



Garages at Whitsbury Road
Havant
Hampshire

Combined Geotechnical and
Ground Contamination Risk Assessment

Report Beneficiary:
Stop Domestic Abuse (SDA)
PO Box 53
Havant
Hampshire
PO9 1UA

Project Reference: P16424

Report Reference: R16043

Document Control			
Issue No.	Status	Issue Date	Notes
1	Final	1 st February 2024	
Report Section		Prepared By	Approved By
Factual Section		Georgia Roper-Docherty BSc MRes	Rebecca Webb BSc FGS
Geotechnical Assessment		Adam Cormack HNC FGS	Rebecca Webb BSc FGS
Quantitative Ground Contamination Risk Assessment		Adam Cormack HNC FGS	Alex Minchell-Bewick BSc MSc DIC AIEEMA MIEEnvSc CEnv

Head Office
Unit 3
The Old Grain Store
Ditchling Common Business Park
Ditchling
East Sussex
BN6 8SG
Tel: 01273 483119
www.ashdownsi.co.uk

Limitations

This report was prepared specifically for the Client's project and may not be appropriate to alternative schemes. The copyright for the report and licence for its use shall remain vested in Ashdown Site Investigation Limited (the Company) who disclaim all responsibility or liability (whether at common law or under the express or implied terms of the Contract between the Company and the Client) for any loss or damage of whatever nature in the event that this report is relied on by a third party, or is issued in circumstances or for projects for which it was not originally commissioned.

This report is not intended to be either an ecological, archaeological or flood risk assessment. An appropriate specialist should be consulted about any concerns that may arise in this regard.

EXECUTIVE SUMMARY

The following presents a summary of the main findings of the report. It is emphasised that no reliance should be placed on any individual point until the whole of the report has been read as other sections of the report may put into context the information contained herein.

It is proposed to redevelop the garage site located at Whitsbury Road, Havant, Hampshire. Whilst at the time of preparation of this report no specific development proposal for the site had been finalised, it is understood the development will be for residential purposes.

Reference to geological datasets indicates that the site is expected to be underlain by the London Clay Formation, with superficial Head soils shown in the vicinity. The ground investigation confirmed the underlying soils to comprise a shallow thickness of made ground/reworked soils, overlying Head and, in turn, London Clay Formation deposits.

The London Clay Formation is classed as an Unproductive Stratum. The site lies within an Inner Zone - SPZ1c. Whilst perched water was noted locally within the made ground soils, the boreholes were generally recorded as being dry during drilling.

Precautions against shrinkage and heave for any new foundation system should assume a high volume change potential for the fine-grained Head and London Clay Formation soils.

A net allowable bearing capacity of 100kN/m^2 may be assumed for spread (pad or strip) foundations up to 1.00m across bearing within the Head or London Clay Formation soils of at least firm consistency, typically encountered below depths of 1.00m below ground level.

A DS-1 Design Sulfate Class and an AC-1 ACEC classification should be assumed as a minimum for the design of concrete in contact with the ground where the ground will not be significantly disturbed.

Ground floors should be suspended unless the conditions set out within this report can be met.

Design equilibrium California bearing ratios and moduli of subgrade reaction are presented in the report. The subgrade is not likely to be susceptible to frost heave.

The ground investigation has identified the presence of asbestos materials within the shallow made ground soils, which are considered to pose an unacceptable risk to proposed end users of the development. Remedial measures will be required, which should be detailed in a separate report.

TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	SITE CONTEXT	2
2.1	Site Description	2
2.2	Geological and Hydrogeological Data	2
3.	SITE WORKS	4
3.1	Introduction	4
3.2	Exploratory Holes	4
3.3	Sampling	4
3.4	In Situ Strength Testing	4
3.5	Laboratory Testing	5
4.	GROUND CONDITIONS	6
4.1	Stratigraphy	6
4.2	Stability	6
4.3	Groundwater Conditions	6
5.	GEOTECHNICAL ASSESSMENT	7
5.1	Foundations	7
5.2	Ground Floors	9
5.3	Groundwater	10
5.4	Stability of Excavations	10
5.5	Aggressivity to Concrete	10
5.6	Pavement Design	11
6.	QUANTITATIVE CONTAMINATION ASSESSMENT	13
6.1	Introduction	13
6.2	Analysis of Contamination Test Results	13
6.3	Quantitative Contamination Risk Assessment	16
6.4	Risks to Other Potential Receptors	17
6.5	Recommendations	17

FIGURES AND APPENDICES

FIGURES

- Figure 1 Site Location Plan
- Figure 2 Site Plan

APPENDIX A

- Explanatory Notes
- Exploratory Hole Records
- DPSH-B Dynamic Probe Records
- In-situ TRL Cone Penetrometer (CBR) Test Results

APPENDIX B

- Geotechnical Laboratory Test Results
- Contamination Laboratory Test Results

APPENDIX C

- Summary of In Situ CBR Test Results
- Graph of Subgrade Surface Modulus vs Depth
- Graph of CBR vs Depth

APPENDIX D

- Classification of Probability, Consequence and Risk

APPENDIX E

- Preliminary Conceptual Model

APPENDIX F

- Quantitative Conceptual Model

1. INTRODUCTION

It is proposed to redevelop the garage site located at Whitsbury Road, Havant, Hampshire. Whilst at the time of preparation of this report no specific development proposal for the site had been finalised, it is understood the development will be for residential purposes.

Ashdown Site Investigation Ltd was requested to undertake a ground investigation to provide advice to assist with the structural design and to enable a ground contamination risk assessment of the site to be undertaken.

The specific objectives of the works were to:

- a) Establish the expected geology and hydrogeology at the site;
- b) Investigate the shallow ground and groundwater conditions prevailing at the site;
- c) Provide advice to assist others in undertaking design of spread foundations, ground floors and road pavements;
- d) Test for the presence of contaminants identified by the preliminary conceptual model; and
- e) Develop a quantitative conceptual model of the site, refining the preliminary model to identify any pollutant linkages that may be present.

The scope of the works covered by this report, and the terms and conditions under which they were undertaken, were set out within the offer letter Q13481, dated 12th October 2023, which included works for the ground contamination risk assessment. Subsequently, a further request to undertake a geotechnical assessment of the site was made, with the scope of works allowed for being set out within the offer letter Q13709, 22nd December 2023. The instruction to proceed with both scopes of works was received on behalf of the client, Stop Domestic Abuse (SDA).

2. SITE CONTEXT

2.1 Site Description

The garage site is located at Whitsbury Road, Havant, Hampshire and is centred on the approximate Ordnance Survey national grid reference 472496, 108270. A site location plan and site plan are presented as Figure 1 and Figure 2, respectively.

At the time of the intrusive works the site comprised an area of concrete hard standing, accessed from Whitsbury Road to the north, with rows of domestic lock-up garages on the western and northern boundaries. An electrical substation was located at the end of the access road in the north western corner of the site.

2.2 Geological and Hydrogeological Data

2.2.1 Expected Geology and Aquifer Designation

The stratigraphic unit that may be expected to underlie the site has been established by reference to British Geological Survey (BGS) mapping and the BGS Lexicon of Named Rock Units. The expected stratigraphy is presented in the following table.

Table 1. Expected Strata and Aquifer Designation

Type	Stratum	Aquifer Designation
Bedrock	London Clay Formation	Unproductive Stratum

The London Clay Formation forms part of the Thames Group. The formation is of Ypresian age (47.8 to 56 million years old; Early Eocene). The London Clay Formation mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occur in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels. The formation is recorded by the BGS to range in thickness up to 150m.

Whilst not specifically shown on site on the geological mapping data, superficial Head deposits are shown in the vicinity of the site and as such may be present on site as part of the weathering profile. The superficial Head is a polymict deposit generally comprising clay and sandy clay with variable amounts of gravel. The lithology of the Head reflects the nature of the parent solid strata. The material is likely to have been disturbed by intense frost action in a periglacial environment. It is usually poorly sorted but may be stratified where it has been subject to solifluction and/or hillwash and soil creep.

2.2.2 Groundwater Source Protection Zones (SPZ)

The Environment Agency defines SPZs as those areas where groundwater supplies are at risk from potentially polluting activities and accidental releases of pollutants. SPZs are primarily a policy tool used to control activities close to water supplies intended for human consumption.

R16043

The site lies within an Inner Zone – SPZ1c.

The 'c' suffixed to the designation indicates the aquifer is confined by overlying low permeability strata.

3. SITE WORKS

3.1 Introduction

The intrusive site works comprised a series of dynamic sampler and hand augered boreholes. The intrusive work was carried out on 4th and 9th January 2024. The exploratory hole locations are shown on Figure 2.

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in Appendix A, together with explanatory notes to assist in their interpretation.

3.2 Exploratory Holes

The following table summarises the intrusive works undertaken at the site.

Table 2. Summary of Intrusive Works Undertaken

Designation	Depth (m bgl)	Method
WS01	0.50	Dynamic Sampler
WS01A	2.70	Dynamic Sampler
WS02	1.00	Hand Auger
WS03	3.00	Dynamic Sampler
WS04	1.00	Hand Auger
WS05	3.00	Dynamic Sampler
WS06	3.00	Dynamic Sampler
WS07	2.70	Dynamic Sampler
WS08	1.00	Dynamic Sampler

Due to an obstruction encountered at shallow depth within borehole WS01, the position was reattempted at a new location denoted WS01A.

3.3 Sampling

Samples of soil were taken from the exploratory holes at the depths shown in the exploratory hole records. The types of samples taken are indicated on the exploratory hole records. Details on the sample types are provided in the explanatory notes.

Where appropriate, samples were stored in cool boxes with cooling blocks to maintain temperatures below 4°C until transferred to refrigerators upon return to the office and subsequently forwarded to the external accredited chemical testing laboratory.

3.4 In Situ Strength Testing

The types and depths of in situ testing, together with the test results, are either given on the exploratory hole records or are summarised separately in Appendix A. Further details on the in situ testing methods are provided in the explanatory notes.

3.5 Laboratory Testing

Laboratory testing was scheduled by Ashdown Site Investigation Ltd. Results from the laboratory tests are provided in Appendix B.

Geotechnical testing was undertaken by Ashdown Site Investigation Ltd.

Chemical testing was undertaken by a laboratory with recognised (UKAS and MCERTS) accreditation for quality control.

4. GROUND CONDITIONS

4.1 Stratigraphy

4.1.1 Surface Covering

Each of the exploratory holes was excavated through a surface cover of concrete some 140mm to 170mm in thickness.

4.1.2 Made Ground/Reworked

Made ground, generally comprising gravelly slightly sandy clay and/or sandy silty clayey gravel, was recorded to depths of between 0.25m and 0.40m below ground level within a majority of the exploratory holes. The made ground was recorded to the full depth of WS01 of 0.50m at which depth an obstruction was encountered. The gravel fraction of the made ground comprised variable quantities of flint, brick and chalk.

Made ground/reworked soils, comprising slightly sandy clay, were recorded to depths of between 0.25m and 0.40m below ground level within boreholes WS02, WS03 and WS04.

4.1.3 Head

Underlying the made ground/reworked soils, the investigation generally progressed into commonly firm varying stiff, but locally soft to firm, very gravelly/gravelly, at times slightly sandy, clay deposits. The gravel fraction mainly comprised flint. These soils were recorded to depths of between 0.55m and 1.10m below ground level within a majority of the boreholes.

Due to the high proportion of flint gravel within these upper soils, it is considered that they likely represent superficial Head deposits, as shown in the vicinity of the site on BGS geological maps.

4.1.4 London Clay Formation

Beneath the made ground and/or Head, the boreholes encountered undisturbed firm varying stiff clay deposits, containing a variable proportion of mudstone, ironstone, shell fragments, selenite crystals and sand pockets.

These deposits, considered to represent the London Clay Formation indicated to underlie the site on BGS geological maps, continued to the full depth of investigation.

4.2 Stability

Each of the exploratory holes was recorded to remain stable during the course of drilling.

4.3 Groundwater Conditions

With the exception of perched water noted at a depth of 0.40m and 0.19m below ground level in boreholes WS01 and WS02 respectively, each of the exploratory holes was recorded to have remained dry.

5. GEOTECHNICAL ASSESSMENT

At the time of preparation of this report no specific development proposal for the site had been finalised and no specific details concerning loads likely to be applied to any foundations were available.

5.1 Foundations

5.1.1 Soil Shrinkage / Heave Potential

The fine-grained soils of the Head and London Clay Formation have been classified as clays, and with modified plasticity indices in the range of 12% to 48%, the soils may be expected to exhibit a low to high volume change potential.

It is recommended that the design of precautions against shrinkage and heave for any new foundation system (spread footings, and ground beams etc.) should assume a high volume change potential for the fine-grained Head and London Clay Formation soils and take into account current guidance such as that given by the Building Research Establishment (BRE)¹ or the National House Builders Council (NHBC)².

Whilst this report has been prepared to provide advice to assist designers in undertaking detailed design, the report itself does not represent a detailed design statement. Detailed foundation design, including assessment of foundation type, minimum founding depths for spread foundations, and requirements for placement of void formers et cetera, should take into account the findings of this report and the presence of trees (previous, present and proposed). In connection with the latter, it is recommended that an arboricultural survey that identifies the species and maturity of the existing or recently felled trees in the areas of the proposed new buildings should be provided to engineers responsible for the foundation design. Information on proposed planting schemes that may affect foundation design should also be provided.

5.1.2 Spread Foundations

5.1.2.1 Foundation Depths for Spread Foundations

Foundations should be constructed to bear below soils that are likely to be affected by significant soil volume changes caused by seasonal changes in moisture content to avoid damage to foundations that could otherwise arise. In addition, all made ground and any soils disturbed by the construction or removal of any previously existing foundations or services should be regarded as being variable in nature and state of compaction and, as such, unsuitable as a founding medium for shallow footings. New footings should be constructed so as to bear below made ground/disturbed natural soils and soil subject to seasonal soil volume changes, whichever is the deeper, and onto undisturbed, competent, natural deposits.

Summary guidance on suitable minimum foundation depths to protect against the effects of seasonal soil volume changes is presented in the table below but designers undertaking detailed design of foundations should follow the detailed guidance provided within Chapter 4.2 of the NHBC Standards.

¹ www.bre.co.uk : BRE Digests 240, 241 and 242, Low rise buildings on shrinkable clay soils, parts 1, 2 and 3; and BRE Digest 298 , The influence of trees on house foundations in clay soils and BRE Digest 412, Desiccation in clay soils.

² <http://www.nhbc.co.uk/> : NHBC Standards, Chapter 4.2.

