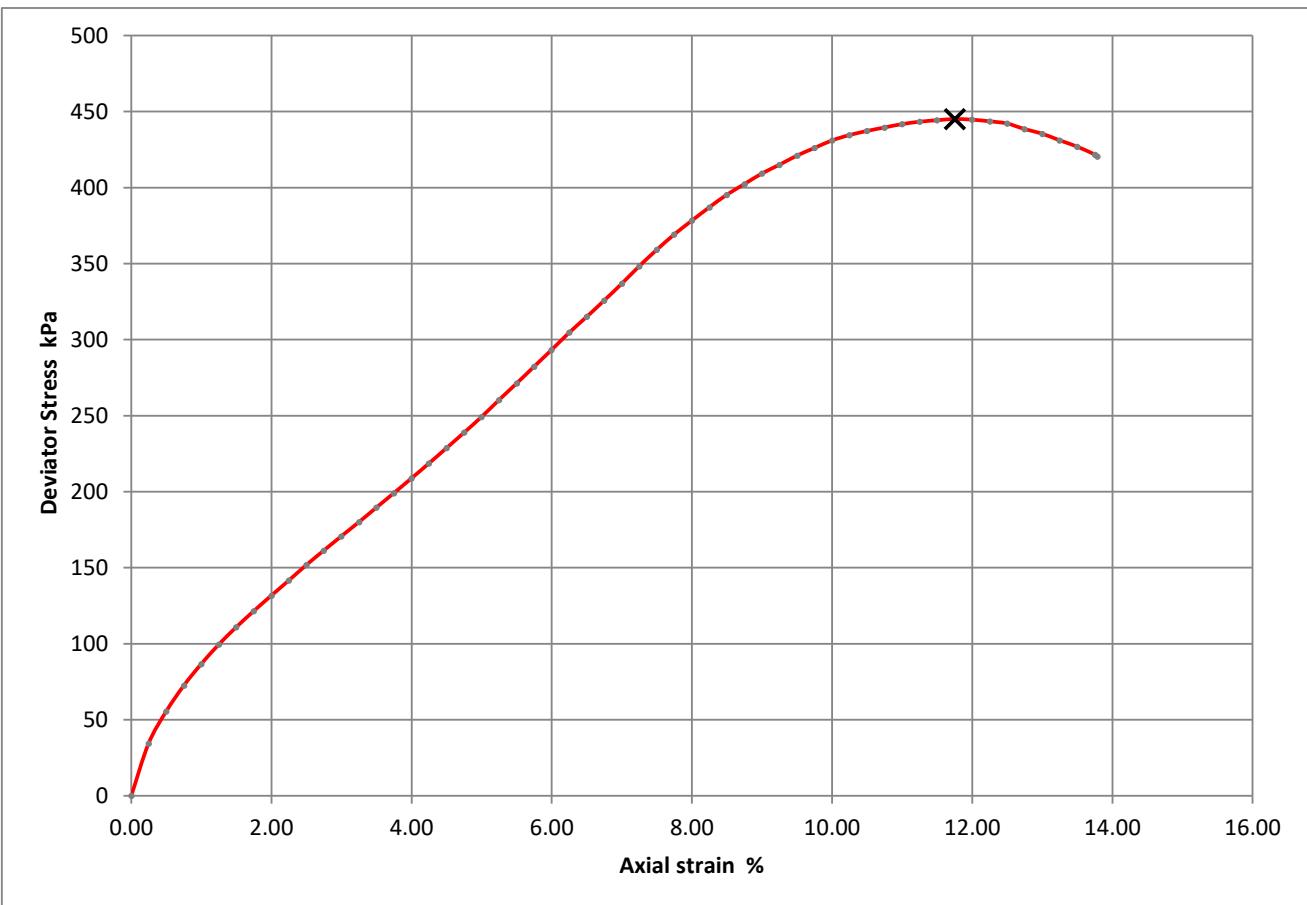
Notes.



Failure Sketch.

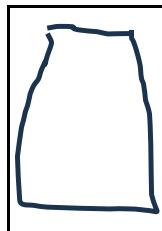
**Single Stage Unconsolidated-Undrained Triaxial  
Test  
BS 1377 : 1990 Part 7 : 8**

Project Name	Haydon Drive		Sample No.	
Soil Description	Grey/brown silty CLAY		Depth Top (m)	12.00
			Depth Base (m)	
Date Tested	28/01/2025		Sample Type	U
			Operator	David Edwards



Moisture Content (%)	15
Bulk Density (Mg/m <sup>3</sup> )	2.12
Dry Density (Mg/m <sup>3</sup> )	1.84
Specimen Length (mm)	204.5
Specimen Diameter (mm)	104.2
Cell Pressure (kPa)	240
Deviator Stress (kPa)	445
Undrained Shear Strength (kPa)	223
Failure Strain (%)	12
Mode Of Failure	Plastic
Membrane Used/Thickness	Rubber/0.4mm
Rate of Strain (%/min)	1.34

Notes.



Failure Sketch.



Nikos Sidiropoulos  
Soils Ltd  
Newton House  
Cross Road  
Tadworth  
Surrey  
KT20 5SR

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

## **DETS Report No: 25-00550**

**Site Reference:** Haydon Drive  
**Project / Job Ref:** 21724  
**Order No:** 21724  
**Sample Receipt Date:** 22/01/2025  
**Sample Scheduled Date:** 22/01/2025  
**Report Issue Number:** 1  
**Reporting Date:** 29/01/2025

**Authorised by:**

Steve Knight  
Customer Support Manager

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

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



**Soil Analysis Certificate**

DETS Report No: 25-00550	~Date Sampled	16/01/25	16/01/25	16/01/25	16/01/25	
Soils Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: Haydon Drive	~TP / BH No	BH1	BH2	BH3	BH4	
~Project / Job Ref: 21724	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
~Order No: 21724	~Depth (m)	1.00	7.00	11.00	15.00	
Reporting Date: 29/01/2025	DETS Sample No	760434	760435	760436	760437	

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.5	8.0	8.3	8.6
Total Sulphate as SO <sub>4</sub>	mg/kg	< 200	MCERTS	< 200	658	297	337
Total Sulphate as SO <sub>4</sub>	%	< 0.02	MCERTS	< 0.02	0.07	0.03	0.03
W/S Sulphate as SO <sub>4</sub> (2:1)	mg/l	< 10	MCERTS	< 10	282	82	92
W/S Sulphate as SO <sub>4</sub> (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.28	0.08	0.09
Total Sulphur	%	< 0.02	NONE	< 0.02	0.02	< 0.02	< 0.02
Ammonium as NH <sub>4</sub>	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	< 0.5
Ammonium as NH <sub>4</sub>	mg/l	< 0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	14	46	83	55
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	7.2	23.1	41.7	27.6
Water Soluble Nitrate (2:1) as NO <sub>3</sub>	mg/kg	< 3	MCERTS	6	4	< 3	< 3
Water Soluble Nitrate (2:1) as NO <sub>3</sub>	mg/l	< 1.5	MCERTS	2.9	1.9	< 1.5	< 1.5
W/S Magnesium	mg/l	< 0.1	NONE	2.4	13	6.4	5.9

