

RIDGE

PROPERTY & CONSTRUCTION CONSULTANTS



GROUND CONDITION ASSESSMENT (STAGE 1), DUNSBURY HILL FARM, HAVANT

May 2017

Prepared for

BAM Construction Ltd

Centrium,
Griffiths Way,
St Albans,
Herts,
AL1 2RD

Prepared by

Ridge and Partners LLP

Partnership House,
Moorside Road,
Winchester,
Hampshire,
SO23 7RX

Tel: 01962 834400

VERSION CONTROL

Project Name Dunsbury Hill Farm, Havant – GCA (Stage 1)

Project No. 5002713

Report No. 5002713-815-01

Desk Top Study	
Prepared by: David Pethica – Engineer	Reviewed by: Antony Platt – Technical Associate
Factual Report	
Prepared by: David Pethica – Engineer	Reviewed by: Antony Platt – Technical Associate
Generic Quantitative Risk Assessment	
Prepared by: Antony Platt – Technical Associate	Review  Rasmus Palmgren – Associate I am approving this document 2017.05.23 09:36:41 +01'00'
Geotechnical Design Report	
Prepared by: David Fall – Geotechnical and Environmental Consulting Ltd	Reviewed by: Rasmus Palmgren – Associate  Rasmus Palmgren I am approving this document 2017.05.23 09:36:17 +01'00'

VERSION	DATE	DESCRIPTION	CREATED BY	APPROVED BY
1.0	22.05.2017	Ground Condition Assessment	 A Platt 2017.05.23 10:05:40 +01'00'	

CONTENTS

CONTENTS	3
1. INTRODUCTION	8
1.1. Introduction.....	8
1.2. Legal Context	8
1.3. Methodology.....	9
1.3.1. Pollutant Linkage Concept.....	9
1.3.2. Conceptual Model.....	10
1.3.3. Risk Assessment.....	10
1.4. Proposed Use.....	10
1.5. Report Scope and Limitation	10
2. HAZARD IDENTIFICATION	12
2.1. Site Location and Description	12
2.2. Site History	12
2.3. Documented Ground Conditions.....	13
2.3.1. Geology.....	13
2.3.2. Hydrogeology	13
2.3.3. Hydrology	14
2.3.4. Radon.....	14
2.4. Environmental Data Search.....	15
2.5. Department of Environment – Industry Profiles.....	15
2.6. Previous Reports Reviewed	16
2.7. Conclusions of Preliminary Risk Assessment	16
3. FIELDWORK SUMMARY OF SCOPE AND RATIONALE.....	17
3.1. Rationale and Summary of Scope	17
3.2. Sampling	17
3.3. Monitoring.....	17
3.4. Site Investigation Standards	17

4. GROUND CONDITIONS ENCOUNTERED	18
4.1. Soil Conditions	18
4.1.1. Surfacing	20
4.1.2. Made Ground	21
4.1.3. Topsoil and Subsoil	21
4.1.4. Head Deposits	21
4.1.5. Bognor Sand Member.....	21
4.1.6. London Clay Formation	22
4.2. Obstructions	22
4.3. Groundwater Conditions	22
4.4. Visual/Olfactory Evidence of Contamination	22
5. GENERIC RISK ASSESSMENT	23
5.1. Contamination Assessment Methodology	23
5.1.1. Soils	23
5.1.2. Assessment framework	24
5.1.3. Ground Gas	24
5.2. Soil Assessment	24
5.2.1. General	24
5.2.2. Heavy metals.....	25
5.2.3. Petroleum hydrocarbons.....	25
5.2.4. Polyaromatic hydrocarbons (PAHs)	25
5.2.5. BTEX compounds and MTBE	25
5.2.6. Inorganics.....	26
5.3. Statistical Analysis.....	26
5.4. Ground Gas Assessment.....	26
6. CONCEPTUAL SITE MODEL	28
6.1. Sources	28
6.1.1. On-site – Historic and Current	28

6.1.2. Off-site – Historic and Current	28
6.2. Pathways.....	28
6.2.1. Indirect	28
6.2.2. Direct.....	28
6.3. Receptors.....	28
6.3.1. Human.....	28
6.3.2. Environmental	28
7. RISK ASSESSMENT.....	29
7.1. Risk Assessment Procedure.....	29
7.2. Pollutant Linkage Assessment.....	31
7.2.1. Asbestos in Made Ground	31
7.2.2. Ground Gas from adjacent former inert landfill, Made Ground and natural soil	32
8. GEOTECHNICAL ASSESSMENT.....	33
8.1. Introduction.....	33
8.2. Geotechnical Tests.....	33
8.3. Geotechnical and Geological Parameters.....	33
8.3.1. Topsoil / Subsoil	34
8.3.2. Made Ground	34
8.3.3. Head Deposits	34
8.3.4. Bognor Sand Member.....	38
8.3.5. London Clay	41
8.4. Aggressive Ground Soil Chemistry	52
8.5. Characteristic Geotechnical Parameters.....	55
9. PRELIMINARY FOUNDATION AND GROUND ENGINEERING OPTIONS.....	57
9.1. Introduction.....	57
9.2. Shallow Foundations	58
10. CONCLUSIONS AND RECOMMENDATIONS	66
10.1. Contamination	66

10.2. Geotechnical	66
10.2.1. Retaining Walls.....	67
10.2.2. Concrete Aggressivity.....	68
FIGURE 1 – SITE LOCATION PLAN	69
FIGURE 2 – INVESTIGATION LOCATION PLAN	70
FIGURES 3 – 7 – CROSS SECTIONS.....	71
FIGURES 8 - 9 – SPT N VS DEPTH / ELEVATION – HEAD DEPOSITS.....	72
FIGURES 10 - 11 – CONSISTENCY LIMITS V DEPTH / ELEVATION – HEAD DEPOSITS.....	73
FIGURES 12 - 13 – UNDRAINED SHEAR STRENGTH V DEPTH / ELEVATION – HEAD DEPOSITS.....	74
FIGURES 14 – 15 – SPT N V DEPTH / ELEVATION – BPGNOR SAND MEMBER.....	75
FIGURES 16 – 17 – SPT N V DEPTH / ELEVATION – LONDON CLAY	76
FIGURES 18 -21 – CONSISTENCY LIMITS V DEPTH / ELEVATION – LONDON CLAY	77
FIGURES 22 – 23 – UNDRAINED SHEAR STRENGTH – LONDON CLAY FORMATION	78
FIGURE 24 – EFFECTIVE SHEAR STRENGTH FAILURE ENVELOPE – LONDON CLAY FORMATION	79
FIGURE 25 – COEFFICIENT OF VOLUME COMPRESSIBILITY V DEPTH - LONDON CLAY FORMATION	80
APPENDIX 1 – REPORT CONDITIONS	81
APPENDIX 2 – ENGINEERING LOGS	83
APPENDIX 3 – GENERIC ASSESSMENT CRITERIA.....	84
APPENDIX 4 – SOIL, LEACHATE AND WATER SCREENING SUMMARIES.....	85
APPENDIX 5 – CHEMICAL ANALYSIS RESULTS	86
APPENDIX 6 – MONITORING RECORDS	87
APPENDIX 7 – GEOTECHNIAL TEST CERTIFICATES	88
APPENDIX 8 – ULS BEARING RESISTANCE CALCULATIONS.....	89
APPENDIX 9 – AXIAL PILE CAPACITY WORKSHEETS.....	90
APPENDIX 10 – RETAINING WALL WORKSHEETS.....	91

1. INTRODUCTION

1.1. Introduction

Ridge and Partners LLP (Ridge) was commissioned by Bam Construction Ltd in February 2017 to undertake a Ground Condition Assessment of a site between Havant and Waterlooville known as Dunsbury Hill Farm, Havant, Hampshire PO9 4EE. .

The brief was to undertake a site investigation and assessment to identify any ground contamination or geotechnical issues that may affect the proposed development. This report provides an assessment of the identified and potential ground conditions of the site, with regard to the proposed works in accordance with the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency. In addition, the geotechnical sections of this report provide a detailed assessment of the materials present beneath the site and present characteristic parameters that should be used in design of all geotechnical facets of the proposed development.

This report is prepared in line with the agreed brief and is subject to the report conditions shown in Appendix 1.

1.2. Legal Context

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

The guidance defines "risk" as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

While Part IIA of the Environmental Protection Act provides a risk based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment, the regime does not take into account future uses. New developments are therefore controlled by the planning regime, with reference to the National Planning Policy Framework (NPPF), rather than directly by Part IIA of the Environmental Protection Act.

The NPPF is based on the principal that the site should be suitable for its new use, taking account of ground conditions, including from natural hazards or former activities and states that “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”. The NPPF also links the planning and Part IIA regimes by stating that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Key components of the Part IIA regime, such as the definition of Contaminated Land and the associated risk based assessment approach, are therefore considered to also be applicable to the planning regime.

1.3. Methodology

This report has been prepared in accordance with published Environment Agency guidance (‘Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR) 11’). CLR 11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment).

1.3.1. Pollutant Linkage Concept

In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage.

1.3.2. Conceptual Model

An important thread throughout the overall process of risk assessment is the need to formulate and develop a conceptual model for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

1.3.3. Risk Assessment

CLR 11 advocates a phased approach to risk assessment comprising the following in order, as necessary:

Preliminary Risk Assessment – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

Generic Quantitative Risk Assessment (GQRA) - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

Detailed Quantitative Risk Assessment (DQRA) - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

This document constitutes a Preliminary and Generic Quantitative Risk Assessment and a Geotechnical Design Report.

1.4. Proposed Use

It is understood that the site is proposed for development as a number of large industrial units, a hotel and restaurant facility with associated infrastructure, parking and loading bays and soft landscaping. A change in the site use from that currently proposed may result in the need for re-assessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

1.5. Report Scope and Limitation

This report is based upon a review of readily available historical and current information and the recent site investigation data detailed herein. The report presents an interpretation of the borehole and laboratory data provided by the Ridge site investigation undertaken between the 14th February and 27th March 2017. In addition, this report outlines the basic ground conditions encountered in the exploratory holes and the results of any monitoring of ground installations.

This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks for the proposed development.

The recommendations and opinions expressed in this report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. Ridge takes no responsibility for conditions that have not been revealed by the exploratory holes, or which occur between them.

Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and Ridge cannot guarantee its accuracy.

The information contained in this report is intended for the use of Bam Construction Ltd and Ridge can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2. HAZARD IDENTIFICATION

2.1. Site Location and Description

The site is located to the north east of the A3M junction 3, between Waterlooville and Havant, in South Hampshire and is centred on grid reference 469972, 109178. The site is of an irregular shape, occupying an area of approximately 17.3ha, with a topographic fall from ~40mAOD in the north of the site to ~18mAOD in the south of the site over ~700m distance. At the time of reporting the site is largely undeveloped former arable farm land, divided by lines of vegetation and hedgerow dotted with mature trees and surface water courses in the form of field drains. The site is divided by a recently constructed road running east west, to serve the site once developed and the already completed industrial unit to the south of the site. A number of stockpiles are located either side of the road containing material believed to have been imported to site and site strip material associated with the recently completed unit.

The northern site boundary is denoted by a line of mature trees and vegetation separating the site from an area of fallow land. To the east the site limit is defined by a line of vegetation separating the site from Park Lane bridleway, beyond which lies fallow land in the north and an area of residential estate in the south. The southern limit of the site is defined by vegetation and mature trees forming an area of woodland. To the west of the site lies a band of woodland and vegetation separating the site from the A3M and Hulbert Road public highway.

At the time of investigation the site offices and welfare facilities were located around the roundabout on the road crossing the site. Herras fencing had been erected around the central portion of the site. The site is crossed north to south in the east of the site by an underground high pressure gas main marked by several posts and notices, a 132kV overhead power line with a steel pylon base located just to the north of the road and a 33kV overhead power line with wooden poles located across the site. A 33kV overhead power line and associated wooden poles also run east west across the north of the site. All service standoffs were marked and access and egress routes set out by the client prior to commencement of investigations.

2.2. Site History

The Ordnance Survey maps provided and reviewed from 1859 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) indicate that the site was undeveloped in 1859, appearing to be divided into a number of fields, surrounded by woodland to the west and other fields and Middle Parks Farm to the east, with a linear feature representing Park Lane running down the eastern border.

The 132kV power line route is apparent in map extracts from the late 1960s onwards. The A3M is apparent from 1980 onwards, with a stream running directly to the south of the site known as the Hermitage Stream rerouted slightly to avoid junction 3 of the A3M. To the east a proportion of the residential estate appears developed by 1960, with further development appearing on map extracts from 1975. Prospect school located to the south east of the site is present in map extracts from 2010 onwards. The large expanse of woodland present in historic mapping, to the west of the site gradually sees development of Waterlooville filling up to the A3M through the late 70s to 90s, when it represents its present state.

Dunsbury Hill Farm buildings are present in map extracts up until the 1990s, some 150m to the north of the site limits, becoming an outline of a structure in 2002 map extracts.

Historic listings of potentially contaminative land uses include a brick and tile works located to the south of the Hermitage Stream dated 1866 and the cuttings associated with the A3M construction. Additionally, it is identified that an electrical substation is located 300m to the east of the site centre dated 1970-1985.

Potentially infilled land records include the area of cuttings, the brick and tile works and a number of pond features around the Dunsbury Hill Farm with records dating from 1866 to 1991.

2.3. Documented Ground Conditions

Ground conditions recorded in readily available sources are summarised below.

2.3.1. Geology

Reference to the British Geological Survey (BGS) Map (See Desk Study Appendix 2) indicates the site to overlie superficial deposits of Head (Clay, Silt, Sand and Gravel) across some of the site overlying bedrock geology of Bognor Sand Member (Sand) which in turn overlies the parent unit of London Clay Formation (Clay, Silt and Sand).

2.3.2. Hydrogeology

The Environment Agency Groundwater Vulnerability Map (See Desk Study Appendix 2) indicates that the site is underlain in part by superficial Secondary Aquifer – Undifferentiated Layers, interpreted as the Head Deposits. The site overlies a bedrock Secondary (A) Aquifer – Permeable Layers, interpreted as the Bognor Sand Member, which in turn overlies an Unproductive Stratum, interpreted as the London Clay Formation.

Secondary Undifferentiated Aquifers has been assigned in cases where it has not been possible to attribute either category A or B rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Secondary (A) Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Unproductive strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

The site does lie within an unconfined aquifer groundwater source protection zone (SPZ). A Source Protection Zone 1 – Inner Catchment SPZ within confined aquifer lies across the entirety of the site. It is assumed that the confined aquifer relates to the Chalk strata underlying the London Clay Formation.

2.3.3. Hydrology

A number of surface water drainage features are located along the field boundaries, running north to south across the site, these are not presented in hydrological records. A drain running along the eastern periphery of the recently constructed industrial unit is identified on site. The Hermitage Stream, identified as a Primary River, is located directly to the south of the site running west to east.

2.3.4. Radon

Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building.

National Radiological Protection Board data presented within the Groundsure Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is less than 1%. Therefore the British Geological Survey recommends that no radon protective measures are necessary in the construction of new dwellings or extensions.

2.4. Environmental Data Search

A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in the following sections. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1: Data search results

Discharge consents	There are no recorded discharge consents within 250m of the site.
Pollution incidents	There is 1no recorded pollution incident with significant impact to water and minor impact to land and air within 250m of the site, relating to crude sewage immediately to the south of the Hermitage Stream.
Water abstractions	There are no recorded groundwater abstractions within 1000m of the site.
Fuel stations	There are no recorded fuel stations within 250m of the site.
Landfill sites	There is 1no recorded historic landfill site within 500m of the site. An Inert landfill was located at Dunsbury Hill Farm, with waste indicated to have been placed directly to the north east of Park Lane, adjacent to the north east of the site.

The site is located in an area which may not be affected by mining.

The following ground hazards were identified:

- Compressible ground stability hazards – Negligible hazard
- Collapsible ground stability hazards – Very Low hazard
- Ground dissolution stability hazards –Negligible hazard
- Landslide ground stability hazard – Very Low hazard
- Shrinking or swelling clay ground stability hazard – Negligible hazard
- Running sand ground stability hazards – Low hazard

2.5. Department of Environment – Industry Profiles

The Department of Environment Industry Profiles do not cover the known existing or historic land uses for the site.

2.6. Previous Reports Reviewed

Three reports relating to the site and wider area were reviewed:

- Factual Report on Ground Investigation at Dunsbury Hill Farm for Portsmouth City Council. Produced by ESG in August 2011.
- Geotechnical Design Report of Dunsbury Hill Farm (Spine Road) Leigh Park Hampshire for Portsmouth City Council. Produced by Mayer Brown in February 2014.
- Geotechnical and Land Contamination Assessment of Plot 2 Dunsbury Hill Farm, Waterloooville, Havant for Bam Construction Ltd. Produced by LBH Wembley Geotechnical and Environmental in November 2015.

These reports confirmed the general geological stratigraphy identified on the BGS maps, namely localised Head deposits over Bognor Sand Member over London Clay Formation.

2.7. Conclusions of Preliminary Risk Assessment

The following potential sources of contamination were identified:

- Potential for asbestos containing material fragments associated with farm access way construction
- Potential for ground gas associated with Made Ground, off site former landfill to north east and natural soils

As such, an intrusive investigation was recommended for the site to further assess the risks and allow geotechnical characterisation of ground conditions.

3. FIELDWORK SUMMARY OF SCOPE AND RATIONALE

3.1. Rationale and Summary of Scope

Site investigation works were undertaken by Ridge between the 14th February and 27th March 2017. The scope and rationale of the ground investigation undertaken are presented below.

- 16no. windowless sample boreholes (WS) to a maximum depth of 5.00mbgl
- 19no. cable percussive boreholes (BH) to a maximum depth of 25.00mbgl
- Collection of representative samples to undergo chemical and geotechnical laboratory testing as detailed in later sections of this report.
- Installation of 19no. gas / water monitoring standpipes.

Table 3.1: Exploratory hole location rationale

Location	Rationale	Max Depth (mbgl)
BH501-BH519	19no. cable percussive boreholes positioned across the proposed development area of the site to assess the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical and geotechnical laboratory testing / analysis.	25.00
WS501-516	16no. windowless sample boreholes positioned across the site to assess the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical and geotechnical laboratory testing / analysis.	5.00

The layout of the exploratory positions is presented in Figure 2.

3.2. Sampling

Soil sampling of the near surface materials and materials anticipated to become near surface following excavations was undertaken to assess the contamination risks to human health and controlled waters. Soil samples were also taken from various depths in the boreholes for geotechnical testing purposes.

3.3. Monitoring

One ground gas and ground water monitoring round of the Ridge installed monitoring wells was undertaken on the 11th of April to provide an initial assessment of the groundwater and ground gas regime at the site. The results of the monitoring round are presented in Appendix 7.

3.4. Site Investigation Standards

Methods employed during the investigation were generally undertaken in accordance with BS10175, BS EN 1997-2 and BS5930.

4. GROUND CONDITIONS ENCOUNTERED

4.1. Soil Conditions

Ground conditions encountered during the recent ground investigation were broadly consistent with those identified in the published literature and in summary comprised a thin layer Topsoil and Subsoil or locally Made Ground overlying a sequence of Head Deposits and/or the Bognor Sand Member overlying the London Clay Formation.

Variations in stratum thicknesses are summarised in Table 4.1 below, engineering logs are presented in Appendix 3.

Table 4.1a: Summary of encountered ground conditions at Cable Percussive Borehole locations

Location	Topsoil		Made Ground		Head Deposits		Bognor Sand Member		London Clay Formation	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
BH501	GL	0.65	N/E		0.65	2.55	N/E		3.20	>21.80
BH502	GL	0.40	N/E		0.40	2.60	N/E		3.00	>22.00
BH503	GL	0.42	N/E		0.42	2.28	N/E		2.70	>17.30
BH504	GL	0.30	N/E		0.30	2.60	N/E		2.90	>17.10
BH505	GL	0.50	N/E		N/E		0.50	2.40	2.90	>22.10
BH506	GL	0.40	N/E		N/E		0.40	2.10	2.50	>22.50
BH507	GL	0.40	N/E		N/E		0.40	2.00	2.40	>17.60
BH508	GL	0.40	N/E		N/E		0.40	2.20	2.60	>17.40
BH509	GL	0.10	N/E		0.10	2.60	N/E		2.70	>17.30
BH510	GL	0.35	N/E		N/E		0.35	2.30	2.65	>17.35
BH511	GL	0.35	N/E		N/E		0.35	2.25	2.60	>17.40
BH512	N/E		GL	0.60	N/E		0.60	2.40	3.00	>17.00
BH513	N/E		GL	0.15	0.15	2.25	2.40	2.50	4.90	>15.10
BH514	N/E		GL	0.75	N/E		0.75	2.05	2.80	>17.20
BH515	GL	0.40	N/E		0.40	0.60	1.00	3.50	4.50	>15.50
BH516	GL	0.40	N/E		0.40	2.40	2.80	1.00	3.80	>16.20
BH517	N/E		GL	1.20	N/E		1.20	2.70	3.90	>16.10
BH518	GL	0.35	N/E		N/E		0.35	1.65	2.00	>18.00
BH519	N/E		GL	1.00	1.00	1.40	2.40	1.40	3.80	>16.20

NE – Not Encountered

Table 4.2b: Summary of encountered ground conditions at Window Sample Borehole locations

Location	Topsoils		Made Ground		Head Deposits		Bognor Sand Member		London Clay Formation	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
WS501	GL	0.50	N/E		0.50	2.20	N/E		2.70	>2.30
WS502	GL	0.50	N/E		0.50	>1.50	N/E		N/E	
WS502A	GL	0.50	N/E		0.50	2.00	N/E		2.50	>2.50
WS503	GL	0.40	N/E		0.40	1.80	N/E		2.20	>2.80
WS504	GL	0.45	N/E		0.45	2.05	N/E		2.50	>2.50
WS505	GL	0.32	N/E		N/E		0.32	2.13	2.45	>2.55
WS506	GL	0.35	N/E		0.35	2.55	N/E		2.90	>2.10
WS507	GL	0.35	N/E		0.35	3.50	N/E		3.85	>1.15
WS508	GL	0.40	N/E		0.40	2.70	N/E		3.10	>2.30
WS509	GL	0.32	N/E		0.32	2.38	N/E		2.70	>1.3
WS510	N/E		GL	1.70	N/E		1.70	0.80	2.50	>2.50
WS511	N/E		GL	0.80	0.80	2.40	3.20	>1.80	N/E	
WS512	N/E		GL	1.10	1.10	2.10	3.20	>0.80	N/E	
WS513	GL	0.10	N/E		0.10	1.45	1.55	>2.95	N/E	
WS514	GL	0.10	N/E		0.10	0.95	1.05	>2.95	N/E	
WS515	GL	0.20	N/E		N/E		0.20	>4.80	N/E	
WS516	GL	0.40	N/E		0.40	1.20	1.60	>3.40	N/E	

NE – Not Encountered

4.1.1. Surfacing

Surfacing was encountered in the form of loose 6F5 fill material utilised as access roads to various areas of the site. Although not encountered within intrusive investigations it should be noted that asphalt surfaced roadways and pedestrian footpaths are present running east west across the centre of the site. A thin layer of what was interpreted as flint and ash fill held together with grout or concrete was encountered in BH511 and BH512. It is understood that batching plant was present in the vicinity of these locations, historically.

4.1.2. Made Ground

Made Ground was encountered in investigation locations BH512-514, BH517, BH519 and WS510-512. Although variable in the nature generally comprised a soft to firm orange brown to grey clayey sandy gravelly silt, locally a clay with gravel component being of fine to coarse angular to sub rounded fragments of brick and locally tile, plastic, metal and asphalt chippings. Locally the Made Ground comprised materials as surfacing as detailed above. Additionally, Made Ground was noted locally as disturbed or reworked site won material. Made Ground was recorded to a maximum thickness of 1.70m at WS510. WS510 was located on an area of known stockpile or bunding. It is anticipated that Made Ground thickness is likely to greatly exceed this in areas of the site with stockpiling.

4.1.3. Topsoil and Subsoil

Topsoil or a subsoil was encountered in all investigative locations except those where Made Ground was encountered. These typically comprised a thin layer of soft brown clayey sandy silt with rootlets and locally flint gravels overlying soft brown clayey sandy gravelly silt locally with roots. These soils attained a maximum thickness of 0.65m in BH501.

4.1.4. Head Deposits

Head deposits were encountered in all locations excluding BH505-508, BH510-512, BH514, BH517, BH518, WS505, WS510 and WS515. Head Deposits generally comprised soft orange brown clayey sandy gravelly silt. Locally mottled and locally with organic material. Head Deposits we found to achieve a maximum thickness of 2.70m.

4.1.5. Bognor Sand Member

The Bognor Sand Member was encountered in locations BH505-508, BH510-519, WS505 and WS510-516. The Bognor Sand Member generally comprised an orange yellow to grey brown locally clayey silty fine sand. Encountered in the north of the site where Head Deposits were absent and in the south of the site underlying the Head Deposits and overlying the London Clay Formation, the Bognor Sand Member was recorded to a maximum thickness of at least 4.80m in WS516 and formed the basal stratum in WS502 and WS511-516.

4.1.6. London Clay Formation

The London Clay Formation was encountered in all exploratory locations except WS502 and WS511-516 and typically comprised firm to stiff silty slightly sandy to very sandy clay with occasional fossil content. Sandy clay was noted nearer to surface with less sand or sand free clay deposits recorded at depth shallowing toward the north and not encountered in many locations across the south of the site. The London Clay Formation was recorded as exceeding 22.50m at location BH506 and formed the basal stratum in all if the cable percussive boreholes and WS501-510 (except WS502).

4.2. Obstructions

Obstructions were encountered as siltstone within the London Clay Formation at various depths in the form of thin siltstone bands and pyritised nodules.

4.3. Groundwater Conditions

Groundwater, assumed to be perched, was observed within the near surface deposits within the majority of investigative locations, with water ingress at shallow depths usually noted as seepage. Confined water strikes were observed within siltstone bands in a number of locations resulting in water rising up the borehole. It is interpreted that the sandy nature of the upper horizon within the London Clay Formation and near surface deposits allows them to be connected hydraulically with greater groundwater mobility in horizons of the fractured or fissured siltstone. Boreholes to the south of the site, where sandy material was encountered to the base of locations encountered water as seepage from near surface to the termination of the location.

During the monitoring round water was present in all monitored locations, generally recorded between 0.56 and 3.29mbgl. Well installations were screened over strata that were observed to be water bearing. Terminating either at a sand/clay interface within the London Clay Formation or at or near the base of the investigative location where the less sandy horizons of the London Clay Formation were not encountered.

4.4. Visual/Olfactory Evidence of Contamination

Although no signs of contamination were observed at the time of investigation, areas of Made Ground were encountered and large stockpiles of material believed to have been imported were present on site at the time of investigation.