R16043

Table 3. Indicative Minimum Foundation Depths

Tree Type	Water Demand of Tree	Tree Distance to Tree Height Ratio (D/H)									
		0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.25
		Minimum Foundation Depth Required in High Volume Change Potential Soils (m)									
Broad Leaf	High	†					2.50	2.30	1.90	1.50	1.00*
	Moderate	2.40	2.25	2.05	1.85	1.65	1.50	1.30	1.00*	1.00*	1.00*
	Low	1.80	1.65	1.50	1.35	1.20	1.00*	1.00*	1.00*	1.00*	1.00*
Coniferous	High	†			2.20	1.80	1.40	1.00*	1.00*	1.00*	1.00*
	Moderate	2.40	2.00	1.60	1.20	1.00*	1.00*	1.00*	1.00*	1.00*	1.00*

* Minimum foundation depth required to protect against soil volume changes.

† Foundations deeper than 2.50m require specialist design to protect against soil volume changes.

Where specialist foundation design is required (foundation depths exceeding the maximum permitted by the guidance) then piled foundations are likely to be needed, though commercial considerations may also dictate that piled foundations may be more economic even in comparison with conventional spread foundations constructed to depths less than the maximum permitted by guidance. Further works including deep boreholes would be required if structural engineers or quantity surveyors decide that piled foundations should be adopted.

Details on the water demand and mature height of common trees is given within Table 3 of Chapter 4.2 of the NHBC standards which should be referred to when assessing minimum foundation depths required for the proposed development. A summary is provided in the table below.

Table 4. Indicative Summary of Water Demand and Mature Height of Common Trees

Tree Type	High Water Demand		Moderate Water Demand		Low Water Demand	
	Tree	Height (m)	Tree	Height (m)	Tree	Height (m)
Broad Leaf	Elm	18 – 24*	Acacia	18	Birch	14
	Oak	16 – 24*	Alder	18	Elder	10
	Poplar	15 – 28*	Apple	10	Fig	8
	Willow	16 – 24*	Ash	11 – 23*	Hazel	8
	Eucalyptus	18	Laurel	10	Holly	12
	Hawthorn	10	Beech	20	Honey Locust	14
			Blackthorn	8	Hornbeam	17
			Cherry	8 – 17*	Laburnum	12
			Chestnut	20 – 24*	Magnolia	9
			Lime	22	Mulberry	9
			Maple	8 – 18*	Tulip Tree	20
			Pear	12		
			Plane	26		
			Plum	10		
			Sycamore	22		

R16043

Tree Type	High Water Demand		Moderate Water Demand		Low Water Demand	
	Tree	Height (m)	Tree	Height (m)	Tree	Height (m)
			Tree of Heaven	20		
			Walnut	18		
			Whitebeam	12		
Coniferous	Cypress	18 – 20*	Cedar	20		
			Douglas Fir	20		
			Larch	20		
			Monkey Puzzle	18		
			Pine	20		
			Spruce	18		
			Wellingtonia	30		
			Yew	12		

* Dependent on particular species.

5.1.2.2 Bearing Capacity for Spread Foundations

For design purposes, a net allowable bearing capacity of 100kN/m² may be assumed for spread (pad or strip) foundations up to 1.00m across bearing within the Head or London Clay Formation soils of at least firm consistency, typically encountered below depths of 1.00m below ground level. The quoted bearing capacity is expected to limit settlement to less than 25mm.

In view of the potential for localise soft to firm soils to be present, such as those encountered within borehole WS01A, it would be prudent for the foundation formations to be inspected and tested by suitably qualified persons to confirm that soils of at least firm consistency are present at and below formation level.

5.2 Ground Floors

In view of the presence of soils of high volume change potential, it is recommended that ground floors should be suspended.

Current guidance³ suggests that ground bearing floor slabs may, however, be considered where:

1. All made ground is removed from beneath the building footprint;
2. The depth of foundations required to protect against seasonal soil volume changes close to trees is less than 1.5m; and
3. Further works demonstrate that close to the time of construction, no significant soil desiccation is present.

Where the above criteria cannot be met ground floors should be suspended.

If ground bearing floors are adopted it is recommended that the potential for differential movement, both between the floor slab and walls and across the floor slab itself, should be anticipated. Such floors should be fully debonded from walls. Formations should be adequately proof rolled and any excessively soft materials excavated and replaced with a suitable, well

³ <http://www.nhbc.co.uk/> : NHBC Standards, Chapter 4.2.

graded granular fill. The depth of any fill should be limited to a maximum of 600mm unless placed to an engineering specification designed to limit internal settlement of the fill materials to a tolerance to be advised by the designer.

5.3 Groundwater

Perched water was encountered at a depth of 0.40m and 0.19m below ground level within boreholes WS01 and WS02, respectively, originating in the made ground soils.

Whilst no other groundwater seepages were recorded during the short period of the intrusive works, it should be noted that water levels within the exploratory holes may not have equilibrated with the groundwater table at the time the readings were recorded and that groundwater levels should be expected to fluctuate seasonally.

Perched water bodies, particularly within the made ground soils, should be expected. It is also possible that heavy precipitation during construction could lead to the ingress of perched groundwater or surface water run-off into excavations. In such circumstances it would be expected that water entering excavations would be adequately managed by pumping from sumps.

5.4 Stability of Excavations

All made ground and reworked soils exposed in excavations should be assumed to be unstable, even in the short term. Whilst fine-grained natural soils may remain stable for a short period of time if not subjected to surcharge loads (such as may be imposed by existing foundations, traffic or storage of materials), the stability of these deposits if left unsupported should be assumed to have the potential to deteriorate. Where stable excavations are required, excavations should either be suitably supported or, where space permits, side slopes could be battered back to a safe angle of repose.

All excavations requiring human entry must be shored or battered as necessary to conform to current best practice, as accepted by the Health and Safety Executive (HSE)⁴. Current legislation requires that where personnel access is required into any excavation a competent person must inspect excavation supports or battering of slopes at the start of the working shift and at other specified times. No work should take place until the excavation is safe. Excavations should also be inspected after any event that may have affected their stability, such as a significant weather event, changes in surcharge loadings imposed by temporary storage of materials or changes in site traffic plans or alteration of support systems. Inspections should be formally recorded and any faults that are found should be corrected immediately.

Particular attention must be paid to ensuring the stability of nearby structures, services and neighbouring sites.

5.5 Aggressivity to Concrete

The aggressivity of the soils to concrete has been assessed in accordance with guidance published by the BRE⁵.

⁴ Relevant guidance is given on the HSE website, www.hse.gov.uk

⁵ BRE Special Digest 1:2005 Concrete in Aggressive Ground.

In consideration of the soils encountered beneath the site it is considered that 'natural ground conditions' may be assumed for the purpose of assessing the aggressivity of the chemical environment for concrete classification (ACEC class). In the absence of long term monitoring data, 'mobile groundwater' conditions should be conservatively assumed.

The soils present beneath the site may be expected to contain sulphides which if exposed to air and water, and potentially bacterial action, may oxidise and convert into sulphates. The sulphides are significantly more likely to oxidise in ground that has been significantly disturbed, for example by cutting and filling as part of earthworks or by excavation and backfilling. Ground that is not disturbed beyond the cut face (e.g. piling operations or excavation without backfill) would not generally be considered by the guidance as being disturbed ground. Where disturbed ground is likely to result from construction activities a Design Sulfate Class based on the total potential sulphate should be adopted.

The following table summarises the characteristic values indicated from the chemical analysis of the soils present beneath the site.

Table 5. Assessment of the Chemical Analysis of the Soil

	Characteristic Value	Design Sulfate Class	ACEC Classification
pH	5.9	-	-
Water Soluble Sulphate (mg / l as SO ₄) *	100	DS-1	AC-1
Total Potential Sulphate (TPS % SO ₄)	No Oxidisable Sulphides	N/A	N/A

Notes: * Characteristic value rounded to nearest 100.

In accordance with the guidance, a DS-1 Design Sulfate Class and an AC-1 ACEC classification may be assumed as a minimum for the design of concrete in contact with the ground where the ground will not be significantly disturbed. Given the propensity of the London Clay Formation soils to contain potential sulphides, and the noted occurrence of selenite crystals, should the soils be significantly disturbed it would be prudent to undertake further testing prior to finalising designs.

5.6 Pavement Design

Current guidance⁶ suggests that pavement design should be based on the design subgrade surface modulus, determined as being equal to the lower of the short-term subgrade modulus and the long-term subgrade modulus. The subgrade surface modulus can be related to California bearing ratio using the formula, $E = 17.6(\text{CBR})^{0.64}$, where E is the subgrade modulus expressed in MPa.

Cone penetrometer tests were undertaken to establish the California bearing ratio (CBR) of the in situ soils at the time of the investigation. The range of values determined is presented on the test result records within Appendix A, and the table and graphs contained within Appendix C. A summary of the in situ test data is presented below. It is noted that in situ CBR values are, in part, dependent on the moisture content of the tested soils and are consequently subject to seasonal variation.

⁶ Highways England Design Manual for Roads and Bridges CD 225 Rev1; Design for new pavement foundations.

Table 6. In Situ CBR Values (At Time of Ground Investigation Works)

	CBR (%)	Modulus of Subgrade Reaction E (MPa)
Minimum	1.4	21.5
Average	15.4	91.9
Maximum	114.7	366.0
10 %ile	3.8	41.0
20 %ile	4.9	48.5
50 %ile (Median)	9.6	75.1

Equilibrium CBR values can be derived from knowledge of soil classification data (plasticity index for soils exhibiting cohesion (clay type) and particle size distribution for granular soils) and pavement thickness. Historical guidance⁷ suggests the following design equilibrium CBR values would be applicable to the Head and London Clay Formation soils and derived made ground for the construction of pavement. The subgrade moduli calculated from these design equilibrium CBR values can be reasonably considered to be representative of long-term subgrade modulus using the formula given above.

Table 7. Long-term CBR Values

Stratum	Design Equilibrium CBR Value (%)			†Modulus of Subgrade Reaction E (MPa)
		Thin Road* Pavement	Thick Road* Pavement	
Fine grained London Clay Formation	Minimum	2.1	2.6	27.9
	Average	2.5	3.1	31.4
	Maximum	2.9	3.7	34.4

* Thin pavement being 300mm sub-base, thick pavement being 1200mm sub-base. †Modulus based on average of all calculated moduli based on CBR values for thin sub-base.

Designers will need to select an appropriate design equilibrium CBR value / modulus of subgrade reaction taking account of proposed pavement thickness, expected winter groundwater conditions, the standard to which pavement is to be designed and any local authority or other regulatory/warrantor requirements together with construction conditions likely to prevail at the time of construction.

The subgrade may be assumed not to be susceptible to frost heave.

⁷ Highways England Design Manual for Roads and Bridges Interim Advice Note 73/09 Rev1; now withdrawn.

6. QUANTITATIVE CONTAMINATION ASSESSMENT

6.1 Introduction

A Phase 1 Contaminated Land Assessment Report has been prepared for the proposed development by GeoSmart⁸. The preliminary assessment concluded that there was the potential for contamination to be present and recommended that an intrusive investigation should be undertaken to enable a quantitative risk assessment to be carried out.

A copy of the preliminary conceptual model is presented in Appendix E.

To assess the identified potential risks, representative samples of made ground from across the site were sampled and tested for a range of commonly occurring sources of contamination including heavy metals, PAH compounds, petroleum hydrocarbons and also screened for asbestos. Samples taken from adjacent to the existing electrical substation were also screened for the presence of PCBs.

The risk assessment for the site considers the sources of contamination identified, the receptors that may be present in view of the development proposals and the contaminant pathways by which these may be linked.

A complete pollutant linkage is only deemed to exist where all three are present and a site is considered suitable for use where no complete pollutant linkages are identified.

Where a complete pollutant linkage is considered to be present, an assessment of the level of risk associated with the pollutant linkage has been carried out in line with published guidance⁹.

The level of risk is determined using the risk matrix presented in the following table. Classifications of probability, consequence and risk are presented in Appendix D.

Table 8. Risk Assessment Matrix

		Probability			
		Very Low	Low	Moderate	High
Consequence	Very Minor	Negligible	Very Low	Low	Low/Moderate
	Minor	Very Low	Low	Low/Moderate	Moderate
	Moderate	Low	Low/Moderate	Moderate	High
	Severe	Low/Moderate	Moderate	High	Very High

6.2 Analysis of Contamination Test Results

6.2.1 Method of Assessment

For the assessment of risk to end users, comparison of the results of the laboratory testing has been made against published soil screening values (SSV) comprising the 'Suitable For Use Levels'

⁸ GeoSmart Report No. 76896R1, dated June 2022.

⁹ Contaminated Land Risk Assessment: A guide to good practice, CIRIA C552, 2001.

R16043

(S4UL)¹⁰ or, in lieu of an S4UL being developed for lead, the Category 4 Screening Level (C4SL)¹¹.

In view of the development proposals, the SSV utilised in this assessment are those calculated for the generic "Residential with homegrown produce" land use.

For the assessment of risk to controlled waters a qualitative assessment has been undertaken based upon the concentrations of contaminants recorded within the soil samples and the information obtained about the sensitivity of the underlying strata or nearby surface water receptors.

6.2.2 Heavy Metals & Polycyclic Aromatic Hydrocarbon (PAH) Compounds

The following table summarises the SSV along with the maximum and minimum concentrations of the heavy metals and PAH compounds tested for.

Table 9. Summary of Test Results – Heavy Metals and PAH Compounds

Contaminant	SSV (mg / kg)	No. of Samples	Minimum Concentration (mg / kg)	Maximum concentration (mg / kg)	Limit of Detection (mg / kg)	No of exceedances
Arsenic	37	7	<LOD	14	< 2	0
Water Soluble Boron	290	7	<LOD	<LOD	< 1	0
Cadmium	11	7	<LOD	1.9	< 0.2	0
Chromium	910	7	5	29	< 2	0
Hexavalent Chromium	6	7	<LOD	<LOD	< 2	0
Copper	2400	7	6	37	< 4	0
Lead	200	7	8	176	< 3	0
Mercury	40	7	<LOD	<LOD	< 1	0
Nickel	180	7	3	25	< 3	0
Selenium	250	7	<LOD	<LOD	< 3	0
Zinc	3700	7	12	121	< 3	0
Naphthalene	2.3	7	<LOD	<LOD	< 0.1	0
Acenaphthylene	170	7	<LOD	<LOD	< 0.1	0
Acenaphthene	210	7	<LOD	<LOD	< 0.1	0
Fluorene	170	7	<LOD	<LOD	< 0.1	0
Phenanthrene	95	7	<LOD	<LOD	< 0.1	0
Anthracene	2400	7	<LOD	<LOD	< 0.1	0
Fluoranthene	280	7	<LOD	<LOD	< 0.1	0
Pyrene	620	7	<LOD	<LOD	< 0.1	0
Benz(a)anthracene	7.2	7	<LOD	<LOD	< 0.1	0
Chrysene	15	7	<LOD	<LOD	< 0.1	0
Benzo(b)fluoranthene	2.6	7	<LOD	<LOD	< 0.1	0
Benzo(k)fluoranthene	77	7	<LOD	<LOD	< 0.1	0
Benzo(a)pyrene	2.2	7	<LOD	<LOD	< 0.1	0
Indeno(123-cd)pyrene	27	7	<LOD	<LOD	< 0.1	0
Dibenz(ah)anthracene	0.24	7	<LOD	<LOD	< 0.1	0

¹⁰ Nathanail, C.P, et al., The LQM/CIEH S4ULs for Human Health Risk Assessment, 2015, Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3071.