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

Subcontracted analysis (S)

~Sample details provided by customer and can affect the validity of results



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



**Soil Analysis Certificate - Sample Descriptions**

**DETS Report No: 25-00550**

**Soils Ltd**

**~Site Reference: Haydon Drive**

**~Project / Job Ref: 21724**

**~Order No: 21724**

**Reporting Date: 29/01/2025**

<b>DETS Sample No</b>	<b>~TP / BH No</b>	<b>~Additional Refs</b>	<b>~Depth (m)</b>	<b>Moisture Content (%)</b>	<b>Sample Matrix Description</b>
760434	BH1	None Supplied	1.00	20.8	Light brown clay
760435	BH2	None Supplied	7.00	18.8	Light brown clay
760436	BH3	None Supplied	11.00	13.2	Light brown clay
760437	BH4	None Supplied	15.00	16.7	Light grey clay

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

Insufficient Sample <sup>1/S</sup>

Unsuitable Sample <sup>U/S</sup>

~Sample details provided by customer and can affect the validity of results



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



**Soil Analysis Certificate - Methodology & Miscellaneous Information**

DETS Report No: 25-00550

Soils Ltd

~Site Reference: Haydon Drive

~Project / Job Ref: 21724

~Order No: 21724

Reporting Date: 29/01/2025

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried

AR As Received

~Sample details provided by customer and can affect the validity of results



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



**List of HWOL Acronyms and Operators**

**DETS Report No: 25-00550**

**Soils Ltd**

**~Site Reference: Haydon Drive**

**~Project / Job Ref: 21724**

**~Order No: 21724**

**Reporting Date: 29/01/2025**

<b>Acronym</b>	<b>Description</b>
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

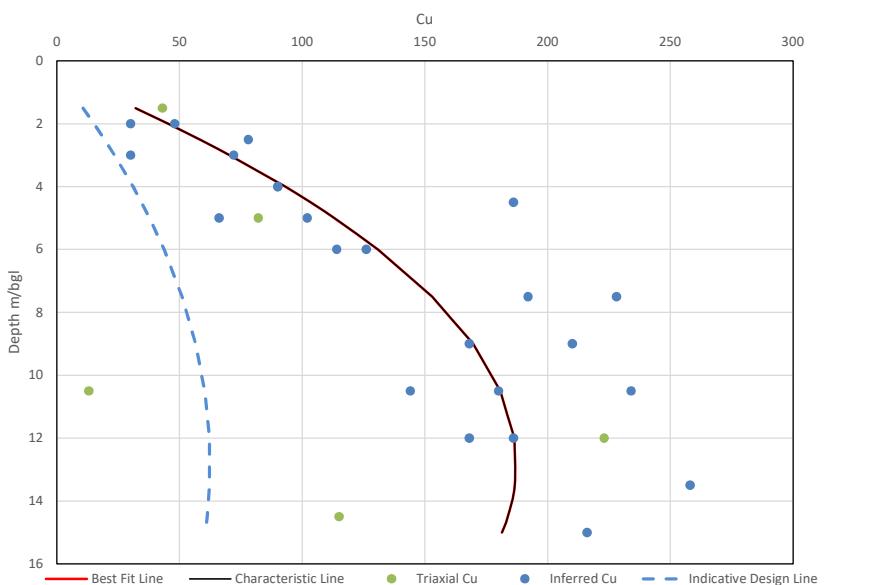
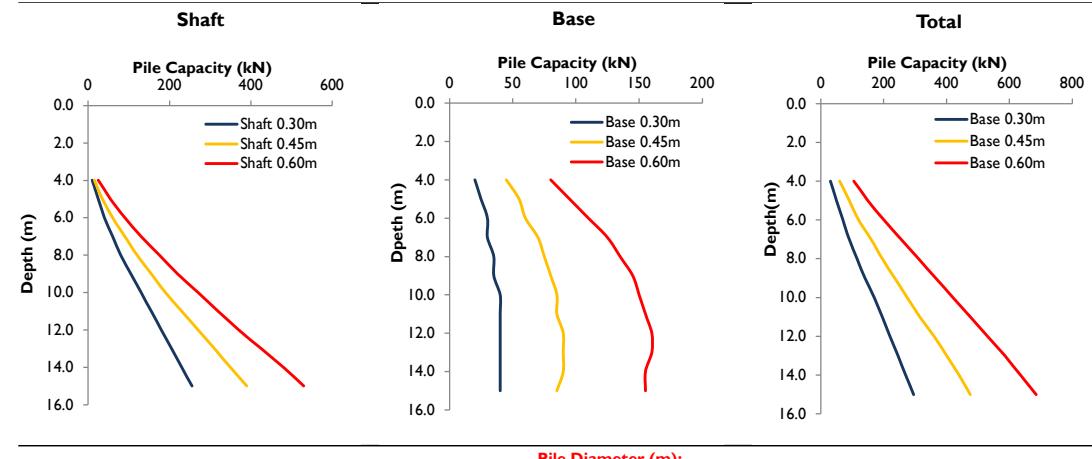
Det - Acronym

## **Appendix D     Foundation Design**

### **Appendix D.I   Preliminary Pile Design**

Preliminary Pile Working Loads  
Single Vertically Loaded Pile (kN)

Name:	<u>NS</u>	$N_c$ value	9	Pile Start Depth:	3	FOS
Job No:	21724	$\alpha$ value:	0.45	Pile Final Depth:	15	Shaft Base
Date:	10.2.25			Pile Increment:	1	3 3



