

REPORT ON A SITE INVESTIGATION

Site

**ORCHARDS PADDOCK,
BASINGSTOKE ROAD,
SWALLOWFIELD, READING,
BERKSHIRE RG7 1PT**

Client

CHRISTOPHER DERING

Report Ref

26/13364/GO

Issued

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The following foreword should be read in conjunction with this report. Any variations on the general procedures outlined below are indicated in the text.

FOREWORD

The recommendations made and opinions expressed in this Report are based on the strata conditions revealed by the fieldworks as indicated on the exploratory records, together with an assessment of the data from in situ and laboratory tests. No liability can be accepted for conditions which have not been revealed by the fieldworks, for example, between exploratory positions. While this Report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. The data obtained relate to the conditions which are relevant at the time of the investigation.

The groundwater observations entered on exploratory records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. It should be noted that groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the exploratory hole upon completion.

It should be appreciated that this report does not constitute a Geotechnical Design Report (GDR) as defined in Eurocode 7 and no aspect of this report constitutes a design. Specific sections of this report are generally in line with the guidance set out in Eurocode 7 for a Ground Investigation Report (GIR), as defined within BS EN 1997:-2 (2024). This provides guidance on the number and spacing of investigation positions, methods of investigation and sample quality class to be achieved which may not have been met by this investigation.

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REPORT REF: 26/13364/GO
CONTRACT: BASINGSTOKE ROAD, SWALLOWFIELD

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EXECUTIVE SUMMARY

This investigation has demonstrated that significant thicknesses of made ground overlies granular soils associated with River Terrace Deposits of Quaternary age, which in turn rest upon the weathered London Clay Formation of the Eocene epoch. A high groundwater table has been encountered and dewatering is anticipated should traditional foundations be adopted. In order to avoid potential problems relating to differential settlement, all foundations would need to be located within the London Clay Formation at a nominal depth of 2.20m. Alternatively, should this proposal be uneconomic or impractical, attention should be given to the use of a piled foundation solution.

1 INTRODUCTION

1.1 Scope

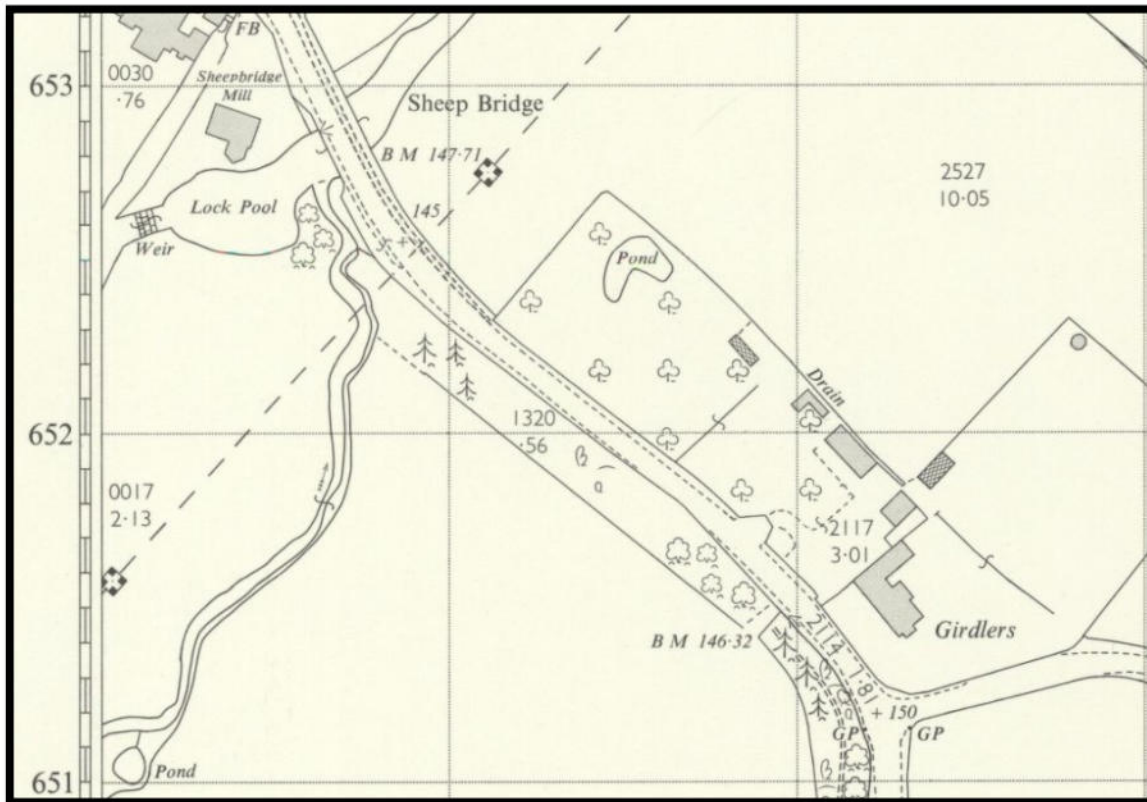
The client proposes to construct an extension with glazed conservatory link, a detached garage and pool at Orchards Paddock, Basingstoke Road, Swallowfield ("the site"). Accordingly, a site investigation has been undertaken in order to ascertain the nature and engineering properties of the soils underlying the proposed development site and to obtain data which will assist in the formulation of a safe and economical foundation solution.

The programme of this investigation comprised the construction of four boreholes using hand-held window sampling techniques, with a continuous dynamic probe (DPH) completed using a lightweight rig. During this work samples were recovered for further examination and laboratory testing. In addition, a number of in situ hand shear vane tests were also performed. This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to foundation design and construction.

1.2 The Site

The site is located at Ordnance Survey National Grid Reference 472201, 165202 and the River Loddon lies to the north west. Examination of the available OS historical mapping reveals structures on the site in 1968, with a drain present on the northern boundary and a pond to the west. A relevant extract is presented below.

Photographs which give a general impression of the site at the time of the fieldworks are included below. At the time of the site works the existing structures were present.