¹¹ SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report, published by DEFRA, 2014.

None of the samples of made ground tested recorded concentrations of heavy metals or PAH compounds above their respective SSV. The concentrations of heavy metals and PAH compounds present within the made ground soils are not considered to pose an unacceptable risk to end users of the site.

At the concentrations recorded, none of the heavy metals or PAH compounds would be expected to exhibit significant mobility within the soils and are therefore not considered to pose an unacceptable risk to controlled waters beneath the site.

6.2.3 Asbestos

Seven samples of the made ground were screened for the presence of asbestos. The sample from borehole WS01 at 0.40m recorded chrysotile asbestos present in the form of loose fibres within the soil matrix.

6.2.4 Petroleum Hydrocarbons

The following table lists the SSV for petroleum hydrocarbon equivalent carbon weight fractions and BTEX compounds calculated for 1% organic content.

Table 10. SSV for petroleum hydrocarbon equivalent carbon weight fractions

Petroleum Hydrocarbon Fraction	SSV (mg / kg)	Petroleum Hydrocarbon Fraction	SSV (mg / kg)
Aliphatic EC 5-6	42	Aromatic EC 5-7	70
Aliphatic EC >6-8	100	Aromatic EC >7-8	130
Aliphatic EC >8-10	27	Aromatic EC >8-10	34
Aliphatic EC >10-12	130	Aromatic EC >10-12	74
Aliphatic EC >12-16	1100	Aromatic EC >12-16	140
Aliphatic EC >16-35	65000	Aromatic EC >16-21	260
Aliphatic EC >35-44	65000	Aromatic EC >21-35	1100
		Aromatic EC >35-44	1100

Whilst full speciation of the concentrations of petroleum hydrocarbons by aromatic and aliphatic fractions was not undertaken, the results of the testing undertaken can still be compared with the more stringent of the screening values for the respective equivalent carbon weight fraction and, where the concentration recorded is found to be lower, it can be reasonably concluded that no significant risk is present.

The concentrations of petroleum hydrocarbons recorded were either below the limit of detection for the test or significantly lower than the more conservative screening value for each weight fraction.

Comparison of the test results for petroleum hydrocarbons has been undertaken with the threshold value for PE water supply pipework¹². The concentrations do not exceed the threshold value.

¹² Set out within Table 3.1 of the Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UK Water Industry Research, 2010.

6.2.5 Polychlorinated Biphenyls (PCB)

A sample of the made ground from borehole WS01 and a sample of the undisturbed soils immediately beneath the made ground from borehole WS01A were screened for concentrations of PCB, due to their proximity to the electrical substation.

Neither recorded concentrations of PCB above the limit of detection for the test.

6.3 Quantitative Contamination Risk Assessment

6.3.1 Contaminant Pathways Identified

Although no development plans are available, it is understood the site will be developed to provide housing with areas of private garden.

Pathways associated with gas and vapour intrusion into new buildings are considered to be valid, along with direct contact and dust related pathways, and pathways associated with the consumption of home grown produce.

Should the proposed development plans be altered, a revised risk assessment may be required.

It is noted that an asbestos survey of existing structures and infrastructure¹³ was beyond the brief of this report. The risk assessment assumes that, should asbestos be identified within buildings or infrastructure, any such materials will be managed in accordance with current legislation and guidance, to ensure this does not represent an ongoing risk to end users and, specifically, to ensure that asbestos materials are not introduced into the underlying soils.

The site is underlain by the London Clay Formation which is classed as an Unproductive Stratum. Whilst shallow perched groundwater was locally identified within the made ground, the London Clay Formation is likely to yield a very low to negligible infiltration with any leachable contaminants unlikely to come into contact with sensitive groundwater receptors.

Although the site lies within a source protection zone, this refers to the abstraction of water from a confined aquifer. The anticipated thickness of the London Clay Formation would inhibit any potential mobile contaminants from leaching into the aquifer at depth. As such, there are not considered to be viable pathways linking potential contamination on the site with sensitive groundwater.

6.3.2 Contamination Source Identified

The following source of contamination has been identified by the quantitative contamination risk assessment:

Asbestos fibres within the shallow made ground.

6.3.3 Quantitative Conceptual Model

The quantitative conceptual model for the proposed development is presented in Appendix F.

¹³ As defined under Section 5(a) of the Control of Asbestos Regulations, 2012.

6.4 Risks to Other Potential Receptors

All construction workers must undertake their own risk assessment, based upon the works to be carried out and the proposed method by which this will be achieved, in accordance with current health and safety legislation. Their assessment should take into account all available information about the site, including that present within this report.

Appropriate working procedures and PPE should be adopted to ensure the health and safety of the site operatives. Instruction should be given in the recognition of potentially hazardous materials. All site personnel should be appropriately briefed on the discovery strategy, presented below, and what actions they must take in the event that further evidence of contamination is identified or suspected.

6.5 Recommendations

As a complete pollutant linkage relating to end users has been identified at the site, it is considered that remedial measures will be required as part of the proposed development.

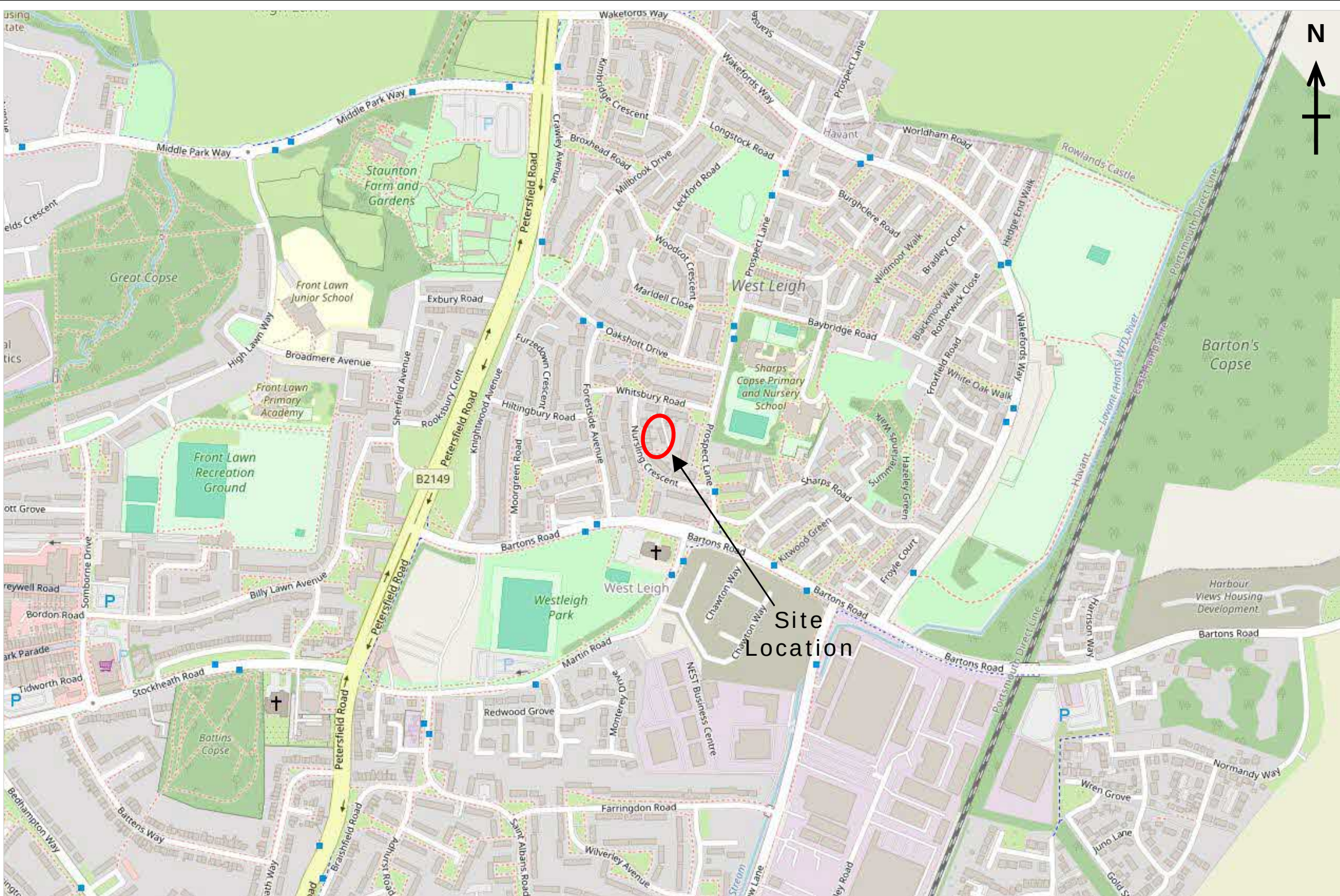
The remediation works ultimately adopted should be detailed within a separate remediation strategy, along with a verification plan. This should be produced once this risk assessment report has been reviewed and approved by the appropriate authority.

Ashdown Site Investigation Ltd.

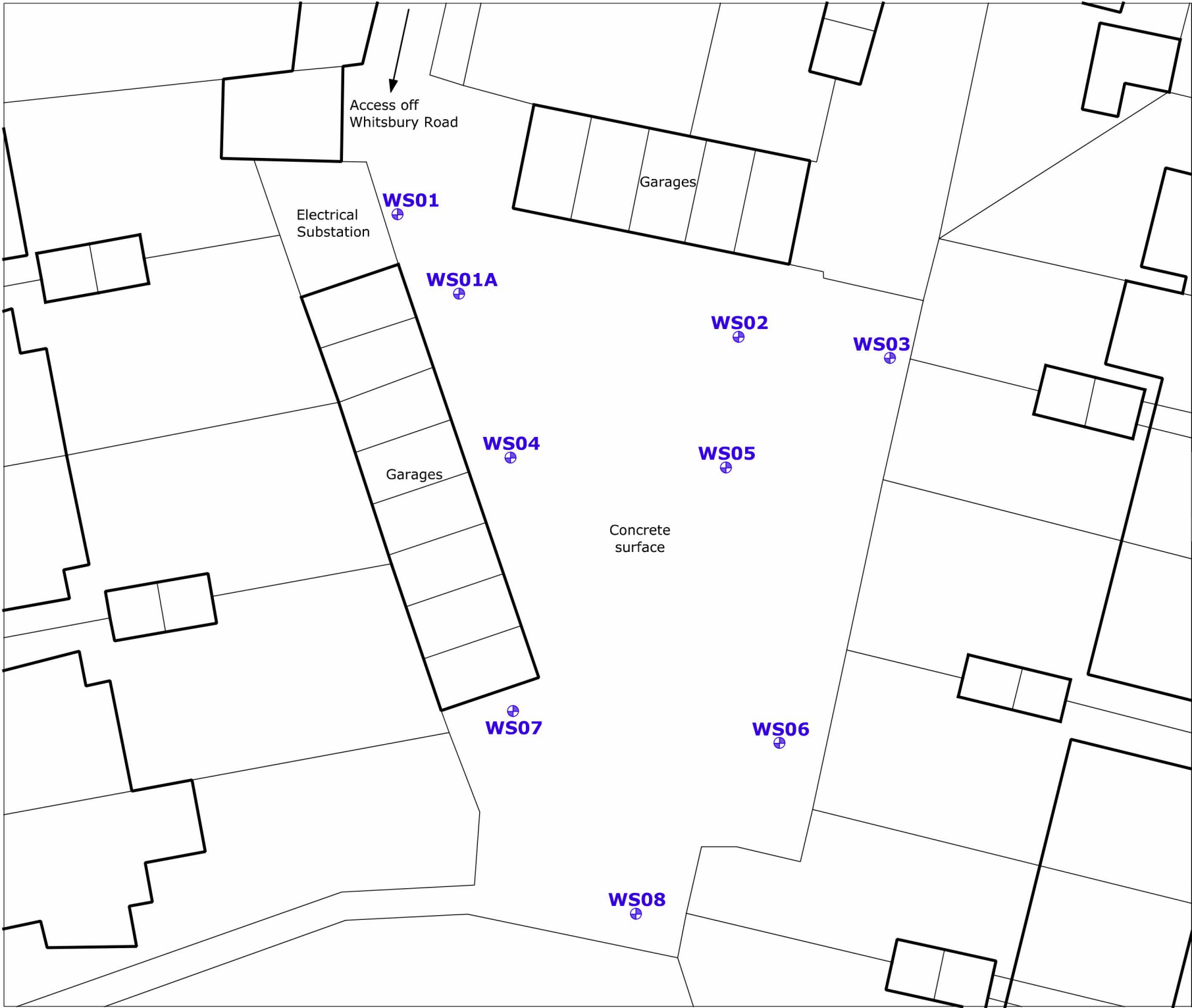
FIGURES

Figure 1 Site Location Plan

Figure 2 Site Plan



© OpenStreetMap contributors, CC BY-SA



**ASHDOWN SITE
INVESTIGATION**
L · I · M · I · T · E · D

Unit 3
The Old Grain Store
Ditchling Common Business Park
Ditchling
East Sussex
BN6 8SG
01273 483119
contact@ashdownsi.co.uk

Site:

Garages at Whitsbury Road
Havant
Hampshire

Project Ref:

P16424

Figure No.

2

Drawing Title

Site Plan

Scale

NTS

APPENDIX A

Explanatory Notes

Exploratory Hole Records

DPSH-B Dynamic Probe Records

In-situ TRL Cone Penetrometer (CBR) Test Results

Explanatory Notes

Symbols and abbreviations on Exploratory Hole Records

Samples

- U 'Undisturbed' Sample: - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
- Pi Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
- D Disturbed Sample
- R Root Sample
- B Bulk Disturbed Sample
- W Water Sample
- ES Environmental Suite (on older records may be referenced J T)

In Situ Testing

- S Standard penetration test (SPT): Using the split spoon sampler.
- C Standard Penetration Test (SPT): Using a solid cone instead of the sampler – conducted usually in coarse grained soils or weak rocks.
- V Shear Vane Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
- H Hand penetrometer Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
- P Perth Penetrometer Test: Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column.