5. GENERIC RISK ASSESSMENT

5.1. Contamination Assessment Methodology

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, Ridge undertook an initial screen of the laboratory results using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

5.1.1. Soils

In order to assess the soil analyses results with regard to potential human health risks, Ridge has adopted the LQM/CIEH Suitable 4 Use Levels (S4ULs), generic assessment criteria (GACs) derived in accordance with the UK framework set out in the most recent CLR (Contaminated Land Report) documents using the Contaminated Land Exposure Assessment (CLEA) Model.

S4ULs have been published for an extensive suite of contaminants, with assessment criteria derived for each contaminant for four different land use scenarios namely:

- Residential with homegrown produce;
- Residential without homegrown produce
- Allotments; and
- Commercial and industrial

A full list of the GACs together with an indication of the method used for their derivation is provided in Appendix 4. Although the site is proposed for commercial/industrial use, consideration has been given to the potential for the excess material from the site to be reused off site. While the data have been reviewed in relation to GACs applicable to commercial/industrial end use, the data have also been reviewed and presented in this report in relation to the more conservative Residential with Homegrown Produce GACs to demonstrate the potential suitability for reuse of the material on this and other sites. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. However, concentrations of contaminants above the GACs may require further consideration through statistical analysis, if appropriate, or further detailed assessment using site specific data.

This document does not constitute a Site Assessment Report (SAR) as outlined in the UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref: 10/WM/03/21, 2010). As such, the full generic suite of testing recommended in the UKWIR guidance may not have been undertaken for this site and may be required by some water companies. However, consideration has been given to the 'threshold' concentrations presented in Table 3.1 of the UKWIR guidance, where they are applicable to the analysis undertaken, to provide an indication of the potential risks to buried water supply pipes.

5.1.2. Assessment framework

In regards to human health, the CLEA model states that, 'the contamination is assumed to be at or within 1m of the surface' (CLR10 pg10). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway.

5.1.3. Ground Gas

The criteria used to assess the ground gas monitoring results, where monitored, have been taken from the following guidance documents:

- Assessing risks posed by ground gases to buildings, CIRIA Report C665, 2007
- Code of practice for the characterisation and remediation from ground gas in affected developments, British Standard BS 8576, 2013
- A Pragmatic Approach to Ground Gas Risk Assessment, CL:AIRE Research Bulletin RB17, 2012

The frequency and period of monitoring is assessed based on the gas generation potential of the source material and the sensitivity of the development, in accordance with Figure 6 of BS8576 and Table 5.5 of CIRIA C665. As BS8576 promotes a risk based approach to ground gas assessment, it recognises that ground gas monitoring might not be necessary if a viable pollutant linkages is not present, e.g. if a 'credible' source with significant ground gas generation potential and/or a 'credible' migration pathway are not present.

The Characteristic Situation for a monitoring location is determined using the worst case gas screening value for methane or carbon dioxide from all of the monitoring rounds at that location. Following the precautionary principal, the most stringent of the Characteristic Situations for the monitoring locations within the Site is generally used to classify the site as a whole.

5.2. Soil Assessment

5.2.1. General

A total of 57no. soil samples collected during the site investigation from a variety of depths and locations across the site were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polyaromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. The results of the laboratory analyses are summarised in Appendix 5, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 6.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.2.2. Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations below the Commercial/Industrial and Residential with Homegrown Produce GACs in all of the samples across the site. Therefore heavy metals are not considered to present a significant source of contamination with regard to human health.

5.2.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to be well below Commercial/Industrial and Residential with Homegrown Produce GACs in the soil samples across the site and predominantly below the laboratory detection limits. Therefore the identified TPH concentrations are not considered to represent a significant source of contamination with regard to human health.

Concentrations of TPH C11-C40 fractions were recorded to be below the UKWIR 'threshold' values for mineral oil at all locations. TPH is therefore not considered to represent a significant source of contamination to proposed PE water supply pipes. However, the designers of the water supply pipes for this site should review the data in this report to inform their decision making process.

5.2.4. Polyaromatic hydrocarbons (PAHs)

Polyaromatic hydrocarbons (PAH) compound concentrations were recorded to be well below the Commercial/Industrial and Residential with Homegrown Produce GACs in the soil samples across the site and predominantly below the laboratory detection limits. Therefore PAHs are not considered to represent a significant source of contamination with regard to human health.

5.2.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the Commercial/Industrial and Residential with Homegrown Produce GACs in all of the samples from across the site. Therefore BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to human health.

Concentrations of BTEX and MTBE were not recorded to exceed the UKWIR 'threshold' values. BTEX and MTBE are therefore not considered to represent a significant source of contamination to proposed water supply pipes.

5.2.6. Inorganics

The concentrations of free cyanide fell below laboratory detection limits in all of the soil samples analysed.

The pH of the soil samples analysed was generally between the GAC parameters of the 7-9 range. Two samples returned alkali readings of pH11.17 at 0.40-0.70m in BH514 and pH9.49 at 0.40-0.60m in BH517. Three samples returned acid readings of pH4.8 at 2.50-3.00m in WS504, pH4.87 at 0.60-1.00m in WS507 and pH4.86 at 2.00-3.00m in WS515. However, these localised pH anomalies are not considered to be representative of significant contamination.

Asbestos was not identified within any of the soil samples analysed. Asbestos is therefore not considered likely to be a significant source of contamination with regard to human health, although vigilance for asbestos containing materials on site should be maintained throughout the development.

5.3. Statistical Analysis

Statistical analysis was not considered to be appropriate on the presented analysis results.

5.4. Ground Gas Assessment

The intrusive investigation of the site identified Made Ground of up to 1.7m thickness over superficial deposits of head deposits which locally contained organic material, which together represent the most significant potential sources of ground gas on site. A former inert landfill is also located just to the north east of the site with a potential for gas migration onto site.

Due to shallow groundwater at the time of monitoring, the response zones in some of the installations were saturated and therefore compromised. The ground gas measurements obtained during the monitoring round are therefore considered to be representative of the air trapped in the head of the wells in some instances and are not considered to be representative of the ground gas regime of the soil.

Where unsaturated response zones were measureable, ground gas flow rates were generally recorded to be <0.1 l/hr with concentrations of flammable gas as methane of <0.1% by volume and carbon dioxide of up to 2.5% by volume. Local exceptions to this trend were recorded in BH512 and BH513 where flammable gas a methane concentrations of 3.7% and 1.8% by volume, respectively, and carbon dioxide concentrations of 6.2% and 1.2% by volume, respectively, were recorded.

BH512 and BH513 are the two borehole well installations within Plot 1 in the southwest of the site and are the closest monitoring wells to the Hermitage Stream. The unsaturated response zones in both of these wells are screened across natural soils comprising the Bognor Sand Member in BH512 and Head Deposits in BH513 with minimal organic matter content recorded in the samples from both of these locations. It is currently unclear what the source of the recorded methane and carbon dioxide in these monitoring wells is.

This initial ground gas data indicates a Characteristic Situation 2 gas regime may be considered to be appropriate for the site with an associated requirement for at least basic gas protection measures (in accordance with BS8485) to be included in proposed enclosed buildings with the potential for gas to accumulate. It is therefore recommended that further monitoring is undertaken across the site to provide further clarification on the ground gas regime in Plot 1 but also to attempt to gather useable data from the wells identified to be saturated during the initial round in order to better characterise the site as a whole.

6. CONCEPTUAL SITE MODEL

6.1. Sources

The conceptual model, based on information obtained as part of the intrusive investigation and screening of the chemical analysis results, identified the following contaminant sources:

6.1.1. On-site – Historic and Current

- Potential asbestos containing materials and fibres in Made Ground
- Ground gas from Made Ground and Alluvium

6.1.2. Off-site – Historic and Current

- Potential ground gas from adjacent former inert landfill, Made Ground and natural soil

6.2. Pathways

The key environmental pathways and exposure routes by which potentially toxic substances can reach the identified potential receptors are considered to be:

6.2.1. Indirect

- Lateral and vertical migration of gas leading to accumulation in enclosed spaces

6.2.2. Direct

- Inhalation of contaminated dust.
- Inhalation of gas
- Explosion

6.3. Receptors

Receptors that may be affected by the potential contamination are:

6.3.1. Human

- Future site users
- Construction workers

6.3.2. Environmental

- Proposed buildings

7. RISK ASSESSMENT

7.1. Risk Assessment Procedure

By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

The risk assessment has been undertaken with reference to BS 10175:2011+A1:2013 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential magnitude of the hazard and the sensitivity of the target, based on the categories given overleaf.

Table 7.1: Sensitivity of receptor

Category	Examples
High	Residential with gardens/Groundwater Source Protection Zone
Medium	Residential without gardens/Principal (Major) Aquifer/sensitive watercourse
Low	Commercial and industrial use/Secondary (Minor) Aquifer
Very Low	Construction and maintenance workers/non-sensitive watercourse

Table 7.2: Magnitude of impact

Category	Examples
Gross Impact	Heavily contaminated gasworks or industrial Site, hazardous waste landfill
Moderate Impact	Major leaks and spills from fuel infrastructure (e.g. petrol stations), domestic waste landfills
Slight Impact	Minor leaks and spills from fuel infrastructure, 'inert' waste landfills

Table 7.3: Level of severity of potential hazard

Magnitude of impact	Sensitivity of receptor			
	High	Medium	Low	Very Low
Gross Impact	Severe	Medium	Mild	Minor
Moderate Impact	Medium	Mild	Minor	Minor
Slight Impact	Mild	Minor	Minor	Minor

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 7.4: Probability of risk definition

Category	Examples
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 7.5: Level of risk for potential hazard definition

Probability of risk	Sensitivity of receptor			
	Severe	Medium	Mild	Minor
High likelihood	Very High	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low likelihood	Moderate	Low/Moderate	Low	Very Low
Unlikely	Low/Moderate	Low	Very Low	Very Low

The assessment is discussed below in terms of plausible pollutant linkages. A complete assessment of the pollutant linkages is presented in Table 7.6.

A description of these risk classifications and likely action required are given in CIRIA 552 as:

Very high risk – 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 substantial liability. Urgent investigation and remediation are likely to be required.

High risk – Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk – It is possible that harm could arise to a designated receptor from an identified hazard.

However, it is either 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 is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk – It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk – It is a low possibility that harm could arise to a designated receptor. In the event of such harm being realised it is not likely to be severe.

7.2. Pollutant Linkage Assessment

Table 7.6: Pollutant linkage assessment

Source	Pathway	Receptor	Severity	Likelihood	Risk Level
Potential asbestos containing material in soil	Inhalation	Future Site users	Medium	Unlikely	Low
		Construction workers	Medium	Unlikely	Low
Ground gas from adjacent former inert landfill, Made Ground and natural soil	Lateral and vertical migration leading to accumulation in enclosed spaces and inhalation	Future Site users	Medium	Low Likelihood	Low/ Moderate
	Lateral and vertical migration leading to accumulation in enclosed spaces and explosion	Future Site users	Severe	Low Likelihood	Moderate
	Lateral and vertical migration leading to accumulation in enclosed spaces and explosion	Proposed Buildings	Medium	Low Likelihood	Low/ Moderate

7.2.1. Asbestos in Made Ground

Little Made Ground has been identified on site and no asbestos containing materials have been identified in the soil samples from the site. However, the potential remains for discrete asbestos containing material fragments or loose fibres to be present in Made Ground, particularly imported materials, and at access and crossing points within the site where such material may have been used to aid access for farm vehicles. It is therefore recommended that vigilance for asbestos containing materials is maintained throughout the development works.

7.2.2. Ground Gas from adjacent former inert landfill, Made Ground and natural soil

The initial ground gas monitoring round has identified the presence of shallow groundwater saturating the response zones of a number of the monitoring wells on site. Ground gas concentrations within the monitoring wells with unsaturated section of the response zone have generally been negligible with the exception of methane and carbon dioxide concentrations identified in BH512 and BH513 in Plot 1 in the southwest of the site. The results from the initial ground gas monitoring round indicate that Plot 1 has a Characteristic Situation 2 ground gas regime, requiring gas protection measures for the proposed buildings. No ground gas protection measures are recommended for the remainder of the site.

It is therefore recommended that further monitoring is undertaken across the site to provide further clarification on the ground gas regime in Plot 1 but also to attempt to gather useable data from the wells identified to be saturated during the initial round in order to better characterise the site as a whole.

8. GEOTECHNICAL ASSESSMENT

8.1. Introduction

This geotechnical assessment and the subsequent preliminary foundation design recommendations will use the findings of the ground investigation and the results of the in-situ and laboratory geotechnical testing carried out in the boreholes and on representative samples of the materials encountered across the site.

8.2. Geotechnical Tests

A programme of geotechnical laboratory testing was carried out on representative samples collected from the strata encountered during the ground investigation.

Details of the specific procedure used in each case are shown below in Table 8.1 and the geotechnical test certificates are presented in Appendix 7.

Table 8.1: Summary of Geotechnical Testing

Test	Standard (BS1377:1990) unless otherwise indicated	No.
Classification Tests		
Atterberg Limits	Part 2, Clauses 4.3, 5.3 & 5.4	105
Particle Size Distribution – Wet Sieve	Part 2, Clause 9.2	21
Particle Size Distribution – Sedimentation	Part 2, Clause 9.0	3
Shear Strength Tests		
Quick Undrained Triaxial	Part 7, Clause 8.4	55
Consolidated Undrained Triaxial	Part 8, Clauses 1.0 to 7.0	11
Chemical Tests		
Sulphate Content 2:1 soil water extract	Part 3, Clause 5.3	30
pH value	Part 3, Clause 9.0	30
BRE SD1	Various	46

8.3. Geotechnical and Geological Parameters

This section discusses the key geotechnical characteristics of each encountered stratum as determined from field observations, in-situ and laboratory geotechnical testing. The stratigraphy revealed during the ground investigation comprised Topsoil / Subsoil with some isolated areas of Made Ground in turn overlying a laterally discontinuous sequence of Head Deposits. The basal unit of the ground investigation comprised the

London Clay Formation: two facies of the LCF were identified on the site; the Bognor Sand Member (BSM), and the London Clay (LC). Each of these strata will be discussed separately in the following Sections of the Report.

The Distribution of each stratum has been reported in Tables 4.1a and 4.1b. and graphically in the 5No. subsurface sections presented as Figures 3 to 7.

8.3.1. Topsoil / Subsoil

Topsoil / Subsoil (TS) was encountered at all investigative positions except the 8No. borehole positions where Made Ground was reported (BH312-514, 517, 519 and WS 510-512).

The TS attained thicknesses between 0.10 (BH509) and 0.50m (BH505 and WS501-502A). The TS comprised a soft brown slightly gravelly sandy silt with rootlets overlying a soft brown silt.

No in-situ or geotechnical laboratory testing was carried out on the Topsoil / Subsoil as this material will be stripped prior to any development works.

8.3.2. Made Ground

Made Ground (MG) was encountered from ground level (gl) at 8No. locations (BH312-514, 517, 519 and WS 510-512). The MG attained thicknesses between 0.15 (BH513) and 1.70 (WS510) and comprised two types of material. In BH517 and 519 and the 3No. WS locations the MG comprised soft orange brown and grey clayey sandy silt with anthropogenic inclusions of brick and concrete. Whilst in BH512 and 513 the MG comprised construction materials including concrete and metal fragments. BH514 was located on a temporary access way from a previous phase of site development such that the MG comprised a 6F fill and subbase.

No in-situ or geotechnical laboratory testing was carried out on the Made Ground as all foundations and other engineering works will be constructed beneath this potentially highly variable material.

8.3.3. Head Deposits

Head Deposits (HD) were identified immediately beneath the Topsoil / Made Ground in 22No. borehole locations (Table 4.1a & 4.1b). The distribution of the HD is shown in Figures 3 to 7. The HD comprised between 0.10m (WS513 & 514) and 3.50m (WS507) of very soft to firm orange brown mottled grey sandy Silt / Clay with varying amounts of medium to coarse sub- to well-rounded flint gravel. Black organic fragments reported throughout and wood identified in WS506 at 1.70mbgl along with an organic odour.

In-Situ Testing

Standard penetration tests (SPTs) were carried out throughout the HD (Table 8.2).

Table 8.2: Distribution of SPT N Values in the Head Deposits

BH No.	Depth (mbgl)	SPT N Value	Main Constituents	BH No.	Depth (mbgl)	SPT N Value	Main Constituent
BH501	2.00	9	Sandy Silt	WS501	1.00	12	Slightly Gravelly Silt
BH502	1.20	4	Sandy Silt		2.00	14	
BH504	2.00	13	Sandy Clay	WS502	1.00	17	
BH509	1.20	13		WS502A	1.00	13	
	2.00	26			2.00	26	
BH515	1.20	13	Clayey Sand	WS503	1.00	11	
	2.00	11		WS504	1.00	22	
BH516	1.20	12	Slightly Gravelly Silt		2.00	20	
	2.10	18		WS506	1.00	8	
				WS507	1.00	0	Very Sandy Silty
					2.00	0	
				WS508	1.00	13	Slightly Gravelly Silt
					2.00	17	
				WS509	1.20	11	Gravelly Silt
					2.00	11	
				WS511	1.00	16	Sandy Clay
					2.00	10	
				WS513	1.00	14	
				WS516	1.00	14	Sandy silt

The results of the SPTs indicate a wide range of N-values from 0 to 26. The two N values recorded as 0 were both located in WS507 in an horizon described as very sandy Silt, although no reason for these extremely low values is readily identifiable they are not considered representative but could be indicative of soft areas being present.

The SPT N values have been plotted against depth (Figure 8) and level (Figure 9) and show no easily identifiable trend in the data set. Based on the distribution of N-values a characteristic N-value of 13 is considered appropriate for the Head Deposits.

Classification Testing

Consistency Limits

9No. representative samples of the Head Deposits underwent Atterberg limits testing to determine their consistency limits.

Table 8.3: Results of the Atterberg Limits Analyses – Head Deposits

Location	Depth (mbgl)	Level (mAOD)	Natural Moisture Content, w (%)	Liquid Limit w_L (%)	Plastic Limit w_P (%)	Plasticity Index I_P (%)	Corrected Plasticity Index (%)
BH501	1.20	39.83	26	36	21	15	15
	2.00	39.03	22	45	19	26	26
BH503	1.20	35.33	25	34	21	13	13
BH504	1.60	31.54	23	33	22	11	11
BH509	1.20	29.22	24	34	17	17	17
BH513	2.00	21.42	21	58	21	37	35
BH519	1.65	27.12	26	46	20	26	26
WS503	1.00	33.84	25	33	24	9	9
WS507	1.00	32.71	30	35	25	10	10

The samples of Head Deposits tested returned plasticity indices in the range from 9 to 37% which is indicative of a fine-grained material of low to intermediate plasticity. After correction to account for $>425\mu\text{m}$ content of the test samples a corrected $I_{p\text{ cor}}$ of 9 to 35% was attained which is indicative of a low to medium volume change material.

All the consistency limits and the natural moisture content have been plotted against depth and elevation (Figures 10 and 11). Careful inspection of these plots indicates an increase in plasticity index (i_P) with depth.

Based on the distribution of plasticity indices presented in Figure 10 a characteristic plasticity index (I_{Pk}) of 10% at 0.90mbgl rising to 30% at 2.10mbgl is considered appropriate for the Head Deposits.

Calculations based on the results of the Atterberg limits test (Table 8.3) give a range of consistency indices of 0.50 to 1.00 which is indicative of a firm to stiff consistency.

Shear Strength

Undrained Shear Strength

3No. representative samples of the Head Deposits underwent laboratory quick undrained triaxial compression testing. The results of the laboratory testing are presented in Table 8.4; whilst the laboratory test certificates are located in Appendix 7.

Table 8.4: Results of the QU triaxial Compression Testing – Head Deposits

Location	Depth (mbgl)	Level (mAOD)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)	Strength Description
BH501	1.20	39.83	2.07	28	73	Medium Strength
BH513	1.20	22.22	2.03	25	71	Medium Strength
BH519	1.20	27.57	1.94	25	53	Medium Strength

The results of the QU triaxial testing give c_{uk} values of between 53 and 73kN/m² which are consistent with a medium strength material.

The laboratory test results have been augmented with c_{uk} values derived from the widely accepted empirical relationship:

$$c_u = f_1 \times SPTN$$

Where f_1 is a correlation factor based on the I_{Pk}

Using a correlation factor of 5, all the undrained shear strength data has been plotted against depth and level and reveals no easily identifiable trend in the undrained shear strength. (Figures 12 and 13).

Based on all the shear strength data a characteristic undrained shear strength parameter of $c_{uk} = 55\text{kN/m}^2$ is considered a moderately conservative value for the undrained shear strength (c_{uk}) of the Head Deposits.

Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters (BS 8002:2015). In terms of effective stress, the shear strength of a fine-grained soil can be considered as frictional, such that $c'_k = 0\text{kN/m}^2$.

The upper bound characteristic plasticity index of 30% gives a conservative characteristic effective angle of shearing resistance (ϕ'_k) of 24°.

Other Geotechnical Parameters

Modulus of Deformation (E_k)

Bjerrum (1973) gives a lower bound E_{uk}/C_{uk} ratio of 500 for normally consolidated clay giving a E_{uk} of 27MN/m² for the Head Deposits. CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as $0.75E_{uk}$. Therefore an drained modulus (E'_k) of 20MN/m² is appropriate for the Head Deposits.

Coefficient of Volume Compressibility

The coefficient of volume compressibility (m_v) has been determined from the empirical relationship with the plasticity index (I_{Pk}) and published data for similar materials giving an m_{vk} of 0.13m²/MN which is indicative of a material of medium compressibility.

8.3.4. Bognor Sand Member

The Bognor Sand Member (BSM) was identified immediately below the TS MG or HD at 22No. of the 35No. investigative positions (Figures 3 to 7). The BSM comprised between 1.00 (BH516) and > 4.80m (WS515) of loose to medium dense becoming dense orange brown and grey occasionally light brown silty locally clayey fine Sand.

In-Situ Testing

Standard penetration tests (SPTs) were carried out throughout the BSM (Table 8.5).

Table 8.5: Distribution of SPT N Values in the Bognor Sand Member

BH No.	Depth (mbgl)	SPT N Value	Main Constituents	BH No.	Depth (mbgl)	SPT N Value	Main Constituent
BH505	1.20	10	Silty Fine Sand	WS505	1.00	13	Sandy Silt
BH506	1.20	9			2.00	12	
BH507	1.20	6		WS510	2.00	25	Silty Fine Sand
BH508	1.20	15		WS511	4.00	39	
	2.00	19			5.00	50	
BH510	1.20	18		WS512	4.00	50	
	2.00	18		WS513	2.00	25	Sand
BH511	1.20	10			3.00	35	Silty Fine Sand
	2.00	20			4.00	49	

Table 8.5 Contd.

BH512	1.20	10		WS514	2.00	25	Sand
BH513	3.00	40	Silty Fine Sand	WS514	3.00	35	Silty Fine Sand
	4.00	33			4.00	37	
BH514	1.20	16	Gravelly Fine Sand	WS515	1.00	16	
BH515	1.20	13	Clayey Fine Sand		2.00	15	
	2.00	11			3.00	21	
	3.00	20			4.00	14	
	4.00	18			5.00	18	
BH516	3.00	20	Silty Fine Sand	WS516	2.00	11	Clayey Silty Sand
BH517	1.20	9			3.00	12	
	2.10	12			4.00	14	
	3.00	20			5.00	15	
BH518	1.20	10					

The results of the SPTs undertaken within the BSM indicate a range of N-values from 6 to 50.

The SPT N values have been plotted against depth (Figure 14) and level (Figure 15) and reveal an increase in characteristic N value from 10 at 1.00mbgl to 30 at 5.00mbgl. N-Values of these magnitudes are consistent a medium dense to dense granular material.

Classification Testing

Particle Size Distribution

21No. representative samples of the BSM underwent particle size distribution analysis using the wet sieving method; sedimentation analysis was carried out on 3No. of these samples to determine the <63 µm grading.

The results of these analyses are presented in Table 8.6 and the laboratory test certificates and grading envelopes are located in Appendix 7.

Table 8.6: Results of the Particle Size Distribution Analyses – Bognor Sand Member

Location	Depth (mbgl)	Granulometric Composition (%)					Uniformity Coefficient	Curvature Coefficient
		Clay	Silt	Sand	Gravel	V Coarse		
BH506	1.20	6.2	19.7	74	0.1	0	23	11
	2.00	47.24		52.8	0	0	Not Calculated	
BH507	0.40-0.70	44.62		54.3	1.1	0	Not Calculated	
	1.20	29.28		70.7	0	0	Not Calculated	
BH508	1.00	9.0	14.8	74.9	1.3	0	44	19
	1.50-1.90	18.11		81.9	0	0	Not Calculated	
BH508	2.50	27.14		72.9	0	0	Not Calculated	
BH510	1.50-1.80	8.5	18.5	72.9	0.1	0	37	16
	2.00	25.61		74.4	0	0	Not Calculated	
BH511	1.50-1.80	24.71		75.2	0.1	0	Not Calculated	
BH512	1.60-1.80	30.70		69.3	0.1	0	Not Calculated	
	2.50	37.40		62.6	0	0	Not Calculated	
BH514	1.00	25.80		72.9	1.3	0	Not Calculated	
BH515	1.40	16.50		83.5	0	0	Not Calculated	
	3.40	18.40		81.6	0	0	Not Calculated	
BH517	1.50	34.50		48.6	16.9	0	Not Calculated	
BH519	3.45	53.80		46.2	0	0	Not Calculated	
WS513	2.00-2.80	12.52		87.5	0	0	Not Calculated	
WS513	3.00-4.00	20.48		79.5	0	0	Not Calculated	
WS515	1.00-2.00	12.81		87.2	0	0	Not Calculated	
WS516	2.00-3.00	43.68		56.3	0	0	Not Calculated	

The results of the particle size distribution analyses confirm the engineering description of the BSM as a clayey silty Sand. Sand content was generally within the fine sand size range (0.06 to 0.20mm) and usually accounted for > 60% of the material. 10No. of the 18No. samples tested had fine-grained contents >25%.

3no. samples underwent follow on sedimentation analyses and indicated there to be a greater percentage of silt (0.002 to 0.06mm) than clay (<0.002mm). The calculated coefficients of uniformity and curvature and the shape of the grading envelopes suggest the BSM to be multi-graded.

Shear Strength

BS 8002: 2015 states that when a materials has a fine-grained content of >25% their characteristic shear strength parameters should be determined following the same procedure as for fine-grained soils. However, as no specific shear strength testing of the BSM has been carried out it is proposed to include the BSM into the data form the underlying London Clay (LC) and determine a single characteristic shear strength for both the BSM and LC.

8.3.5. London Clay

The London Clay formed the basal unit encountered during the ground investigation and attained proven thickness of >22.50m in BH506. The LC comprised a firm to stiff grey silty sandy Clay with some shell fragments overlying a stiff to very stiff grey silty Clay. Several strong siltstone bands up to 0.40m thick were reported during the ground investigation. It is not possible to correlate any of these across the site so they may not be laterally extensive or they pinch out and have not been identified in all boreholes.