Extract of 1968 1:2,500 OS map

2 FIELDWORKS

The boreholes and probe were constructed on 20th March 2026 at locations as shown on the site plan, drawing no. 26/13364/1, which is presented as Figure 1. The exploratory positions were located in order to establish the prevailing ground conditions beneath the proposed extension and garage.

The depths and descriptions of the strata encountered in the boreholes are given on the records which comprise Appendix 1 to this report. These records note the depths at which samples were taken, the results of in situ tests and the groundwater observations noted at

the time of the fieldworks. At location 1 continuous dynamic probing was completed using a lightweight rig utilising DPH specification equipment. The results are presented in graphical format, as a penetration resistance-depth relationship, with the number of blows required to drive the probe 100mm.

3 GROUND CONDITIONS

3.1 Geology

A desk-based examination of the British Geological Survey (BGS) GeoIndex of superficial and bedrock mapping at 1:50,000 scale, indicates the site as being underlain by River Terrace Deposits of Quaternary age. These superficial deposits are underlain at depth by the London Clay Formation of the Eocene epoch.

A review of the UK Radon maps indicate that the site is within an area where less than 1% of homes are above the action level and protection measures are not required.

3.2 Stratigraphy

Consideration of the exploratory records indicates that grass over made ground in the form of dark brown silty sand with roots and variable amounts of flint gravel, brick and tile fragments, with some metal wire, was encountered from surface and proved to depths of between 0.40m and 0.70m. Below these depths further made ground varying in composition to dark brown gravelly to very gravelly sandy clay and slightly organic gravelly clayey sand was revealed, which was proved to depths of between 0.80m and 1.90m.

Brown clayey to silty sand and flint gravel was exposed beneath the made ground at boreholes 1, 2 and 4. These granular soils are thought to represent the River Terrace Deposits and were proved to depths of 1.30m, 2.20m and 1.40m respectively.

Brown and grey to brown silty clay with occasional partings of orangish or yellowish brown silt and fine sand at depth, was exposed beneath the granular soils and the made ground within borehole 3. These cohesive soils represent the weathered London Clay Formation and were proved to the concluding depths of the boreholes at 3.10m and 4.10m.

3.3 Groundwater

During the construction of the exploratory positions groundwater strikes were recorded at 0.70m, 0.80m and 0.90m. Corresponding, short-term standing water levels of 0.60m, 0.85m and 0.90m were observed upon completion of the boreholes.

3.4 In Situ Testing

During the construction of boreholes 1 and 4 a series of in situ hand shear vane tests were performed using the Geonor Shear Vane test equipment. Shear strengths corrected for plasticity effects ranging between 70kPa and 80kPa were recorded, reflecting a firm to stiff condition in situ for a cohesive soil.

Dynamic probing was performed adjacent to borehole 1. Initially low blow counts were recorded from the base of the hand excavated starter pit to 1.00m, where increased resistances to penetration of between 6 and 16 blows/100mm were recorded within the granular soils. These results infer a medium dense in situ condition for a granular soil. The blow counts reduce below 1.40m, ranging from 2 blows/100mm to 4 blows/100mm to 6.50m, steadily increasing to between 5 to 11 blows/100mm within the cohesive soils. The probing was concluded at the target depth of 10.00m.

4 LABORATORY TESTING

A programme of laboratory testing has been undertaken and the results are presented as Appendix 2 to this report. Each type of test is summarised below and the results obtained have been used to assist in the formulation of the discussion.

4.1 Water Content

The water contents of samples of the soils encountered at this site have been determined. Water contents within the range 17.8% to 39.0% have been recorded.

4.2 Index Properties

The liquid and plastic limits of samples of the clay soils have been determined. The results of this work indicate that samples of the River Terrace Deposits tested can generally be described as inorganic clays of low plasticity and low volume change potential. In one instance the sample was proved to be non-shrinkable. The London Clay Formation has been shown to be of high plasticity and medium to high volume change potential.

4.3 Particle Size Distribution

Two samples of the granular soils encountered at this site have been subjected to sieve analysis in order to determine the soils' particle size distribution. The results of this work are presented in the form of grading curves.

4.4 Chemical Testing – Sulphates & pH

Samples of the soils and groundwater encountered at this site have been subjected to chemical analyses in order to determine their sulphate contents and pH values. Under the conditions of this work low concentrations of soluble sulphate have been recorded in association with near neutral pH values. The results are summarised in tabular form below.

Table 1 - Summary of Chemical Tests

BH/TP No.	Sample		Concentration of Sulphates expressed as SO ₄		Total Sulphate as SO ₄ mg/kg	pH
	Depth m	Type	2:1 Water : Soil Extract mg/l	Groundwater mg/l		
1	2.00	CLAY	11		140	6.7
2	0.50	MADE GROUND	10		400	6.7
3	(0.60)	Water		53		7

5 GEOTECHNICAL DISCUSSION

5.1 Foundations

The client proposes to construct an extension with glazed conservatory link, a detached garage and pool at the site under consideration. The proposed layout is shown in Figure 2. At the time of the preparation of this report the anticipated structural loads were not known.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement could occur even under the action of light loading intensities. Therefore, it will be necessary to continue foundation excavations through these undesirable materials where they are of less than 1.00m in thickness to this minimum depth in order to avoid that zone of soil which is subject to normal seasonal moisture variation or frost action. The above precautions need not necessarily be applied to light ancillary structures, which will be formed structurally discrete from the main development and in which a greater degree of settlement can be tolerated.

This investigation has revealed that variable and inconsistent thicknesses of granular soils, associated with River Terrace Deposits, conceals the weathered margins of the London Clay Formation. In view of the variable thicknesses of made ground and granular soils, it would be

necessary to locate all foundations within a consistent soil type to avoid problems relating to differential settlement. This infers that all foundations should be extended to the London Clay Formation, revealed at depths ranging between 1.30m and 2.20m.