Excavation Method

- CP Cable Percussion Borehole
- RC Rotary Cored Borehole
- WLS Dynamic Sampler Borehole using windowless sampler tubes
- WS Dynamic Sampler Borehole using window sampler tubes
- TP Trial Pit excavated using mechanic excavator
- HDP Trial Pit excavated using hand tools

Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1) and Part 2 Principles of classification (BS EN 14688-2) as well as the BS5930 code of Practice for Ground Investigations.

Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1) as well as the BS5930 code of Practice for Ground Investigations. TCR – Total Core Recovery, SCR – Solid Core Recovery, RQD – Rock Quality Designation, NI – Non Intact, If – indicative fracture spacing (min/ave/max), FI – Fracture Index.

Chalk Description

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk.

In Situ Strength Testing

Standard penetration testing (SPT) carried out in accordance with BS EN ISO 22476-3:2005.

Continuous dynamic probe testing conducted using a super heavy DPSH-B (As defined by BS EN ISO 22476-2:2005) probing geometry. The DPSH-B configuration is similar to that of the standard penetration test (SPT); the main differences being that the tip comprises a 90° cone, the driving rods are lighter than those used for SPT testing and the blow counts are recorded over 100mm increments rather than 300mm, as is the case for the SPT.

Perth penetrometer tests carried out in accordance with Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes; no equivalent European or British Standard having been published to date.

Undrained shear strength determinations made in-situ using a Geonor hand shear vane or a hand penetrometer.

Testing to determine the in-situ California Bearing Ratio (CBR) of soils conducted at shallow depths using a hand-held Transport Research Laboratory (TRL) cone penetrometer.

[illegible]

Samples and In Situ Testing					
Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend

[illegible]

Samples and In Situ Testing					
Standpipe	Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend

[illegible]

[illegible]

ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

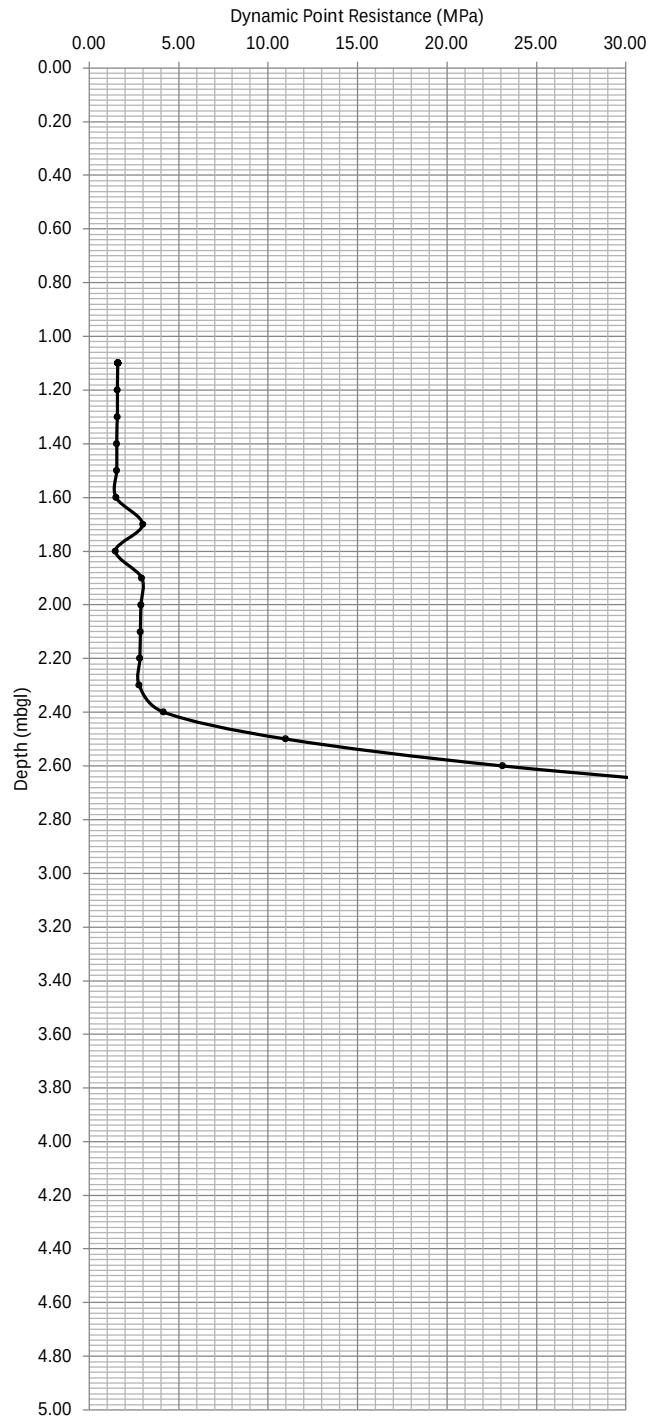
SITE Garages at Whitsbury Road, Havant, Hampshire

Report Ref.

P16424

Test Location Reference WS01A

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10				
0.20				
0.30				
0.40				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10	1	0.10	1.87	1.60
1.20	1	0.10	1.87	1.58
1.30	1	0.10	1.87	1.56
1.40	1	0.10	1.87	1.55
1.50	1	0.10	1.87	1.53
1.60	1	0.10	1.87	1.51
1.70	2	0.05	3.74	2.99
1.80	1	0.10	1.87	1.48
1.90	2	0.05	3.74	2.92
2.00	2	0.05	3.74	2.89
2.10	2	0.05	3.74	2.86
2.20	2	0.05	3.74	2.83
2.30	2	0.05	3.74	2.80
2.40	3	0.03	5.61	4.16
2.50	8	0.01	14.95	10.98
2.60	17	0.01	31.77	23.10
2.70	30	0.00	56.06	40.35
2.80				
2.90				
3.00				
3.10				
3.20				
3.30				
3.40				
3.50				
3.60				
3.70				
3.80				
3.90				
4.00				
4.10				
4.20				
4.30				
4.40				
4.50				
4.60				
4.70				
4.80				
4.90				
5.00				



Notes:

No further progress below 2.70m depth - hammer bouncing.

Hammer Mass	63.5 kg
Fall Height	0.76 m
Cone Area	0.0019 m ²
E _{theor}	473 J
Energy Ratio	0.75
Anvil Mass	1 kg
Rod Mass	8.79 kg/m

ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

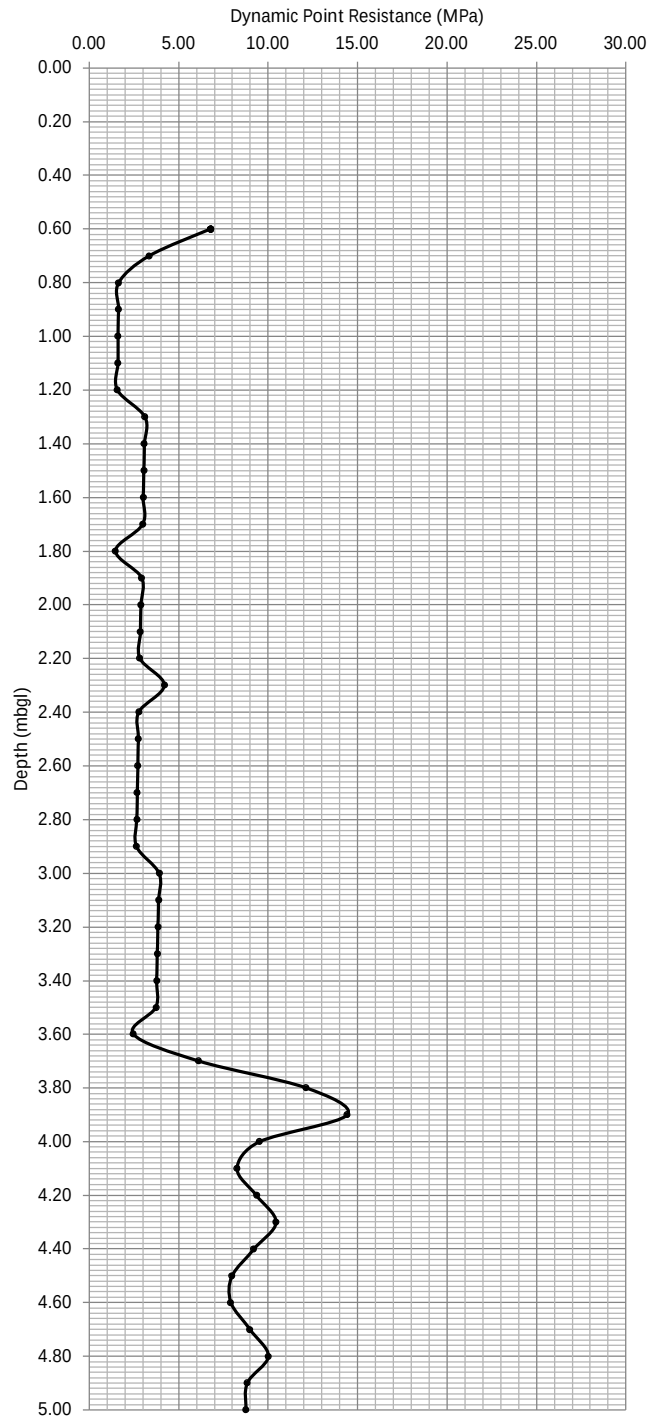
SITE Garages at Whitsbury Road, Havant, Hampshire

Report Ref.

P16424

Test Location Reference WS03

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10				
0.20				
0.30				
0.40				
0.50				
0.60	4	0.03	7.48	6.80
0.70	2	0.05	3.74	3.36
0.80	1	0.10	1.87	1.66
0.90	1	0.10	1.87	1.64
1.00	1	0.10	1.87	1.62
1.10	1	0.10	1.87	1.60
1.20	1	0.10	1.87	1.58
1.30	2	0.05	3.74	3.13
1.40	2	0.05	3.74	3.09
1.50	2	0.05	3.74	3.06
1.60	2	0.05	3.74	3.02
1.70	2	0.05	3.74	2.99
1.80	1	0.10	1.87	1.48
1.90	2	0.05	3.74	2.92
2.00	2	0.05	3.74	2.89
2.10	2	0.05	3.74	2.86
2.20	2	0.05	3.74	2.83
2.30	3	0.03	5.61	4.20
2.40	2	0.05	3.74	2.77
2.50	2	0.05	3.74	2.74
2.60	2	0.05	3.74	2.72
2.70	2	0.05	3.74	2.69
2.80	2	0.05	3.74	2.66
2.90	2	0.05	3.74	2.64
3.00	3	0.03	5.61	3.92
3.10	3	0.03	5.61	3.88
3.20	3	0.03	5.61	3.84
3.30	3	0.03	5.61	3.81
3.40	3	0.03	5.61	3.77
3.50	3	0.03	5.61	3.74
3.60	2	0.05	3.74	2.47
3.70	5	0.02	9.34	6.12
3.80	10	0.01	18.69	12.12
3.90	12	0.01	22.43	14.42
4.00	8	0.01	14.95	9.53
4.10	7	0.01	13.08	8.26
4.20	8	0.01	14.95	9.36
4.30	9	0.01	16.82	10.44
4.40	8	0.01	14.95	9.20
4.50	7	0.01	13.08	7.98
4.60	7	0.01	13.08	7.92
4.70	8	0.01	14.95	8.97
4.80	9	0.01	16.82	10.01
4.90	8	0.01	14.95	8.83
5.00	8	0.01	14.95	8.76



Notes:

Hammer Mass	63.5 kg
Fall Height	0.76 m
Cone Area	0.0019 m ²
E _{theor}	473 J
Energy Ratio	0.75
Anvil Mass	1 kg
Rod Mass	8.79 kg/m

ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

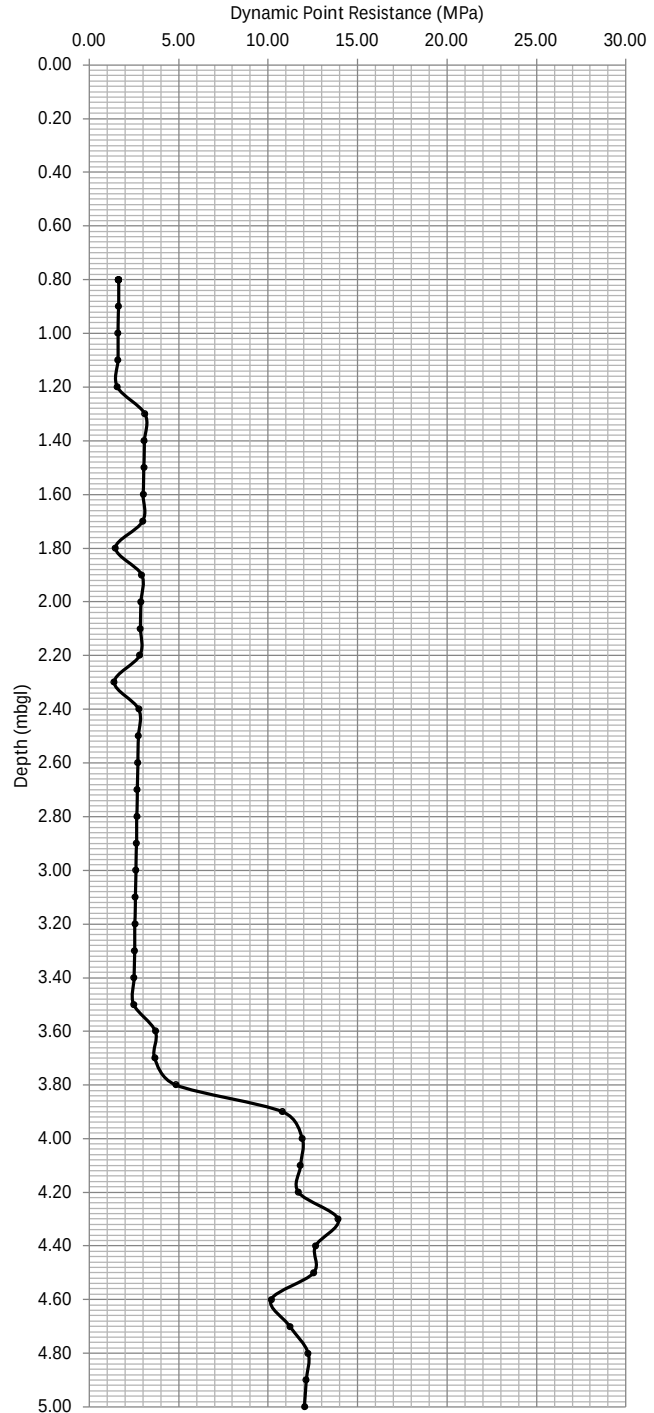
SITE Garages at Whitsbury Road, Havant, Hampshire

Report Ref.