## **Appendix E      Chemical Laboratory Analyses**

### **Appendix E.I    Conceptual Site Model**

**Table E.I.1 CSM Pre-Chemical Analyses**

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
On Site	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Mild	Unlikely	Very Low	The intrusive investigation identified Topsoil in each of the 4 no. exploratory holes from ground level to a depth of 0.30m bgl comprising grass over brown sandy CLAY with roots.	Soil sampling strategy in order to confirm ground conditions and allow for chemical laboratory testing prior to undertaking a generic quantitative risk assessment.
			End Users	Mild	Low	Low		
			Off-site Users	Minor	Unlikely	Very Low		
	PAHs, TPHs	Inhalation of vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Unlikely	Very Low	There were no significant visual or olfactory indicators of contamination noted.	The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).
			End Users	Minor	Unlikely	Very Low		
			Off-site Users	Minor	Unlikely	Very Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Unlikely	Low	The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).	
			End Users	Mild	Unlikely	Very Low		
			Surface Water	Mild	Low	Low		
Electric Sub-Station	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Mild	Low	Low	The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).	
			Surface Water	Mild	Low	Low		
			Shallow Aquifer	Mild	Low	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Direct contact with construction material	Buried Structures	Minor	Low	Very Low		
			Buried Services	Minor	Low	Very Low		
			Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
	PAHs, TPHs	Migration of gases via permeable soils	End Users	Mild	Unlikely	Very Low		
			Off-site Users	Minor	Unlikely	Very Low		
			Building and Confined Spaces	Site Workers/Site Maintenance	Mild	Unlikely		
Contaminative processes.	Metals, Semi-metals and non-metals, PAHs, TPHs, PCBs	Inhalation of dust	End Users	Mild	Unlikely	Very Low	The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).	
			Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
	PAHs, TPHs, PCBs	Inhalation of Vapour/gases	End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Site Workers/Site Maintenance	Medium	Unlikely	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, PCBs	Ingestion and absorption via direct contact	End Users	Mild	Unlikely	Very Low		
			Direct contact with construction material	Buried Structures	Mild	Low		
			Site Workers	Mild	Unlikely	Very Low		
Off Site	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Mild	Unlikely	Very Low	The Topsoil was underlain by the bedrock of the Weathered Lambeth Group/Lambeth Group (Secondary A Aquifer).	
			End Users	Mild	Unlikely	Very Low		
	PAHs, TPHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Minor	Unlikely	Very Low		
			End Users	Minor	Unlikely	Very Low		
			Site Workers/Site Maintenance	Minor	Unlikely	Very Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	End Users	Minor	Unlikely	Very Low		
			Site Workers/Site Maintenance	Minor	Unlikely	Very Low		
			End Users	Minor	Unlikely	Very Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Mild	Low	Low		
			Surface Water	Mild	Low	Low		
			Shallow Aquifer	Mild	Low	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Direct contact with construction material	Buried structures	Mild	Unlikely	Very Low		
			Buried Services	Mild	Unlikely	Very Low		
			Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
	PAHs, TPHs	Migration of gases via permeable soils	End Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		

**Table E.1.2 CSM Revised Post-Chemical Analyses**

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
On-Site	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	NONE	NONE	NONE	Representative samples for potential environmental testing were obtained from the exploratory holes at depths of between 0.10m and 0.50m to allow appropriate representation of the materials encountered, with additional samples to be obtained, if necessary, where there was visual or olfactory evidence of contamination.	The generic quantitative risk assessment established that there was no risk to the active receptors and no soil remedial measures would be required based on the sampling undertaken. However, a discovery strategy is put in place in case of unexpected contamination being encountered during construction.
			End-Users	NONE	NONE	NONE		
			Off-site Users	NONE	NONE	NONE		
	PAHs, TPHs	Inhalation of vapour/gases (including Radon)	Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Off-site Users	NONE	NONE	NONE		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	NONE	NONE	NONE		The chemical analyses were carried out on 3 no. samples of Topsoil and 1 no. sample of the underlying Weathered Lambeth Group
			End-Users	NONE	NONE	NONE		
			Surface Water	NONE	NONE	NONE		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	NONE	NONE	NONE		None of the samples tested showed concentrations in excess of the relevant GAC for a "Residential with home grown produce" land-use scenario. The Tier I Quantitative risk assessment therefore established that there was no risk to the human health receptors of construction workers or future end-users due to soil contamination.
			Shallow Aquifer	NONE	NONE	NONE		
			Buried Structures	NONE	NONE	NONE		
Electric Sub-Station	Metals, Semi-metals and non-metals, PAHs, TPHs, PCBs	Inhalation of dust	Site Workers/Site Maintenance	NONE	NONE	NONE	None of the samples tested showed concentrations in excess of the relevant GAC for a "Residential with home grown produce" land-use scenario. The Tier I Quantitative risk assessment therefore established that there was no risk to the human health receptors of construction workers or future end-users due to soil contamination.	As discussed in Section 8.7, there was no requirement for any precautionary measures against the ingress of ground gas.
			End-Users	NONE	NONE	NONE		
			Off-site Users	NONE	NONE	NONE		
	PAHs, TPHs, PCBs	Inhalation of Vapour/gases	Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Off-site Users	NONE	NONE	NONE		
	Metals, Semi-metals and non-metals, PAHs, TPHs, PCBs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Buried Structures	NONE	NONE	NONE		
Off-Site	Metals, Semi-metals and non-metals, PAHs, Asbestos	Inhalation of dust	Site Workers/Site Maintenance	NONE	NONE	NONE	None of the samples tested showed concentrations in excess of the relevant GAC for a "Residential with home grown produce" land-use scenario. The Tier I Quantitative risk assessment therefore established that there was no risk to the human health receptors of construction workers or future end-users due to soil contamination.	As discussed in Section 8.6, there was no merit in undertaking any remedial action for the protection of groundwater.
			End-Users	NONE	NONE	NONE		
			Site Workers	NONE	NONE	NONE		
	PAHs, TPHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Site Workers	NONE	NONE	NONE		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Surface Water	NONE	NONE	NONE		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	NONE	NONE	NONE		
			Shallow Aquifer	NONE	NONE	NONE		
			Buried Structures	NONE	NONE	NONE		
	PAHs, TPHs	Migration of gases via permeable soils	Buried Services	NONE	NONE	NONE		
			Site Workers/Site Maintenance	NONE	NONE	NONE		
			End-Users	NONE	NONE	NONE		
			Building and Confined Spaces	NONE	NONE	NONE		

**Appendix E.2 Chemical Laboratory Results**

Nikos Sidiropoulos  
Soils Ltd  
Newton House  
Cross Road  
Tadworth  
Surrey  
KT20 5SR

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

### **DETS Report No: 25-00549**

**Site Reference:** Haydon Drive

**Project / Job Ref:** 21724

**Order No:** 21724

**Sample Receipt Date:** 22/01/2025

**Sample Scheduled Date:** 22/01/2025

**Report Issue Number:** 1

**Reporting Date:** 31/01/2025

**Authorised by:**

A handwritten signature in black ink, appearing to read 'S. Knight'.

Steve Knight  
Customer Support 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**



<b>Soil Analysis Certificate</b>					
<b>DETS Report No: 25-00549</b>	<b>~Date Sampled</b>	16/01/25	16/01/25	16/01/25	16/01/25
<b>Soils Ltd</b>	<b>~Time Sampled</b>	None Supplied	None Supplied	None Supplied	None Supplied
<b>~Site Reference: Haydon Drive</b>	<b>~TP / BH No</b>	BH1	BH2	BH3	BH4
<b>~Project / Job Ref: 21724</b>	<b>~Additional Refs</b>	None Supplied	None Supplied	None Supplied	None Supplied
<b>~Order No: 21724</b>	<b>~Depth (m)</b>	0.10	0.10 - 0.30	0.10 - 0.30	0.10 - 0.50
<b>Reporting Date: 31/01/2025</b>	<b>DETS Sample No</b>	760430	760431	760432	760433