It is known that a number of trees are present in the vicinity of the proposed structures. A discussion of the causes, effects and classification of desiccation in clay soils is included in Appendix 3 to this report. Consideration of the results of the laboratory testing indicates that moisture deficiency may be present at 1.50m depth in borehole 4. The final foundation depth should be in agreement with NHBC criteria, on the basis that the London Clay Formation is of high volume change potential. A depth of 2.00m would be necessary in the area of borehole 4.

Strip or spread foundations constructed within the London Clay Formation, at a nominal depth of 2.20m, can be designed to accept a maximum increase in load of 125kPa. At this loading intensity a factor of safety of 3 against general shear failure will be operative. Moreover, settlements should remain within tolerable limits for the type of structures proposed, these movements occurring over a number of years post completion of the build. It is recommended to incorporate flexible construction joints between the existing and proposed structures, to accommodate any small differential movements which may occur between them.

Should the necessity to dewater prove impractical or uneconomic, particularly given the requirement to support the excavation for the proposed pool, then an alternative solution will be required. In this context consideration could be given to the use of a piled foundation solution. The design of piles lies outside the scope of this report as it is dependent upon the type of pile employed, its size and bearing capacity. Therefore, when the loadings are known it will be sensible to seek the advice of suitably experienced specialist piling contractors in order to provide a satisfactory solution to the problem. It is probable that a deep cable percussive borehole would be required to provide sufficient characterisation of the London Clay Formation at greater depth.

5.2 Retaining Wall Parameters

The walls to the pool structure should be designed to resist any earth pressures generated by the surrounding ground and surcharge loads, for example adjacent foundations. The earth pressures can be calculated using the following soil parameters which are quoted in terms of effective stress and, therefore, reflect the long-term conditions.

Table 2 - Retaining Wall Design

Soil Parameter	Effective Cohesion c' kPa	Effective Angle of Friction ϕ'	Soil Density kg/cum
Made Ground	0	20	1800
Terrace Gravels	0	32	1900
London Clay Formation	0	25	2000

5.3 Heave

The depth of the proposed pool is not known. The reduction in overburden loading as a consequence of the pool construction could result in long-term heave, which will need to be catered for in the design of the pool, possibly in the form of either ground anchors or tension piles. This measure will also overcome potential problems relating to hydrostatic uplift, which will be particularly pronounced when the pool is left empty for extended periods, for example, during maintenance.

5.4 Stability of Excavations

It is evident that support will have to be given to the surrounding ground for the construction of the proposed pool. This support may be provided by some form of strutted cofferdam, which will be constructed in order to give clearer access to the construction works. The decision as to whether temporary works in the form of sheet piles or permanent installation, comprising contiguous or secant bored cast in situ piled walls, lies outside the scope of this report. This decision will be dependent upon economic considerations as well as the type of piling method adopted and the design philosophy of the contractor. It is likely that a deep borehole will have to be constructed in order to provide information for the design of any retaining structure.

Excavations of less than 0.60m depth should not require temporary support to their sides. However, as excavations are likely to be extended below this level, adequate temporary support or shoring should be provided in order to comply with current statutory safety regulations and to maintain the stability of the excavation sides.

5.5 Groundwater

The observations made at the time of the fieldworks imply that a high groundwater table is present beneath this site. This will necessitate some form of dewatering and given the granular nature of the upper strata, it may be feasible to employ a system of wellpointing to achieve the excavation and construction of the swimming pool under dry conditions. Care will need to be taken to ensure that fines are not washed from the granular soils. The advice of

specialist dewatering contractors should be sought in this regard. The pool structure will also need to be constructed as a water-tight element.

The cohesive soils revealed in this investigation are susceptible to rapid softening in the unconfined state. Where excavations are to be left open for extended periods then the bases should be blinded using leanmix concrete following final trimming to prevent deterioration of the founding medium.

5.6 Drainage

The near surface drainage characteristics of the underlying soils have not been considered. The presence of groundwater and London Clay Formation at depth, which is of negligible permeability, would be an unsuitable drainage medium and alternative means of surface water disposal should be explored.

5.7 Ground Floor Slabs

The thickness of made ground revealed by this investigation, commonly in excess of 0.60m, infers that a system of fully suspended floor slabs should be incorporated within the proposed structure in accordance with NHBC criteria. The earlier comments regarding heave and uplift will need to be taken into account for the pool slab and should be suitably reinforced.

5.8 Buried Concrete

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1, 2005 Edition, Concrete in Aggressive Ground. Using the information in Table C1 (natural ground) of this publication the Aggressive Chemical Environment for Concrete Classification (ACEC) is AC-1, which coincides with a Design Sulphate Class DS-1. It would be prudent to consider an increased Design Sulphate Class DS-2 due the propensity for selenite and sulphate to be present within the weathered London Clay. The ACEC Class above can be used to determine the Design Chemical Class for concrete for general cast-in-situ use as required in Part D of the Digest.