P16424

Test Location Reference WS05

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10				
0.20				
0.30				
0.40				
0.50				
0.60				
0.70				
0.80	1	0.10	1.87	1.66
0.90	1	0.10	1.87	1.64
1.00	1	0.10	1.87	1.62
1.10	1	0.10	1.87	1.60
1.20	1	0.10	1.87	1.58
1.30	2	0.05	3.74	3.13
1.40	2	0.05	3.74	3.09
1.50	2	0.05	3.74	3.06
1.60	2	0.05	3.74	3.02
1.70	2	0.05	3.74	2.99
1.80	1	0.10	1.87	1.48
1.90	2	0.05	3.74	2.92
2.00	2	0.05	3.74	2.89
2.10	2	0.05	3.74	2.86
2.20	2	0.05	3.74	2.83
2.30	1	0.10	1.87	1.40
2.40	2	0.05	3.74	2.77
2.50	2	0.05	3.74	2.74
2.60	2	0.05	3.74	2.72
2.70	2	0.05	3.74	2.69
2.80	2	0.05	3.74	2.66
2.90	2	0.05	3.74	2.64
3.00	2	0.05	3.74	2.61
3.10	2	0.05	3.74	2.59
3.20	2	0.05	3.74	2.56
3.30	2	0.05	3.74	2.54
3.40	2	0.05	3.74	2.52
3.50	2	0.05	3.74	2.49
3.60	3	0.03	5.61	3.70
3.70	3	0.03	5.61	3.67
3.80	4	0.03	7.48	4.85
3.90	9	0.01	16.82	10.81
4.00	10	0.01	18.69	11.91
4.10	10	0.01	18.69	11.81
4.20	10	0.01	18.69	11.70
4.30	12	0.01	22.43	13.92
4.40	11	0.01	20.56	12.65
4.50	11	0.01	20.56	12.55
4.60	9	0.01	16.82	10.18
4.70	10	0.01	18.69	11.22
4.80	11	0.01	20.56	12.24
4.90	11	0.01	20.56	12.14
5.00	11	0.01	20.56	12.04



Notes:

Hammer Mass	63.5 kg
Fall Height	0.76 m
Cone Area	0.0019 m ²
E _{theor}	473 J
Energy Ratio	0.75
Anvil Mass	1 kg
Rod Mass	8.79 kg/m

ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

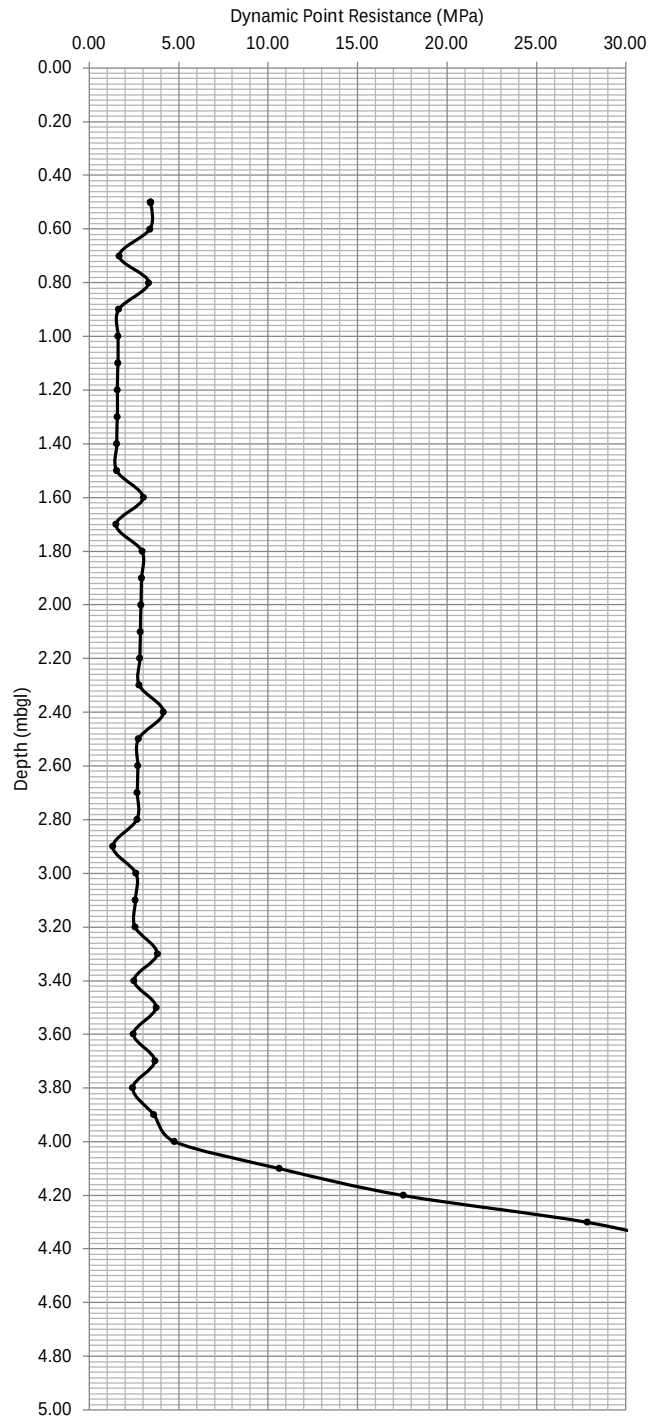
SITE Garages at Whitsbury Road, Havant, Hampshire

Report Ref.

P16424

Test Location Reference WS06

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10				
0.20				
0.30				
0.40				
0.50	2	0.05	3.74	3.45
0.60	2	0.05	3.74	3.40
0.70	1	0.10	1.87	1.68
0.80	2	0.05	3.74	3.32
0.90	1	0.10	1.87	1.64
1.00	1	0.10	1.87	1.62
1.10	1	0.10	1.87	1.60
1.20	1	0.10	1.87	1.58
1.30	1	0.10	1.87	1.56
1.40	1	0.10	1.87	1.55
1.50	1	0.10	1.87	1.53
1.60	2	0.05	3.74	3.02
1.70	1	0.10	1.87	1.49
1.80	2	0.05	3.74	2.96
1.90	2	0.05	3.74	2.92
2.00	2	0.05	3.74	2.89
2.10	2	0.05	3.74	2.86
2.20	2	0.05	3.74	2.83
2.30	2	0.05	3.74	2.80
2.40	3	0.03	5.61	4.16
2.50	2	0.05	3.74	2.74
2.60	2	0.05	3.74	2.72
2.70	2	0.05	3.74	2.69
2.80	2	0.05	3.74	2.66
2.90	1	0.10	1.87	1.32
3.00	2	0.05	3.74	2.61
3.10	2	0.05	3.74	2.59
3.20	2	0.05	3.74	2.56
3.30	3	0.03	5.61	3.81
3.40	2	0.05	3.74	2.52
3.50	3	0.03	5.61	3.74
3.60	2	0.05	3.74	2.47
3.70	3	0.03	5.61	3.67
3.80	2	0.05	3.74	2.42
3.90	3	0.03	5.61	3.60
4.00	4	0.03	7.48	4.76
4.10	9	0.01	16.82	10.63
4.20	15	0.01	28.03	17.56
4.30	24	0.00	44.85	27.85
4.40	30	0.00	56.06	34.51
4.50				
4.60				
4.70				
4.80				
4.90				
5.00				



Notes:

No further pregress below 4.40m depth - hammer bouncing.

Hammer Mass	63.5 kg
Fall Height	0.76 m
Cone Area	0.0019 m ²
E _{theor}	473 J
Energy Ratio	0.75
Anvil Mass	1 kg
Rod Mass	8.79 kg/m

ASHDOWN SITE INVESTIGATION LTD

Dynamic Probe Record

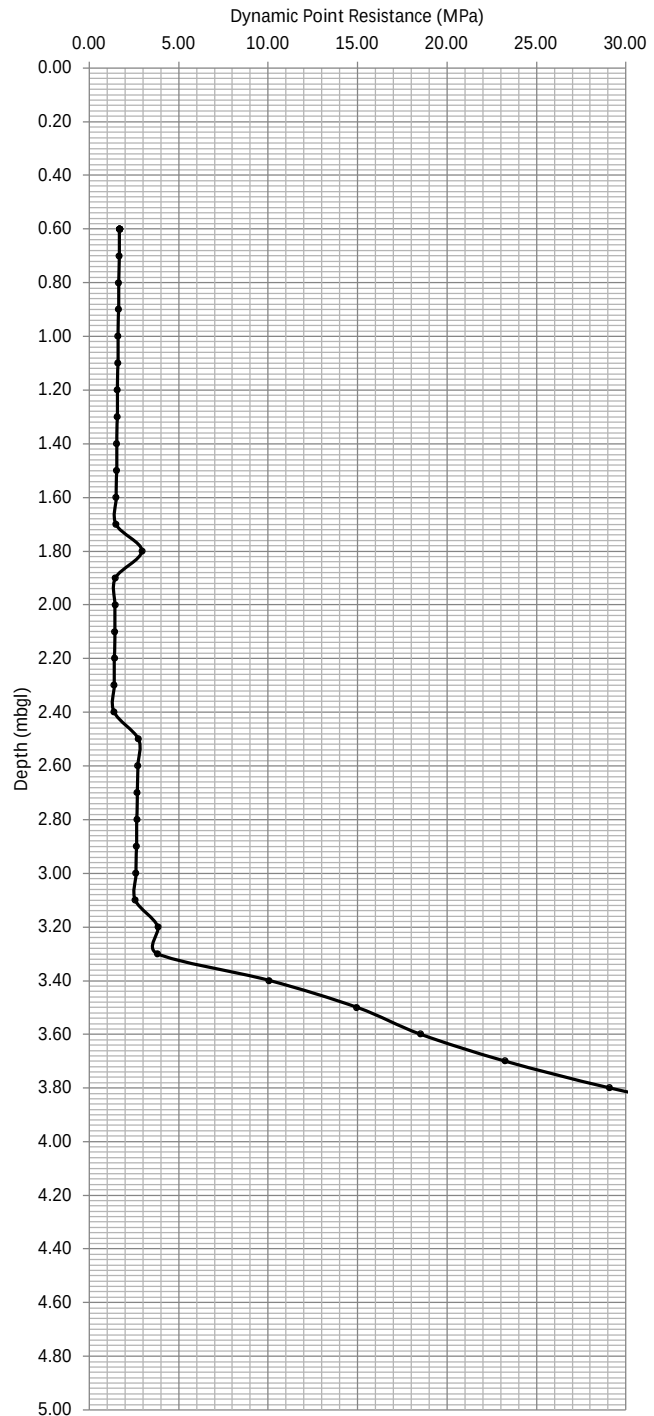
SITE Garages at Whitsbury Road, Havant, Hampshire

Report Ref.

P16424

Test Location Reference WS07

Depth (mbgl)	Blows (per 100mm)	Average Penetration per Blow (m)	Unit Point Resistance (MPa)	Dynamic Point Resistance (MPa)
0.10				
0.20				
0.30				
0.40				
0.50				
0.60	1	0.10	1.87	1.70
0.70	1	0.10	1.87	1.68
0.80	1	0.10	1.87	1.66
0.90	1	0.10	1.87	1.64
1.00	1	0.10	1.87	1.62
1.10	1	0.10	1.87	1.60
1.20	1	0.10	1.87	1.58
1.30	1	0.10	1.87	1.56
1.40	1	0.10	1.87	1.55
1.50	1	0.10	1.87	1.53
1.60	1	0.10	1.87	1.51
1.70	1	0.10	1.87	1.49
1.80	2	0.05	3.74	2.96
1.90	1	0.10	1.87	1.46
2.00	1	0.10	1.87	1.45
2.10	1	0.10	1.87	1.43
2.20	1	0.10	1.87	1.42
2.30	1	0.10	1.87	1.40
2.40	1	0.10	1.87	1.39
2.50	2	0.05	3.74	2.74
2.60	2	0.05	3.74	2.72
2.70	2	0.05	3.74	2.69
2.80	2	0.05	3.74	2.66
2.90	2	0.05	3.74	2.64
3.00	2	0.05	3.74	2.61
3.10	2	0.05	3.74	2.59
3.20	3	0.03	5.61	3.84
3.30	3	0.03	5.61	3.81
3.40	8	0.01	14.95	10.06
3.50	12	0.01	22.43	14.95
3.60	15	0.01	28.03	18.52
3.70	19	0.01	35.51	23.24
3.80	24	0.00	44.85	29.10
3.90	30	0.00	56.06	36.05
4.00				
4.10				
4.20				
4.30				
4.40				
4.50				
4.60				
4.70				
4.80				
4.90				
5.00				



Notes:

No further progress below 3.90m depth - hammer bouncing.