<b>Determinand</b>	<b>Unit</b>	<b>RL</b>	<b>Accreditation</b>	<b>(n)</b>		
Asbestos Screen <sup>(S)</sup>	N/a	N/a	<b>ISO17025</b>	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	<b>MCERTS</b>	6.7	7.4	6.7
Organic Matter (SOM)	%	< 0.1	<b>MCERTS</b>	2.4	2.3	3.1
Arsenic (As)	mg/kg	< 2	<b>MCERTS</b>	12	14	14
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	<b>MCERTS</b>	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	<b>MCERTS</b>	21	22	20
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	<b>MCERTS</b>	25	18	21
Lead (Pb)	mg/kg	< 3	<b>MCERTS</b>	36	36	46
Mercury (Hg)	mg/kg	< 1	<b>MCERTS</b>	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	<b>MCERTS</b>	17	17	12
Selenium (Se)	mg/kg	< 2	<b>MCERTS</b>	< 2	< 2	< 2
Vanadium (V)	mg/kg	< 1	<b>MCERTS</b>	46	54	46
Zinc (Zn)	mg/kg	< 3	<b>MCERTS</b>	55	55	50
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2

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

~Sample details provided by customer and can affect the validity of results

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation

Subcontracted analysis (S)



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



**Soil Analysis Certificate - Speciated PAHs**

DETS Report No: 25-00549	~Date Sampled	16/01/25	16/01/25	16/01/25	16/01/25
Soils Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Haydon Drive	~TP / BH No	BH1	BH2	BH3	BH4
~Project / Job Ref: 21724	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: 21724	~Depth (m)	0.10	0.10 - 0.30	0.10 - 0.30	0.10 - 0.50
Reporting Date: 31/01/2025	DETS Sample No	760430	760431	760432	760433

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

~Sample details provided by customer and can affect the validity of results

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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



**Soil Analysis Certificate - EPH Texas Banded**

DETS Report No: 25-00549	~Date Sampled	16/01/25	16/01/25	16/01/25	16/01/25
Soils Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Haydon Drive	~TP / BH No	BH1	BH2	BH3	BH4
~Project / Job Ref: 21724	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: 21724	~Depth (m)	0.10	0.10 - 0.30	0.10 - 0.30	0.10 - 0.50
Reporting Date: 31/01/2025	DETS Sample No	760430	760431	760432	760433

Determinand	Unit	RL	Accreditation	(n)			
EPH Texas (C6 - C8) : HS 1D MS Total	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH Texas (>C16 - C21) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH Texas (>C21 - C40) : EH 1D Total	mg/kg	< 6	MCERTS	< 6	< 6	< 6	< 6
EPH Texas (C6 - C40) : HS 1D MS+EH 1D Total	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6

~Sample details provided by customer and can affect the validity of results

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



**Soil Analysis Certificate - Sample Descriptions**

**DETS Report No: 25-00549**

**Soils Ltd**

**~Site Reference: Haydon Drive**

**~Project / Job Ref: 21724**

**~Order No: 21724**

**Reporting Date: 31/01/2025**

<b>DETS Sample No</b>	<b>~TP / BH No</b>	<b>~Additional Refs</b>	<b>~Depth (m)</b>	<b>Moisture Content (%)</b>	<b>Sample Matrix Description</b>
760430	BH1	None Supplied	0.10	22.9	Light brown clay
760431	BH2	None Supplied	0.10 - 0.30	25.3	Light brown clay
760432	BH3	None Supplied	0.10 - 0.30	24.3	Light brown clay with vegetation
760433	BH4	None Supplied	0.10 - 0.50	24.3	Light brown clay

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

Insufficient Sample <sup>1/S</sup>

Unsuitable Sample <sup>U/S</sup>

~Sample details provided by customer and can affect the validity of results



**Soil Analysis Certificate - Methodology & Miscellaneous Information**

DETS Report No: 25-00549

Soils Ltd

~Site Reference: Haydon Drive

~Project / Job Ref: 21724

~Order No: 21724

Reporting Date: 31/01/2025

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried

AR As Received

~Sample details provided by customer and can affect the validity of results



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



**List of HWOL Acronyms and Operators**

**DETS Report No: 25-00549**

**Soils Ltd**

**~Site Reference: Haydon Drive**

**~Project / Job Ref: 21724**

**~Order No: 21724**

**Reporting Date: 31/01/2025**

<b>Acronym</b>	<b>Description</b>
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

EPH Texas (C10 - C12) - EH_1D_Total
EPH Texas (C12 - C16) - EH_1D_Total
EPH Texas (C16 - C21) - EH_1D_Total
EPH Texas (C21 - C40) - EH_1D_Total
EPH Texas (C6 - C40) - HS_1D_MS+EH_1D_Total
EPH Texas (C6 - C8) - HS_1D_MS_Total
EPH Texas (C8 - C10) - EH_1D_Total

**Appendix E.3 General Assessment Criteria**

## HUMAN HEALTH RISK ASSESSMENT

### Introduction

The statutory definition of contaminated land was initially defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2, and retained in the Environment Act 2021, ref 1.3, as;

‘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 land has developed as a direct result of the introduction of these Acts. The technical guidance supporting the original legislation was summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs). These have since been replaced or superseded by Land Contamination Risk Management (LCRM) 2021, ref 1.4 produced and administrated by the Environment Agency online through the .GOV.uk website <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> .

However, the basic definitions, methodology and guidance remain essentially the same utilizing the UK Contaminated Land Exposure Assessment Models (CLEA) as within the original CLR and planning guidance it replaces or supersedes.

In establishing whether a site fulfils the statutory definition of ‘contaminated land’ it remains 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 identified 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 therefore be defined as the confirmation of a link between a contaminant ‘source’ and a vulnerable at risk ‘receptor’ by means of a ‘pathway’ and that the risk is potentially significant. If there is no complete linkage, risk defaults to low to negligible and can never be potentially significant.

## Assessment Methodology

A four-stage assessment process is followed for identifying potential pollutant linkages on a site. These stages are summarised 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 in the context of existing and future proposals.

Stages 1 and 2 develop an initial '*conceptual model*' based upon information collated from desk-based available and existing site information and a walkover of the site as recommended in BS10175 and LCRM. The formation of any conceptual model is an iterative process and as such it should be updated and refined throughout each phase of the project to reflect any additional information obtained and unknowns being resolved and identify the potential contaminants of concern at the site, i.e. those with the potential to cause significant harm to identified receptors.

The extent of the desk studies and enquiries to be conducted should be in general accordance with BS10175 and other UK guidance to produce an initial conceptual model highlighting the known potential risks, remaining unknowns and contaminants of concern. The information from these enquiries is presented in a desk study or preliminary report with recommendations, if necessary, for further work based upon the conceptual model findings and any identified or unresolved unknowns.

If potential pollutant linkages or potentially significant unknowns are identified within the initial conceptual model, further site investigation and report will be recommended and usually required under planning. Such investigation should be based on and driven by the findings of the initial conceptual model and planned in general accordance with BS10175, LCRM and other current UK guidance where relevant. The number of exploratory holes and samples collected for analysis should be consistent with the size, extent and nature of the site, the identified contaminants of concern and the level of initial risk identified in the initial conceptual model. This will enable a contamination risk assessment to be conducted in accordance with current UK requirements, at which point the conceptual model can be updated and any relevant pollutant linkages can be further quantified and any remaining unknowns resolved. As previously this is an iterative process that may highlight or require additional investigation to resolve to the satisfaction of the regulator.