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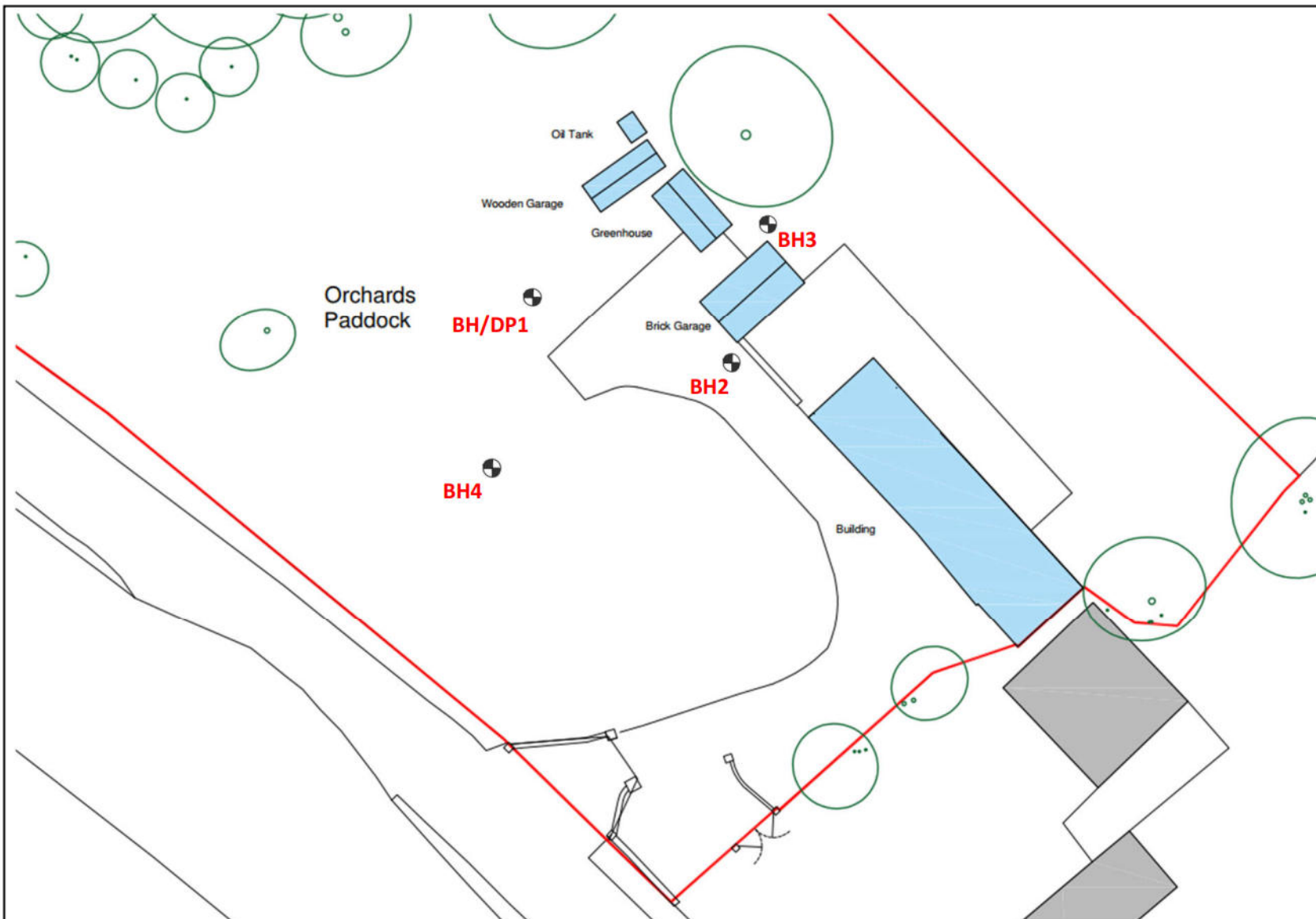
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LIST OF ABBREVIATIONS

AOD	-	Above Ordnance Datum
ACM	-	Asbestos-containing Material
AST	-	Above-ground Storage Tank
BGS	-	British Geological Survey
BH	-	Borehole
BRE	-	Building Research Establishment
BSI	-	British Standards Institution
BS	-	British Standard
C4SL	-	Category Four Screening Level
CIRIA	-	Construction Industry Research and Information Association
CP	-	Cable Percussive
DPH	-	Dynamic Probing Heavy
DPSH	-	Dynamic Probing Super Heavy
EA	-	Environment Agency
GAC	-	Generic Assessment Criteria
LL	-	Liquid Limit
mAOD	-	Metres Above Ordnance Datum
mBGL	-	Metres Below Ground Level
mOD	-	Metres Ordnance Datum
OS	-	Ordnance Survey
PAH	-	Polycyclic Aromatic Hydrocarbons
PCB	-	Polychlorinated Biphenyl
PID	-	Photo Ionisation Detector
PL	-	Plastic Limit
PSD	-	Particle Size Distribution
SGV	-	Soil Guideline Value
SOM	-	Soil Organic Matter
SPT	-	Standard Penetration Test
SPZ	-	Source Protection Zone
SVOC	-	Semi-volatile Organic Compounds
TPH	-	Total Petroleum Hydrocarbon
UST	-	Underground Storage Tank
UXB	-	Unexploded Bombs
UXO	-	Unexploded Ordnance
VOC	-	Volatile Organic Compound

FIGURE 1

SITE LAYOUT PLAN



Legend:

-  Borehole Location
-  Site Boundary

Title: Site Plan

Dwg No: 26/13364/1

Drawn by: GO

Client: Christopher Dering

Contract: Basingstoke Rd,
Swallowfield

Job Ref: 26/13364/GO

Scale: NTS

Revision: 0

Issue Date: 17/04/2026



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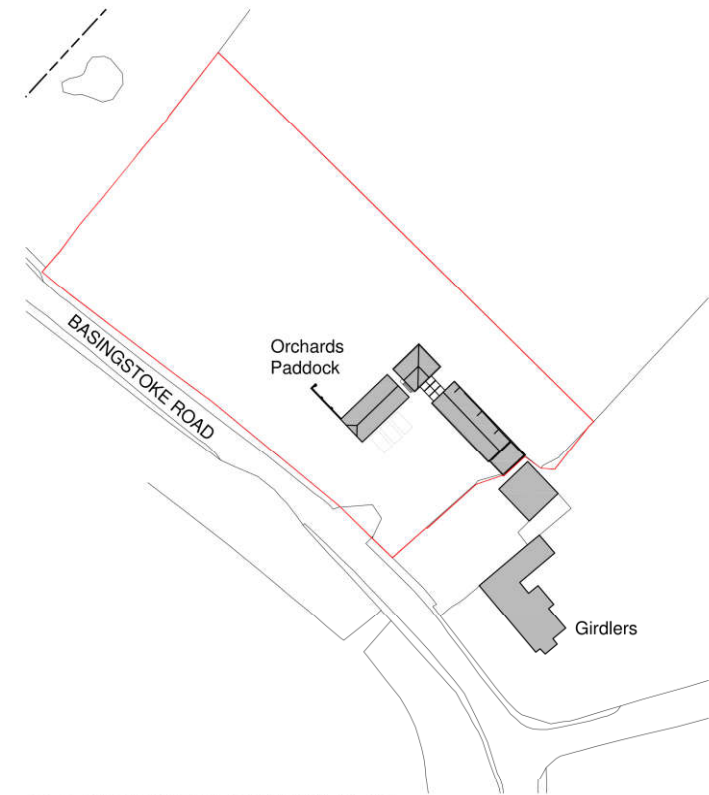
FIGURE 2