Hammer Mass	63.5 kg
Fall Height	0.76 m
Cone Area	0.0019 m ²
E _{theor}	473 J
Energy Ratio	0.75
Anvil Mass	1 kg
Rod Mass	8.79 kg/m

TRL Dynamic Cone Penetrometer Record

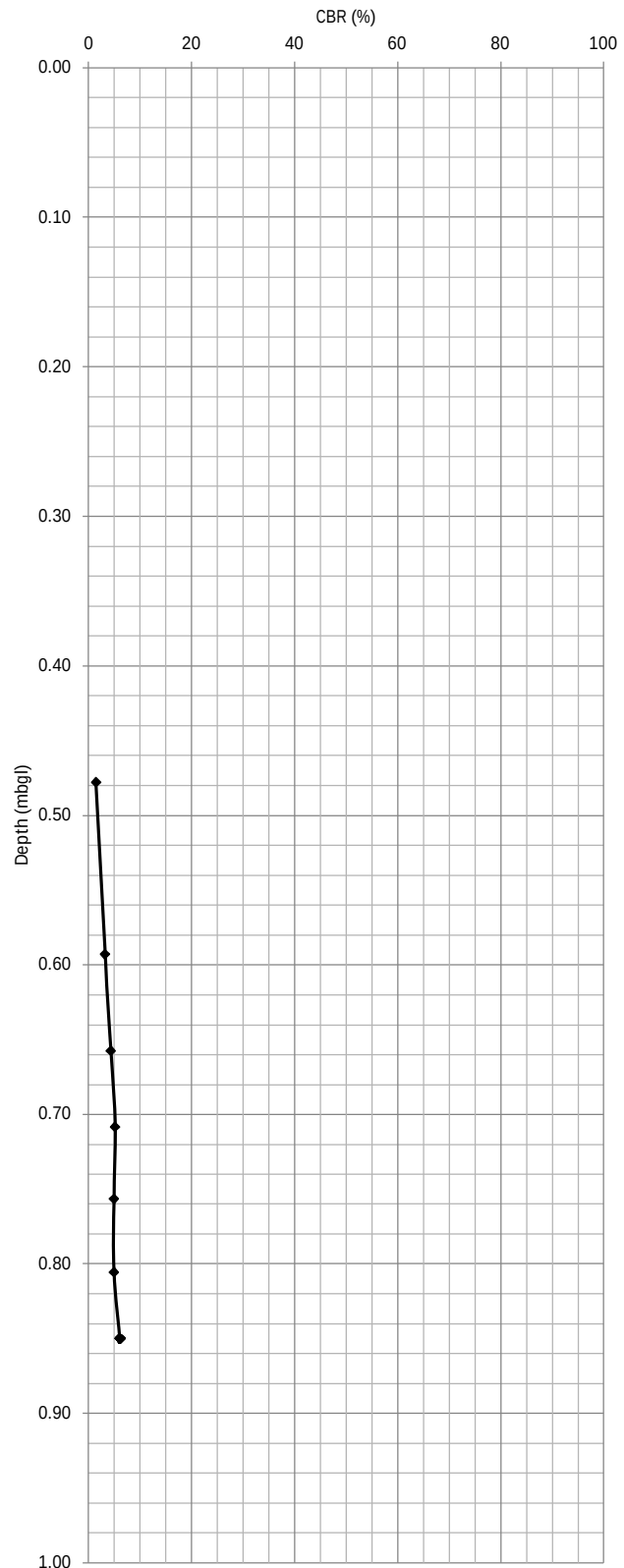
P16424

Depth (mbgl)	CBR (%)
0.41	40
0.44	35
0.46	30
0.50	40
0.55	40
0.60	40
0.65	40
0.70	40
0.75	40
0.80	40
0.85	40
0.90	40
0.95	40
1.00	40

Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

TRL Dynamic Cone Penetrometer Record

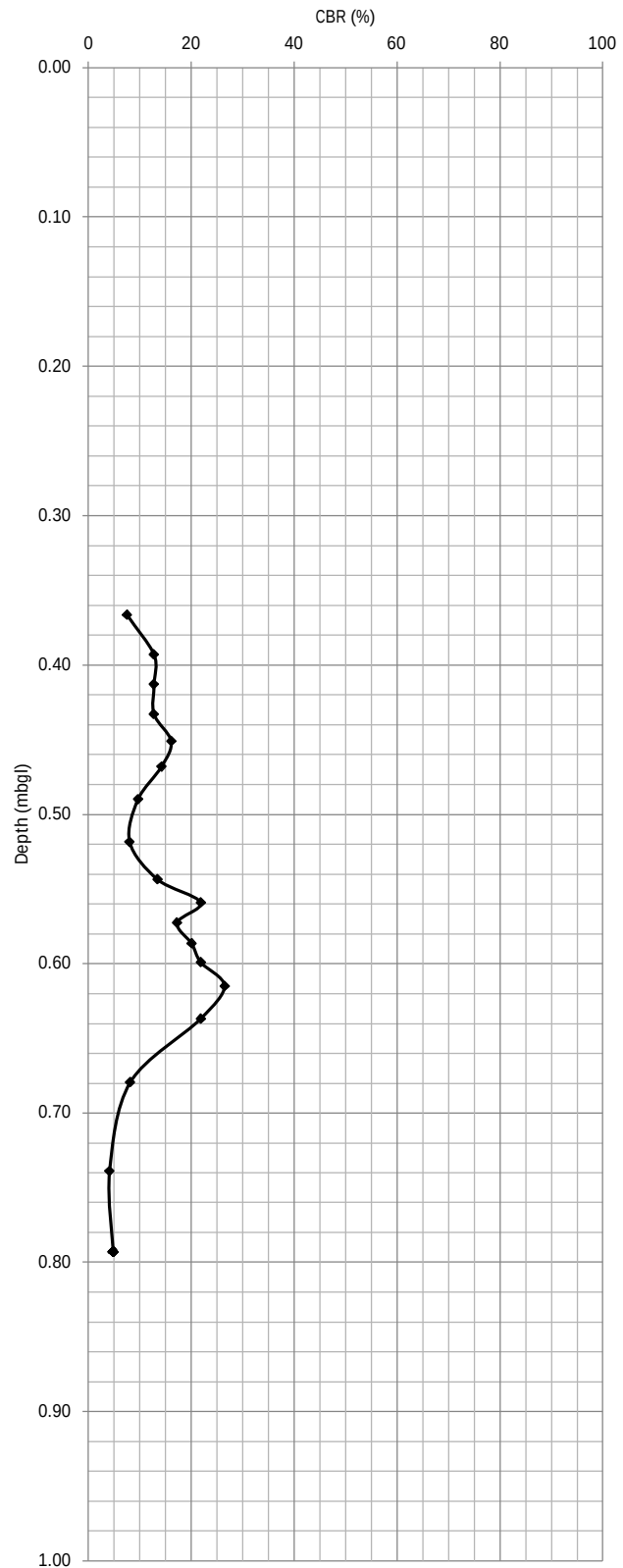
P16424



Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

TRL Dynamic Cone Penetrometer Record

P16424



Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

ASHDOWN SITE INVESTIGATION LTD

TRL Dynamic Cone Penetrometer Record

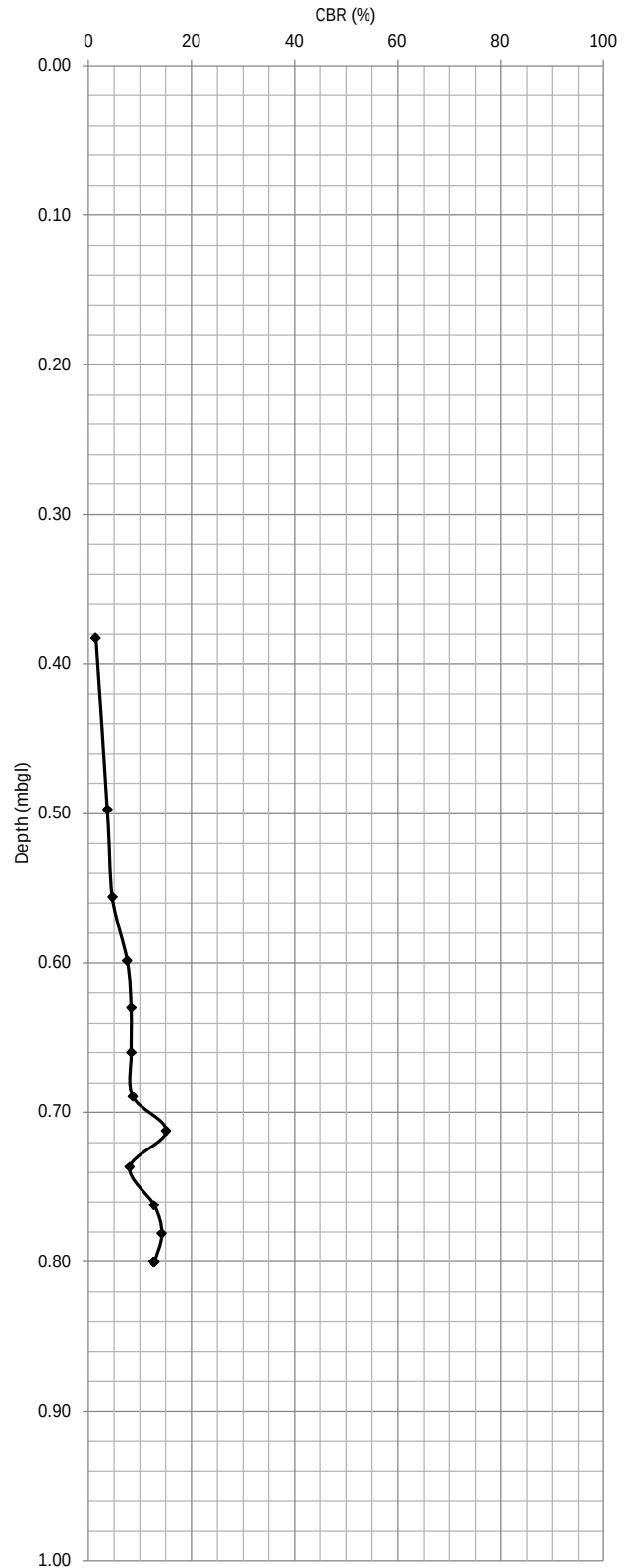
SITE Garages at Whitsbury Road, Havant, Hampshire

Project Ref.

P16424

Test Location Reference	WS05
Depth of Start of Test (mbgl)	0.30

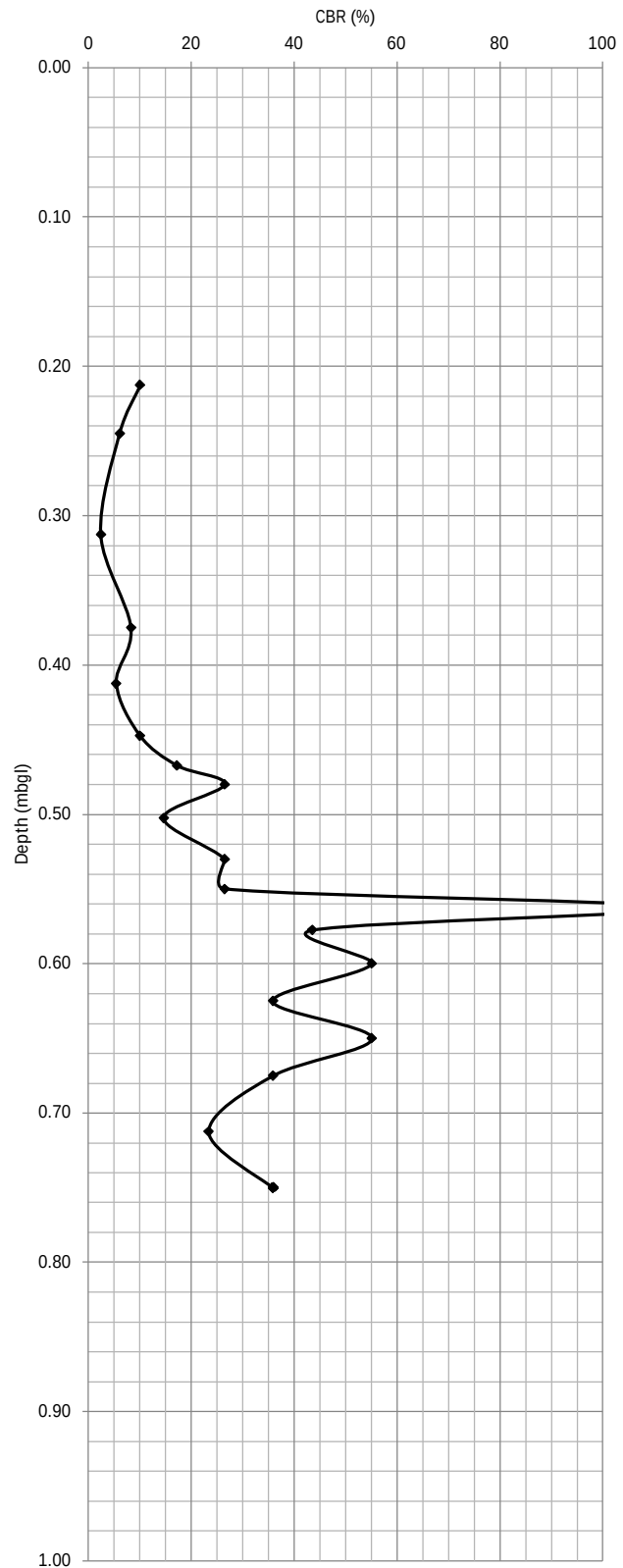
No. Blows	Total Blows	Reading (mm)	Depth (mbgl)	CBR%
DCP Zero Reading		350	0.30	
1	1	515	0.47	1
1	2	580	0.53	4
1	3	632	0.58	5
1	4	665	0.62	7
1	5	695	0.65	8
1	6	725	0.68	8
1	7	754	0.70	9
1	8	771	0.72	15
1	9	802	0.75	8
1	10	822	0.77	13
1	11	840	0.79	14
1	12	860	0.81	13



Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

TRL Dynamic Cone Penetrometer Record

P16424



Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

TRL Dynamic Cone Penetrometer Record

P16424

Notes: CBR Value calculated in accordance with the TRRL equation given in TRL Road Note 8.

APPENDIX B

Geotechnical Laboratory Test Results
Contamination Laboratory Test Results

ASHDOWN SITE INVESTIGATION LIMITED

Soil Classification Summary

Site Name:	Garages at Whitsbury Road, Havant, Hampshire	Job No:	P16424
------------	--	---------	--------

BH/TP No.	Depth (m)	Nat. Moist. Cont. (w %)	Equiv. Moist. Cont. (w _a %)	Atterberg Limits			Class'n	Cons. Index (I _c)	% passing 425 µm sieve	Visual Description of Sample
				W _l %	W _p %	I _p %				
WS01A	2.50	28		68	25	43	CIH	0.93*	98	Stiff gery, orange brown and brown mottled slightly gravelly CLAY. Gravel is fine to medium mudstone.
WS03	1.10	28		64	25	39	CIH	0.92*	99	Stiff grey, orange brown and brown mottled CLAY with rare fine gravel of ironstone.
WS05	2.40	36		57	24	33	CIH	0.64*	100	Firm brown, orange brown and grey mottled slightly sandy CLAY.
WS06	0.90	13		58	20	38	CIH	1.18*	31	Very stiff orange brown, brown and grey mottled very gravelly slightly sandy CLAY. Gravel is fine to coarse flint.
WS07	1.90	27		71	22	49	CIV	0.90*	97	Stiff orange brown and grey brown mottled slightly gravelly CLAY. Gravel is fine mudstone.