In-situ Testing

Standard penetration testing was carried out throughout the LC. The results of these tests are presented in Table 8.7 and plotted against depth and level in Figures 16 and 17.

Table 8.7: Distribution of SPT N Values in the London Clay

BH No.	Depth (mbgl)	SPT N Value	Main Constituents	BH No.	Depth (mbgl)	SPT N Value	Main Constituent
BH501	4.00	18	Silty Sandy Clay	BH502	14.50	31	Silty Clay
	6.50	28			17.50	36	
	9.50	36			20.50	38	
	12.50	29	23.50		50	Siltstone Interbeds	
	15.50	35	Silty Clay	BH503	4.00	17	Silty Sandy Clay
	18.50	32			6.50	31	
	21.50	34			9.50	33	
	24.50	44			12.50	41	Slightly Sandy Clay
BH502	3.00	14	15.50		37		
	5.00	23	18.50	33			
	8.50	34					

Table 8.7 Contd.

	11.50	34	Silty Clay					
BH504	4.00	18	Silty Sandy Clay	BH508	3.00	12	Silty Sandy Clay	
	6.50	50	Siltstone Band		5.50	23		
	9.50	36	Silty Sandy Clay		8.50	31		
	12.50	33			11.50	41	Silty Clay	
	14.50	35	14.50		41			
	17.50	37	17.50		38			
	19.50	40	19.50		39			
BH505	3.00	11	Silty Sandy Clay	BH509	4.00	18	Silty Sandy Clay	
	5.00	22			6.50	28		
	8.00	36			9.50	28		
	11.00	39			12.50	42		
	14.00	37	15.50		35			
	17.00	37	18.50		37	Silty Clay		
	20.00	35	Silty Clay	3.00	19	Silty Sandy Clay		
	23.00	25		5.00	18			
BH506	3.00	14	Silty Sandy Clay	BH510	8.50		34	Silty Sandy Clay
	5.00	50	Siltstone Band		11.50		34	
	8.00	30	Silty Sandy Clay		14.50		40	
	11.00	35			17.50		39	
	14.50	36	Silty Clay		19.50	43	Silty Clay	
	17.50	38			BH511	3.00	17	Silty Sandy Clay
	20.50	31		5.00		16		
	24.50	39		8.00		22		
BH507	3.00	11	Silty Sandy Clay	11.00		37		
	5.00	17		14.00	41			
	8.50	34		17.00	46			
	11.50	42		19.50	45			
		14.50	40	Silty Clay	BH512	5.00	19	Silty Sandy Clay

Table 8.7 Contd.

BH507	17.50	35	Silty Clay	BH512	8.00	39	Silty Sandy Clay	
	19.50	37			11.00	41		
BH512	14.00	45	Silty Sandy Clay	BH517	14.00	42	Silty Sandy Clay	
	17.00	46			17.00	40		
	19.50	38			19.50	43		
BH513	5.00	32	Silty Sandy Clay	BH518	3.00	12	Silty Sandy Clay	
	8.50	34			5.00	23		
	11.50	29			8.00	33		
	14.50	32			11.00	36		
	17.50	49	Silty Clay		14.00	40		
	19.50	43			17.00	39		
BH514	3.00	11	Silty Sandy Clay		BH519	19.50		38
	5.00	15		4.00		20		
	8.30	24		6.50		30		
	11.00	36	9.50	38				
	14.00	41	Silty Clay	12.50		32		
	17.00	39		15.50		35		
BH515	6.50	22	Silty Sandy Clay	WS501		18.50	37	Silty Sandy Clay
	9.50	31			3.00	15		
	12.50	37			4.00	18		
	15.50	46		5.00	20			
	19.50	48		WS502A	3.00	14	Silty Sandy Clay	
BH516	5.00	18	Silty Sandy Clay		4.00	18		Silty Sandy Clay
	8.00	31			5.00	20		
	11.00	35	WS503	3.00	19	Silty Sandy Clay		
	14.00	41		4.00	21			
	17.00	50		5.00	26			
	BH517	4.00	14	Silty Sandy Clay	WS504	3.00	13	Silty Sandy Clay
			4.00			18		

Table 8.7 Contd.

BH517	5.00	10	Silty Sandy Clay	WS504	5.00	20	Silty Sandy Clay
	8.00	27		WS505	3.00	18	Silty Sandy Clay
	11.00	37			4.00	23	
WS505	5.00	30	Silty Sandy Clay	WS508	4.00	50	Silty Sandy Clay
WS506	3.00	16	Silty Sandy Clay		5.00	18	
	4.00	19		WS509	3.00	19	Silty Sandy Clay
	5.00	29			4.00	17	
WS507	4.00	17	Silty Sandy Clay	WS510	3.00	12	Silty Sandy Clay
	5.00	25			4.00	17	
						5.00	

Careful inspection of the plot of both SPT N v Depth and v Elevation clearly show an increase in N value with depth. As discussed in the previous section inclusion of the SPT N Values attributed to BSM does not appear to affect the overall distribution of results (Figures 16 and 17).

Classification Testing

Consistency Limits

93No. representative samples of the London Clay underwent Atterberg limits testing to determine their consistency limits.

Table 8.8: Results of the Atterberg Limits Analyses – London Clay

Location	Depth (mbgl)	Natural Moisture Content, w (%)	Liquid Limit w_L (%)	Plastic Limit w_P (%)	Plasticity Index I_P (%)	Corrected Plasticity Index (%)
BH501	5.0	21	46	21	25	25
	7.5	19	52	20	32	32
	10.5	22	58	21	37	37
	14.0	25	62	22	40	40
	20.0	27	77	27	50	50
	22.5	27	65	23	42	42
BH503	3.0	21	41	20	21	21

Table 8.8 Contd.

BH503	5.0	24	44	21	23	23
	6.5	18	44	19	25	25
	9.0	20	56	19	37	37
	11.0	32	60	23	37	37
	13.5	20	59	21	38	38
BH503	17.0	24	64	25	39	39
	18.5	23	64	21	43	43
BH504	3.0	25	41	20	21	21
	4.0	37	44	18	26	23
	6.7	29	49	20	29	29
	9.0	21	54	19	35	35
	12.0	25	57	21	36	36
	17.5	22	67	24	43	43
	19.0	24	65	25	40	40
BH505	4.0	20	45	19	26	
	5.0	20	45	20	25	25
	8.0	21	48	21	27	27
	9.5	20	50	22	28	28
	11.0	22	54	21	33	33
	19.5	25	70	24	46	46
	21.5	27	73	25	48	48
BH506	4.0	22	45	19	26	26
	5.3	28	44	17	27	19
	11.0	23	52	21	31	31
	16.0	23	66	26	40	40
BH507	2.9	24	40	21	19	19
	4.0	22	45	19	26	26
	5.0	22	48	21	27	27
	8.0	25	50	21	29	29
	12.0	22	57	21	36	36
	16.0	26	60	25	35	35

Table 8.8 Contd.

BH507	18.0	27	67	24	43	43
BH508	3.5	25	35	20	15	15
	6.5	21	45	19	26	26
	8.0	26	46	19	27	27
	10.0	23	45	22	23	23
	13.0	22	56	20	36	36
	14.0	25	60	24	36	36
BH508	17.0	26	65	24	41	41
BH509	4.0	21	41	18	23	23
	6.0	23	49	20	29	29
	9.5	22	51	21	30	30
	13.0	20	59	22	37	37
	15.0	22	61	22	39	39
	17.0	34	59	22	37	34
BH510	4.0	23	43	19	24	24
	6.5	21	46	19	27	27
	8.5	21	45	19	26	26
	13.0	22	53	21	32	32
	16.0	20	48	18	30	30
	19.0	34	60	23	37	37
BH511	3.0	24	36	22	14	14
	6.0	22	47	20	27	27
	7.0	25	45	19	26	26
	9.0	21	51	21	30	30
	13.0	24	58	21	37	37
	14.0	22	59	22	37	37
BH512	4.0	19	40	19	21	21
	6.0	21	48	18	30	30
	9.0	30	46	19	27	19
	11.0	21	57	21	36	36
	14.0	22	59	22	37	37

Table 8.8 Contd.

BH512	17.0	24	66	24	42	42
BH513	6.7	29	41	19	22	22
	8.5	20	49	19	30	30
	11.0	22	57	21	36	36
	19.0	22	62	23	39	39
BH514	3.4	21	44	19	25	25
	9.0	23	51	21	30	30
	14.0	23	61	25	36	36
BH515	7.0	21	48	19	29	28
	11.0	23	48	21	27	27
	13.0	22	54	21	33	33
	17.0	25	63	24	39	39
BH516	4.0	20	38	20	18	18
	6.0	20	44	18	26	26
	13.0	25	31	25	6	6
	14.0	24	58	23	35	35
BH517	5.5	22	42	15	27	27
	9.0	22	46	21	25	25
	16.0	31	56	23	33	33
BH518	2.0	24	44	20	24	24
	6.5	20	45	18	27	27
	8.0	21	53	21	32	32
BH519	4.0	24	47	21	26	26
	13.0	24	61	26	35	35

The results of the Atterberg limits testing give plasticity indices ranging from 6 to 50% which is indicative of a clay of intermediate to high plasticity. The overall range of values does not change after correction to account for >425µm content indicating the LC to be low to high volume potential. However based on the whole data set the LC should be considered as having high volume change potential.

The natural moisture content and consistency limits have been plotted against depth and elevation and show a reasonable consistent moisture content (w) and plastic limit (w_p) and an increase in liquid limit (w_L) and plasticity index (I_p) with depth (Figures 18 and 19). The increase in w_L and I_p is interpreted as an increase in the clay content of the LC with depth, or a fining down sequence, and indicates a gradational boundary

between the BSM and the LC. A characteristic I_{pk} of 38% is considered appropriate for the LC based on results of the consistency limits testing.

Based on the data presented in Table 8.8 a range of consistency indices of 0.55 to 1.07 have been determined with the majority of the data lying within the range 0.76 to 1.07. The consistency indices have been plotted against depth and elevation and indicates a general increase in the consistency index from 0.75 at the top of the LC rising to 1.00 at the full depth of the ground investigation (Figures 20 and 21). This is consistent with a firm becoming stiff to very stiff material.

Shear Strength

Undrained Shear Strength

52No. representative samples of the LC underwent laboratory quick undrained triaxial compression testing. The results of the laboratory testing are presented in Table 8.9; whilst the laboratory test certificates are located in Appendix 7.

Table 8.9: Results of the QU triaxial Compression Testing – London Clay

Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)	Strength Description
BH501	5.00	2.08	105	196	Very High
	14.00	2.11	290	169	Very High
	20.00	2.08	400	130	High
BH502	7.10	2.14	145	229	Very High
	16.00	2.08	325	112	High
BH503	8.00	2.07	160	194	Very High
	11.0	1.88	220	29	Low
	17.0	2.05	340	167	Very High
BH504	3.00	2.07	60	96	High
	5.00	2.13	100	223	Very High
	19.00	2.05	380	143	High
BH505	6.50	2.10	130	218	Very High
	9.50	2.08	190	146	High
	15.50	2.11	310	194	Very High
BH506	4.00	2.13	80	117	High

Table 8.9 Contd.

BH506	6.50	2.13	130	216	Very High
	16.00	2.11	320	277	Very High
	23.50	2.00	470	134	High
BH507	4.00	2.10	80	138	High
	7.00	2.14	140	306	Extremely High
	13.00	2.10	260	196	Very High
	16.00	1.90	320	8	Extremely Low
BH508	4.50	2.13	90	168	High
	10.00	2.12	200	308	Extremely High
	19.00	2.01	380	75	Medium
BH509	3.00	2.09	60	120	High
	8.00	2.06	160	179	Very High
	14.00	2.08	280	167	Very High
	19.60	1.97	380	112	High
BH510	6.50	2.10	130	210	Very High
	16.00	1.92	320	111	High
	19.00	2.00	380	70	Medium
BH511	4.00	2.11	80	139	High
	9.50	2.11	190	204	Very High
	15.50	2.09	310	201	Very High
BH512	6.50	2.10	130	309	Extremely High
	9.50	2.10	190	51	Medium
	12.50	2.10	250	174	Very High
BH513	13.00	2.10	260	240	Very High
	19.00	2.00	380	152	Very High
BH514	4.00	2.10	85	78	Medium
	9.50	2.10	185	213	Very High
	15.50	2.10	310	279	Very High
BH515	5.00	2.10	105	200	Very High

Table 8.9 Contd.

	17.00	2.10	345	219	Very High
BH516	6.50	2.10	135	215	Very High
	15.50	2.10	315	241	Very High
BH517	6.50	2.10	135	145	High
	15.50	2.10	315	188	Very High
BH518	12.50	2.09	255	206	Very High
BH519	8.00	2.10	165	243	Very High

The results of the QU triaxial testing give c_{uk} values of between 8 and 309kN/m². Of the 52No. tests undertaken 7No. returned undrained shear strength values less 100kN/m² and the mean average for the whole data set was 174kN/m² which is indicative of a very high strength material.

All the undrained shear strength data has been plotted against depth and elevation (Figures 22 and 23) including data derived from the SPT N values using a correlation of 5. The undrained shear strength data recorded within the BSM has also been included in these plots and sits within the general distribution of data points.

Based on the distribution of undrained shear strength values presented in Figures 22 and 23 a single undrained shear strength relationship is proposed for both the LC and the BSM (London Clay Formation). A characteristic undrained shear strength (c_{uk}) of 50kN/m² at 1.00mbgl rising to a maximum of 200kN/m² at 25.00mbgl is recommended for the LCF.

Drained (Effective) Shear Strength

11No. representative samples of the LC underwent laboratory consolidated undrained triaxial compression tests with measurement of porewater pressure. A precis of the results is presented in Table 8.10 and the full test reports are located in Appendix 7.

Table 8.10: Results of the Consolidated Undrained Triaxial compression Tests

BH Location	Depth	σ'_{1f} (kN/m ²)	σ'_{3f} (kN/m ²)	$(\sigma'_{1f} - \sigma'_{3f})/2$ (kN/ m ²)	$(\sigma'_{1f} + \sigma'_{3f})/2$ (kN/m ²)
BH501	8.00	388	85	151.5	236.5
BH502	4.00	323	76	123.5	199.5
BH503	5.00	310	65	122.5	187.5
BH504	11.00	404	117	143.5	260.5
BH505	4.00	300	67	116.5	183.5
BH506	9.50	521	113	204	317
BH508	7.00	537	123	207	330
BH510	10.00	544	146	199	345
BH514	6.50	302	71	115	186.5
BH515	8.00	312	84	114	198
BH519	14.00	420	150	135	285

A lower bound modified failure envelope and a linear regression modified failure envelope has been fitted to the data presented in Table 8.10 (Figure 24). The two modified failure envelopes give a single d' of 11kN/m² and α' angles of 33 and 28° for linear regression and lower bound envelopes respectively.

To determine the effective shear strength parameters the two simple trigonometric functions have been used; where

$$\phi' = \sin^{-1}(\tan \alpha)$$

And

$$c' = d' / \cos \phi'$$

The results of these two conversions give lower bound and line of best fit give effective angles of friction 26 and 33° and effective cohesions 13 and 12kN/m² respectively.

The plot of the effective stress testing of the London Clay does show some variance most likely as a result of variations in the composition of the material. Therefore it is considered most appropriate to adopt the lower bound values of $c' = 12\text{kN/m}^2$ and $\phi' = 26^\circ$ for the characteristic effective shear strength parameters for both the LCF.

Other Geotechnical Parameters

Modulus of Deformation (E_k)

Butler (1974) gives a lower bound E_{uk}/c_{uk} ratio of 400 for the London Clay giving a E_{uk} of 20MN/m² rising to 80MN/m² at 20mbgl in the LCF. CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as

0.75Euk. Therefore an drained modulus (E'_k) of 15MN/m² rising to 60MN/m² at 20mbgl is appropriate for the LCF.

Coefficient of Volume Compressibility

As part of the consolidation phase of the effective stress triaxial tests the coefficient of volume compressibility (m_v) has been determined (Table 8.11).

Table 8.11: Results of the Consolidation Phase of the Consolidated Undrained Triaxial Testing

Borehole Location	Depth (mbgl)	Elevation (mAOD)	Coefficient of Volume Compressibility (m ² /MN)
BH501	8.00	33.03	0.18
BH502	4.00	34.51	0.42
BH503	5.00	31.56	0.39
BH504	11.00	22.14	0.08
BH505	4.00	30.02	0.44
BH506	9.50	23.79	0.08
BH508	7.00	23.91	0.24
BH510	10.00	22.57	0.23
BH514	6.50	20.71	0.23
BH515	8.00	11.07	0.20
BH519	14.00	14.77	0.18

The data has been plotted against depth and indicates a decrease in m_v with depth from 0.40m²/MN toward the top of the LCF decreasing to 0.10 at 12mbgl and below. However after application of a laboratory correction factor of $\mu_g = 0.50$ these values are reduced to 0.20 and 0.05m²/MN which are indicative of a material of medium to low compressibility (Figure 25).

It is recommended that a range of characteristic m_{vk} values are used which should be selected based on the depth/ level of the foundation construction.

8.4. Aggressive Ground Soil Chemistry

Chemical testing was carried out on 76No.samples of the encountered materials in accordance with Box C10, BRE Special Digest 1. The results are summarised in Tables 8.12 & 8.13.

Table 8.12: Summary of the Results of Chemical Testing for Concrete Classification

BH	Depth	Stratum	pH	Sulphate (SO ₄) (g/l)	BH	Depth (mbgl)	Stratum	pH	Sulphate (SO ₄) (g/l)
BH501	4.50	LCF	7.58	0.77	BH508	6.50	LCF	7.66	0.81
	6.00		7.53	0.51	BH509	1.20	HD	7.53	0.14
BH502	0.40	HD	7.49	0.03	BH510	1.50	BSM	7.32	0.21
	12.50	LCF	7.73	0.25		17.00	LCF	7.78	0.39
BH503	1.00	HD	7.52	0.07	BH511	1.50	BSM	7.73	0.13
	11.00	LCF	7.68	0.19	BH512	2.50	BSM	7.60	0.35
	15.50		7.68	0.22	BH514	1.00	BSM	7.72	0.25
BH504	17.50	LCF	7.86	0.81	BH515	0.40	HD	7.83	0.22
BH505	0.50	BSM	7.78	0.23		4.00	LCF	7.82	0.65
	11.00	LCF	7.90	0.59	BH516	1.50	HD	7.90	0.12
BH506	2.00	BSM	7.73	0.21	BH517	3.30	LCF	7.88	0.33
	14.50	LCF	7.87	0.64		12.00		7.92	0.50
BH507	0.40	BSM	7.80	0.25	BH519	0.25	MG	7.88	0.12
	14.00	LCF	7.89	0.74	WS501	1.00	HD	7.62	0.13
BH508	1.50	BSM	7.32	0.21	WS513	2.00	BSM	7.70	0.20

Table 8.13: Summary of BRE SD1 Results

BH	Depth (mbgl)	Stratum	pH	Total Sulphate AS (% SO ₄)	Total Sulphur TS (%)	Total Potential Sulphate TPS (%)	Oxidisable (Sulphate) (%)	OS > 0.30%
BH501	1.65	HD	7.5	0.04	0.02	0.06	0.02	No
	15.50	LCF	8.0	0.10	0.29	0.87	0.77	Yes
BH502	4.45	LCF	7.8	0.12	0.41	1.23	1.11	Yes
BH503	4.00	LCF	8.1	0.12	0.48	1.44	1.36	Yes
	7.00	LCF	8.1	0.17	0.46	1.38	1.21	Yes
BH504	2.50	HD	7.4	0.02	0.02	0.06	0.04	No
	5.45	LCF	7.9	0.12	0.43	1.29	1.17	Yes
	12.50	LCF	8.5	0.09	0.34	1.02	0.93	Yes
BH505	3.00	LCF	8.2	0.11	0.50	1.50	1.39	Yes
	9.00	LCF	8.2	0.16	0.44	1.32	1.16	Yes
	12.95	LCF	8.3	0.12	0.36	1.08	0.96	Yes
BH506	4.00	LCF	8.0	0.15	0.35	1.05	0.70	Yes
	9.00	LCF	8.1	0.19	0.38	1.14	0.95	Yes
	21.50	LCF	8.4	0.12	0.29	0.87	0.75	Yes
BH507	4.00	LCF	8.1	0.10	0.45	1.35	1.25	Yes
	9.50	LCF	8.0	0.16	0.62	1.86	1.70	Yes
BH508	4.00	LCF	8.2	0.13	0.46	1.38	1.25	Yes
	10.30	LCF	8.0	0.16	0.54	1.62	1.46	Yes
	17.00	LCF	8.2	0.12	0.45	1.35	1.23	Yes
BH509	4.00	LCF	7.7	0.10	0.32	0.96	0.86	Yes
	9.50	LCF	8.2	0.11	0.31	0.93	0.82	Yes
	17.00	LCF	8.8	0.07	0.31	0.93	0.86	Yes
BH510	5.00	LCF	8.0	0.11	0.45	1.35	1.24	Yes
	12.50	LCF	8.2	0.08	0.24	0.72	0.64	Yes
BH511	7.00-7.40	LCF	7.9	0.19	0.75	2.25	2.06	Yes
	11.00	LCF	8.2	0.12	0.28	0.84	0.72	Yes

Table 8.13 Contd.

BH512	4.00	LCF	7.9	0.12	0.53	1.59	1.47	Yes
	6.50	LCF	7.9	0.12	0.56	1.68	1.56	Yes
	14.00	LCF	8.0	0.20	0.43	1.29	1.09	Yes
BH513	4.00	BSM	7.3	0.02	0.05	0.15	0.13	No
	7.20	LCF	8.0	0.09	0.32	0.96	0.87	Yes
	14.00	LCF	8.0	0.16	0.21	0.63	0.47	Yes
BH514	5.00	LCF	7.3	0.17	0.43	1.29	1.12	Yes
	11.00	LCF	7.9	0.14	0.32	0.96	0.82	Yes
BH515	7.00	LCF	7.8	0.27	1.50	4.50	4.23	Yes
BH516	4.00	LCF	7.8	0.11	0.33	0.99	0.88	Yes
	9.50	LCF	8.1	0.10	0.40	1.20	1.10	Yes
	19.50	LCF	8.2	0.11	0.37	1.11	1.00	Yes
BH518	0.40	BSM	8.0	0.04	0.02	0.06	0.02	No
	5.00	LCF	7.7	0.20	0.69	2.07	1.87	Yes
	16.50	LCF	7.8	0.19	0.85	2.55	2.36	Yes
BH519	6.50	LCF	8.0	0.17	0.43	1.29	1.12	Yes
WS505	1.00	BSM	7.5	0.04	0.01	0.06	0.02	No

The amounts of oxidisable sulphides have been determined following the procedure documented in Paragraph C5.1.2 of BRE SD1. The results indicate that pyrite is likely to be present within the London Clay Formation in significant amounts. Based on the maximum determined total potential sulphate content Table C1 of BRE SD1 gives a Design Sulphate Classification of DS-5 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-4s assuming static groundwater conditions.

8.5. Characteristic Geotechnical Parameters

Based on the laboratory test results, in-situ testing and subsequent analysis a range of characteristic geotechnical parameters, which should be used in the subsequent geotechnical and foundation design calculations are presented in Table 8.14.

Table 8.14: Characteristic Geotechnical Parameters

Stratum	Parameter		Source	Value
Made Ground	Not used in foundation design			
Head Deposits	Unit Weight γ_k (kN/m ³)		Laboratory QU Triaxial Testing	20kN/m ³
	Undrained Shear Strength	c_{uk} (kN/m ²)	Laboratory QU Triaxial Testing	55kN/m ²
		ϕ_{uk} (°)		0°
	Drained Shear Strength	c'_k (kN/m ²)	Relationship with I_{pk} (BS8002; 2015)	0kN/m ²
		ϕ'_k (°)		24°
	Modulus of Deformation	Undrained E_{uk} (MN/m ²)	500 x c_{uk}	27MN/m ²
		Drained E'_k (MN/m ²)	CIRIA C143	20MN/m ²
	Coefficient of Volume Compressibility		Relationship with N and I_{pk}	0.13m ² /MN
Bognor Sand Member	Unit Weight γ_k (kN/m ³)		BS8002	19kN/m ³
	Due to a fine grained content >25% BS8002; 2015 states it should be treated as a fine-grained material. Therefore the characteristic shear strength parameters presented for the LCF should be used.			
London Clay	Unit Weight γ_k (kN/m ³)		Laboratory QU Triaxial Testing	21kN/m ³
London Clay Formation including Bognor Sand Member	Undrained Shear Strength	c_{uk} (kN/m ²)	Laboratory QU Triaxial Testing and Relationship with I_{pk} and SPT	50kN/m ² at 1.00mbgl rising to a maximum of 200kN/m ² at 25.00mbgl.
		ϕ_{uk} (°)		0°
	Drained Shear Strength	c'_k (kN/m ²)	Laboratory CU Triaxial Testing	12kN/m ²
		ϕ'_k (°)		26°
	Modulus of Deformation	Undrained E_{uk} (MN/m ²)	400 x c_{uk}	20MN/m ² at 1.00mbgl rising to 80MN/m ² at 25.00mbgl
		Drained E'_k (MN/m ²)	CIRIA C143	15MN/m ² at 1.00mbgl rising to 60MN/m ² at 25.00mbgl.
	Coefficient of Volume Compressibility		Laboratory CUT testing	Depth Dependant

9. PRELIMINARY FOUNDATION AND GROUND ENGINEERING OPTIONS

9.1. Introduction

The preliminary geotechnical assessment below relates to the details of the proposed development. It is understood that the site is to be developed as 8No. separate plots for industrial / warehousing use.

The purpose of this Section of the Report is to provide a general overview and give some initial geotechnical guidance. It has been produced on the understanding that each of the individual development plots will require a targeted investigation and detailed geotechnical design once the usage and structural loadings of each is finalised.

The ground investigation comprised 19No. cable percussive boreholes (BH501-519) and 16No. windowless sample boreholes (WS501 – 516) to a maximum depth of 25.00m. The ground conditions revealed by the ground investigation consisted of a discontinuous cover of Head Deposits up to 3.50m thick (WS507) directly overlying either London Clay (LC) in the northwest of the site or Bognor Sand Member (BSM) over LC in the southerly areas of the site. 5No. cross sections showing the distribution of the different strata across the site is presented in Figures 3 to 7. The geotechnical laboratory testing has shown that the boundary between the BSM and the LC is gradational and that, due to its grading, the BSM should be considered fine grained. Therefore a single set characteristic shear strength values has been presented for this combined stratum (LCF).

The groundwater strikes recorded during the ground investigation are presented in Table 9.1.