PROPOSED LAYOUT PLAN



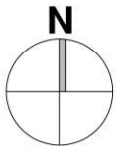
01 PROPOSED BLOCK PLAN
1:500

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02 PROPOSED LOCATION PLAN
1:1250

Application site



revision/date	note
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project
**Orchards Paddock,
Swallowfield**

title
**Proposed Site Location
Plan and Block Plan**

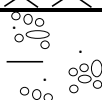
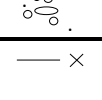
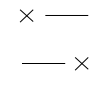
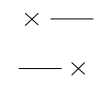
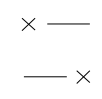
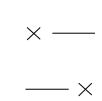
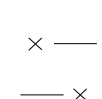
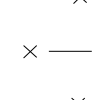
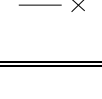
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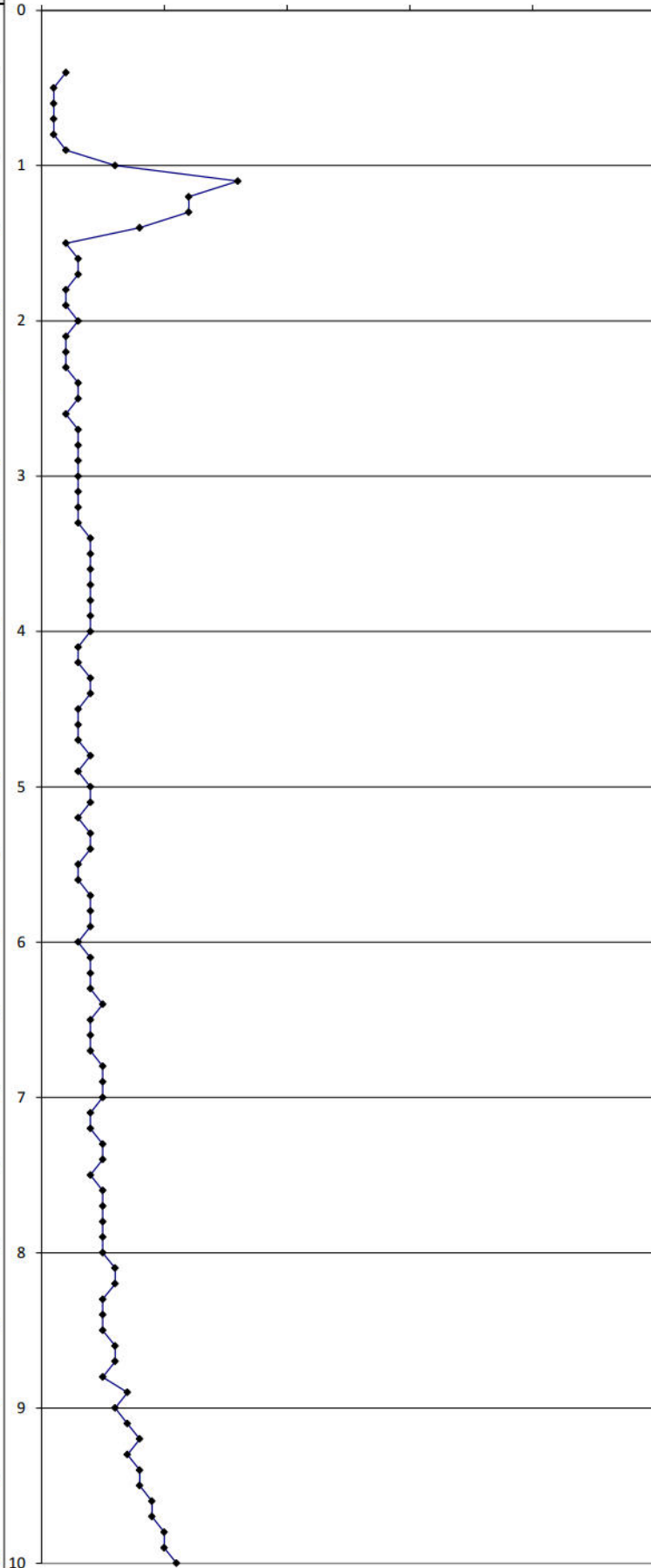
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APPENDIX 1

EXPLORATORY RECORDS

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH www.alburysi.co.uk				BOREHOLE	1
CONTRACT		Basingstoke Road, Swallowfield		Report Ref	26/13364/GO
Client		Christopher Dering		Date	20/03/2026
Site Address		Orchards Paddock, Basingstoke Road, Swallowfield, Reading, Berkshire RG7 1PT		Ground Level	
Water Strikes (m)		Type & Dimensions		Ease of excavation (m)	
1. 0.80		Drive-in Window Sampler		Very easy: Difficult: 0.80 - 4.00	
2.		60mm to 50mm diameter		Moderate: GL - 0.80 Very hard:	
Water level observed upon completion (m): 0.90				Technician: KM	
Remarks DPH dynamic probe performed adjacent to position					
Samples or tests		Shear Strength (kPa)	Depth	Legend	Strata Description
Type	Depth (m)				
D	0.10		0.40		Grass over MADE GROUND (dark brown slightly gravelly silty SAND with occasional fine roots. Gravel of flint and brick fragments with traces of charcoal)
D	0.30				
D	0.50				
		70	0.80		MADE GROUND (brown gravelly very sandy CLAY with traces of fine brick. Gravel of flint)
D	1.00				
					
D	1.50	75	1.30		Medium dense brown clayey SAND and flint GRAVEL
					
D	2.00				
					
D	2.50				
					
D	3.00				
					
D	3.50				
					
D	4.00		4.10		END OF BOREHOLE

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		Report Ref	26/13364/GO	DYNAMIC PROBE	1			
Sheet 1 of 1		Client	Christopher Dering		Date	20/03/2026		
DPH Dynamic Probe		Contract	Basingstoke Road, Swallowfield		Ground Level			
Sacrificial Tip						Torque, Nm		
Depth, m	Blows / 100 mm							
GL		0	10	20	30	40	50	
								