A two-stage investigation process may therefore be more appropriate where time constraints are less of an issue with the first intrusive investigation being conducted as an initial or screening assessment to confirm or validate the presence of potential sources on site identified in the initial conceptual model and to investigate if additional unknown sources not previously identified are present. This helps to define the scope, extent and requirements of a second more refined and targeted investigation to delineate wherever possible the extent of the identified contamination, contaminants of concern and/or remaining unknowns.

All site works should be undertaken in general accordance with the British Standards BS 10175, ref. 5, for environmental only investigations and BS 5930:2015, ref. 1.6, in the case of combined Geoenvironmental and/or Geotechnical investigations.

The results of analysis are compared initially against generic guidance values which are dependent on the proposed end-use of the development and which must ultimately be based on traceable, scientifically valid and justified exposure and chemical data using the UKCLEA methodology.

The end-use and therefore potential exposure pathways may be defined as one of the following under current UK guidance;

- Residential with homegrown produce i.e. typical low rise and low-density housing with gardens where vegetables and fruits may be grown for home consumption.
- Residential without homegrown produce i.e. low-density housing where no gardens are present where vegetables and fruits could be grown for home consumption.
- Allotments – i.e. areas where vegetables and fruits are grown for home consumption but are not specifically associated with a residential property.
- Public open space residential – i.e. grassed areas adjacent and/or directly related to high density housing and other common or communal open areas on which underlying soils could be exposed but on which vegetables and fruits are not grown for consumption.
- Public open space – i.e. areas such as parks, playing fields and other recreational areas to which public access is possible but otherwise to which there is no direct residential linkage.
- Commercial – i.e. industrial premises where there is limited exposure to soil and residents are not present on site.

### **Standard Land-use Scenarios**

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

#### **Residential with homegrown produce**

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

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- Critical receptor is assumed to be a young female child (zero to six years old)
- 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.

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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 homegrown vegetables will not occur and the pathways of direct ingestion and produce inputs are suitably moderated.

### Allotments

Areas of open space commonly made available to local users but remote from residential properties, but on which tenants may grow fruit and vegetables 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 only occasional accompanied visits.

Although some allotment holders may choose to keep animals on allotments, potential exposure to animal products is not currently considered within the CLEA model.

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- Critical receptor is a young female child (zero to six years old)
- 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 but at reduced exposure levels reflecting non-residential status.

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### Commercial

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

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- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is over working lifetime
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours but exposure reduced to reflect non-residential nature and general lack of open spaces.

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### Public Open Space within Residential Area

This generic scenario refers to any grassed area up to 0.05 ha that is associated with residential properties but is not for their exclusive use and on which no fruit or vegetables are grown for home consumption.

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- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil which can be interacted with directly
- Predominantly used by children for play and/or access
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply

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- older children chosen as the critical receptor on basis that they will use site most frequently (age class 4-9 years)
- ingestion rate assumed to be 75 mg.day<sup>-1</sup>

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### Public Open Space Park

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

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- 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% assumed cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 mg.day<sup>-1</sup>
- Occupancy period outdoors = 2 hours.day<sup>-1</sup>
- Exposure frequency of 170 days.year<sup>-1</sup> for age classes 2-18 and 85
- days.year<sup>-1</sup> for age class 1
- Outdoor exposure pathways only (no tracking back of soils).

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Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC) generated using the CLEA model based on the exposure and land use scenario assumptions noted above.

GAC's are deliberately conservative values adopted to ensure that they are applicable to the majority of possible contaminated sites and below which there is considered a low to negligible risk to identified human health receptors, i.e. there can be no harm. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC's derived by a competent third party or the Environment Agency / DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC's 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 or the contaminant is susceptible to wide variation depending on factors such as form and bioavailability, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific or remediation values for relevant soil contaminants based on site and contaminant specific conditions.

In 2014, the publication of Category 4 Screening Levels (C4SL), refs 1.8 and 1.9, 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 1.7 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. 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 For Use Levels (S4ULs) published by LQM, ref. 1.10, 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, assessment criteria may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.11, Toxicological and physico-chemical/fate and transport data used to generate the criteria 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 originally from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), where available. Where no TOX report is available reference has been made to appropriately determined health criteria values, derived from the above-noted hierarchy, as this is considered to represent appropriate peer reviewed data sources. Similarly, fate and transport data should also be determined by reference to appropriate sources and the CLEA model assumptions.

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. 1.12. Individual concentrations are then compared to the selected guideline values to identify and isolate concentrations of contaminants that are in excess of the selected screening low or no risk criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, further risk evaluation needs to be undertaken often as a site specific DQRA in line with current guidance to determine and confirm if the identified exceedances are significant in the context of the proposed development or activity.

## References

- 1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.
- 1.2 Environment Act 1995, Section 57, DoE 1995.
- 1.3 Environment Act 2021 OEP 2021.
- 1.4 Land Contamination Risk Management Gov.UK (EA) 2021
- 1.5 BS 10175: 2011+A2:2017 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2017
- 1.6 BS 5930: 2015+A1:2020 '*Code of practice for ground investigations*', British Standards Institute, 2015
- 1.7 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008
- 1.8 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.
- 1.9 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.
- 1.10 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.
- 1.11 CLEA '*Software Version 1.071*' (downloaded from the CL:AIRE website , <https://www.claire.co.uk/home/news/44-risk-assessment/178-soil-guideline-values> )
- 1.12 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.

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							
	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	1	2.5	6	1	2.5	6				
	Type	Contaminants	Species	Year																									
Metals	Antimony			2010									550														EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Arsenic			2014	37		40		49		640			7500													C4SL	DEFRA	2014
				2015	37		40		40		640			79												S4UL	LQM/CIEH	2015	
	Barium			2010			1300							22000													EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Beryllium			2015	1.7		1.7		35		12			2.2												S4UL	LQM/CIEH	2015	
	Boron			2015	290		11000		45		240000			21000												S4UL	LQM/CIEH	2015	
	Cadmium			2015	11		85		1.9		190			120												S4UL	LQM/CIEH	2015	
	Chromium	III		2015	910		910		18000		8600			1500												S4UL	LQM/CIEH	2015	
		VI		2014	21		21		170		49			23												C4SL	DEFRA	2014	
		VI		2015	6		6		1.8		33			7.7												S4UL	LQM/CIEH	2015	
	Copper			2015	2400		7100		520		68000			12000												S4UL	LQM/CIEH	2015	
	Lead			2014*	82-210		130-		30-84		1100-			270-												C4SL	DEFRA	2014	
				2015	310						6000			760															
	Mercury	Elemental		2012	1.0		1.0		26		26															210	DEFRA	2012	
				2015	1.2		1.2		21		58			16												S4UL	LQM/CIEH	2015	
		Inorganic		2012	170		170		80		36000															SGV	DEFRA	2012	
				2015	40		56		19		1100			120												S4UL	LQM/CIEH	2015	
		Methyl		2012	11		11		8		410															SGV	DEFRA	2012	
				2015	11		15		6		320			40												S4UL	LQM/CIEH	2015	
	Molybdenum			2010			670						17000														EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010
	Nickel			2012	130		130		230		1800															SGV	DEFRA	2012	
				2015	130		180		53		980			230												S4UL	LQM/CIEH	2015	
	Selenium			2012	350		595		120		13000															SGV	DEFRA	2012	
				2015	250		430		88		12000			1100												S4UL	LQM/CIEH	2015	
	Vanadium			2015	410		1200		91		9000			2000												S4UL	LQM/CIEH	2015	
	Zinc			2015	3700		40000		620		730000			81000												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												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	56000	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	5700	13000	27000	24000	24000	25000	17000	22000	27000			S4UL	LQM/CIEH	2015		
	Xylenes	o-xylene		2012	250		250		160		2600															SGV	DEFRA	2012	
		m-xylene		2012	240		240		180		3500															SGV	DEFRA	2012	
		p-xylene		2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000			S4UL	LQM/CIEH	2015		
Petroleum Hydrocarbons	Aliphatic >C5 - C6			2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000									