Alex Bewick
Ashdown Site Investigations Ltd
Unit 3 The Grain Store
Ditchling Common Business Park
Ditchling Common
West Sussex
BN6 8SG

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-00236

Site Reference: Garaques at Whitsbury Road, Havant, Hampshire

Project / Job Ref: P16424_1983

Order No: 11472

Sample Receipt Date: 11/01/2024

Sample Scheduled Date: 11/01/2024

Report Issue Number: 1

Reporting Date: 17/01/2024

Authorised by:



Technical Manager

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

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



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



Soil Analysis Certificate						
DETS Report No: 24-00236	Date Sampled	04/01/24	04/01/24	09/01/24	09/01/24	09/01/24
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS01A	WS03	WS05	WS06	WS07
Project / Job Ref: P16424_1983	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 11472	Depth (m)	1.50	2.80	1.00	1.90	0.80
Reporting Date: 17/01/2024	DETS Sample No	693380	693381	693382	693383	693384

Determinand	Unit	RL	Accreditation	(n)				
pH	pH Units	N/a	MCERTS	5.9	8.2	6.6	7.8	7.2
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	< 200	< 200	367	< 200	< 200
Total Sulphate as SO ₄	%	< 0.02	MCERTS	< 0.02	< 0.02	0.04	< 0.02	< 0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	72	38	97	44	26
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.07	0.04	0.10	0.04	0.03
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

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)

(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



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



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-00236	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1983	
Order No: 11472	
Reporting Date: 17/01/2024	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
693380	WS01A	None Supplied	1.50	18.5	Light brown clay
693381	WS03	None Supplied	2.80	19.1	Light brown clay
693382	WS05	None Supplied	1.00	16.2	Light brown clay
693383	WS06	None Supplied	1.90	17.7	Light brown clay
693384	WS07	None Supplied	0.80	13.9	Grey clay with stones

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



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



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-00236

Ashdown Site Investigations Ltd

Site Reference: Garages at Whitsbury Road, Havant, Hampshire

Project / Job Ref: P16424_1983

Order No: 11472

Reporting Date: 17/01/2024

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



DETS Ltd
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: 24-00236	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1983	
Order No: 11472	
Reporting Date: 17/01/2024	

Acronym	Description
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

Det - Acronym



Alex Bewick
Ashdown Site Investigations Ltd
Unit 3 The Grain Store
Ditchling Common Business Park
Ditchling Common
West Sussex
BN6 8SG

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-00112

Site Reference: Garaques at Whitsbury Road, Havant, Hampshire

Project / Job Ref: P16424_1974

Order No: 11467

Sample Receipt Date: 08/01/2024

Sample Scheduled Date: 08/01/2024

Report Issue Number: 1

Reporting Date: 12/01/2024

Authorised by:

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.



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



Soil Analysis Certificate						
DETS Report No: 24-00112	Date Sampled	04/01/24	04/01/24	04/01/24	04/01/24	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS01	WS01A	WS02	WS04	
Project / Job Ref: P16424_1974	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 11467	Depth (m)	0.40	0.50	0.14 - 0.25	0.17 - 0.25	
Reporting Date: 12/01/2024	DETS Sample No	692774	692775	692776	692777	

Determinand	Unit	RL	Accreditation	Detected	Not Detected	Not Detected
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Detected		
Sample Matrix ^(S)	Material Type	N/a	NONE	Loose fibres		
Asbestos Type ^(S)	PLM Result	N/a	ISO17025	Chrysotile		
pH	pH Units	N/a	MCERTS	9.2	9.4	11.0
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	549	360	966
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.05	0.04	0.10
Organic Matter (SOM)	%	< 0.1	MCERTS	3	0.7	0.8
Arsenic (As)	mg/kg	< 2	MCERTS	4	14	8
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	9	29	19
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	12	18	9
Lead (Pb)	mg/kg	< 3	MCERTS	14	13	11
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	5	25	9
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	37	64	29

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



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



Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-00112	Date Sampled	04/01/24	04/01/24	04/01/24		
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS01	WS02	WS04		
Project / Job Ref: P16424 1974	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 11467	Depth (m)	0.40	0.14 - 0.25	0.17 - 0.25		
Reporting Date: 12/01/2024	DETS Sample No	692774	692776	692777		

Determinand	Unit	RL	Accreditation				
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	



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



Soil Analysis Certificate - EPH Banded (Type F)						
DETS Report No: 24-00112	Date Sampled	04/01/24	04/01/24	04/01/24		
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS01	WS02	WS04		
Project / Job Ref: P16424_1974	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 11467	Depth (m)	0.40	0.14 - 0.25	0.17 - 0.25		
Reporting Date: 12/01/2024	DETS Sample No	692774	692776	692777		

Determinand	Unit	RL	Accreditation					
EPH (>C8 - C10) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C10 - C12) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C12 - C16) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C16 - C21) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C21 - C40) : EH 1D Total	mg/kg	< 6	MCERTS	< 6	< 6	< 6		
EPH (C8 - C40) : EH 1D Total	mg/kg	< 6	MCERTS	< 6	< 6	< 6		



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

Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 24-00112	Date Sampled	04/01/24	04/01/24			
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS01	WS01A			
Project / Job Ref: P16424_1974	Additional Refs	None Supplied	None Supplied			
Order No: 11467	Depth (m)	0.40	0.50			
Reporting Date: 12/01/2024	DETS Sample No	692774	692775			

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



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



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-00112	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1974	
Order No: 11467	
Reporting Date: 12/01/2024	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
692774	WS01	None Supplied	0.40	12.4	Light brown sandy clay with stones and chalk
692775	WS01A	None Supplied	0.50	15.3	Light brown clay
692776	WS02	None Supplied	0.14 - 0.25	14.8	Light brown clay
692777	WS04	None Supplied	0.17 - 0.25	14	Light brown sandy clay with stones

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-00112

Ashdown Site Investigations Ltd

Site Reference: Garages at Whitsbury Road, Havant, Hampshire

Project / Job Ref: P16424_1974

Order No: 11467

Reporting Date: 12/01/2024

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



DETS Ltd
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: 24-00112	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1974	
Order No: 11467	
Reporting Date: 12/01/2024	

Acronym	Description
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

Det - Acronym
EPH Banded (C10 - C12) - EH 1D Total
EPH Banded (C12 - C16) - EH 1D Total
EPH Banded (C16 - C21) - EH 1D Total
EPH Banded (C21 - C40) - EH 1D Total
EPH Banded (C8 - C10) - EH 1D Total
EPH Banded (C8 - C40) - EH 1D Total



Alex Bewick
Ashdown Site Investigations Ltd
Unit 3 The Grain Store
Ditchling Common Business Park
Ditchling Common
West Sussex
BN6 8SG

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-00234

Site Reference: Garaques at Whitsbury Road, Havant, Hampshire

Project / Job Ref: P16424_1981

Order No: 11471

Sample Receipt Date: 11/01/2024

Sample Scheduled Date: 11/01/2024

Report Issue Number: 1

Reporting Date: 17/01/2024

Authorised by:



Technical Manager

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

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



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



Soil Analysis Certificate						
DETS Report No: 24-00234	Date Sampled	09/01/24	09/01/24	09/01/24	09/01/24	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS05	WS06	WS07	WS08	
Project / Job Ref: P16424_1981	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 11471	Depth (m)	0.15 - 0.25	0.15 - 0.30	0.15 - 0.30	0.15 - 0.35	
Reporting Date: 17/01/2024	DETS Sample No	693370	693371	693372	693373	

Determinand	Unit	RL	Accreditation	(n)			
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	10.5	10.9	11.0	10.0
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	2626	3825	2228	525
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.26	0.38	0.22	0.05
Organic Matter (SOM)	%	< 0.1	MCERTS	2.2	1.5	2.7	0.5
Arsenic (As)	mg/kg	< 2	MCERTS	7	6	5	< 2
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.8	0.5	1.9	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	18	17	19	5
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	31	16	37	6
Lead (Pb)	mg/kg	< 3	MCERTS	98	150	176	8
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	22	10	14	3
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	94	81	121	12

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)

(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



DETS Ltd
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: 24-00234	Date Sampled	09/01/24	09/01/24	09/01/24	09/01/24	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS05	WS06	WS07	WS08	
Project / Job Ref: P16424 1981	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 11471	Depth (m)	0.15 - 0.25	0.15 - 0.30	0.15 - 0.30	0.15 - 0.35	
Reporting Date: 17/01/2024	DETS Sample No	693370	693371	693372	693373	

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

(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



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



Soil Analysis Certificate - EPH Banded (Type F)						
DETS Report No: 24-00234	Date Sampled	09/01/24	09/01/24	09/01/24	09/01/24	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	TP / BH No	WS05	WS06	WS07	WS08	
Project / Job Ref: P16424_1981	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 11471	Depth (m)	0.15 - 0.25	0.15 - 0.30	0.15 - 0.30	0.15 - 0.35	
Reporting Date: 17/01/2024	DETS Sample No	693370	693371	693372	693373	

Determinand	Unit	RL	Accreditation	(n)				
EPH (>C8 - C10) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH (>C10 - C12) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH (>C12 - C16) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
EPH (>C16 - C21) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	2	< 1	< 1	
EPH (>C21 - C40) : EH 1D Total	mg/kg	< 6	MCERTS	< 6	11	35	< 6	
EPH (C8 - C40) : EH 1D Total	mg/kg	< 6	MCERTS	< 6	13	35	< 6	

(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



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



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-00234	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1981	
Order No: 11471	
Reporting Date: 17/01/2024	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
693370	WS05	None Supplied	0.15 - 0.25	7.9	Brown sandy gravel with stones
693371	WS06	None Supplied	0.15 - 0.30	5.9	Brown sandy clay with stones
693372	WS07	None Supplied	0.15 - 0.30	6.5	Brown sandy clay with stones
693373	WS08	None Supplied	0.15 - 0.35	7.8	Brown sandy clay with stones

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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



Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 24-00234	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1981	
Order No: 11471	
Reporting Date: 17/01/2024	

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



DETS Ltd
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: 24-00234	
Ashdown Site Investigations Ltd	
Site Reference: Garages at Whitsbury Road, Havant, Hampshire	
Project / Job Ref: P16424_1981	
Order No: 11471	
Reporting Date: 17/01/2024	

Acronym	Description
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

Det - Acronym
EPH Banded (C10 - C12) - EH 1D Total
EPH Banded (C12 - C16) - EH 1D Total
EPH Banded (C16 - C21) - EH 1D Total
EPH Banded (C21 - C40) - EH 1D Total
EPH Banded (C8 - C10) - EH 1D Total
EPH Banded (C8 - C40) - EH 1D Total

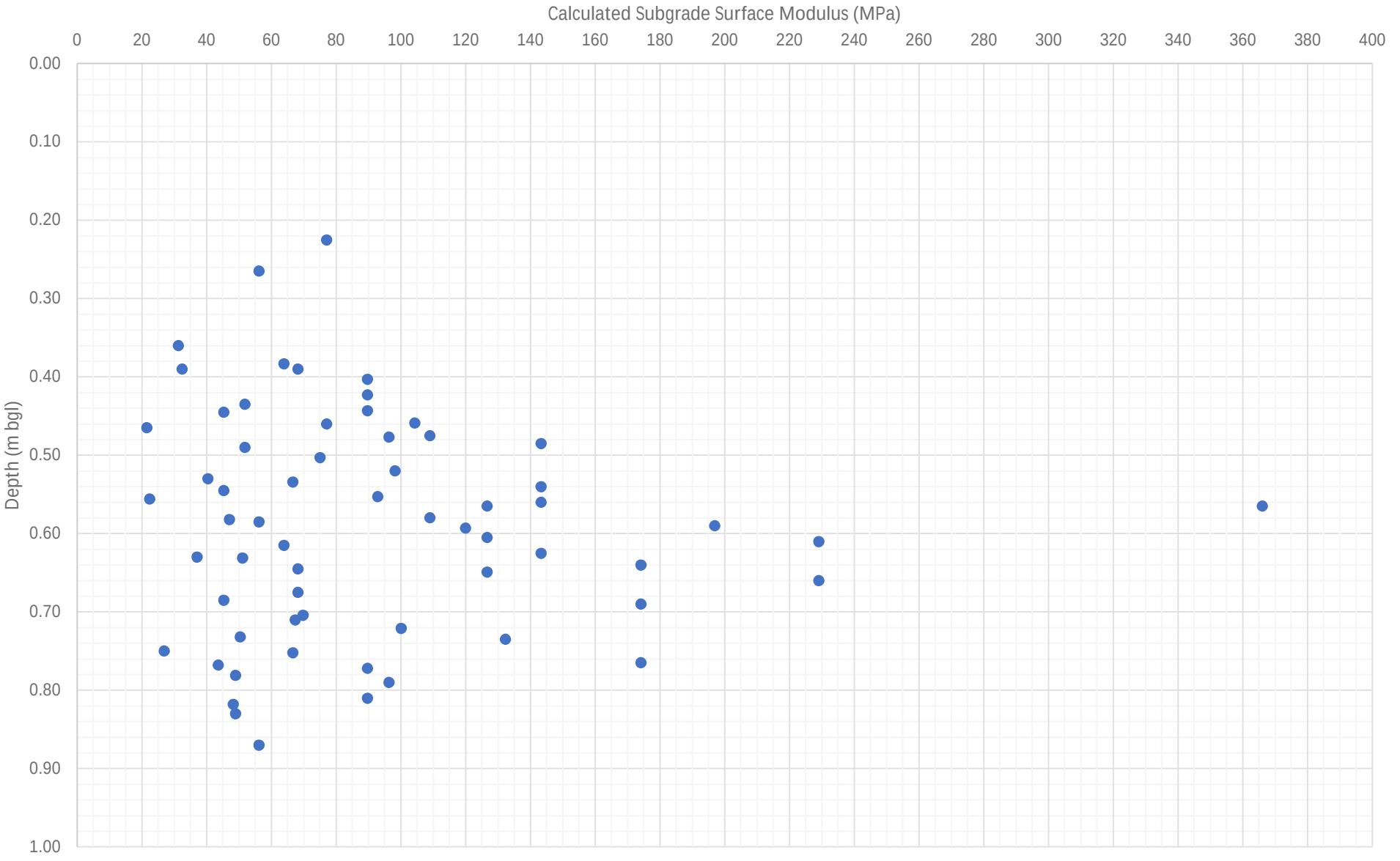
APPENDIX C

Summary of In Situ CBR Test Results
Graph of Subgrade Surface Modulus vs Depth
Graph of CBR vs Depth