1	1							0
2	2							10
3	3							20
4	4							20
5	5							20
6	6							25
7	7							30
8	8							40
9	9							55
10	10							60
11	11							
Remarks		Probing commenced from base of hand excavated starter pit						

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH www.alburysi.co.uk				BOREHOLE		2			
CONTRACT		Basingstoke Road, Swallowfield				Report Ref		26/13364/GO	
Client		Christopher Dering				Date		20/03/2026	
Site Address		Orchards Paddock, Basingstoke Road, Swallowfield, Reading, Berkshire RG7 1PT				Ground Level			
Water Strikes (m)		Type & Dimensions		Ease of excavation (m)					
1. 0.90		Drive-in Window Sampler		Very easy: Difficult: GL - 1.40					
2.		60mm to 50mm diameter		Moderate: 1.40 - 3.10 Very hard:					
Water level observed upon completion (m):				0.85		Technician: EK			
Remarks									
Samples or tests		Shear Strength (kPa)	Depth		Legend	Strata Description			
Type	Depth (m)								
D	0.10					Shingle over MADE GROUND (dark brown slightly gravelly silty SAND. Gravel of flint and brick fragments)			
D	0.30		0.20						
D	0.50					MADE GROUND (dark brown silty SAND and flint GRAVEL with brick fragments)			
D	0.75		0.70						
D	1.00					Brown gravelly sandy CLAY with occasional roots and rare clinker fragment in the upper margins, becoming brown and grey very gravelly at depth (possible disturbed or MADE GROUND)			
D	1.50		1.70						
D	2.00		2.20			Brown silty SAND and flint GRAVEL			
D	2.50								
D	3.00		3.10			Brown and grey silty CLAY with rare pockets of shell remains at depth			
						END OF BOREHOLE			

Symbol Code: **B** - Large Disturbed **D** - Small Disturbed **W** - Water Sample **R** - Root Sample **HSV** - Hand Shear Vane **PID** - Photo Ionisation Detector

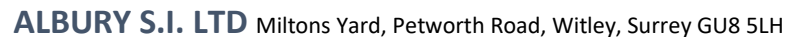
APPENDIX 2

LABORATORY TEST RESULTS

BS 1377 : Part 2 and BS EN ISO 17892: Part 1 and Part 12: 5.3 and 6.1

BH No.	Sample		Water Content W %	Liquid Limit W _L %	Plastic Limit W _p %	Plasticity Index IP %	Passing 425 μm Sieve %	Modified Plasticity Index IP _c %	Atterberg Classification	NHBC Classification VCP	Sample Preparation	Remarks
	Depth m	Description										
1	1.50	Brown and grey silty CLAY	28.2	63	25	38	100	38	CH	Medium	A	
	2.00	Brown silty CLAY with occasional partings of orange fine sand and silt	26.9									
	2.50	Brown silty CLAY with occasional partings of orange fine sand and silt	32.7									
	3.00	Brown silty CLAY with traces of selenite	29.7									
2	1.00	Brown gravelly sandy CLAY with occasional roots and rare clinker fragment (possible MADE GROUND)	17.8	29	15	14	74	10	CL	Low	S	
	2.50	Brown and grey silty CLAY	29.0									
	3.00	Brown and grey silty CLAY with pocket of shell remains	30.3									
3	1.00	MADE GROUND (dark brown slightly organic gravelly clayey SAND with rare brick fragments and roots. Gravel of flint)	39.0	32	20	12	76	9	CL	Non-shrinkable	S	
	1.50	MADE GROUND (brown/grey very gravelly sandy CLAY with occasional fine roots and rare glass fragment. Gravel of flint)	24.4	46	20	26	52	14	CI	Low	S	
	2.00	Brown and grey silty CLAY with root remains and traces of selenite	30.4	68	26	42	100	42	CH	High	A	
	2.50	Brown and grey silty CLAY with traces of selenite	30.4									

KEY:	Soil Type:	C - Clay	M - Silt	O - Organic	NP - Non Plastic
	Plasticity:	L - Low	I - Intermediate	H - High	V - Very High E - Extremely High
	Sample Preparation:	A - As Received	H - Particles >425µm removed by hand picking	S - Particles >425µm removed by washing and wet sieving with oven drying	



INDEX PROPERTIES AND WATER CONTENTS

BS 1377 : Part 2 and BS EN ISO 17892: Part 1 and Part 12: 5.3 and 6.1

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BH No.	Sample		Water Content W %	Liquid Limit W _L %	Plastic Limit W _p %	Plasticity Index IP %	Passing 425 µm Sieve %	Modified Plasticity Index IP _c %	Atterberg Classification	NHBC Classification VCP	Sample Preparation	Remarks
	Depth m	Description										
3	3.00	Brown and grey silty CLAY with rare root remain	32.3									
4	1.50	Brown and grey silty CLAY	26.8	65	25	40	100	40	CH	High	A	
	2.00	Brown and grey silty CLAY with some root remains	29.1									
	2.50	Brown silty CLAY with occasional partings of orangish brown fine sand	31.0									
	3.00	Brown silty CLAY with occasional partings of yellowish brown fine sand	28.3									

Liquid Limit determined by one-point fall cone method using 80g 30° cone and correction factors after Clayton and Jukes (1978) unless otherwise stated above