Table 9.1: Groundwater Strikes Recorded during the Ground Investigation

BH	Strike Depth		Rising to		Stratum	BH	Strike Depth		Rising to		Stratum
	(mbgl)	m(AOD)	(mbgl)	m(AOD)			(mbgl)	m(AOD)	(mbgl)	m(AOD)	
BH501	8.40	32.63	6.50	34.53	LCF	BH512	9.00	16.32	8.60	16.72	LCF
BH502	6.50	32.01	6.00	32.51	LCF	BH513	14.00	9.42	9.00	14.42	LCF
BH503	7.30	29.26	7.00	29.56	LCF	BH514	7.90	19.31	3.00	24.21	LCF
BH507	6.50	25.18	5.50	26.18	LCF	BH515	1.20	17.87	1.20	17.87	BSM
BH508	2.20	28.71	0.50	30.41	BSM	BH516	1.20	19.95	1.20	19.95	HD
BH509	0.40	30.02	0.40	30.02	HD	BH517	3.00	23.64	3.00	23.64	BSM
BH510	7.80	24.77	7.40	25.17	LCF	BH518	6.00	23.31	5.40	23.91	LCF
BH511	9.10	19.95	8.30	20.75	LCF	BH519	2.00	26.77	2.00	26.77	HD

Strike depths within the LC were generally between 3.00 and 9.10mbgl. Where significant thicknesses of Head Deposit or Bognor Sand Member were encountered groundwater strikes were between 0.40 and 3.00m which are indicative of a perched groundwater table.

9.2. Shallow Foundations

For preliminary design purposes the Ultimate Limit State (ULS) bearing resistance of a shallow foundation has been determined. Serviceability Limit State (SLS) settlement analyses will be required as part of the detailed design in accordance with the guidance presented in EC7.

9.2.1. Depth of Foundations

All foundations must be constructed below the Topsoil Made Ground within the natural strata. The minimum depth of foundation will be controlled by the volume change potential of the underlying strata and the thickness of the Made Ground. Atterberg limits testing of the underlying materials indicated the LCF show it to be of high volume change potential.

NHBC Guidance offers two foundation depth scenarios dependant on the planting regimes adopted on the site (Table 9.2).

Table 9.2: Minimum Depth of Foundations for High Volume Change Soil (after NHBC)

Depth of Foundation	Description	No Tree Planting Zone (m)		
		High Water Demand	Moderate Water Demand	Low Water Demand
1.00m	No tree planting within Zone of Influence	1.25 x mature height	0.75 x mature height	0.50 x mature height
1.50m	Restricted tree planting within zone of influence	1.00 x mature height	0.50 x mature height	0.20 x mature height

The topography of the site is such that each individual development plot is to be either entirely cut into the existing ground surface or created using a cut and fill technique such that the minimum depth requirements are likely to have been met as a result of these earthworks.

9.2.2. Ultimate Limit State Bearing Resistance

Bearing resistance analysis was carried out in order to check the Ultimate Limit State (ULS) bearing resistance of the LCF. The ground model and characteristic material properties used in the ULS analysis are presented in Table 9.3.

Table 9.3: Ground Model used in the ULS Bearing Resistance Calculations

Ground Model	Stratum	Thickness		Shear Strength Parameters			
				Total		Effective	
		From (mbgl)	To (mbgl)	c_{uk} (kN/m ²)	ϕ_{uk} (°)	c'_k (kN/m ²)	ϕ'_k (°)
GM1	Made Ground	Removed during earthworks					
	Head Deposits	Foundations constructed within BSM / LCF					
	LCF (LC & BSM)	CDL ¹	>20m	55	0	12	26
Groundwater will be considered as coincident with the development level							

¹ Construction Development Level

The UK has implemented Design Approach 1 (DA1) of BS EN1997-1:2004 (Eurocode 7: Geotechnical Design), which requires two design combinations to be satisfied:

Combination 1 (C1): A1 “+” M1 “+” R1

Combination 2 (C2): A2 “+” M2 “+” R1

Where A, M and R refer to groups of partial factors relating to actions, materials and resistance respectively.

Table 9.4: Partial Factors Applied to the Bearing Resistance Analysis

	Combination 1			Combination 2		
	A1	M1	R1	A2	M2	R2
Tangent of the Angle of Shearing Resistance ($\tan \phi$)		1.00			1.25	
Cohesion Intercept (c')		1.00			1.25	
Undrained Cohesion c_u		1.00			1.40	
Permanent Action	1.35			1.00		
Variable Action	1.50			1.35		
Resistance			1.00			1.00

The summary of the bearing checks are presented in Table 9.5 and the geotechnical calculation sheets are located in Appendix 8.

Table 9.5: Summary of ULS Bearing Resistance Checks

GM	Foundation Type	Foundation Breadth (m)	Depth (mbgl)	DA1 Combination	Bearing Resistance (kN/m ²)	
					Drained	Undrained
1	Strip	0.75	1.00m ¹	C1	444	465
				C2	257	338

¹ Due to the application of depth and shape factors represents the most conservative ULS bearing resistance

These calculations indicate that combination 2 presents the most critical case. The results given represent the ultimate limit state that is the maximum load that can be supported by the soil without failure occurring within the soil mass. However, adoption of these values may cause unacceptable amounts of settlement

The bearing resistance calculated indicate a ULS of 250kN/m² for shallow foundation constructed at a minimum depth of 1.00m below construction platform level.

9.2.3. Serviceability Limit State

Eurocode 7 states that calculations of settlement must always be carried out on footings on soft clays - and should be carried out on footings on firm to stiff clays when the risk is anything other than negligible.

Verification of serviceability limit state (SLS) will be required as part of the detailed design calculations. Furthermore consideration will need to be given to differential settlements where development footprints span between cut and fill areas.

9.2.4. Foundation Excavation Stability

Groundwater was encountered at 0.40 and 9.10mbgl during the ground investigation. Therefore it seems probable that a perched groundwater is present within the BSM. Dependant on the construction development level it is possible that foundation excavations will intercept groundwater and inundation of the excavations cannot be ruled out. As well as creating instability, long term exposure of the foundation bases to standing water may significantly reduce their strength and increase consolidation settlement beyond acceptable limits.

9.3. Piled Foundations

As an alternative to shallow foundation solution preliminary pile calculations have been carried out in accordance with the UK National Annex to EC7 Design Approach 1 only Combination 2 results are presented within this Report as they offer the more conservative values.

9.3.1. Ground Model

The ground model presented in Table 9.3 has been used in the preliminary pile axial capacity analyses

9.3.2. Design Approach

Given the properties of the stratum beneath the site, values for axially loaded piles have been determined using the following relationships:

Characteristic Shaft Resistance – London Clay Formation & Bognor Sand Member

$$R_{sk} = \frac{\alpha \bar{c}_{uk} A_b}{\gamma_{rd}}$$

Characteristic End Bearing – London clay Formation & Bognor Sand Member

$$R_{Bk} = \frac{N_c c_b A_b}{\gamma_{rd}}$$

and the ULS Pile Resistance is

$$R_{cd} = \frac{R_{sk}}{\gamma_s} + \frac{R_{Bk}}{\gamma_B}$$

The pile design has been carried out using the UK National Annex to EC7. The design approach and combination of partial factors and their values are presented in Table 9.6.

Table 9.6: Design Approach and Partial Factors used in Pile Design

CFA Pile								
Combination	Design Action Load	γ_G	Material Factors	All Partial Factors	Design Resistance	γ_b	γ_s	γ_{rd}
1	A1	1.35	M1	1.00	R1	1.00	1.00	1.4
2	A2	1.00	M1	1.00	R4	2.00	1.60	1.4

Although higher carrying capacities are often achieved by driven piles, the use of driven piles can cause environmental issues (noise and vibration). Therefore, the initial axial resistance calculations have been carried out on augured piles.

The ULS axial resistances of a 0.5, 0.6 and 0.75m diameter augured pile of varying length have been determined for the ground model presented in Table 9.3 and Appendix 9.

Table 9.7: Design Pile Resistances – Augured Pile

Pile Diameter (m)	Pile Length (m)	Combination	Design Pile Resistance (kN)			
			MG & Head Deposits	Skin Friction (R_{sd})	End Bearing (R_{bd})	Design Axial Pile Resistance (kN)
0.50	15.00	C2	No input in Axial Resistance	141	34	175
	18.00			204	41	245
	22.00			307	50	357
0.60	15.00	C2	No input to Axial Resistance	169	49	218
	18.00			245	59	304
	22.00			368	72	440
0.75	15.00	C2	No input to Axial Resistance	212	76	288
	18.00			307	91	398
	22.00			452	110	562

The above pile axial resistances should be used as a guide only. A detailed piled foundation design will be required once the pile layout and structural loads are known for each of the development areas.

9.4. Retaining Walls

As discussed earlier in this Report the topography of the site slopes from the north towards the south such that each of the development platforms, where they are cut back into the natural slope will require some form of ground retention.

It is understood that the ground is retained to the rear of the one occupied area of the site by a gabion wall. Therefore initially a gabion wall design will be considered. In order to assess the feasibility of using gabions to retain the ground across the site a preliminary gabion wall design will be carried out for the highest retained height. Of approximately 5.50 m to the rear of Plot 4A.

9.4.1. Gabion Wall Design

The gabion wall design has been checked for stability against sliding and overturning using the GEO5 Gabion V17 software. This version of the software is EN 1997 compliant and allows the user to apply Design Approach 1 partial factors to soil strength, soil modulus, surcharges and lateral soil loads. Alternative water pressures can be specified for Serviceability Limit State (SLS) and Ultimate Limit State (ULS) conditions.

The ground model used in the design of the gabion wall was the same as that used for the previous Foundation analyses with the addition of Class 6G Fill (Table 9.8).

Table 9.8: Geotechnical Characteristic Values of Materials used in the Gabion Design

Material	Unit Weight (kN/m ³)	Effective Stress Parameters	
		c'_k (kN/m ²)	ϕ'_k (°)
Class 6G	16	0	35
LCF / BSM	21	12	26

9.4.2. Gabion Wall Details

Details of the Gabion basket dimensions and required mesh extensions are presented in the gabion verification worksheets and in Table 9.9.

Table 9.9 Gabion Wall Dimensions

Gabion Basket Row (From Base up)	Dimensions (B x H)	Offset between Rows on Front Face (m)	Mesh Extension (m)	Angle of the Horizontal (°)
1	2.00 x 1.20	0.20	5	10
2	1.80 x 1.20	0.20	4	
3	1.60 x 1.20	0.20	3	
4	1.40 x 1.00	0.20	2	
5	1.20 x 1.00			

9.4.3. Results of Gabion Wall Verification Checks

The results of the Gabion Wall Verification Checks are presented in Appendix 10 and a precis of the results are presented in Table 9.10.

Table 9.10 Results of the Gabion Wall Verification

BS EN 1997-1 Design Approach 1	Degree of Utilisation (%)		Maximum Bearing Pressure (kN/m ²)
	Overturning Stability	Sliding Stability	
Combination 1	64	95	117
Combination 2	63	95	90

The verification results indicates a gabion wall design would be serviceable with respect to sliding and overturning. The maximum stress developed on the underside of the gabion baskets is 117kN/m² well below the calculated ULS bearing resistance.

This preliminary gabion wall design has assumed that the material retained behind the wall is the BSM / LCF which has a characteristic effective cohesion of 12kN/m². However, the effective cohesion element of the shear strength can vary and upon saturation of the clay can reduce to values close to 0 due to loss of matric suction. Therefore the gabion wall analyses has been rerun with the effective cohesion set to 0kN/m² (Table 9.11).

Table 9.11 Results of the Gabion Wall Verification – Effective Cohesion = 0kN/m²

BS EN 1997-1 Design Approach 1	Degree of Utilisation (%)		Maximum Bearing Pressure (kN/m ²)
	Overturning Stability	Sliding Stability	
Combination 1	98	133	356
Combination 2	90	127	271

The results of the analysis indicate that if long term softening of the LSF / BSM occurs the gabion wall will lose its integrity and sliding as well as foundation failure may occur.

In order to overcome this the gabion wall would need to be placed on a properly compacted granular material and the LCF / BSM replaced with a Class 6 I Fill.

Repeating the analysis with granular fill instead of the LCF / BSM Behind the wall will ensure it ongoing stability (Table 9.12)

Table 9.12: Results of the Gabion Wall Verification – Effective Cohesion = 0kN/m²

BS EN 1997-1 Design Approach 1	Degree of Utilisation (%)		Maximum Bearing Pressure (kN/m ²)
	Overturning Stability	Sliding Stability	
Combination 1	62	79	124
Combination 2	57	76	95

Therefore a gabion wall solution to the retention of the ground at the rear of each development plot would be appropriate. It would however, require a temporary excavation of the ground behind the wall and placement of Class 6I granular fill with a minimum friction angle of 35°. This would require the import of appropriate material and disposal of the excavated arisings.

9.4.4. Embedded Retaining Walls

As an alternative to a mass gravity structure such as a gabion wall an embedded structure may be appropriate as it will dramatically reduce the requirement for granular import. Two designs have been considered in this preliminary design; embedded sheet pile wall and king post wall (to reduce the amount of steel).

Both designs have been carried out using the Geocentrix Reward Software programme which EC7 compliant. In order to assess the long term stability of the retaining wall designs the effective cohesion has been reduced to 0kN/m².

Table 9.13: Required depths of Embedment for Sheet Pile Retaining Wall

Retained Height (m)	Minimum Safe Embedment (m)		Largest Factored Bending Moment (kMm/m)	Largest Factored Shear Force (kN/m)
	DA1 C1	DA1 C2		
5.50	15.87	19.79	2213.8	1186.6
4.00	10.15	12.62	667.1	581.4
3.00	7.37	8.94	274.4	362.5
2.00	4.88	5.92	82.5	159.7

As can be seen from the results, an embedded sheet piled wall will require approximately 3 times the retained height embedment to ensure the long term stability of the wall.

In order to reduce the amount of steel required consideration has been given to a king post retaining wall.

Table 9.14: Required Depth of Embedment for a King Post Wall

Retained Height (m)	Distance between King Posts (m)	Minimum Safe Embedment (m)		Largest Factored Bending Moment (kMm/m)	Largest Factored Shear Force (kN/m)
		DA1 C1	DA1 C2		
5.50	2.50	21.50	28.78	4273.2	1357.5
4.00		13.87	19.06	1320.0	618.4
3.00		9.74	13.23	500.1	359.8
2.00		6.43	8.48	152.0	175.8

The results indicate that for a universal column placed in a 600mm diameter pre-bored hole will need to be 28.00m long in order to retain 5.50m of LCF / BSM with an effective cohesion reduced to 0kN/m².

9.4.5. Other Retaining Wall Options

Other proprietary retaining wall retention systems are readily available. Any of these systems will require the preparation of a granular foundation a geogrid tie back system to prevent overturning and the importation of Class 6I material to backfill behind the wall.

Detailed design of these systems can be undertaken but has not been included at this stage.

9.4.6. Global Stability

The global stability of both the embedded and gravity option will need to be considered as part of the detailed design.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. Contamination

The following source of contamination was identified:

- Potential asbestos containing materials and fibres in Made Ground at field access point across the site as a result of potential ground improvement by former farmers.
- Ground gas from unconfirmed source in Plot 1 and potentially from adjacent former inert landfill.

The risk of impact to identified receptors from the identified sources is generally considered to be **low to moderate** with the primary risk drivers being the potential for asbestos containing material in the Made Ground at field assess points and ground gas from an unconfirmed source in Plot 1 and potentially from an adjacent former inert landfill.

Although no asbestos containing materials have been identified in the soil by the intrusive investigations, it is recommended that vigilance for asbestos containing materials in soil is maintained across the site throughout the groundworks for the development.

The ground gas regime at the site has been assessed as potentially Characteristic Situation 2, requiring ground gas protection measures, based on a single initial monitoring round. It is therefore recommended that further monitoring is undertaken across the site to provide further clarification on the ground gas regime in Plot 1 but also to attempt to gather useable data from the wells identified to be saturated during the initial round in order to better characterise the site as a whole.

The local authority should be informed if any sources of contamination are identified during the development that have not been assessed in this report. These sources should then be assessed and dealt with appropriately, with the agreement of the Local Authority.

These conclusions are subject to agreement with the regulatory authorities, be it the Local Authority for human health related issues or the Environment Agency for environmental issues.

10.2. Geotechnical

The ground investigation revealed isolated areas of Made Ground overlying a discontinuous cover of Head Deposits in turn overlying the London Clay Formation. Two facies of the LCF were encountered; the Bognor Sand Member and the London Clay. Initially these two materials were dealt with separately but it became apparent that there existed a gradational boundary between these strata and considering them as one lithology was considered appropriate.

Preliminary design options have been considered for both foundations and for the retaining wall that are required to form the 8No. development plots on the sloping site.

A ULS bearing resistance has been calculated for foundation constructed within the London Clay Formation giving a preliminary ULS bearing resistance of 250kN/m². It should be noted that this is the ultimate limit state and its adoptions without any serviceability limit state settlement analysis may lead to unacceptable amounts of settlement occurring. Furthermore consideration should be given to potential differential settlement especially in areas where development footprints cross between in-situ material (cut) and engineered fill.

In addition to the ULS bearing resistance calculations a series of ULS axial pile carrying capacities have been carried out for an augured pile of various diameters and lengths.

All pile calculations have been carried out in accordance with the UK National Annex to EC7 and therefore include the application of a model factor (γ_{Rd}) of 1.4. This value may be reduced to 1.2 if preliminary load testing is carried out.

Higher carrying capacities can be achieved by driven piles but there may be environmental constraints to prevent their use.

10.2.1. Retaining Walls

In order to form the development plots several retaining walls will be required. The highest of these occurs to the rear of Plot 4A and is approximately 5.50m high.

Consideration has been given to types of retaining structure a gabion wall similar to that already constructed to the rear of the one occupied plot, or an embedded structure. Initially a 5.50m high gabion wall design appears stable using the characteristic shear strength parameters presented in Table 8.14. However, consideration must be given to long term softening of the LCF and the reduction in the effective cohesion as a result of loss of matric suction as the stratum becomes saturated. Under this situation the gabion wall will become unstable and failure occur as both sliding and bearing resistance.

This same process would have a similar effect on any gravity structure and would require the preparation of a granular foundation to prevent bearing capacity failure and backfilling behind the wall with a granular fill with a minimum friction angle of 35°. Temporary excavations would be required to place the mesh tie backs and these should be stable in the short term at 1 (h) : 1 (v).

In order to avoid the need for import of granular material consideration was given to construction of an embedded structure. Once again considering the LCF in its fully softened condition, the embedment depth of a sheet piled wall has been considered and for the highest retained height of 5.50m a depth of embedment of 20m is required under design approach 1 combination 2 factoring. This depth could be reduced by the use of tie backs.

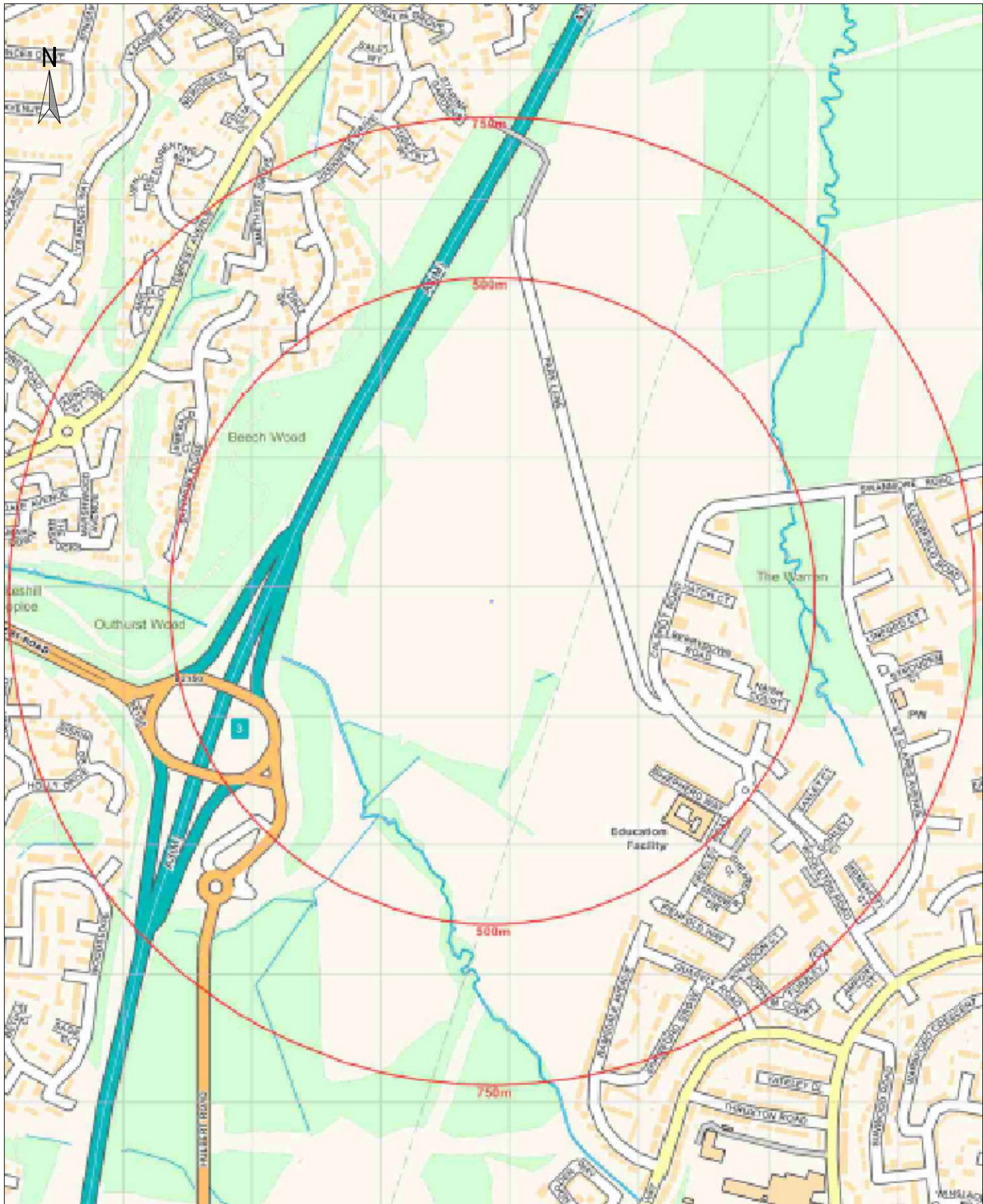
In order to reduce the amount of steel in the wall construction a king post wall has been analysed. In order to retain 5.50m height of fully softened LCF will require a depth of embedment of 30m given a post spacing of 2.50m.

Obviously these depths reduce as the retained height decreases and as a guide Table 9.13 and 9.14 illustrate this reduction.

10.2.2. Concrete Aggressivity

Chemical tests carried out on all the strata encountered during the ground investigation and indicate the London Clay to be potentially pyritic and consistent with Design Sulphate Class 5. Based on the static groundwater conditions in the fine-grained materials an ACEC classification of AC-4s should be adopted for concrete placed on the site.

FIGURE 1 – SITE LOCATION PLAN



-	22.05	REPORT	AP	RP
REF	DATE	REVISION	DRAWN	CHECKED

SURVEY PRODUCED UNDER ORDNANCE SURVEY CROWN COPYRIGHT 2011 ALL RIGHTS RESERVED LICENCE NUMBER 100023183

PROJECT
DUNSURY HILL FARM
HAVANT

RIDGE

PARTNERSHIP HOUSE
MOORSIDE ROAD
WINCHESTER
HAMPSHIRE, SO23 7RX
Also at Reading, Bristol, London and Leicester

TEL: 01962 834400
FAX: 01993 815001

www.ridge.co.uk

CLIENT
BAM CONSTRUCTION LTD

DRAWING
5002713 - SITE LOCATION PLAN

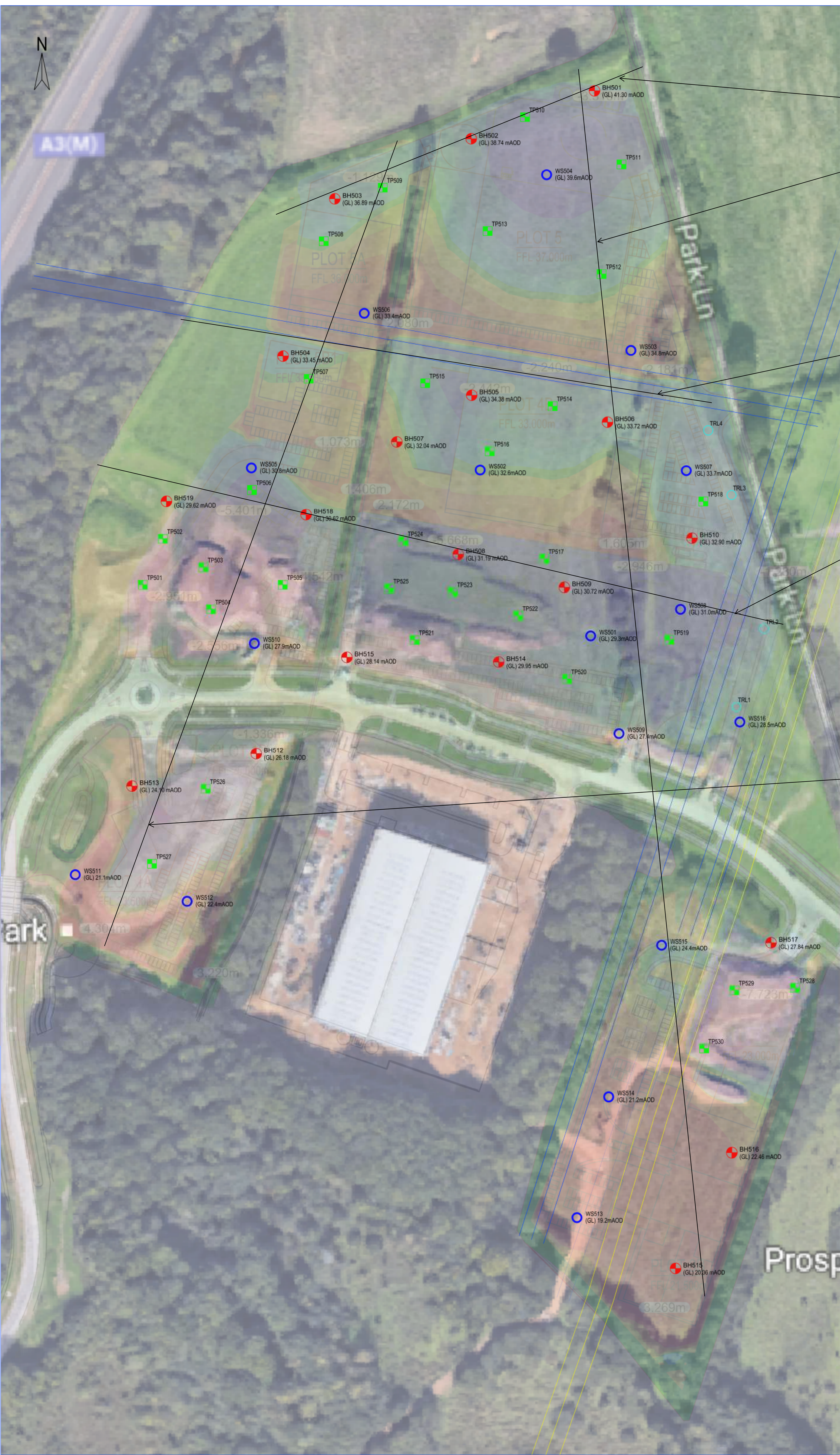
SCALE	DATE	DRAWN BY	CHECKED BY
NTS @ A4	22.05.17	AP	RP

FIGURE 1

REV

-

FIGURE 2 – INVESTIGATION LOCATION PLAN



- NOTES:
1. DO NOT SCALE
 2. DRAWINGS TO BE READ IN CONJUNCTION WITH ALL SERVICES AND STRUCTURAL ENGINEERS DRAWINGS & SPECIFICATIONS.
 3. © COPYRIGHT. DRAWINGS NOT TO BE REPRODUCED OR USED WITHOUT PRIOR WRITTEN CONSENT.