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							
	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	1	2.5	6	1	2.5	6				
	Type	Contaminants	Species	Year																									
Polycyclic Aromatic Hydrocarbons (PAH's) (mg/kg)	Aromatic >C8 - C10			2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9200	S4UL	LQM/CIEH	2015				
	Aromatic >C10 - C12			2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000	S4UL	LQM/CIEH	2015				
	Aromatic >C12 - C16			2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015				
	Aromatic >C16 - C21			2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015				
	Aromatic >C21 - C35			2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015				
	Aromatic >C34 - C44			2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015				
	Aliphatic + Aromatic >C44 - C70				1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	28000	28000	28000	S4UL	LQM/CIEH	2015				
	Acenaphthene			2015	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	29000	29000	S4UL	LQM/CIEH	2015				
	Acenaphthylene			2015	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	29000	29000	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				
Chloroalkanes & alkenes	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	0.79	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					
Explosives	I,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					
	I,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					
	I,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					
	I,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					
	Tetrachloroeth																												

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				
	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	1	2.5	6		
Type	Contaminants	Species	Year																					
Chlorobenzenes	Chlorobenzene		2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300	2000	2900	S4UL	LQM/CIEH	2015
	I,2-Dichlorobenzene		2015	23	55	130	24	57	130	94	230	540	2000	4800	11000	90000	95000	98000	24000	36000	51000	S4UL	LQM/CIEH	2015
	I,3-Dichlorobenzene		2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	I,4-Dichlorobenzene		2015	61	150	350	61	150	350	15	37	88	4400	10000	25000	17000	17000	1700	36000	36000	36000	S4UL	LQM/CIEH	2015
	I,2,3,-Trichlorobenzene		2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770	1100	1600	S4UL	LQM/CIEH	2015
	I,2,4,-Trichlorobenzene		2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700	2600	4000	S4UL	LQM/CIEH	2015
	I,3,5,-Trichlorobenzene		2015	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380	580	860	S4UL	LQM/CIEH	2015
	I,2,3,4,-Tetrachlorobenzene		2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	1500	1600	1600	1600	S4UL	LQM/CIEH	2015
	I,2,3,5,- Tetrachlobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49	120	240	78	79	79	110	120	130	S4UL	LQM/CIEH	2015
	I,2,4, 5,- Tetrachlobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42	72	96	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols	Pentachlorobenzene		2015	5.8	12	22	19	30	38	1.2	3.1	7	640	770	830	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene		2015	1.8	3.3	4.9	4.1	5.7	6.7	0.47	1.1	2.5	110	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
	Phenols		2012		420		420		280		3200										SGV	DEFRA	2012	
			2015	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	S4UL	LQM/CIEH	2015
Others	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH	2015
Others	Hexachloro-1,3-Butadiene		2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.		2012		8		8		8		240										SGV	DEFRA	2012	

## NOTE

Priority Guideline (mg kg⁻¹)

1 Site Specific Assessment Criteria (SSAC) (Soils Limited)

2 2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014 and 2021) \* Use upper range value for Lead unless otherwise indicated

3 2012: Soil Guideline Value (SGV) (Environment Agency, 2009)

4 2015: Suitable 4 Use Level (S4UL) (Nathanail et al, 2015)

For Generic Risk Assessment, the values in Bold should have priority unless site specific, Client or regulatory requirements dictate otherwise – which must be justified