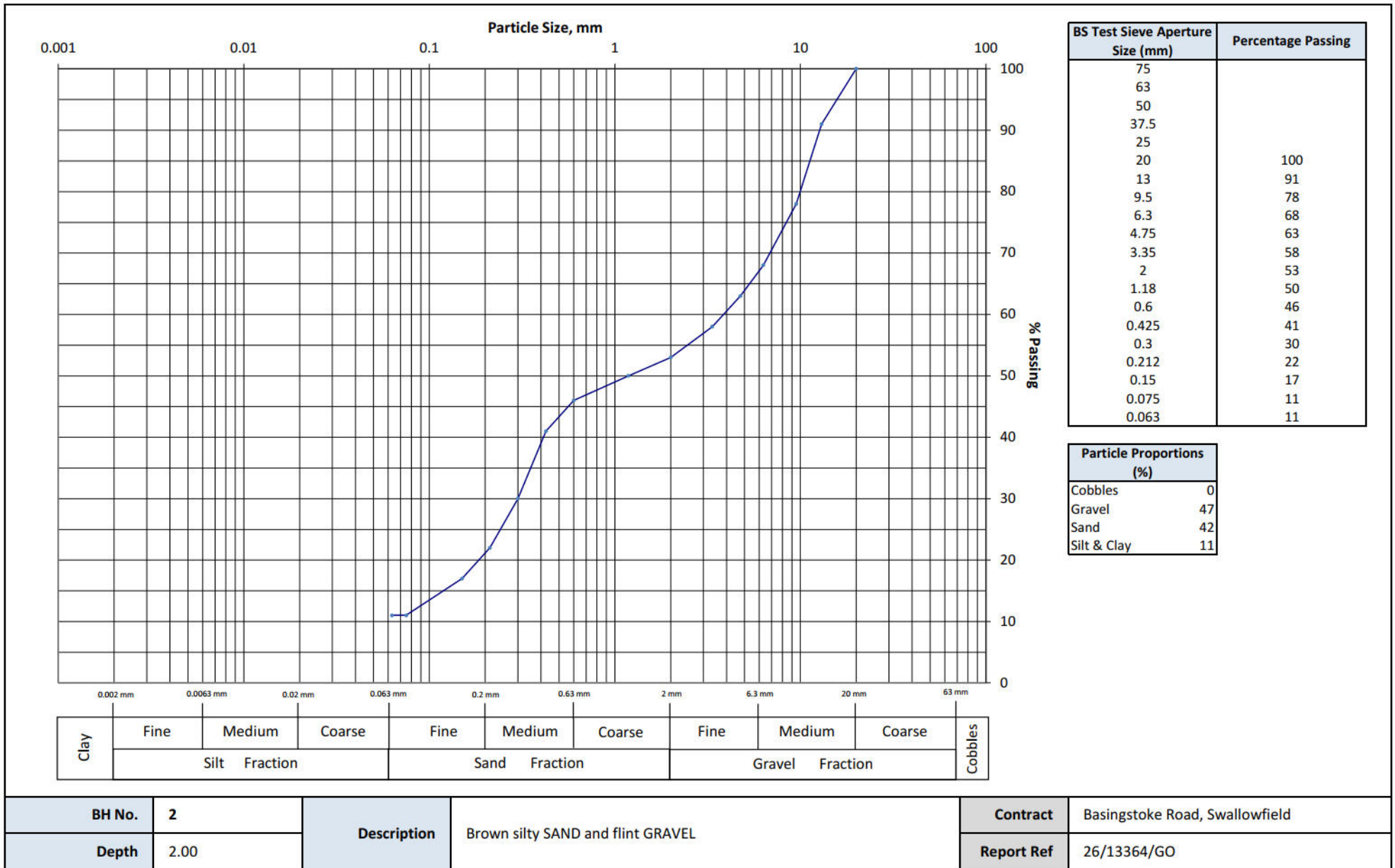
KEY: Soil Type: **C** - Clay **M** - Silt **O** - Organic **NP** - Non Plastic
 Plasticity: **L** - Low **I** - Intermediate **H** - High **V** - Very High **E** - Extremely High
 Sample Preparation: **A** - As Received **H** - Particles >425µm removed by hand picking **S** - Particles >425µm removed by washing and wet sieving with oven drying



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PARTICLE SIZE DISTRIBUTION

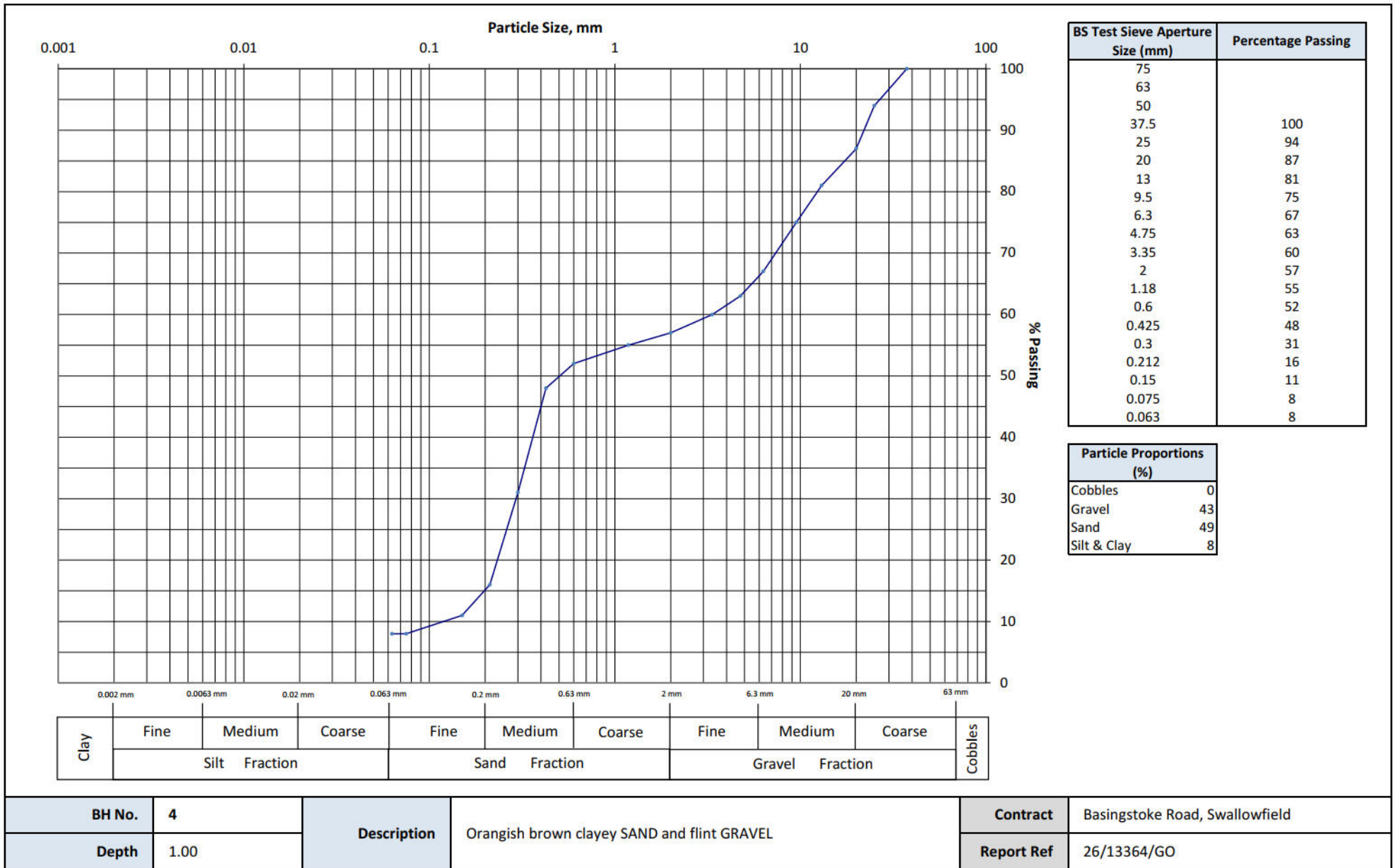
BS EN ISO 17892 : Part 4 : Clause 5.2 Wet Sieving Method