See Figure 5

See Figure 3

See Figure 6

See Figure 7

See Figure 4

INFORMATION

C	18.05	TRIAL PITS	AP	RP
REF	DATE	REVISION	DRAWN	CHECKED
SCALE @A1	DATE	DRAWN BY	CHECKED BY	
1:1000	04/04/17	DAP	AP	

DUNSBURY HILL FARM
INTRUSIVE INVESTIGATION
LOCATIONS - INDICATIVE
PHASE 2

PROJECT
DUNSBURY HILL FARM

CLIENT
BAM

RIDGE

TEL:
FAX:

www.ridge.co.uk

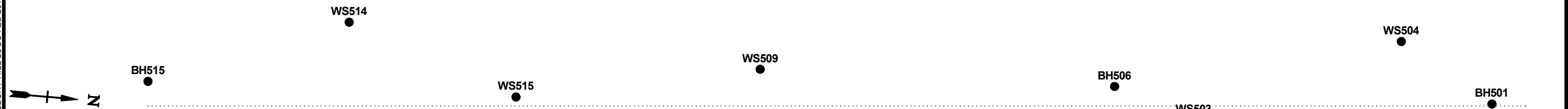
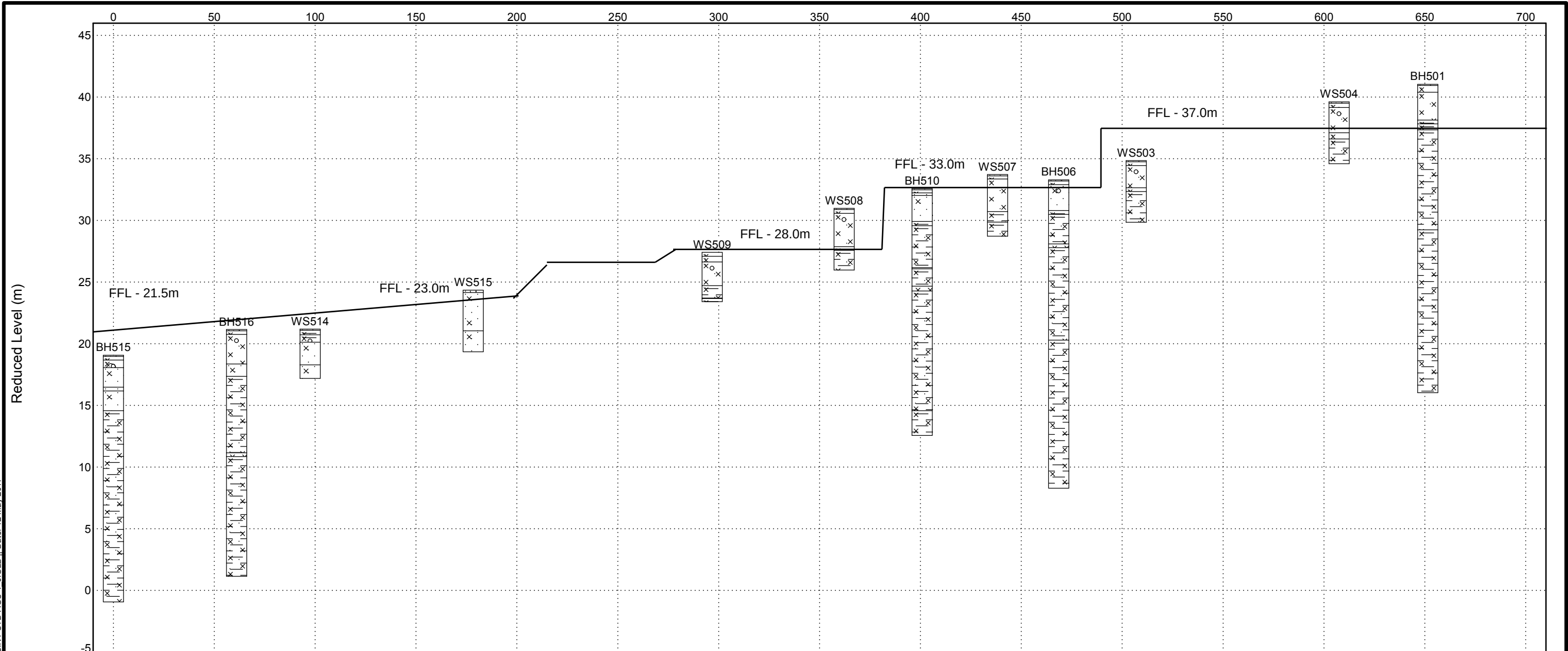
DRG NO
5002713 - SIL01

FILE REFERENCE:

XREF FILE REFERENCE:

FIGURES 3 – 7 – CROSS SECTIONS

Report ID: AGS4 LITHOLOGY SITEMAP - A3 || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 12 May 2017





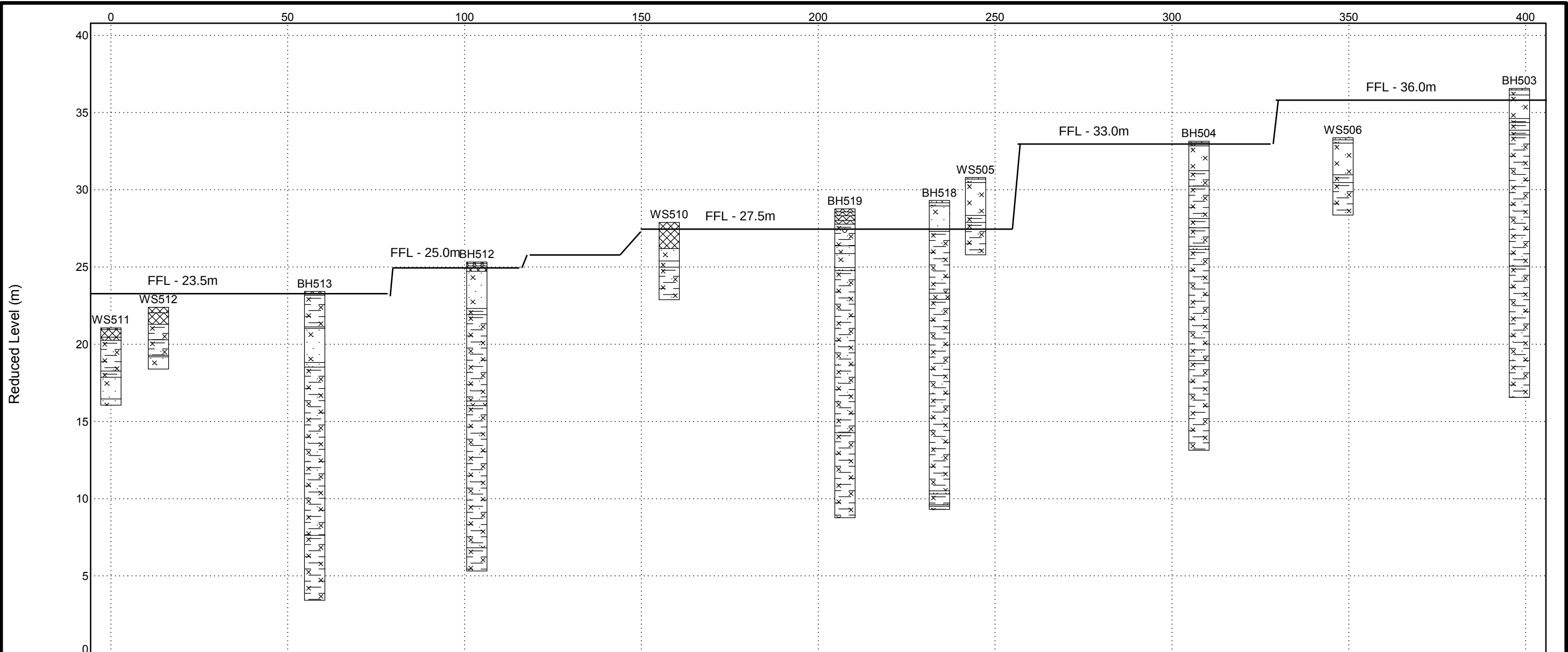
Ridge & Partners LLP
Moorside Road
Winchester
Telephone: -
Fax: -
www.ridge.co.uk

LITHOLOGY GRAPHICS					
 TOPSOIL	 Sandy SILT	 Silty sandy CLAY	 Silty CLAY	 Sandy gravelly SILT	
 Silty gravelly SAND	 SILTSTONE	 Silty SAND	 Sandy gravelly cobbly SILT	 Silty sandy gravelly CLAY	

SUBSURFACE SECTION

Client: BAM
Project: Dunsbury Hill
Number: 5002713 - Figure 3

Report ID: AGS4 LITHOLOGY SITEMAP - A3 || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4.0.GLB || Date: 12 May 2017





Ridge & Partners LLP
Moorside Road
Winchester
Telephone: -
Fax: -
www.ridge.co.uk

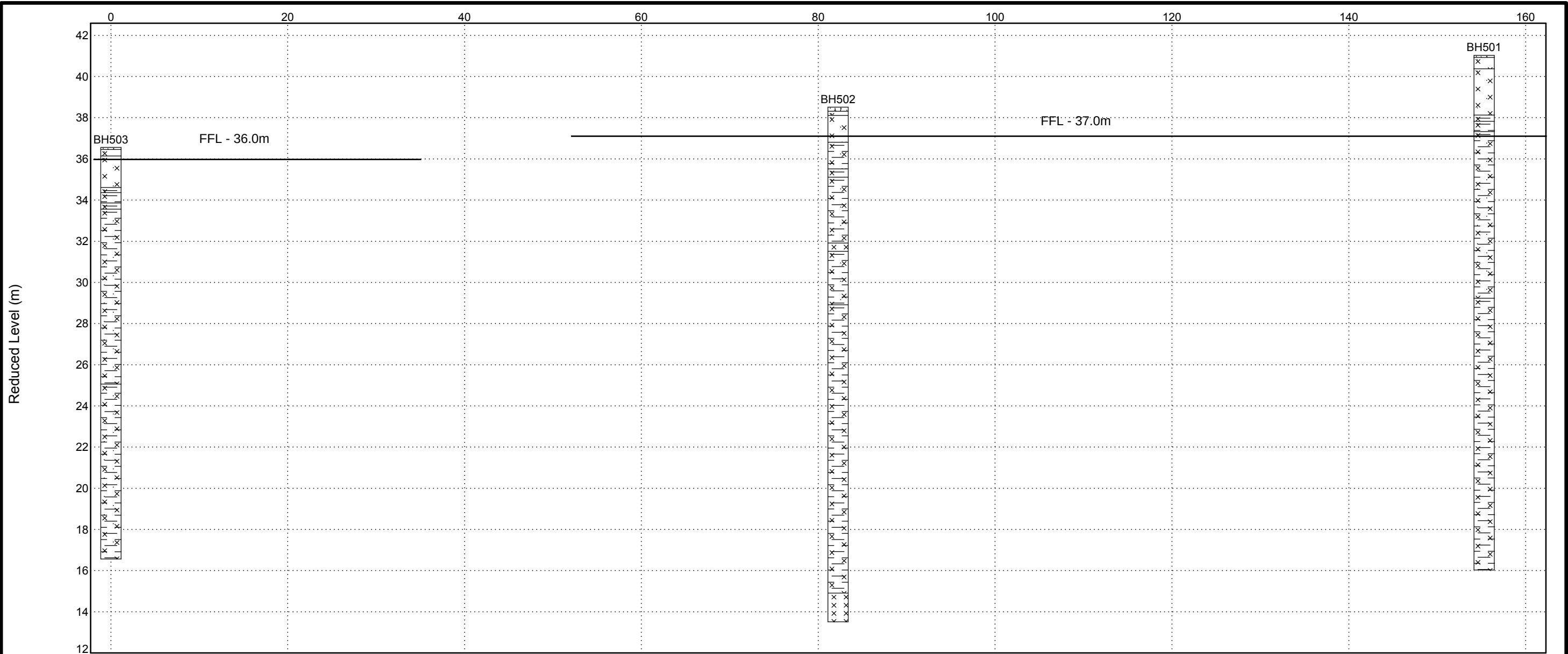
LITHOLOGY GRAPHICS

 TOPSOIL	 Sandy SILT	 Silty sandy CLAY	 SILTSTONE	 Silty CLAY
 MADE GROUND	 Silty SAND	 Sandy gravelly SILT	 Silty sandy gravelly CLAY	

SUBSURFACE SECTION

Client: BAM
Project: Dunsbury Hill
Number: 5002713 - Figure 4

Report ID: AGS4 LITHOLOGY SITEMAP - A3 || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 12 May 2017



BH503

BH502

BH501

RIDGE

Ridge & Partners LLP
Moorside Road
Winchester
Telephone: -
Fax: -
www.ridge.co.uk

LITHOLOGY GRAPHICS



TOPSOIL



Sandy SILT



Silty sandy CLAY



Silty CLAY

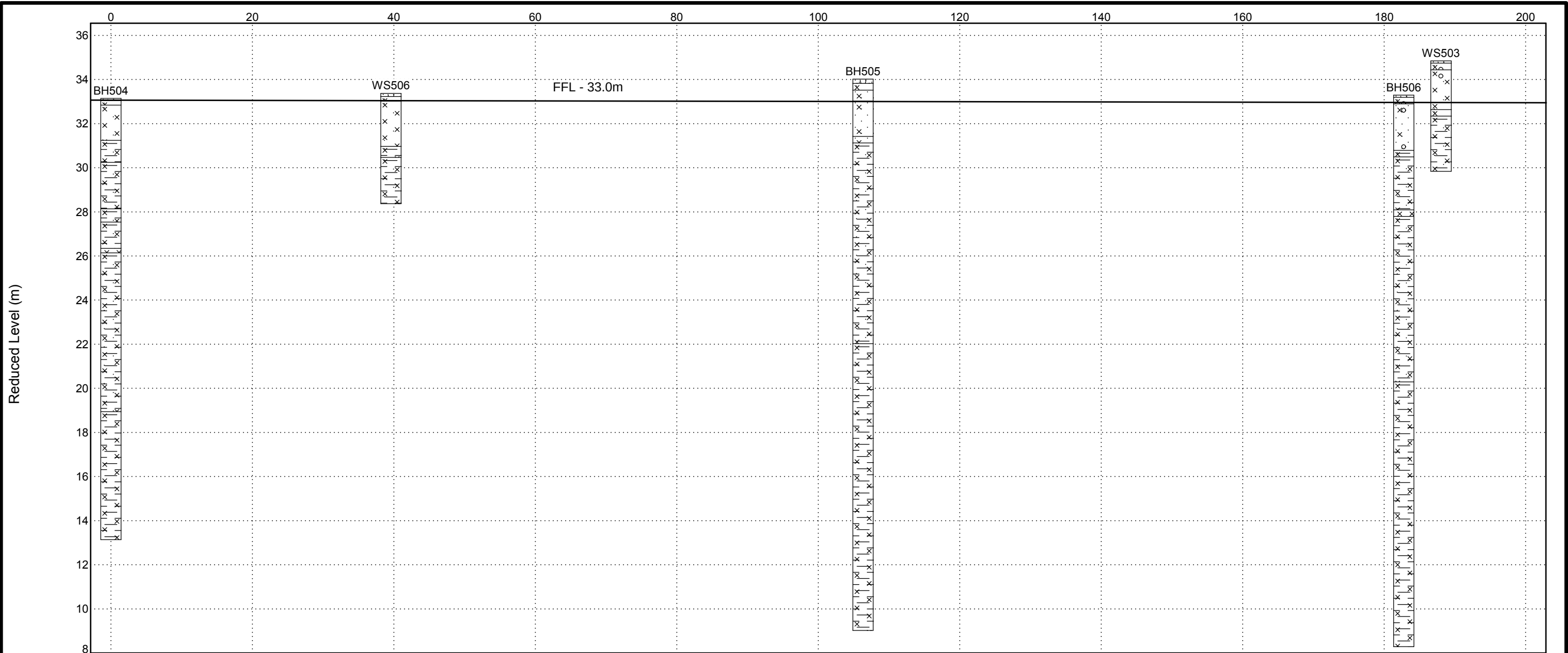


SILTSTONE

SUBSURFACE SECTION

Client: BAM
Project: Dunsbury Hill
Number: 5002713 - Figure 5

Report ID: AGS4 LITHOLOGY SITEMAP - A3 || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 12 May 2017





Ridge & Partners LLP
Moorside Road
Winchester
Telephone: -
Fax: -
www.ridge.co.uk

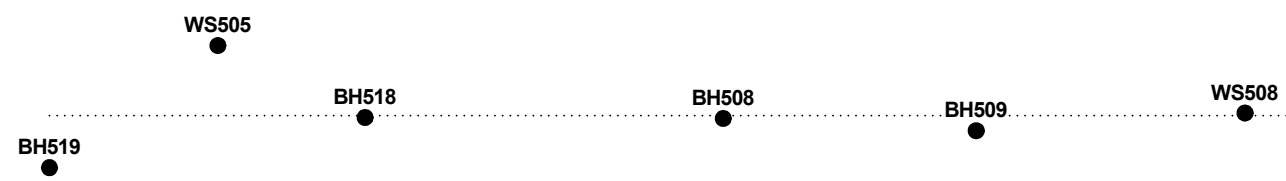
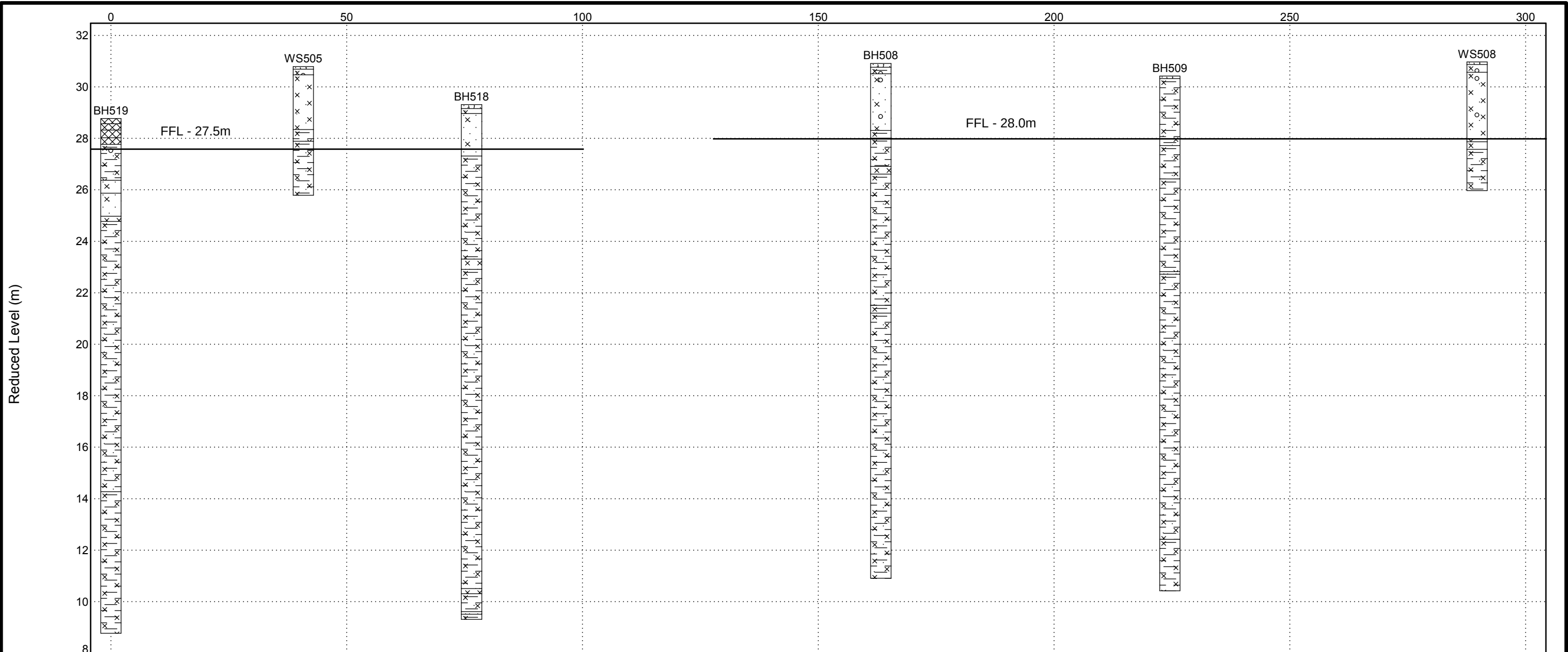
LITHOLOGY GRAPHICS

TOPSOIL	Sandy SILT	Silty sandy CLAY	SILTSTONE	Silty CLAY
Silty SAND	Sandy gravelly SILT	Silty gravelly SAND		

SUBSURFACE SECTION

Client: BAM
Project: Dunsbury Hill
Number: 5002713 - Figure 6

Report ID: AGS4 LITHOLOGY SITEMAP - A3 || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 12 May 2017





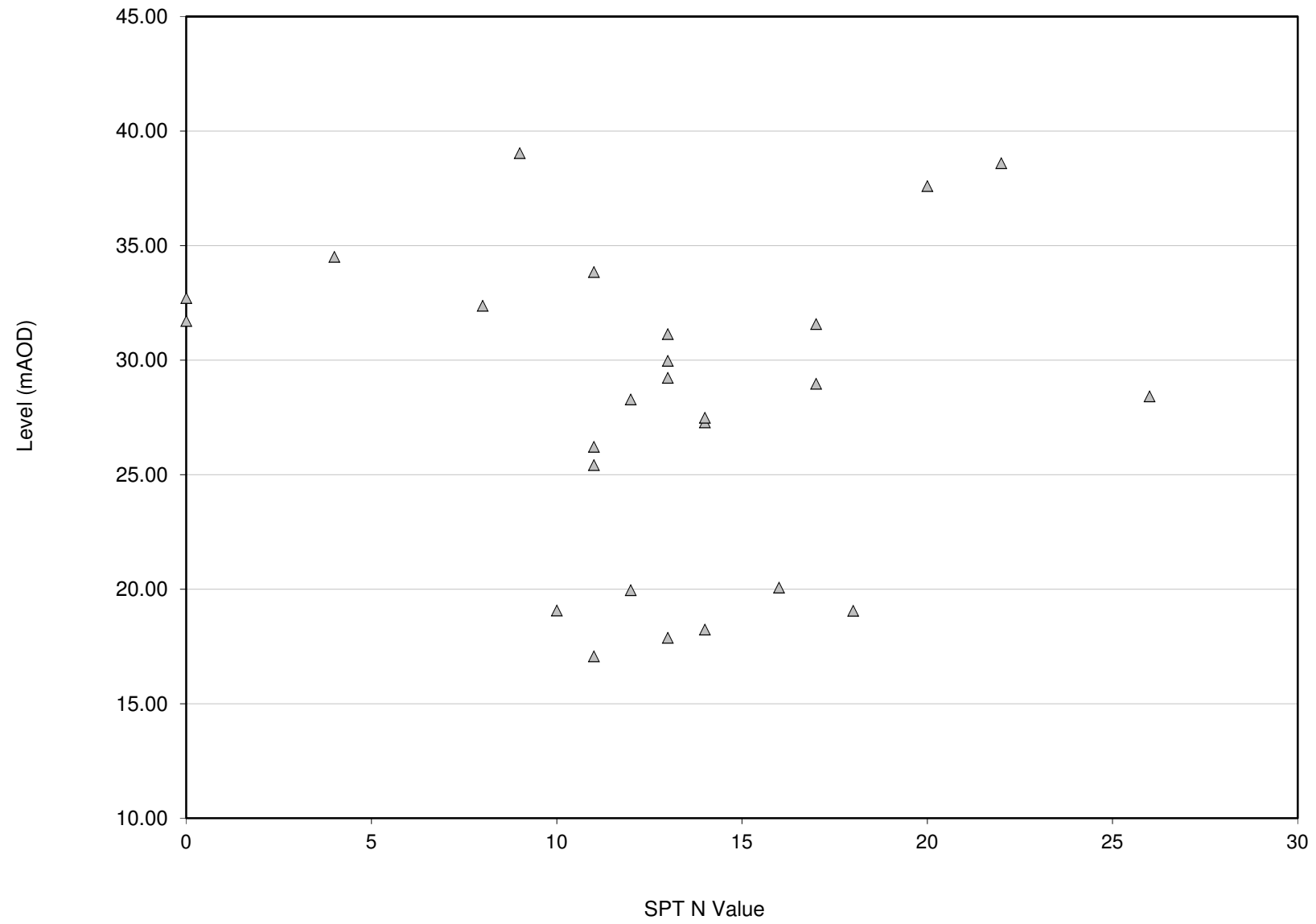
Ridge & Partners LLP
Moorside Road
Winchester
Telephone: -
Fax: -
www.ridge.co.uk