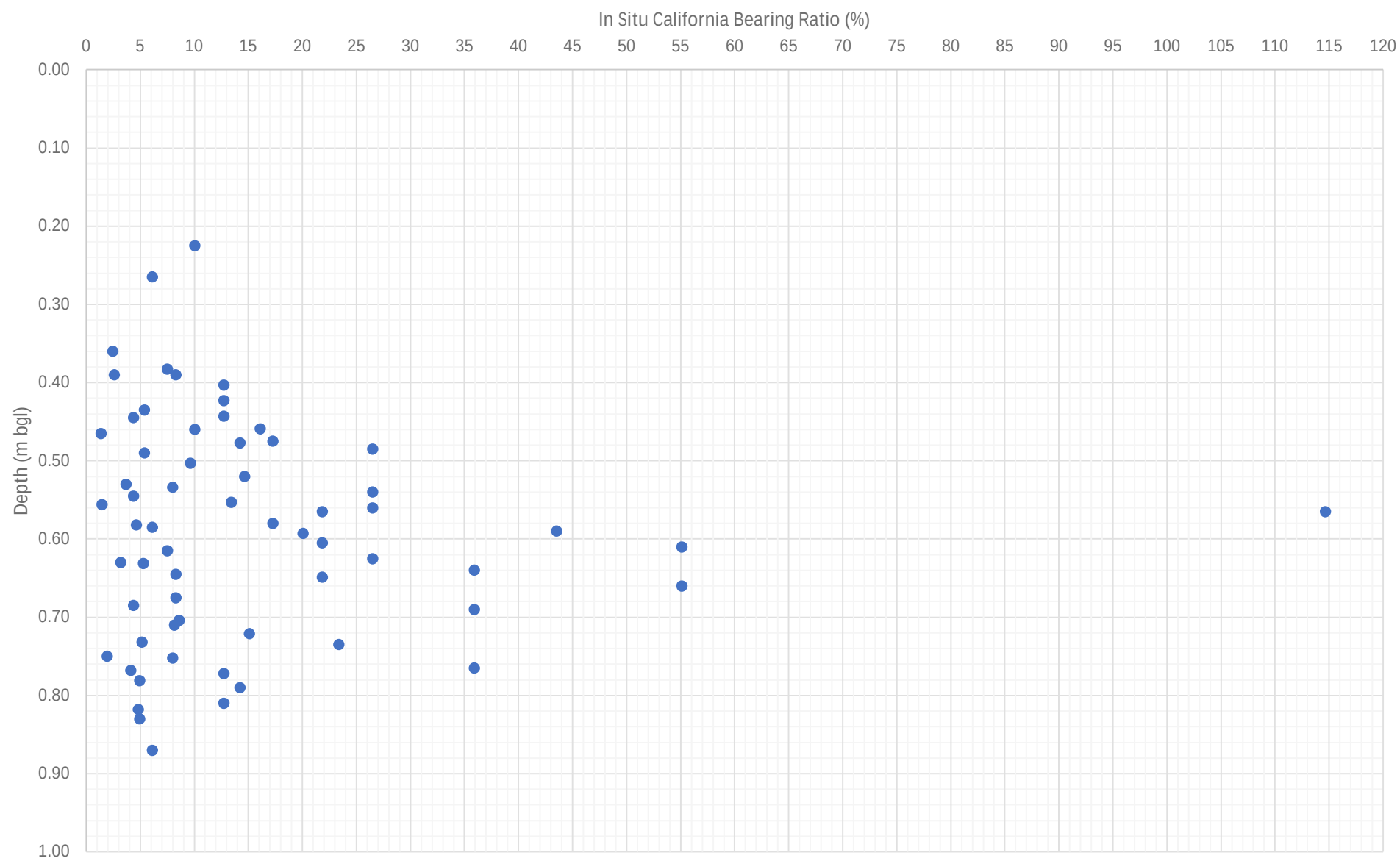
BH	Depth (m)	CBR (%)	Ks (Mpa)
WS01A	0.56	1	22
WS01A	0.63	3	37
WS01A	0.69	4	45
WS01A	0.73	5	50
WS01A	0.78	5	49
WS01A	0.83	5	49
WS01A	0.87	6	56
WS03	0.38	7	64
WS03	0.40	13	90
WS03	0.42	13	90
WS03	0.44	13	90
WS03	0.46	16	104
WS03	0.48	14	96
WS03	0.50	10	75
WS03	0.53	8	67
WS03	0.55	13	93
WS03	0.57	22	127
WS03	0.58	17	109
WS03	0.59	20	120
WS03	0.61	22	127
WS03	0.63	26	143
WS03	0.65	22	127
WS03	0.71	8	67
WS03	0.77	4	44
WS03	0.82	5	48
WS05	0.47	1	22
WS05	0.53	4	40
WS05	0.58	5	47
WS05	0.62	7	64
WS05	0.65	8	68
WS05	0.68	8	68
WS05	0.70	9	70
WS05	0.72	15	100
WS05	0.75	8	67
WS05	0.77	13	90
WS05	0.79	14	96
WS05	0.81	13	90
WS06	0.23	10	77
WS06	0.27	6	56
WS06	0.36	2	31
WS06	0.39	8	68
WS06	0.44	5	52
WS06	0.46	10	77
WS06	0.48	17	109
WS06	0.49	26	143
WS06	0.52	15	98
WS06	0.54	26	143
WS06	0.56	26	143
WS06	0.57	115	366

BH	Depth (m)	CBR (%)	Ks (Mpa)
WS06	0.59	44	197
WS06	0.61	55	229
WS06	0.64	36	174
WS06	0.66	55	229
WS06	0.69	36	174
WS06	0.74	23	132
WS06	0.77	36	174
WS07	0.39	3	32
WS07	0.45	4	45
WS07	0.49	5	52
WS07	0.55	4	45
WS07	0.59	6	56
WS07	0.63	5	51
WS07	0.75	2	27

Calculated Subgrade Surface Modulus (MPa)



In Situ California Bearing Ratio (%)



APPENDIX D

Classification of Probability, Consequence and Risk

Probability of risk being realised	
Classification	Definition
High	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Moderate	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Very Low	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Consequence of risk being realised		
Classification	Category	Definition
Severe	Human Health	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA.
	Controlled Waters	Short term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.
	Property	Catastrophic damage to buildings/property.
	Ecological Systems	A short term risk to a particular ecosystem or organisation forming part of such ecosystem.
Moderate	Human Health	Chronic damage to Human Health.
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).
	Ecological System	A significant change in a particular ecosystem or organism forming part of such ecosystem.
Minor	Controlled Waters	Pollution of non-sensitive water resources.
	Property	Significant damage to crops, buildings, structures and services.
	Ecological Systems	Damage to sensitive buildings/structures/services or the environment.
Very Minor	Human Health	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).
	Property	Easily repairable effects of damage to buildings, structures and services.
	Project	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve.

Risk classification definitions	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but there is a low likelihood of this hazard occurring and if realised, harm would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

APPENDIX E

Preliminary Conceptual Model

2.5 Preliminary Risk Assessment

Nr	Sources	Pathways	TYPE	Receptors	Consequence	Probability	Risk classification	Comments
On-Site sources								
1	Potential for inorganic and low volatility organic contaminants to be present within the subsurface soils	Dermal contact, ingestion & inhalation of soils & soil dust	HH	Future Site occupants	MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the potential presence of Made Ground beneath the Site, any residual contamination associated with this material has the potential to impact on future site users, particularly in garden areas.
2		Consumption of home grown produce			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
3		Ingress into water supply pipework and subsequent water ingestion			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
4		Building materials in direct contact with aggressive ground	PROP	Future Site buildings	MILD	LOW LIKELIHOOD	LOW RISK	Given the potential presence of Made Ground beneath the Site, it would be considered prudent to verify the underlying ground condition prior to foundation design.
5		Dissolution into pore water/shallow groundwater and subsequent migration		London Clay Formation (Unproductive Strata)	MILD	UNLIKELY	VERY LOW RISK	The risk rating reflects to low resource potential of the London Clay (evidenced by the absence of any local licensed groundwater abstractions) and also the low permeability of the clay deposits.
6		Dissolution into pore water/shallow groundwater and subsequent lateral migration		Drainage ditch (c. 190 m south)	MILD	UNLIKELY	VERY LOW RISK	The risk classification reflects the reasonable distance to the nearest surface water feature and also the low permeability of the local geology.
7		Dissolution into aqueous phase and preferential migration via drainage structures			MILD	UNLIKELY	VERY LOW RISK	

2.5 Preliminary Risk Assessment

Nr	Sources	Pathways	TYPE	Receptors	Consequence	Probability	Risk classification	Comments
8	Potential for volatile organic contaminants to be present within the subsurface soils	Dermal contact, ingestion & inhalation of soils & soil dust	TYPE	Future Site occupants	MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the potential presence of Made Ground beneath the Site, any residual contamination associated with this material has the potential to impact on future site users, particularly in garden areas.
9		Consumption of home grown produce			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
10		Ingress into water supply pipework and subsequent water ingestion			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the potential presence of Made Ground beneath the Site, it is considered possible that there are organic contaminants present which could impact water supply pipework. It is recommended that any new water supply is installed in clean fill trenches utilising barrier pipework as a precaution.
11		Migration of vapours to surface; inhalation indoors			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the Site's long standing use as lock-up garages, it is possible some localised vapour phase contamination is present at the Site, which could impact future Site users.
12		Migration of vapours to surface; inhalation outdoors			MEDIUM	UNLIKELY	LOW RISK	
13		Building materials in direct contact with aggressive ground	PROP	Future Site buildings	MILD	LOW LIKELIHOOD	LOW RISK	Given the potential presence of Made Ground beneath the Site, it would be considered prudent to verify the underlying ground condition prior to foundation design.
14		Dissolution into pore water/shallow groundwater and subsequent migration		London Clay Formation (Unproductive Strata)	MILD	UNLIKELY	VERY LOW RISK	The risk rating reflects to low resource potential of the London Clay (evidenced by the absence of any local licensed groundwater abstractions) and also the low permeability of the clay deposits.
15		Dissolution into pore water/shallow groundwater and subsequent migration		Drainage ditch (c. 190 m south)	MILD	UNLIKELY	VERY LOW RISK	The risk classification reflects the reasonable distance to the nearest surface water feature and also the low permeability of the local geology.
16		Dissolution into aqueous phase and preferential migration via drainage structures			MILD	UNLIKELY	VERY LOW RISK	

2.5 Preliminary Risk Assessment

Nr	Sources	Pathways	TYPE	Receptors	Consequence	Probability	Risk classification	Comments
17	Potential for asbestos containing materials within the subsurface soils	Liberation of sub surface ACMs and inhalation of asbestos fibres	HH	Future Site occupants	MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the age of the existing garage structures, asbestos-containing material may be present within the building fabric and potentially also within the underlying Made Ground / subsoils.
18	Potential for dissolved phase contaminants to be present within shallow groundwater	Lateral and vertical groundwater movement via natural or artificial flow paths		London Clay Formation (Unproductive Strata)	MILD	LOW LIKELIHOOD	LOW RISK	The risk rating reflects to low resource potential of the London Clay (evidenced by the absence of any local licensed groundwater abstractions) and also the low permeability of the clay deposits.
19		Lateral and vertical groundwater movement via natural or artificial flow paths		Drainage ditch (c. 190 m south)	MILD	LOW LIKELIHOOD	LOW RISK	Given the likely low permeability of the bedrock and also the distance to the water feature, any groundwater occurring beneath the Site is unlikely to migrate readily towards the nearest surface water feature.
20	Potential for elevated methane to be present within the sub-surface soils	Lateral and vertical migration into on-Site buildings; potential to cause an explosion		On-Site properties and their occupants	SEVERE	NEGLECTIBLE	NO DISCERNABLE RISK	The gas generation potential of on-Site materials is considered likely to be limited.
21		Lateral migration towards off-Site buildings; potential to cause an explosion		Off-Site properties and their occupants	SEVERE	NEGLECTIBLE	NO DISCERNABLE RISK	
22	Potential for elevated carbon dioxide to be present within the subsurface soils	Lateral and vertical migration into on-Site buildings; potential to cause asphyxiation		Occupants of on-Site buildings	SEVERE	NEGLECTIBLE	NO DISCERNABLE RISK	
23		Lateral migration towards off-Site buildings; potential to cause asphyxiation		Occupants of off-Site buildings	SEVERE	NEGLECTIBLE	NO DISCERNABLE RISK	

2.5 Preliminary Risk Assessment

Nr	Sources	Pathways	PE	Receptors	Consequence	Probability	Risk classification	Comments
24	Potential for radon within the subsurface	Lateral migration towards on-Site buildings; potential to cause long term health effects		Occupants of on-Site buildings	MEDIUM	UNLIKELY	LOW RISK	The Site lies in an area where <1% of homes are at or above the UK radon action level (200 Bq/m3).
25	Potential residual polychlorinated biphenyls (PCBs)	Dermal contact, ingestion & inhalation of soils & soil dust		Future Site occupants	MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	Given the presence of an electricity sub station on-Site, there is the potential for PCB contaminants to be present in the underlying subsoils, which could impact future Site users, particularly in garden areas. It is noted that PCB contaminants generally have low mobility and therefore could be localised in the north western corner of the Site.
26		Consumption of home grown produce			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
27		Ingress into water supply pipework and subsequent water ingestion			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
28		Migration of vapours to surface; inhalation indoors			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
29		Migration of vapours to surface; inhalation outdoors			MEDIUM	LOW LIKELIHOOD	MODERATE/LOW RISK	
	OVERALL RISK RATING (on-Site)						MODERATE/LOW RISK	

2.5 Preliminary Risk Assessment

Nr	Sources	Pathways	TYPE	Receptors	Consequence	Probability	Risk classification	Comments
Off-Site sources								
- Industrial development, c. 170 m south-east (1967 to present)								
30	Potential for both inorganic and volatile organic contaminants to be present within the subsurface soils	Dermal contact, ingestion & inhalation of soils & soil dust		Future Site occupants	MEDIUM	UNLIKELY	LOW RISK	The risk classification reflects the reasonable distance between the industrial development and the Site.
31		Consumption of home grown produce			MEDIUM	UNLIKELY	LOW RISK	
32		Ingress into water supply pipework and subsequent water ingestion			MEDIUM	UNLIKELY	LOW RISK	
33		Migration of vapours to surface; inhalation indoors			MEDIUM	UNLIKELY	LOW RISK	
34		Migration of vapours to surface; inhalation outdoors			MEDIUM	UNLIKELY	LOW RISK	
	OVERALL RISK RATING (off-Site)						LOW RISK	

APPENDIX F

Quantitative Conceptual Model

Garages at Whitsbury Road, Havant				Quantitative Conceptual Model		P16424	
Source	Receptor	Contaminants	Pathway	Complete Linkage Present?	Probability	Consequence	Risk
Asbestos fibres have been identified within the shallow made ground soils at borehole WS01.	End Users	Asbestos	Dermal contact with soil and dust (indoor & outdoor)	Identified contaminant(s) do not pose a risk via this pathway			N/A
			Ingestion of soil and indoor dust	Identified contaminant(s) do not pose a risk via this pathway			N/A
			Consumption of home-grown produce and attached soil	Identified contaminant(s) do not pose a risk via this pathway			N/A
			Inhalation of soil dust (indoor and outdoor)	Yes	P2: Low	C4: Severe	Moderate
			Inhalation of soil vapours	Identified contaminant(s) do not pose a risk via this pathway			N/A
			Inhalation of soil gases/ Risk of explosion	Identified contaminant(s) do not pose a risk via this pathway			N/A
	End Users (via Water Supply Pipework)		Contamination of incoming services	Identified contaminant(s) do not pose a risk via this pathway			N/A
	Groundwater		Migration to groundwater	No significant pathway to groundwater exists			N/A