Table reviewed January 2024

**Appendix F      Information Provided by the Client**



Application Site Address:  
 Haydon Drive  
 Pinner  
 Hillingdon  
 HA5 2PW

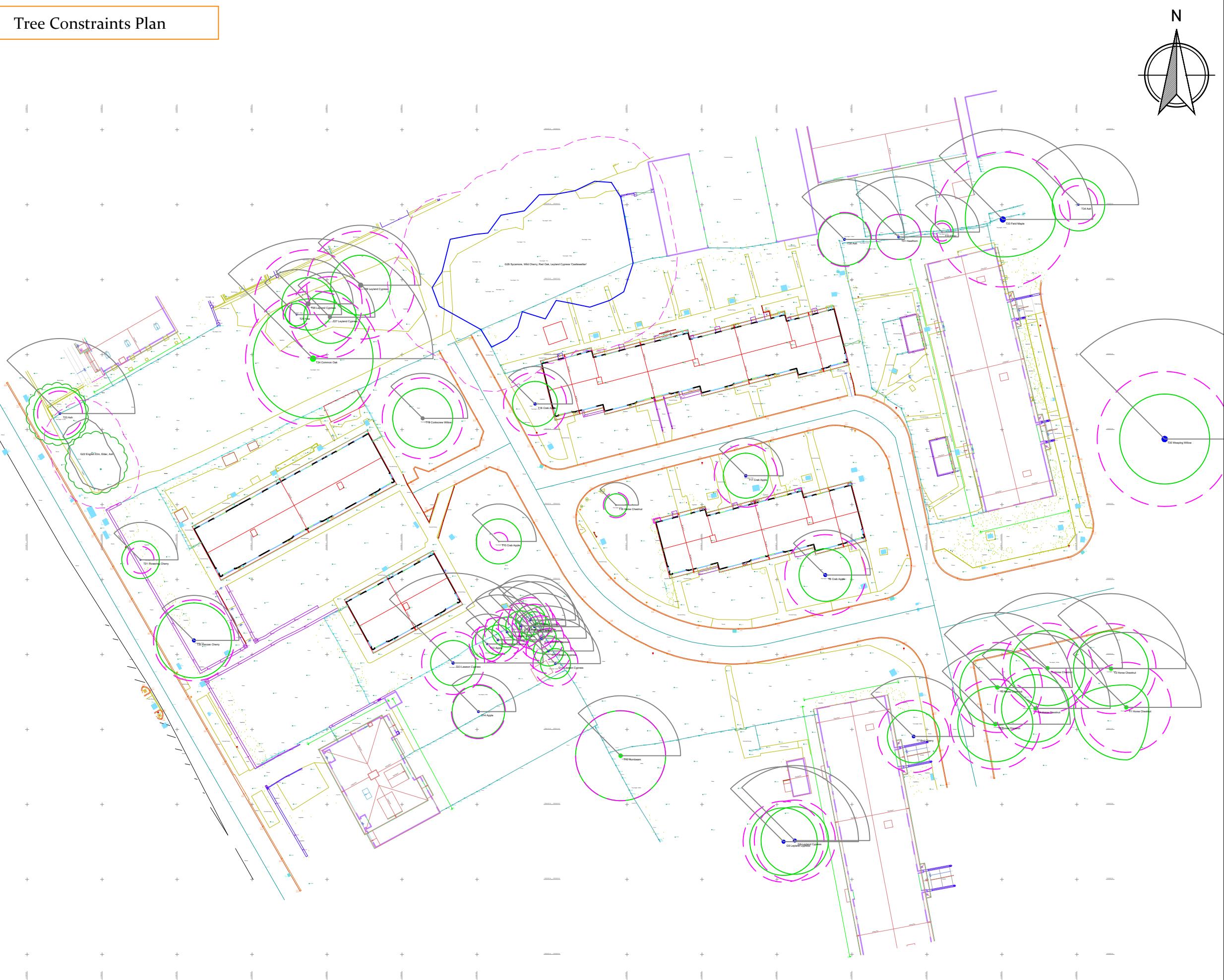
Site Area: 1.24 acres / 0.50ha

	- Application Boundary
<b>LEGEND:</b>	
<b>Boundary Treatment</b>	
	Existing timber fence 1.8m-2m high timber closeboard fencing
	Existing brick wall 1.8m-2m high red brick wall
	Proposed play area fence 1.2m high metal mesh fencing
	Proposed rear garden fence 2m high timber closeboard fencing with trellis
	Proposed front garden fence 300-600mm high brick dwarf wall with 865mm high slatted metal fence
<b>Soft Surfaces &amp; Vegetation</b>	
	Existing tree, retained
	Existing tree, removed
	Proposed Tree Mixed species tree planting (predominantly native)
	Proposed Small Tree Fastigate tree or large shrub (native species)

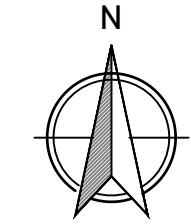
0 1m 5m 10m 20m

1:200 @A0

## Tree Constraints Plan



## Plan Legend



### Tree/s to be retained

### Tree/s to be removed

## Centre colours

## Category A Tree

## Category B Tree

## Category C Tree

Root Protection Area (RPA)  
If amended, the original is a  
dotted blue circle

500 @ A<sub>3</sub>

ess: Haydon Drive

IA5 2PW

Philip Pank Partnership LLP  
No: TH/A3/4042/TPP

TH 4042 | Date: 15/06/2023

Trevor Heaps  
Cultural Consultancy Ltd



07957 763 533  
vor@trevorheaps.co.uk  
www.trevorheaps.co.uk

# Trevor Heaps

## Arboricultural Consultancy Ltd.

12 Plover Drive, Milford-on-Sea, Hampshire, SO41 0XF - Tel: 07957 763 533

Email: [trevor@trevorheaps.co.uk](mailto:trevor@trevorheaps.co.uk) • [www.trevorheaps.co.uk](http://www.trevorheaps.co.uk)



### Tree Data Schedule

For

**Haydon Drive, Pinner**  
**HA5 2PW**

Prepared for Philip Pank Partnership LLP

Prepared by **Trevor Heaps** BSc, MICFor, M. Arbor.A.

Date: 15<sup>th</sup> June 2023

Ref: TH 4042

### Tree data schedule

Ref	Name	Age	DBH (mm)	Hgt. (m)	Can. hgt. (m)	Can N (m)	Can E (m)	Can S (m)	Can W (m)	Physio cond.	Struct cond.	Life Exp.	Ret. Cat.	Comments	Rec's (Proposed works are highlighted)
T1	Aesculus hippocastanum (Horse Chestnut)	EM	500	10	3.5	3	3	7	7	Normal	Normal	40+	A2		
T2	Aesculus hippocastanum (Horse Chestnut)	EM	500	10	3.5	5	5	5	5	Normal	Normal	40+	A2		
T3	Aesculus hippocastanum (Horse Chestnut)	EM	500	10	3.5	5	5	5	5	Normal	Normal	40+	A2		
T4	Aesculus hippocastanum (Horse Chestnut)	EM	450	10	3.5	4.5	4.5	4.5	4.5	Normal	Normal	40+	A2		
T5	Aesculus hippocastanum (Horse Chestnut)	EM	500	10	3.5	5	5	5	5	Normal	Normal	40+	A2		
T6	Aesculus hippocastanum (Horse Chestnut)	EM	500	10	3.5	5	5	5	5	Normal	Normal	40+	A2		
T7	Prunus padus (Bird Cherry)	EM	400	8	5	3.5	3.5	3.5	3.5	Normal	Fair	20+	B2	Crown reduced in past.	
T8	Malus sylvestris (Crab Apple)	M	450	6	3	3.5	3.5	3.5	3.5	Normal	Normal	20+	B2		
G9	X Cupressocyparis leylandii (Leyland Cypress)	EM	450	10	2	4.5	4.5	4.5	4.5	Normal	Normal	40+	B2		
T10	Carpinus betulus (Hornbeam)	EM	500	8	2	6	6	6	6	Normal	Normal	40+	A2		
G11	Chamaecyparis lawsoniana (Lawson Cypress)	EM	250	6	1.5	2	2	2	2	Normal	Normal	40+	B2	Outgrown boundary hedge.	
T12	Malus (Apple)	EM	200	4	2	2	2	2	2	Normal	Normal	40+	B2		
T13	Chamaecyparis lawsoniana (Lawson Cypress)	M	350	12	1.5	3	3	3	3	Normal	Normal	40+	B2		
T14	Malus (Apple)	EM	300	5	2	3.5	3.5	3.5	3.5	Normal	Normal	40+	B2		