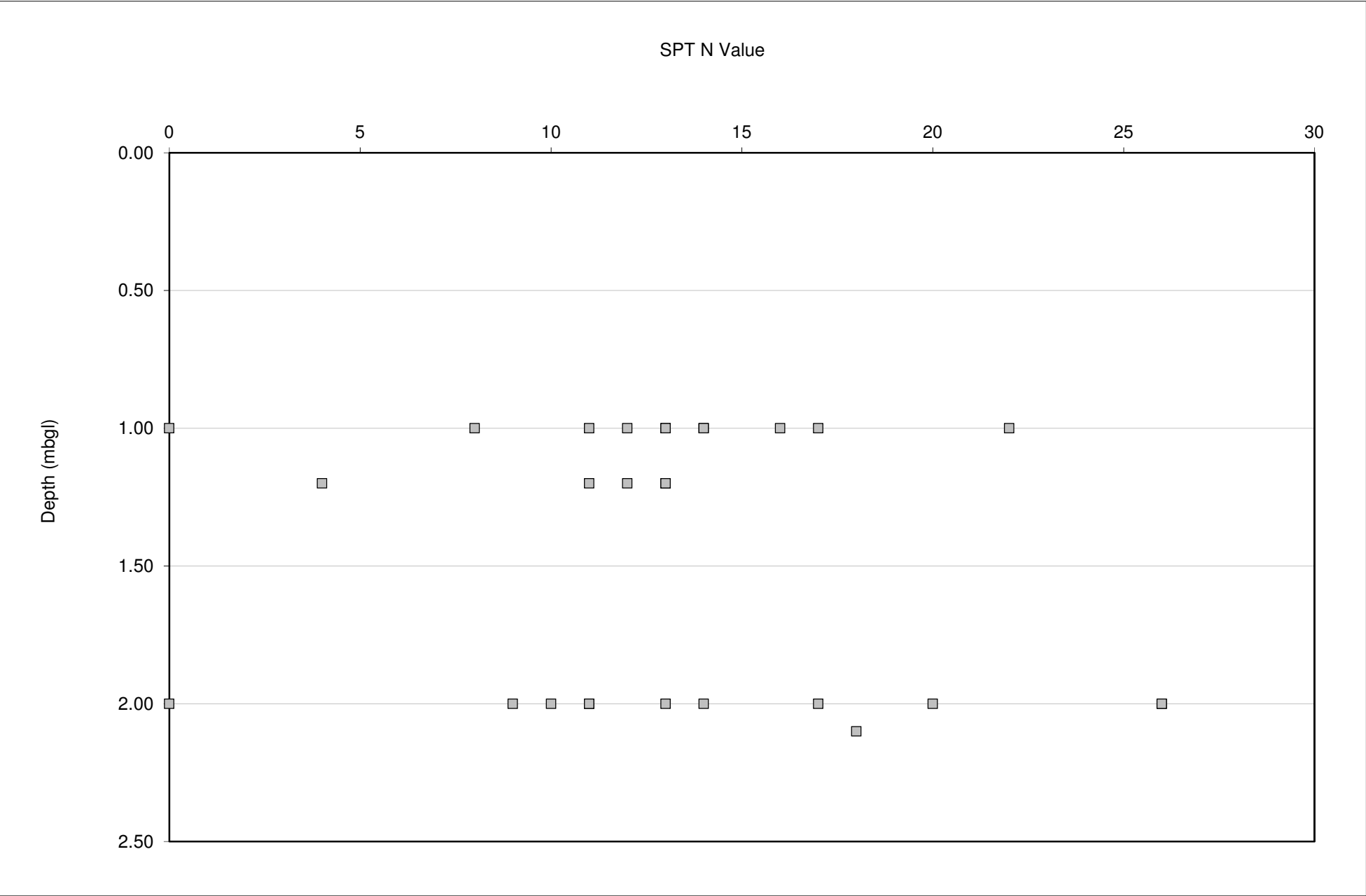
LITHOLOGY GRAPHICS					
 TOPSOIL	 Silty sandy gravelly CLAY	 Silty gravelly SAND	 Silty sandy CLAY	 SILTSTONE	
 Silty CLAY	 Sandy SILT	 Silty SAND	 MADE GROUND	 Sandy gravelly SILT	

SUBSURFACE SECTION

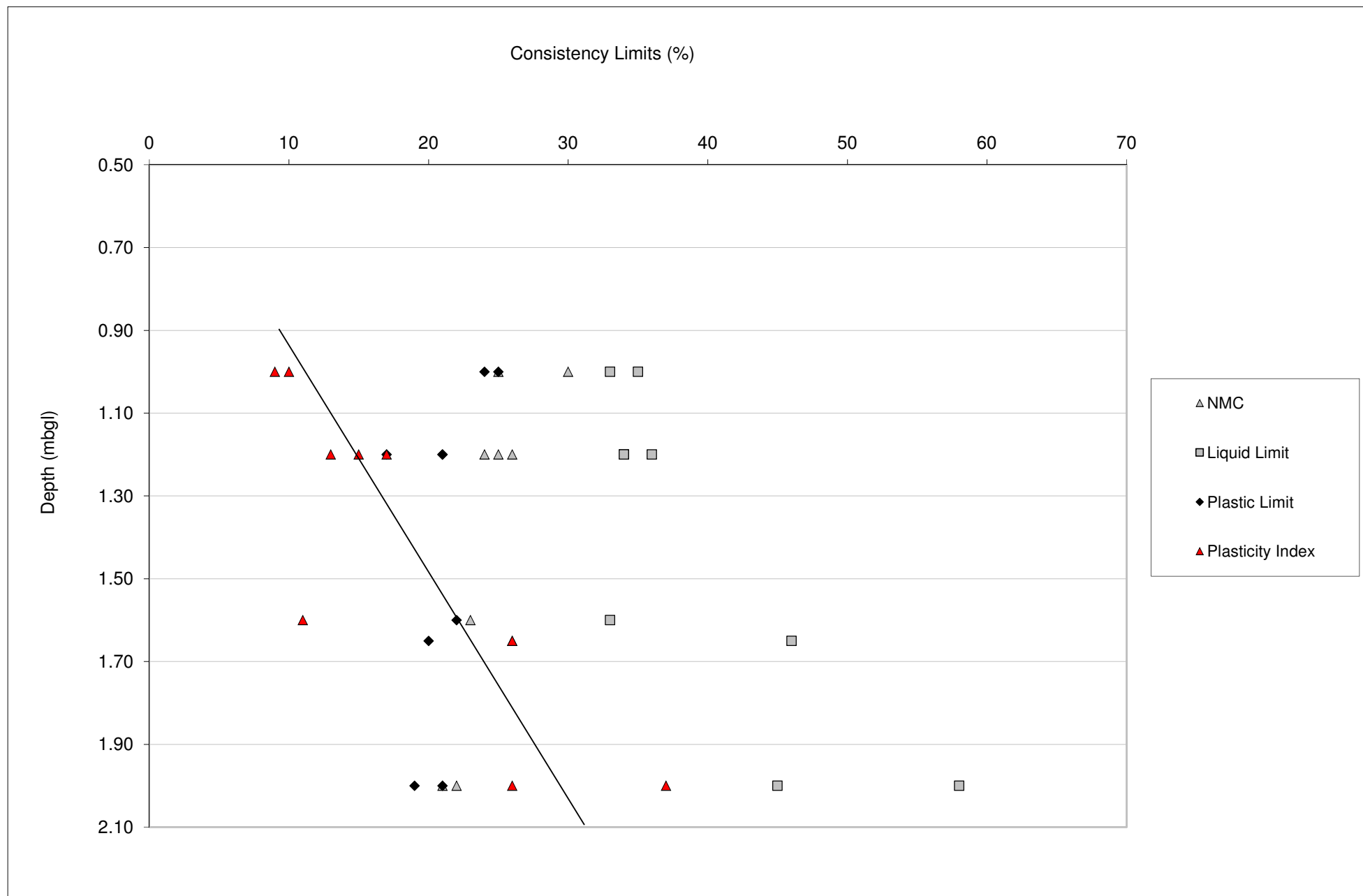
Client: BAM
Project: Dunsbury Hill
Number: 5002713 - Figure 7

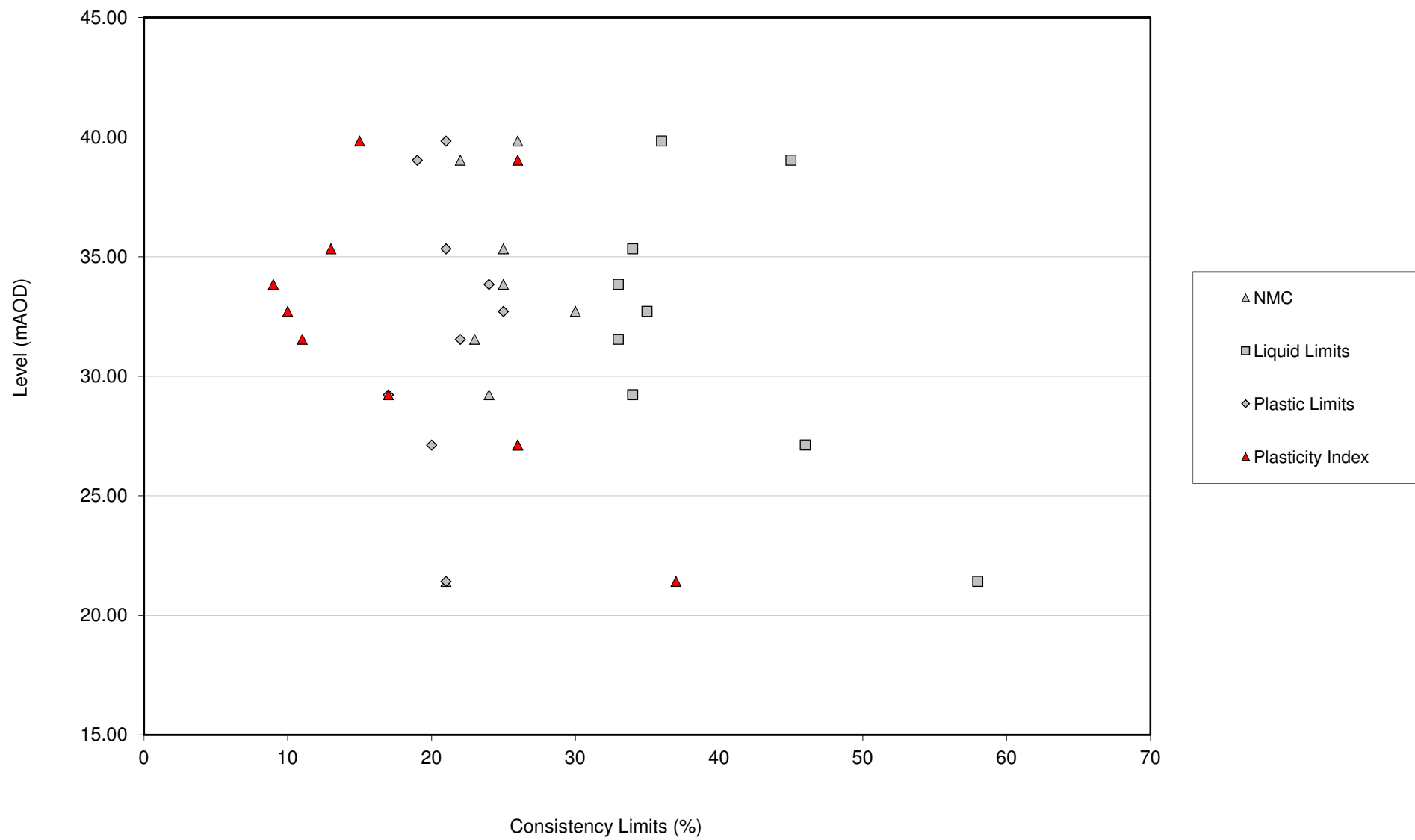
FIGURES 8 - 9 – SPT N VS DEPTH / ELEVATION – HEAD DEPOSITS



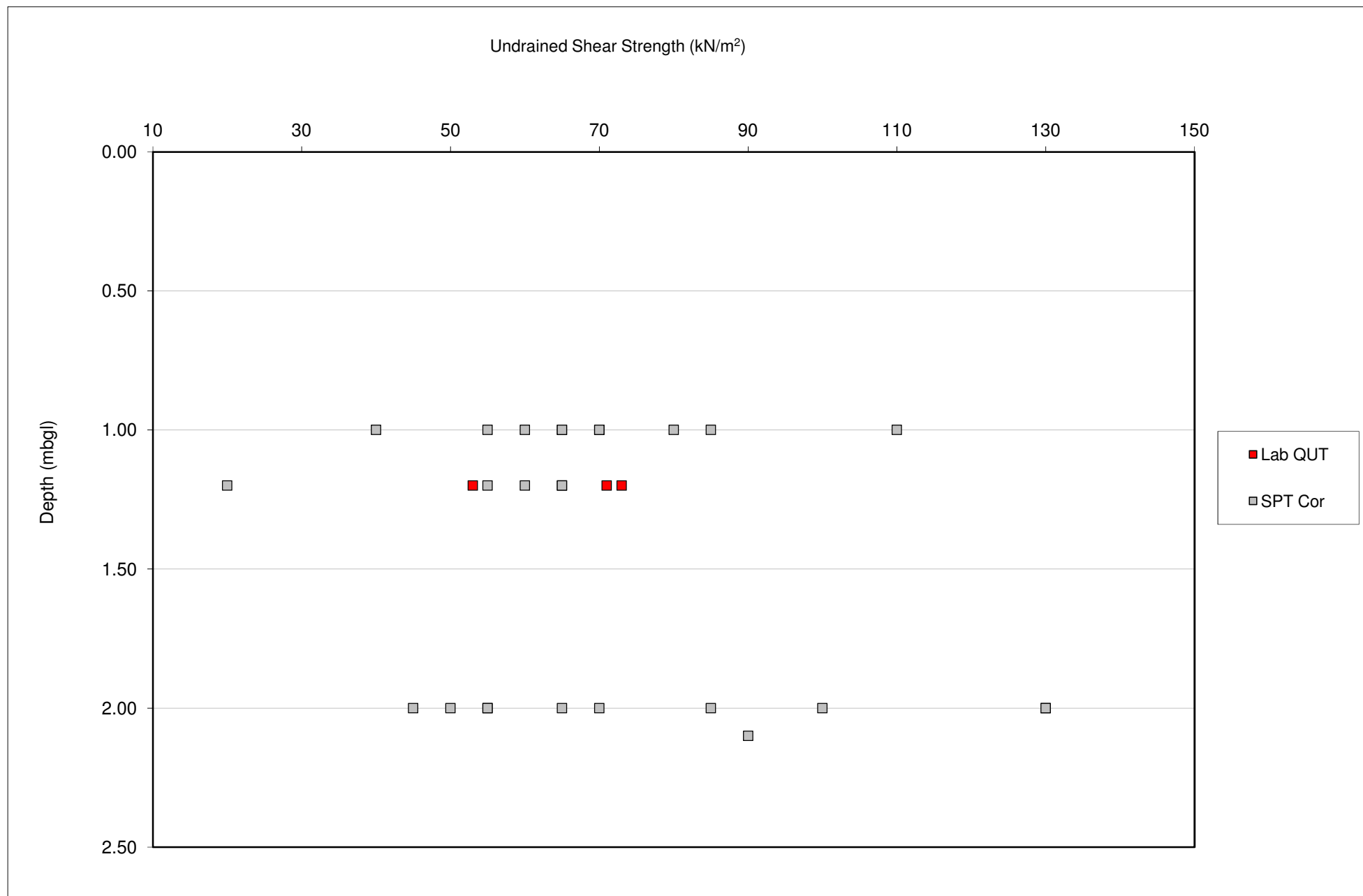


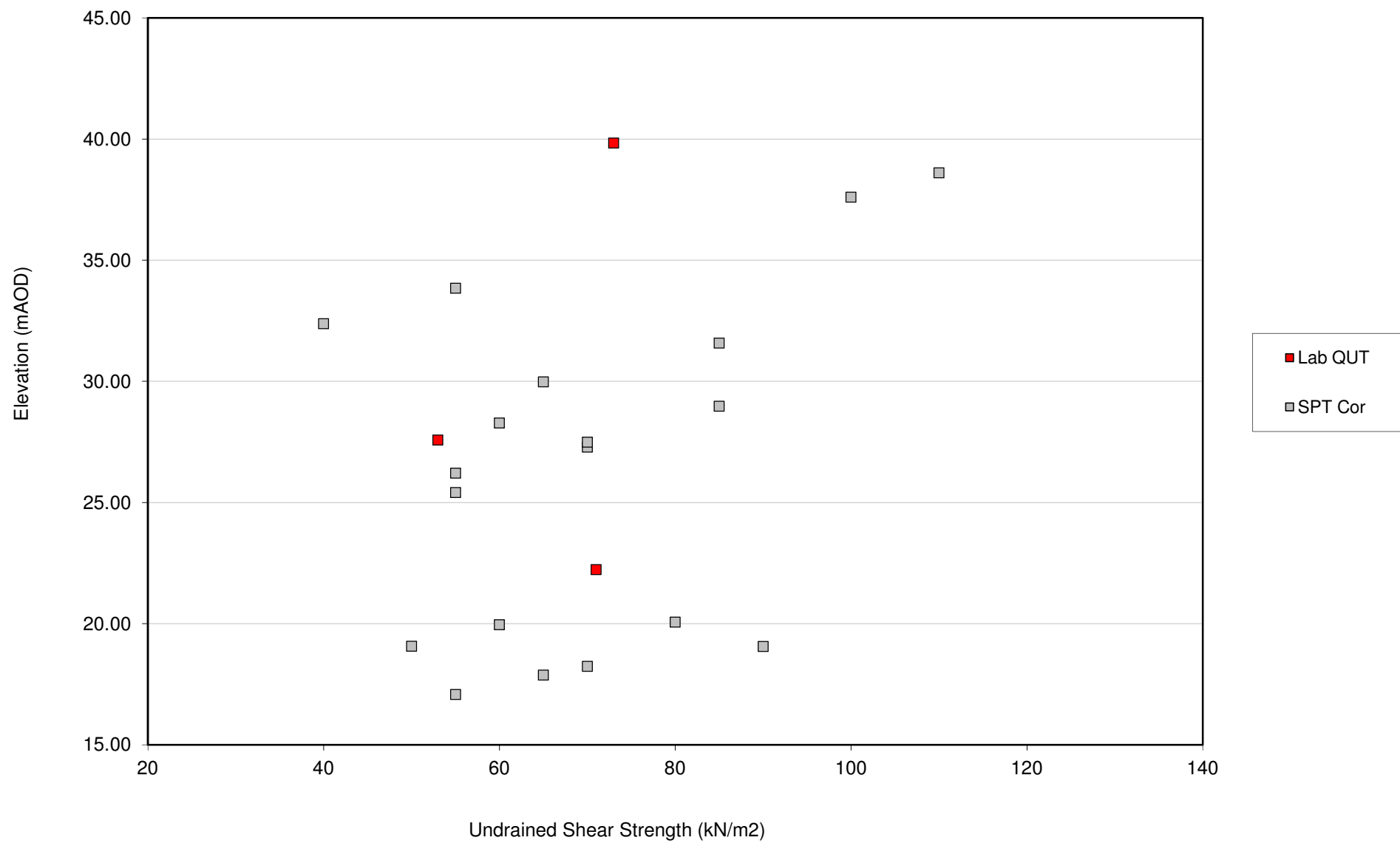
**FIGURES 10 - 11 – CONSISTENCY LIMITS V DEPTH / ELEVATION – HEAD
DEPOSITS**



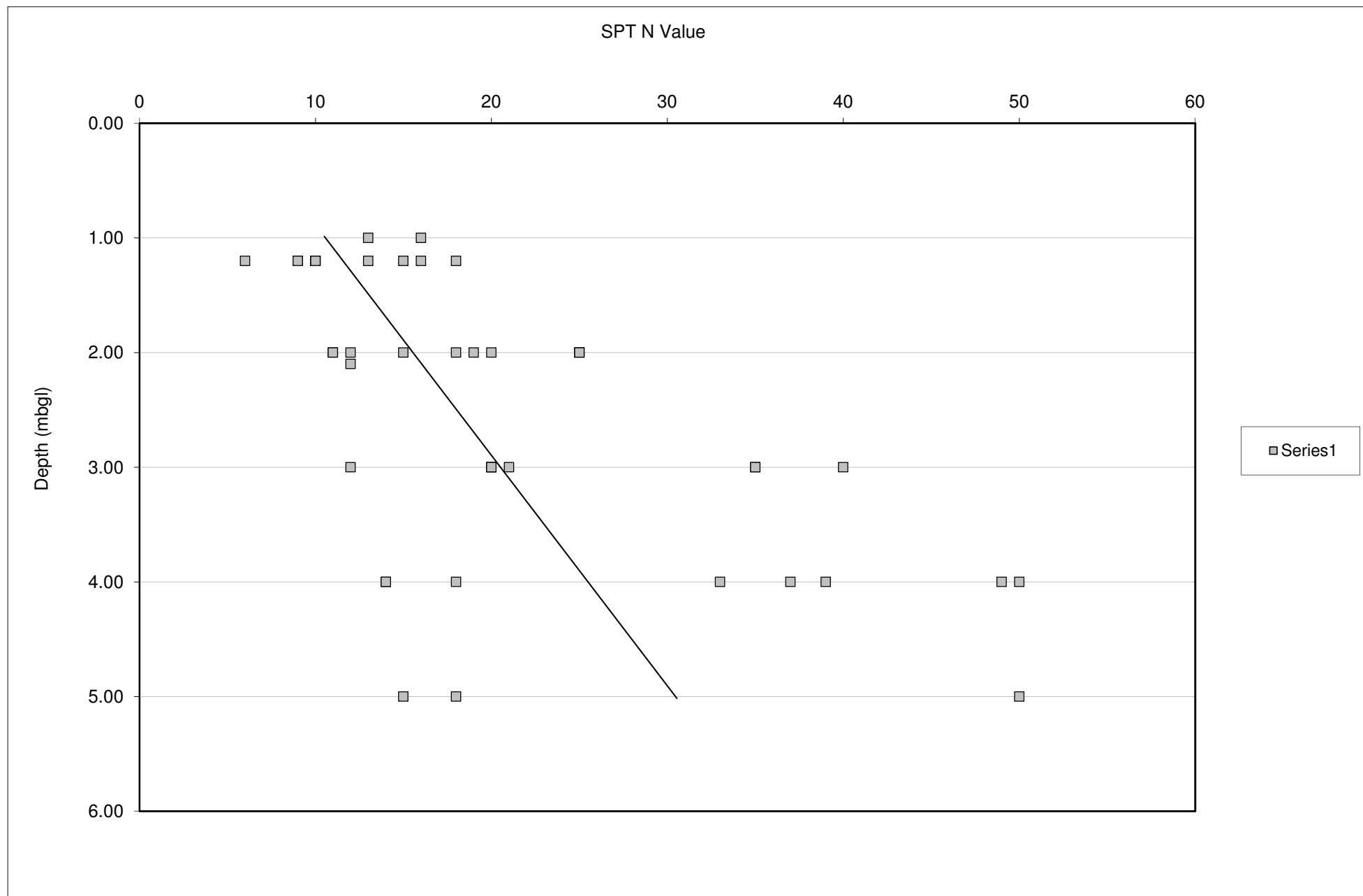


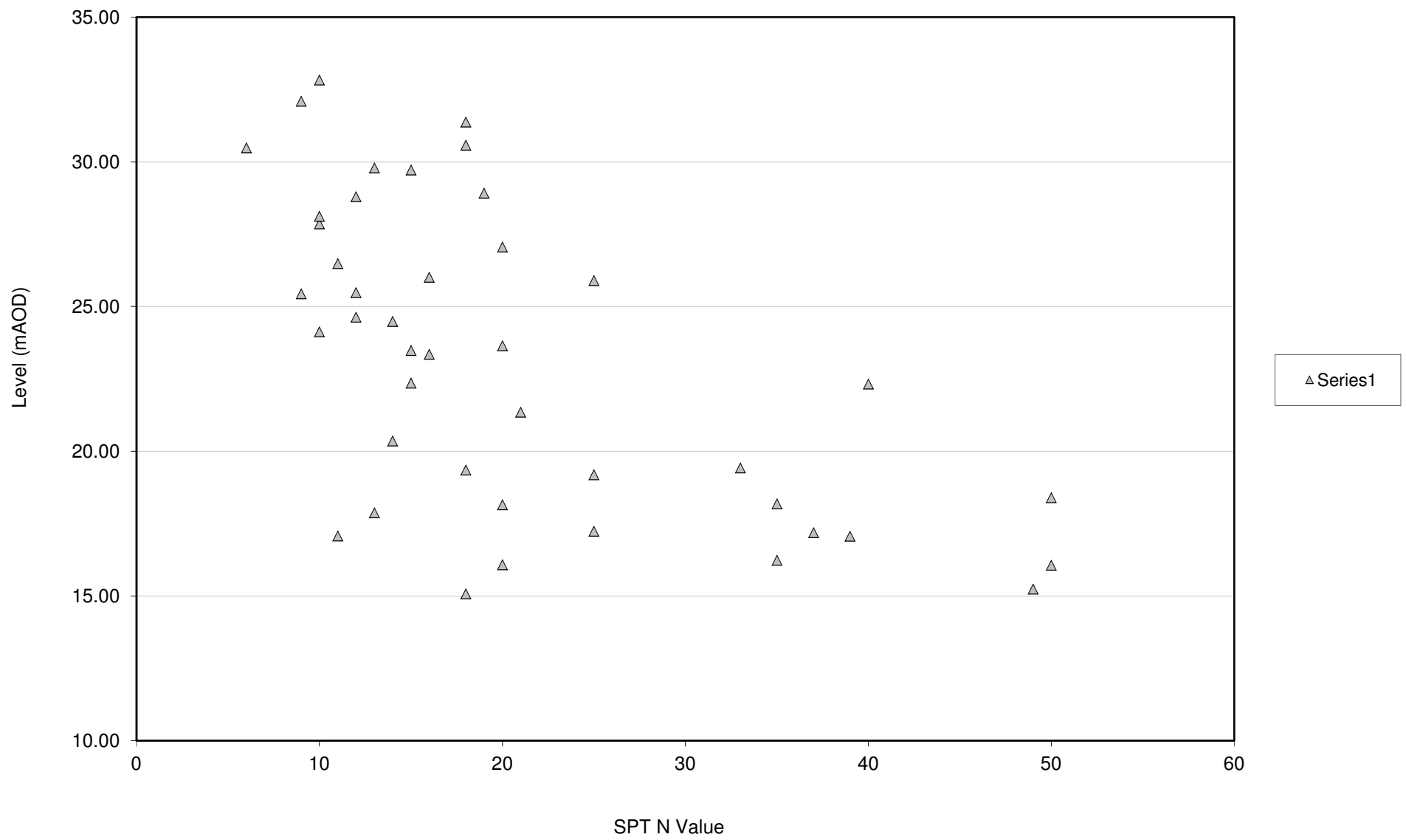
**FIGURES 12 - 13 – UNDRAINED SHEAR STRENGTH V DEPTH / ELEVATION –
HEAD DEPOSITS**