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PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892 : Part 4 : Clause 5.2 Wet Sieving Method



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APPENDIX 3

DESICCATION

DESICCATION

Classification

The removal of moisture from a soil as a result of external influences with a constant stress regime, results in shrinkage or settlement of the soil. The magnitude of shrinkage is dependent upon the geological stress history of the soil, its clay content and the composition of the clay minerals. Under normal climatic conditions, there is a seasonal cyclic variation in soil moisture and, hence, volume change, which extends to depths of approximately 1m. When the soil moisture deficit attains a critical value, the shrinkage of the soil can become significant. In these circumstances, the soil can be regarded as being present in a desiccated state.

Causes

A common cause of desiccation consists of the reduction in soil moisture by tree root action. In the absence of a water table at shallow depth, root action of trees will reduce the soil moisture level in order to maintain growth. In general terms, the increase in rainfall which occurs during winter periods will allow for some replacement of the moisture content of the soil, particularly where isolated or immature trees are concerned.

However, when drought summer conditions or limited winter rainfall occurs, desiccated zones will develop within the zone of influence of tree roots. In woodland, desiccation develops as it is not possible for rainfall to overcome the soil moisture deficit. Other causes of desiccation, which have created problems to structures, include incorrectly installed and insulated heating pipes or ducts and industrial processes, ie furnaces or brick kilns.

Effects

The development of desiccation in clay soils will result in an increase in strength of the material. In addition, negative pore water pressure or soil suction will develop. Any foundation system located within soil which is subject to a reduction in soil moisture can experience structural distress, which results from the loss in volume or shrinkage of the ground. Also, if the source of the desiccation is removed, there will be heave of the soils as a result of an increase in equilibrium water content

It is evident, therefore, that foundation systems founded in soils which are actively experiencing an increase or decrease in soil moisture, will be subject to either heave or settlement, which can induce stresses within the structure. It should also be appreciated that a desiccated soil, which is experiencing an increase in equilibrium water content, will attempt to increase its volume in a horizontal as well as vertical plane. It is important, therefore, to ensure that horizontal movements do not apply differential stresses to structural elements, by incorporating collapsible membranes within remedial works.

Identification

A soil in a state of equilibrium is present in a semi-solid state. At the onset of desiccation, the condition of the soil moves towards the boundary between a solid and semi-solid state, this boundary being defined as the plastic limit of the soil. It follows, therefore, that when the natural water content of a soil lies close to, or falls below, the value of the plastic limit, the soil can be considered to be desiccated.

An alternative proposal was made by Driscoll (1983), who related the soil suction induced by desiccation to a function of the liquid limit of the soil. In general terms, desiccation is assumed to be present when the moisture content falls below a level of 40% liquid limit. The arbitrary factor of 0.4 relates to a soil suction value proposed by Croney (1977) and may vary with the composition and mineralogy of different soil types. This approach is only considered to be valid over a limited depth range as the overburden effect will result in a natural reduction in soil moisture and result in the development of negative pore pressures.

A further approach, which considers the shear strength of the clay, Pugh et al (1995), recognises the fact that a reduction in soil moisture will result in an increase in undrained shear strength as well as the development of negative pore pressures. Whilst this approach has a considerable amount of merit, care is required in establishing the value of the soil's in situ shear strength, particularly if it is not possible to obtain representative "undisturbed" samples from cable percussion boreholes. The proposal made in the Pugh paper that the simple pocket penetrometer will provide accurate consistent results should be treated with care, as the pocket penetrometer can take no account of the effects of disturbance and remoulding that are inevitable when completing a trial pit with a mechanical excavator. It is for this reason that this Company attempts to establish the shear strength of clay soils by using the Geonor Field Vane. With this test equipment the appropriate-sized vane is pushed into the side of the pit, through the thin disturbed zone which is caused by the teeth of the bucket during excavation. Furthermore, by use of the 'blank' probe, it is possible to take account of any skin friction which builds up on the shaft of the vane and thus provide a more accurate assessment of the shear strength of the soils.

Hence, a combination of the methods discussed above should be considered in order to confirm whether the development of soil moisture reduction to achieve a desiccated state has occurred within a particular site. The data for affected areas should, where possible, be compared with soils which lie outside the influence of tree root bulbs and may, therefore, be considered to be present in a stable and equilibrium state.

References

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|--|---|
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