Ref	Name	Age	DBH (mm)	Hgt. (m)	Can. hgt. (m)	Can N (m)	Can E (m)	Can S (m)	Can W (m)	Physio cond.	Struct cond.	Life Exp.	Ret. Cat.	Comments	Rec's (Proposed works are highlighted)
T15	Malus sylvestris (Crab Apple)	SM	100	5	2	3	3	3	3	Normal	Normal	40+	C2		
T16	Aesculus hippocastanum (Horse Chestnut)	SM	100	3	1	1.5	1.5	1.5	1.5	Normal	Normal	40+	C2		
T17	Malus sylvestris (Crab Apple)	M	350	5	3	3	3	3	3	Normal	Normal	20+	B2		
T18	Malus sylvestris (Crab Apple)	M	350	5	3	3	3	3	3	Normal	Normal	20+	B2		
T19	Salix matsudana 'Tortuosa' (Corkscrew Willow)	EM	450	6	2	4	4	4	4	Fair	Fair	20+	C2	Sparse. Die-back in crown.	
T20	Prunus serrulata 'Kanzan' (Kanzan Cherry)	M	450	6	2.5	5	5	5	5	Fair	Normal	20+	B2	Sparse.	
T21	Prunus sps. (Flowering Cherry)	SM	150	5	2	2.5	2.5	2.5	2.5	Fair	Normal	40+	B2		
G22	Ulmus procera (English Elm), Sambucus nigra (Elder), Fraxinus excelsior (Ash)	SM	150	5	0	2	2	2	2	Normal	Normal	40+	C2		
T23	Fraxinus excelsior (Ash)	EM	250	10	3	3.5	3.5	3.5	3.5	Normal	Normal	40+	B2		
T24	Quercus robur (Common Oak)	M	750	16	3	8	8	8	8	Normal	Normal	40+	A2		
T25	Taxus baccata (Yew)	SM	150	6	0.5	1.5	1.5	1.5	1.5	Normal	Normal	40+	B2		
T26	X Cupressocyparis leylandii (Leyland Cypress)	EM	600	6	3	3.5	3.5	3.5	3.5	Fair	Fair	20+	C2	Managed by topping. Sparse. Deadwood noted.	
T27	X Cupressocyparis leylandii (Leyland Cypress)	EM	450	6	3	3.5	3.5	3.5	3.5	Fair	Fair	20+	C2	Managed by topping. Sparse. Deadwood noted.	
T28	X Cupressocyparis leylandii (Leyland Cypress)	EM	600	8	3	4	4	4	4	Fair	Fair	20+	C2	Managed by topping. Sparse. Deadwood noted.	

Ref	Name	Age	DBH (mm)	Hgt. (m)	Can. hgt. (m)	Can N (m)	Can E (m)	Can S (m)	Can W (m)	Physio cond.	Struct cond.	Life Exp.	Ret. Cat.	Comments	Rec's (Proposed works are highlighted)
G29	Acer pseudoplatanus (Sycamore), Prunus avium (Wild Cherry), Quercus rubra (Red Oak), X Cupressocyparis leylandii 'Castlewellan' (Leyland Cypress 'Castlewellan')	EM	450	12	2	3.5	3.5	3.5	3.5	Normal	Normal	40+	B2		
T30	Fraxinus excelsior (Ash)	EM	300	8	3	3.5	3.5	3.5	3.5	Normal	Normal	40+	B2		
T31	Crataegus monogyna (Hawthorn)	EM	250	8	3	3	3	3	3	Fair	Normal	40+	B2		
T32	Sambucus nigra (Elder)	SM	100	5	1.5	1.5	1.5	1.5	1.5	Fair	Normal	40+	C2		
T33	Acer campestre (Field Maple)	M	750	12	2	7	7	5	5	Normal	Fair	40+	B2	Stem formed from multiple stems	
T34	Fraxinus excelsior (Ash)	EM	150	8	3	3.5	3.5	3.5	3.5	Normal	Fair	40+	B2		
T35	Salix X chrysocoma (Weeping Willow)	M	750	16	2	6	6	6	6	Normal	Fair	40+	B2	Pollarded in the past.	

## Tree data schedule explanatory notes

This section explains the terms used in the **Tree data schedule** (Appendix 2).

**Ref:** Each item of vegetation has its own unique number, prefixed by a letter such that:

**T1**=Tree      **S2**=Shrub or stump      **G3**=Group      **H4**=Hedge      **W5**=Woodland

**Species:** Latin (and common names in brackets) are given.

### Age:

- **Y - Young** - Usually less than 10 years' old
- **SM - Semi-mature** - Significant future growth to be expected, both in height and crown spread (typically below 30% of life expectancy)
- **EM - Early-mature** - Full height almost attained. Significant growth may be expected in terms of crown spread (typically 30-60% of life expectancy)
- **M - Mature** - Full height attained. Crown spread will increase but growth increments will be slight (typically 60% or more of life expectancy)
- **V - Veteran** - A level of maturity whereby significant management may be required to keep the tree in a safe condition
- **OM - Over-mature** - As for veteran except management is not considered worthwhile

**DBH (mm):** Stem diameter, measured in mm, taken at 1.5m above ground level where possible.

**Hgt. (m): Height:** Measured from ground level to the top of the crown in metres.

**Can Hgt. (m): Crown height:** Measured from ground level to the lowest tips of the main crown begins in metres. Where the crown is unbalanced it is measured on the side deemed to be most relevant. This is usually the side facing the area of anticipated development.

### Can N, S, E, W: - Canopy extents

Approximate radial crown spread measured to the four cardinal points (for individual trees only)

**Physio cond.:** Indicates the physiological condition of the tree as one of the following categories:

- **Normal** - Healthy tree with no symptoms of significant disease
- **Fair** - Tree with early signs of disease, small defects, decreased life expectancy, or evidence of less-than-average vigour for the species
- **Poor** - Significant disease present, limited life expectancy, or with very low vigour for the species and evidence of physiological stress
- **Very poor** - Tree is in advanced stages of physiological failure and is dying
- **Dead** - No leaves or signs of life

**Struct cond.:** Indicates the structural condition of the tree as one of the following categories:

- **Normal** - No significant structural defects noted
- **Fair** - Some structural defects noted but remedial action not required at present
- **Poor** - Significant defects noted resulting in a tree that requires regular monitoring or remedial action
- **Very poor** - Major defects noted that compromise the safety of the tree. Remedial works or tree removal is likely to be required.
- **Dead** - No leaves or signs of life

**Life Exp.:** The estimated number of years before the tree may require removal (<10), (10 – 20), (20 – 40), or (40+).

**Ret. Cat.:** - Retention category: BS5837:2012 Category where:

- **U = Trees unsuitable for retention.** Trees in such a condition that cannot realistically be retained as living trees in the context of the current land use for longer than 10 years. These trees are shown on the tree plans with red centres.
- **A = Trees of high quality.** Trees of high quality with an estimated remaining life expectancy of at least 40 years. These trees are shown on the tree plans with green centres.
- **B = Trees of moderate quality.** Trees of moderate quality with an estimated remaining life expectancy of at least 20 years. These trees are shown on the tree plans with blue centres.
- **C = Trees of low quality.** Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm. These trees are shown on the tree plans with grey centres.

Trees of notable quality are graded as Category A or Category B. These trees are sometimes divided further into sub-categories:

- Sub-category 1 is allocated where it has been assessed that the tree has mainly arboricultural qualities.
- Sub-category 2 is allocated where it is assessed that the tree has mainly landscape qualities.
- Subcategory 3 is allocated where it is assessed that the tree has mainly cultural qualities, including conservation.

Trees may be allocated more than one sub-category. All sub-categories carry equal weight, with for example an A3 tree being of the same importance and priority as an A1 tree.

**Comments:** Tree form and pruning history are also recorded along with an account of any significant defects.

**Rec's - Recommendations:** Usually based on any defects observed and intended to ensure that the tree is in an acceptable condition.

**Soils Limited**  
**Geotechnical & Environmental Consultants**

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

**T 01737 814221**  
**W soilslimited.co.uk**