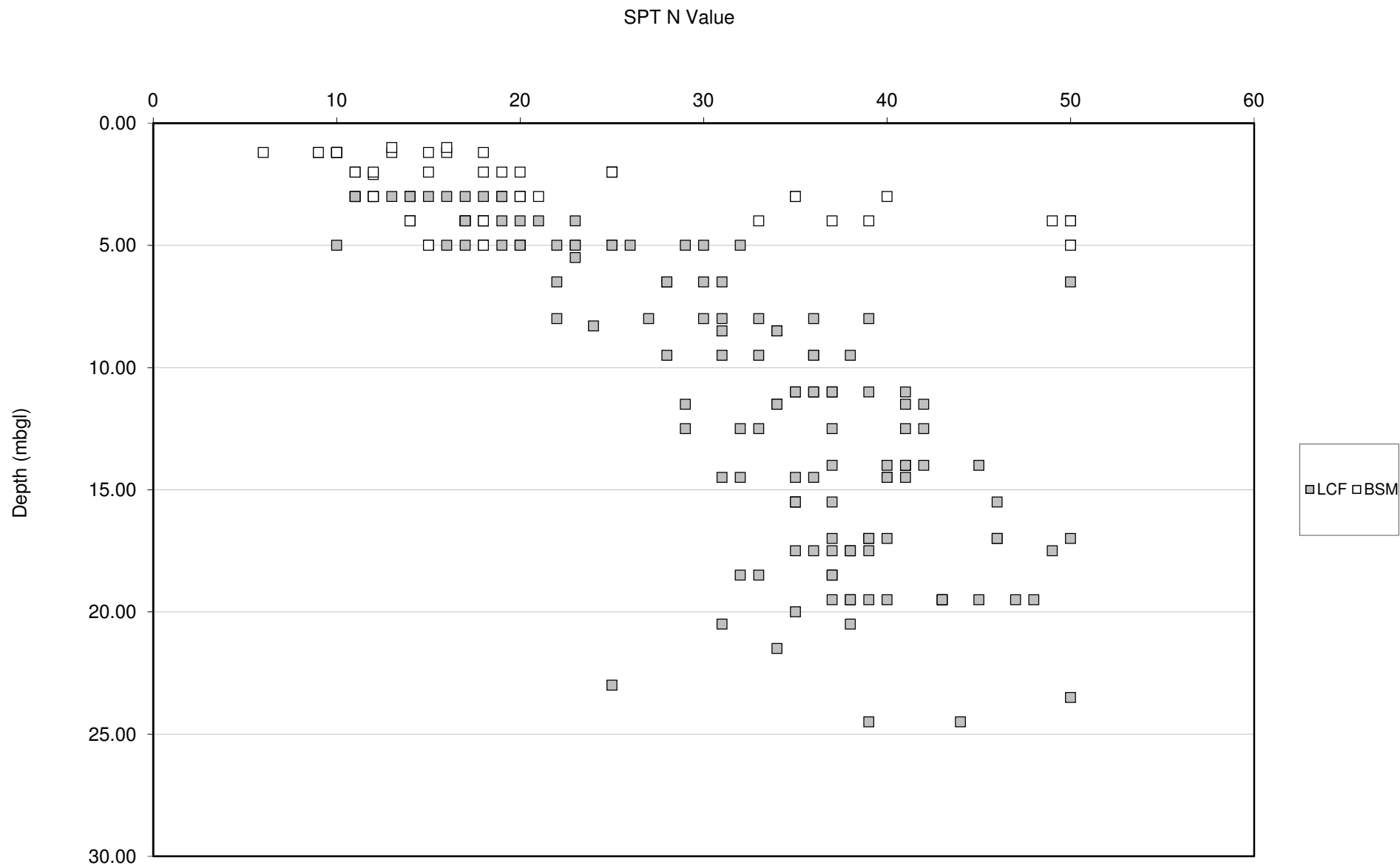


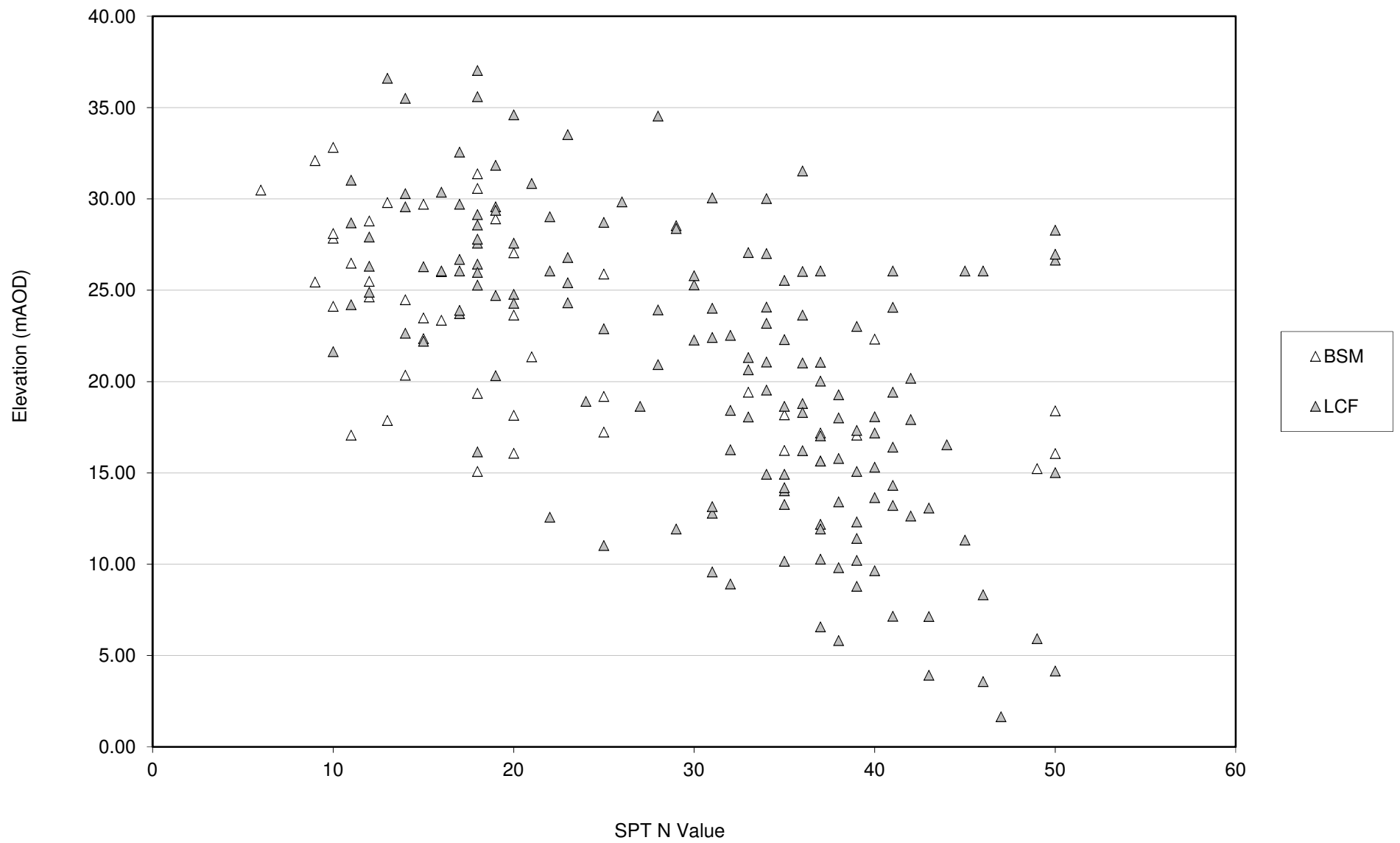
FIGURES 14 – 15 – SPT N V DEPTH / ELEVATION – BPGNOR SAND MEMBER



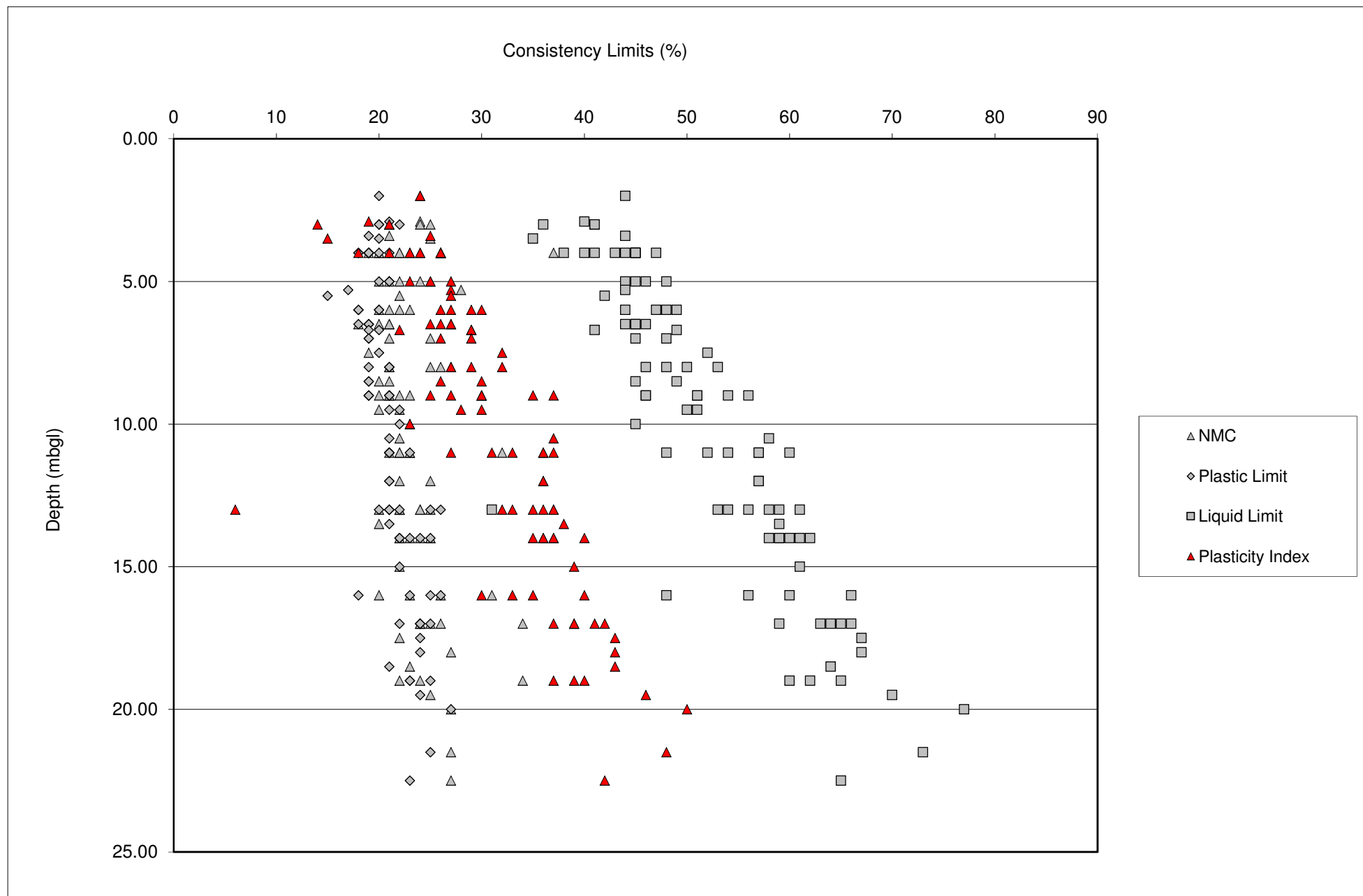


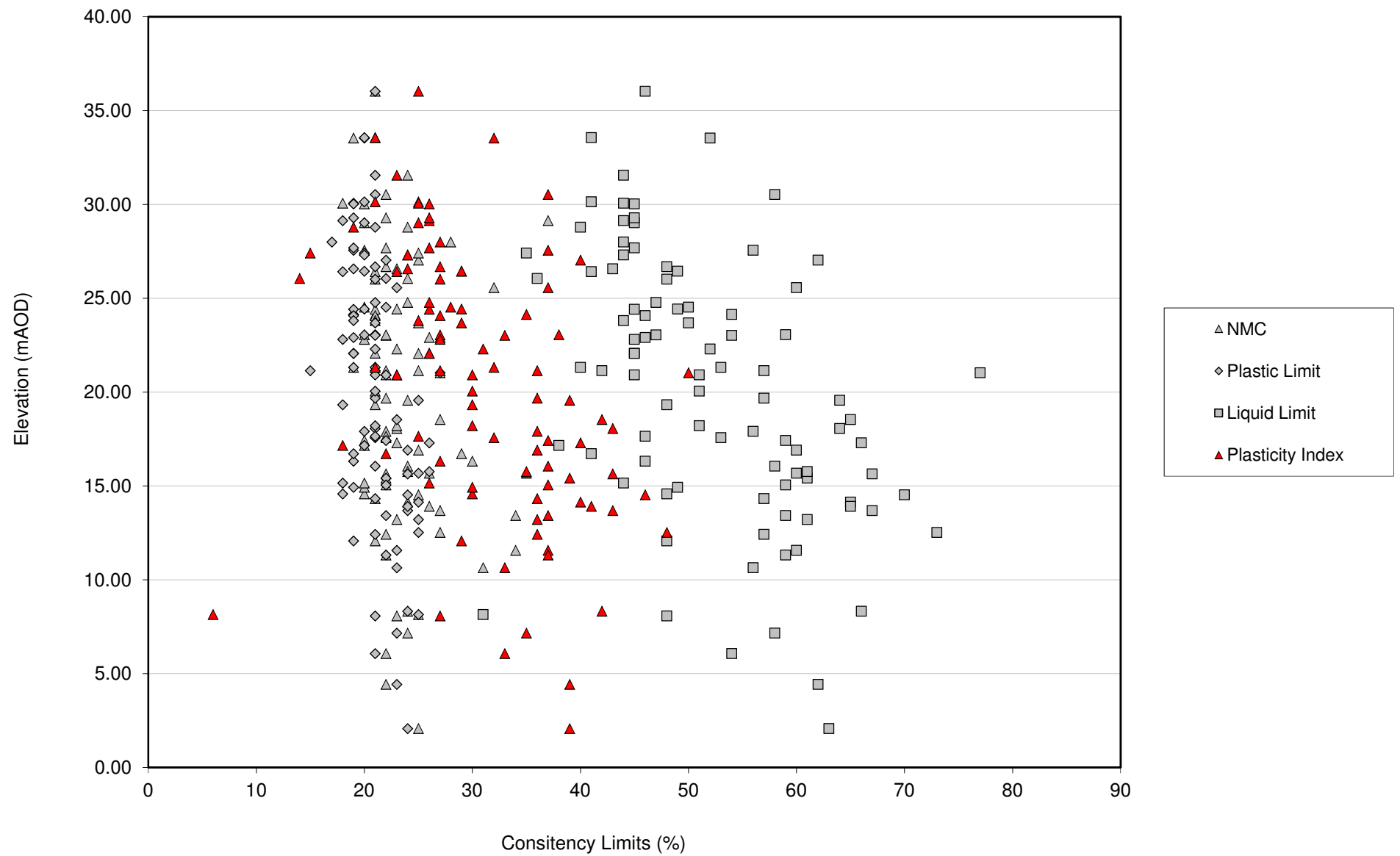
FIGURES 16 – 17 – SPT N V DEPTH / ELEVATION – LONDON CLAY

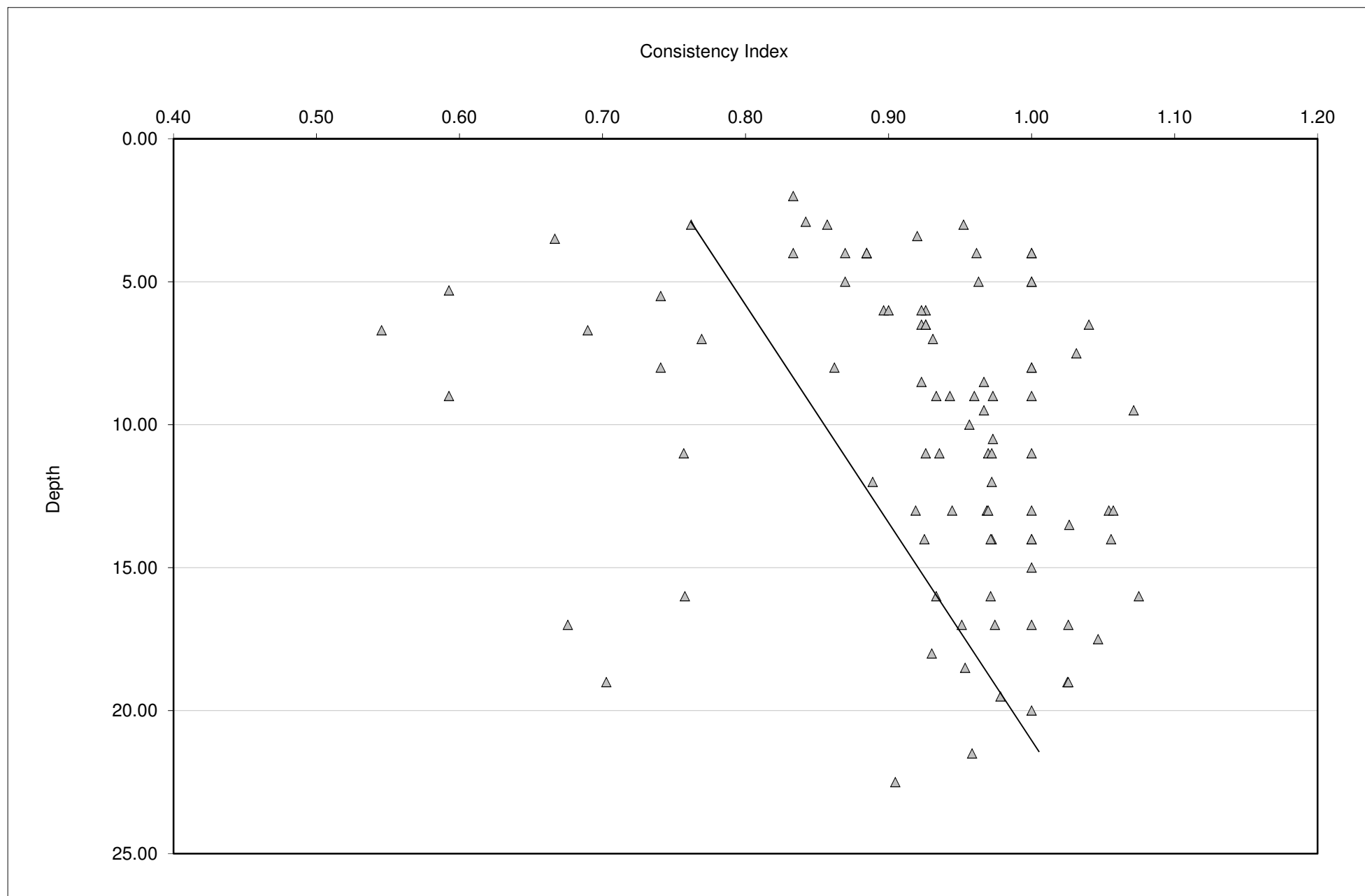


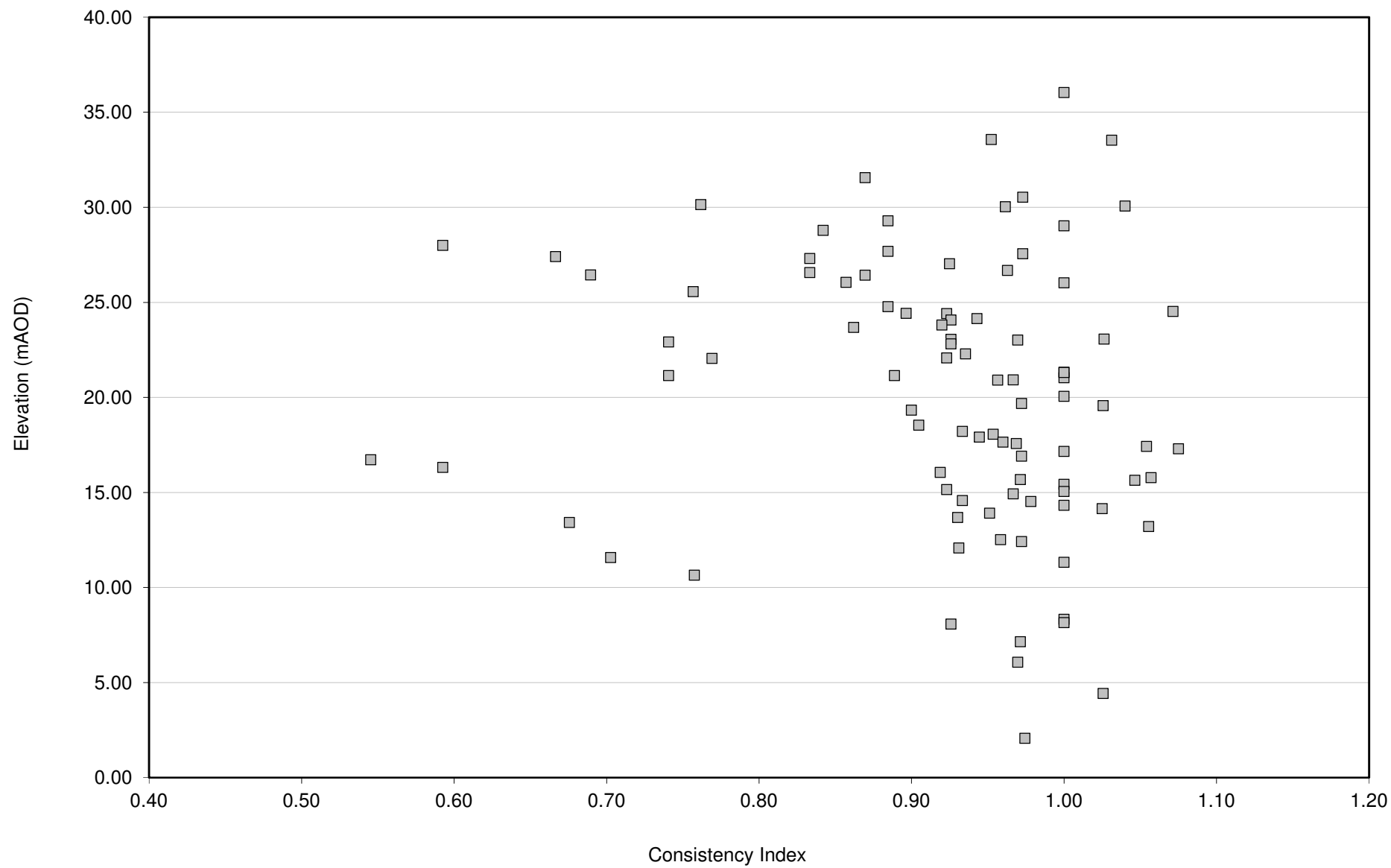


FIGURES 18 -21 – CONSISTENCY LIMITS V DEPTH / ELEVATION – LONDON CLAY

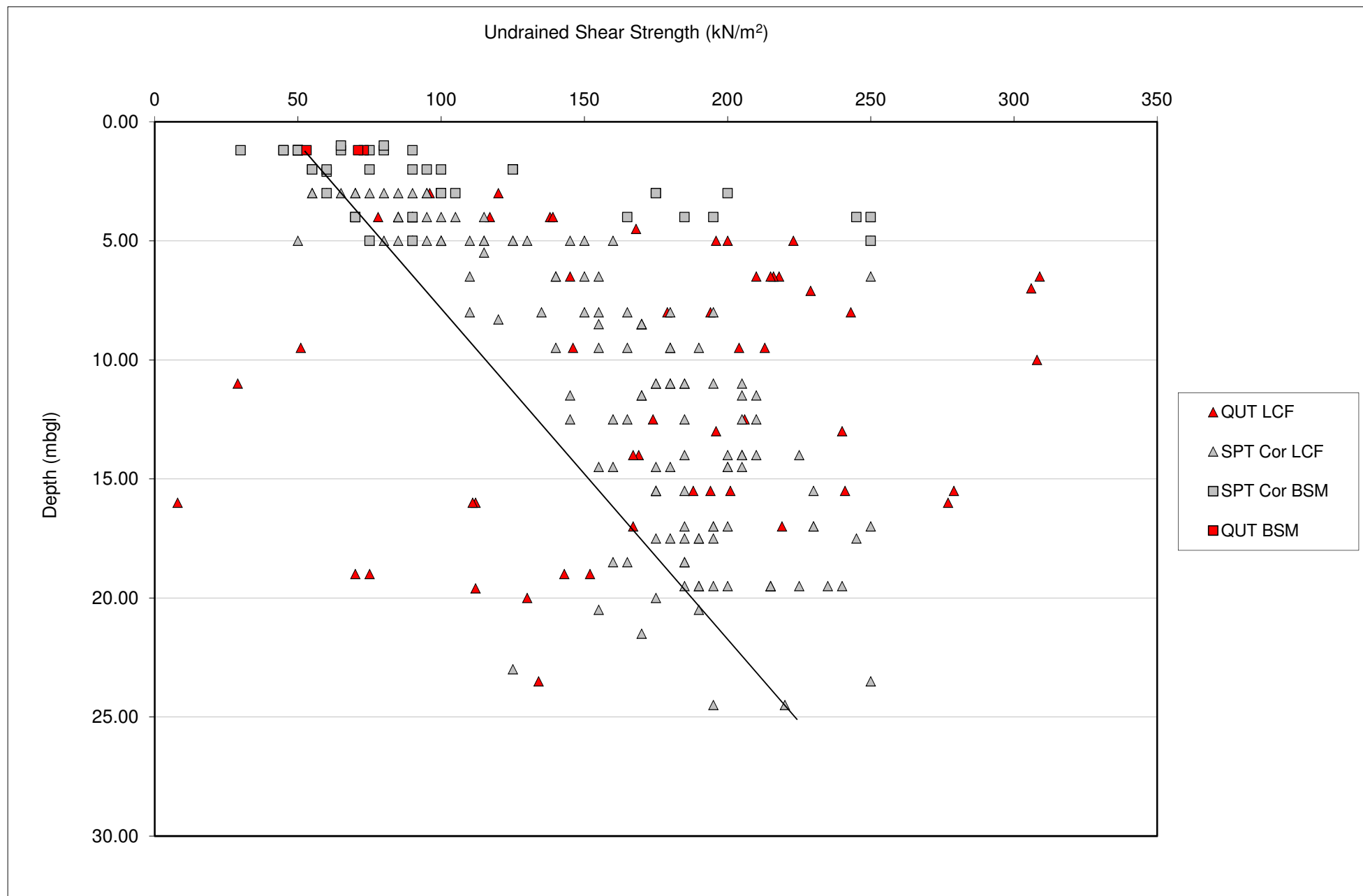








**FIGURES 22 – 23 – UNDRAINED SHEAR STRENGTH – LONDON CLAY
FORMATION**



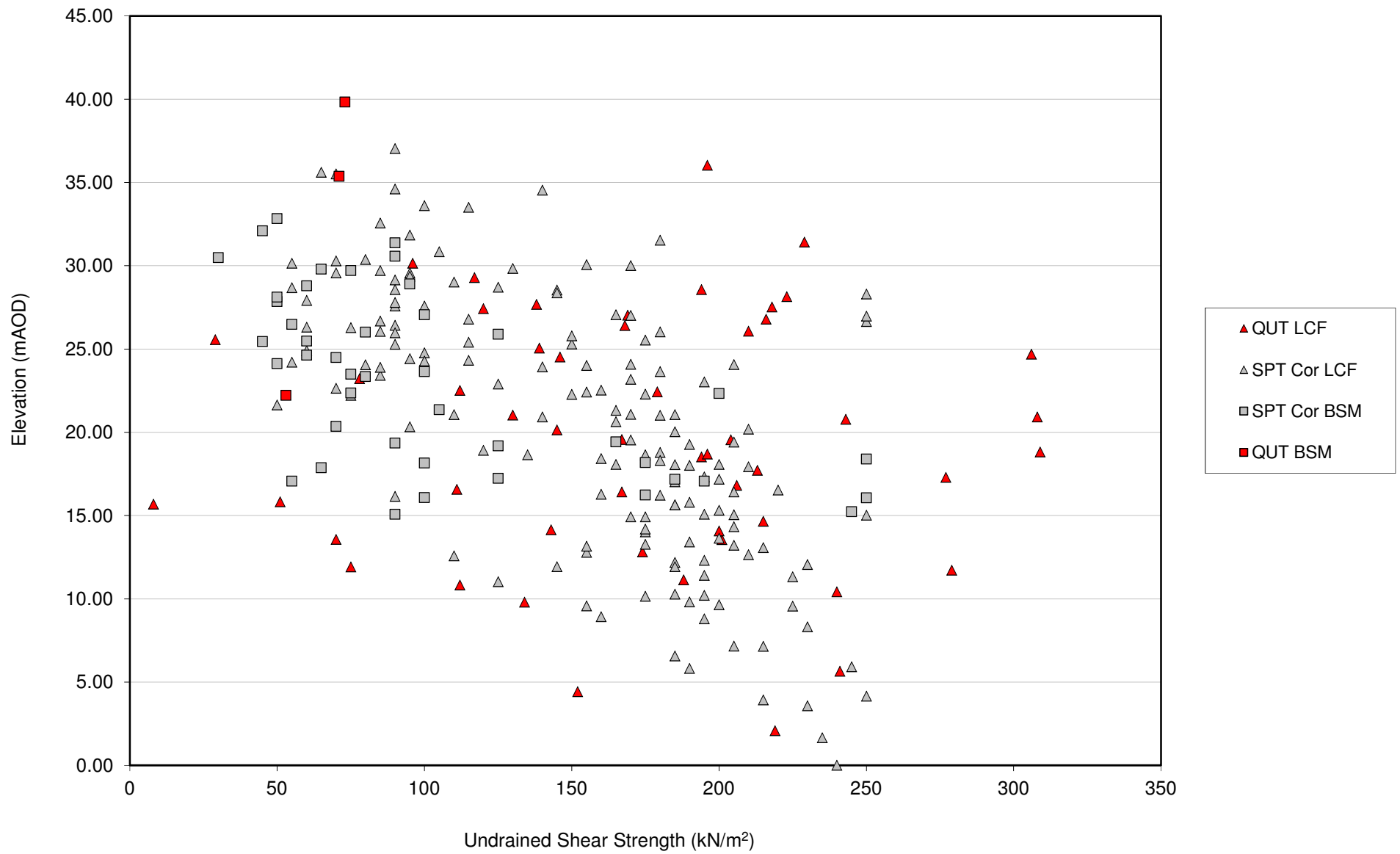


FIGURE 24 – EFFECTIVE SHEAR STRENGTH FAILURE ENVELOPE – LONDON CLAY FORMATION

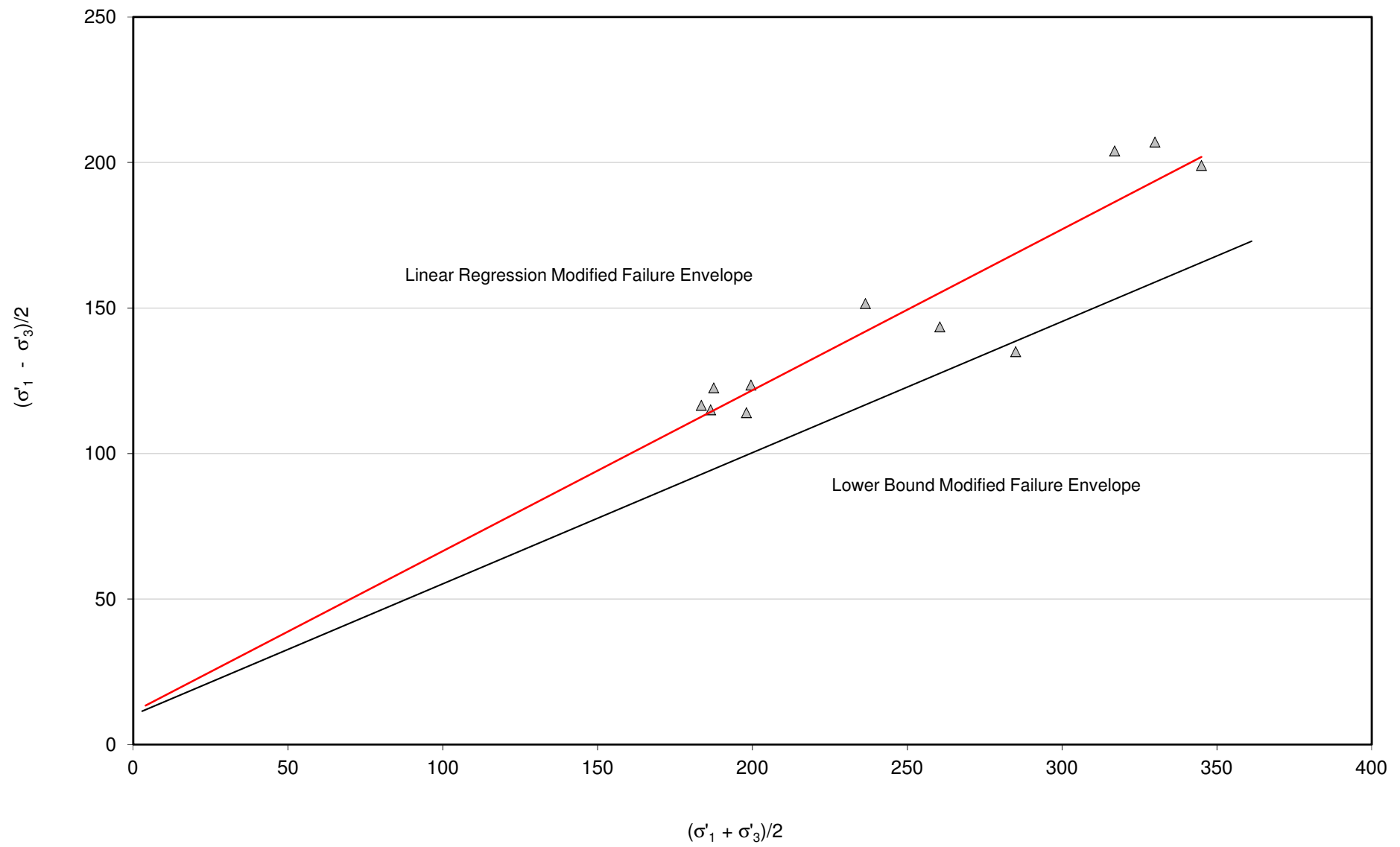
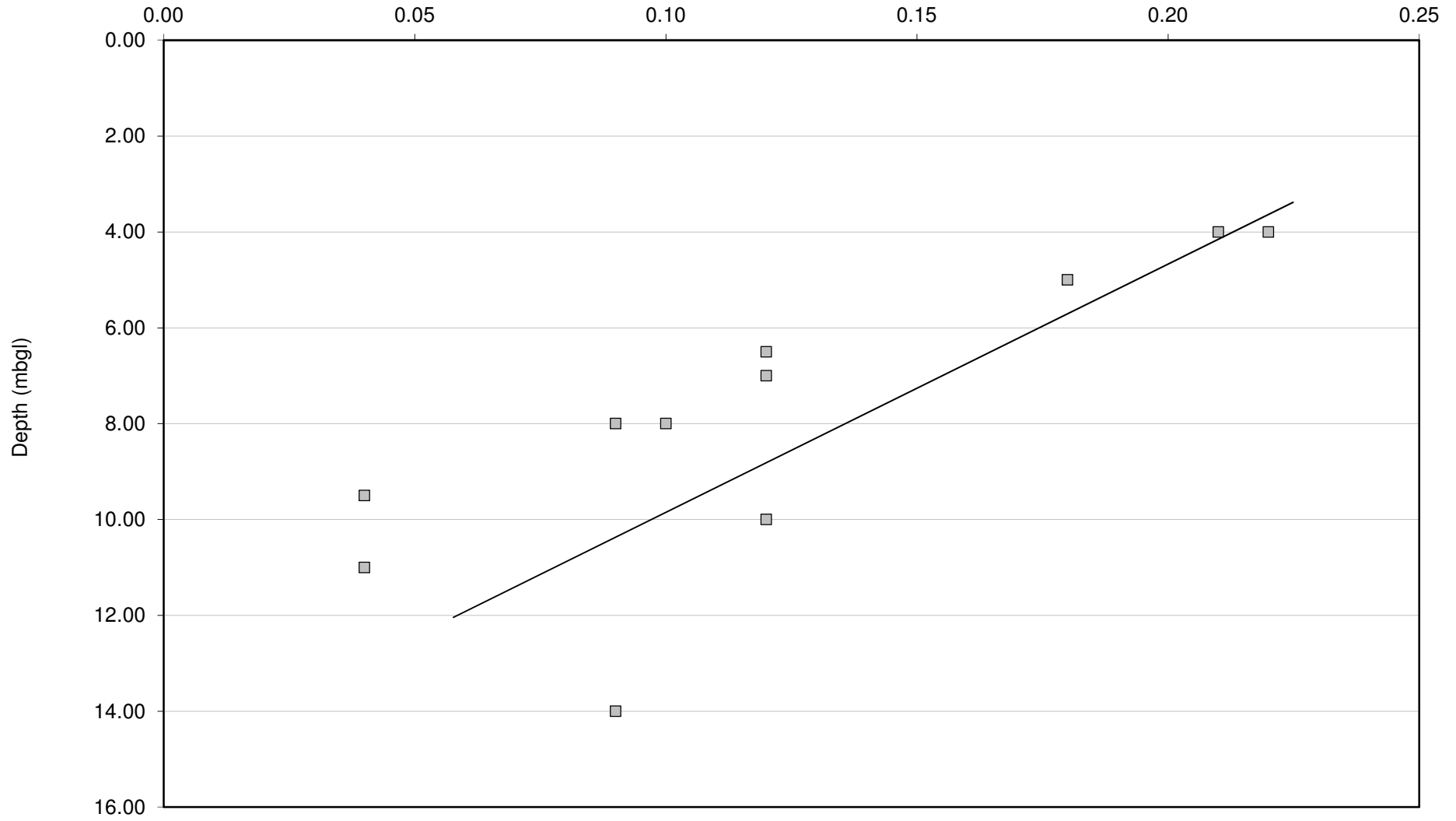


FIGURE 25 – COEFFICIENT OF VOLUME COMPRESSIBILITY V DEPTH - LONDON CLAY FORMATION

Coefficient of Volume Compressibility (m^2/MN)



APPENDIX 1 – REPORT CONDITIONS

This report is produced solely for the benefit of **BAM** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ridge and Partners LLP. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off site intrusive investigations and monitoring.



Ridge & Partners LLP

The Cowyards, Blenheim Park,
Woodstock, OX20 1QR

Groundsure
Reference:

GS-3789471

Your Reference: 5002713_-_602182

Report Date 7 Apr 2017

Report Delivery Method: Email - pdf

Groundsure Enviro Insight

Address: DUNSBURY HILL FARM, HAVANT, PO9 4EE

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Groundsure Enviro Insight

Address: DUNSBURY HILL FARM, HAVANT, PO9 4EE
Date: 7 Apr 2017
Reference: GS-3789471
Client: Ridge & Partners LLP



Aerial Photograph Capture date: 20-Aug-2013
Grid Reference: 469972,109178
Site Size: 0.00ha

Report Reference: GS-3789471
Client Reference: 5002713_-_602182

Contents Page

Contents Page	3
Overview of Findings	6
Using this report	10
1. Historical Land Use	11
1. Historical Industrial Sites	12
1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping	12
1.2 Additional Information – Historical Tank Database	12
1.3 Additional Information – Historical Energy Features Database	12
1.4 Additional Information – Historical Petrol and Fuel Site Database	12
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	13
1.6 Potentially Infilled Land	13
2. Environmental Permits, Incidents and Registers Map	14
2. Environmental Permits, Incidents and Registers	15
2.1 Industrial Sites Holding Licences and/or Authorisations	15
2.1.1 Records of historic IPC Authorisations within 500m of the study site	15
2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site	15
2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site	15
2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site	15
2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site	15
2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site	16
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	16
2.1.8 Records of Licensed Discharge Consents within 500m of the study site	16
2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site	16
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	16
2.2 Dangerous or Hazardous Sites	16
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents	17
2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site	17
2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site	17
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	17
3. Landfill and Other Waste Sites Map	18
3. Landfill and Other Waste Sites	19
3.1 Landfill Sites	19
3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site	19
3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site	19
3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site	19
3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site	20
3.2 Other Waste Sites	20
3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site	20
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site	20
4. Current Land Use Map	21
4. Current Land Uses	22
4.1 Current Industrial Data	22
4.2 Petrol and Fuel Sites	22
4.3 National Grid High Voltage Underground Electricity Transmission Cables	22
4.4 National Grid High Pressure Gas Transmission Pipelines	23

5. Geology	24
5.1 Artificial Ground and Made Ground.....	24
5.2 Superficial Ground and Drift Geology	24
5.3 Bedrock and Solid Geology	24
6 Hydrogeology and Hydrology	25
6a. Aquifer Within Superficial Geology	25
6b. Aquifer Within Bedrock Geology and Abstraction Licenses	26
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses	27
6d. Hydrogeology – Source Protection Zones within confined aquifer	28
6e. Hydrology – Detailed River Network and River Quality	29
6.Hydrogeology and Hydrology	30
6.1 Aquifer within Superficial Deposits.....	30
6.2 Aquifer within Bedrock Deposits.....	30
6.3 Groundwater Abstraction Licences.....	31
6.4 Surface Water Abstraction Licences.....	31
6.5 Potable Water Abstraction Licences.....	31
6.6 Source Protection Zones.....	31
6.7 Source Protection Zones within Confined Aquifer.....	31
6.8 Groundwater Vulnerability and Soil Leaching Potential.....	32
6.9 River Quality.....	32
6.9.1 Biological Quality:.....	32
6.9.2 Chemical Quality:.....	32
6.10 Detailed River Network.....	32
6.11 Surface Water Features.....	34
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)	35
7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)	36
Map	36
7 Flooding	37
7.1 River and Coastal Zone 2 Flooding.....	37
7.2 River and Coastal Zone 3 Flooding.....	37
7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.....	37
7.4 Flood Defences.....	37
7.5 Areas benefiting from Flood Defences.....	37
7.6 Areas benefiting from Flood Storage.....	38
7.7 Groundwater Flooding Susceptibility Areas.....	38
7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.....	38
7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?.....	38
7.8 Groundwater Flooding Confidence Areas.....	38
8. Designated Environmentally Sensitive Sites Map	39
8. Designated Environmentally Sensitive Sites	40
8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:.....	40
8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:.....	40
8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:.....	40
8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:.....	40
8.5 Records of Ramsar sites within 2000m of the study site:.....	40
8.6 Records of Ancient Woodland within 2000m of the study site:	41
8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:.....	43
8.8 Records of World Heritage Sites within 2000m of the study site:.....	43
8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:	43

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:	43
8.11 Records of National Parks (NP) within 2000m of the study site:	43
8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:.....	44
8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:.....	44
8.14 Records of Green Belt land within 2000m of the study site:.....	44
9. Natural Hazards Findings	45
9.1 Detailed BGS GeoSure Data.....	45
9.1.1 Shrink Swell.....	45
9.1.2 Landslides.....	45
9.1.3 Soluble Rocks.....	45
9.1.4 Compressible Ground.....	46
9.1.5 Collapsible Rocks.....	46
9.1.6 Running Sand.....	46
9.2 Radon.....	46
9.2.1 Radon Affected Areas.....	46
9.2.2 Radon Protection.....	47
10. Mining	48
10.1 Coal Mining.....	48
10.2 Non-Coal Mining.....	48
10.3 Brine Affected Areas	48
Contact Details	49
Standard Terms and Conditions	51

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	0	0	0	5
1.2 Additional Information – Historical Tank Database	0	0	0	0
1.3 Additional Information – Historical Energy Features Database	0	0	0	3
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	0	0
1.6 Potentially Infilled Land	0	0	0	14

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	0	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	1
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	1	0	0	1
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	0
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	0

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	0	2	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	0
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	None
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology				0-500m		
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?				Yes		
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?				Yes		
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	1	1	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	1	0	1	0	Not searched	Not searched

Section 6: Hydrogeology and Hydrology	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	Yes
6.10 Detailed River Network entries within 500m of the site	0	0	3	16	Not searched	Not searched
6.11 Surface water features within 250m of the study site	No	No	Yes	Not searched	Not searched	Not searched

Section 7: Flooding						
7.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	No					
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No					
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low					
7.4 Are there any Flood Defences within 250m of the study site?	No					
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No					
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No					
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Limited potential					
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low					

Section 8: Designated Environmentally Sensitive Sites						
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	1	8	22
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	1	1	0	0	2	2
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards

9.1 What is the maximum risk of natural ground subsidence?	Low
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Negligible
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining

10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

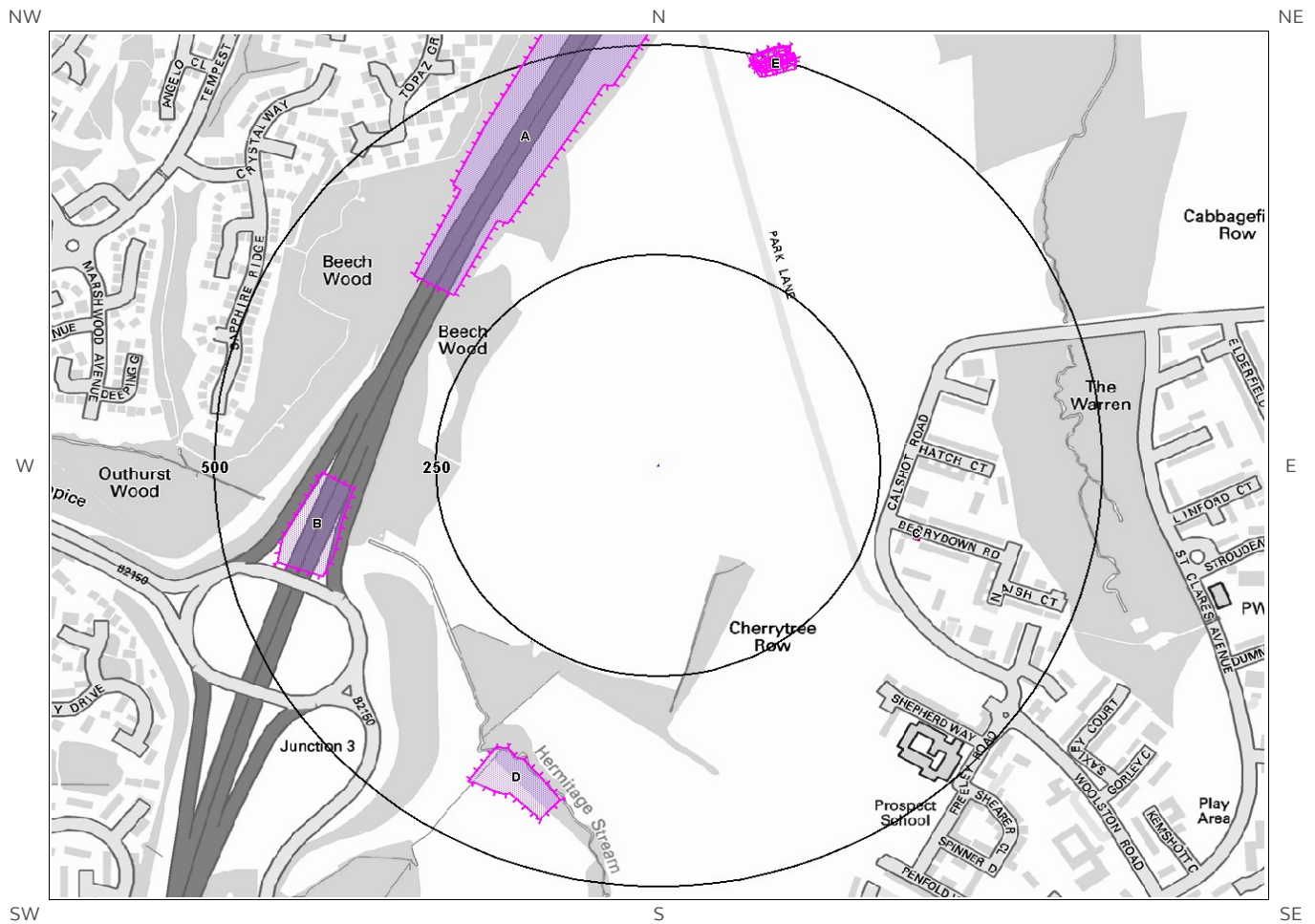
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

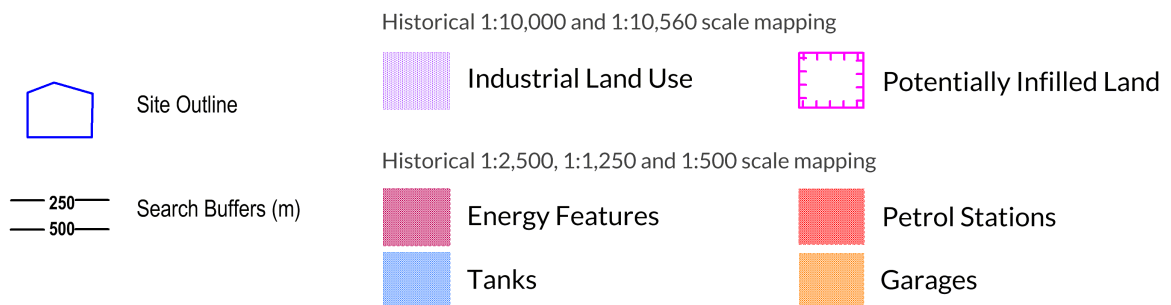
Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Historical Land Use



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 5

ID	Distance [m]	Direction	Use	Date
1A	306	NW	Cuttings	1980
2A	306	NW	Cuttings	1991
3B	344	W	Cuttings	1991
4B	344	W	Cuttings	1980
5D	375	SW	Brick and Tile Works	1866

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 0

Database searched and no data found.

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 3

ID	Distance (m)	Direction	Use	Date
6C	299	E	Electricity Substation	1970
7C	299	E	Electricity Substation	1971
8C	300	E	Electricity Substation	1985

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 0

Database searched and no data found.

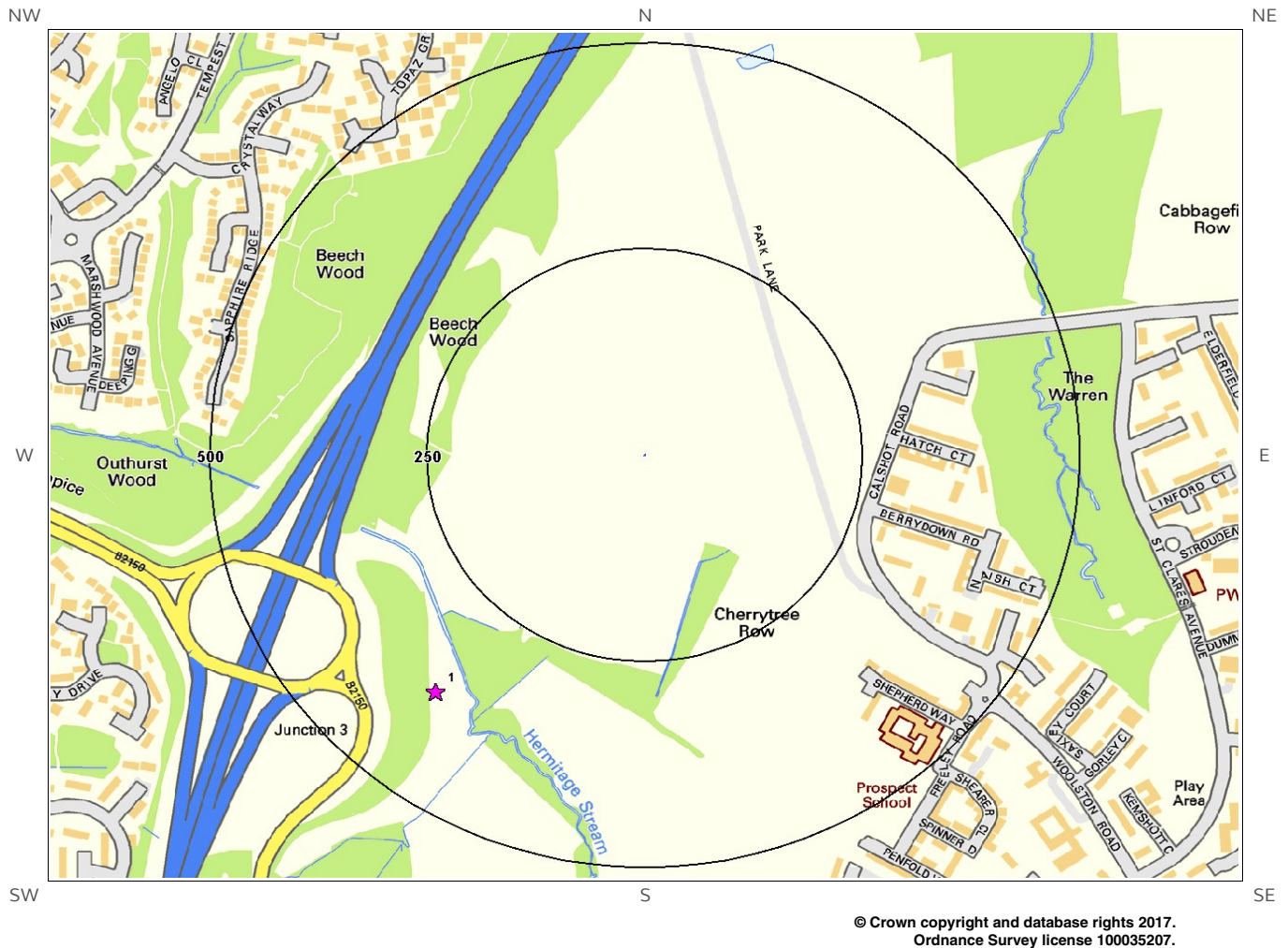
1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 14

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
9A	306	NW	Cuttings	1991
10A	306	NW	Cuttings	1980
11B	344	W	Cuttings	1991
12B	344	W	Cuttings	1980
13D	375	SW	Brick and Tile Works	1866
14E	476	N	Pond	1895
15E	481	N	Pond	1898
16E	482	N	Pond	1963
17E	485	N	Pond	1991
18E	485	N	Pond	1973
19E	486	N	Pond	1930
20E	486	N	Pond	1866
21E	489	N	Pond	1930
22E	491	N	Pond	1907

2. Environmental Permits, Incidents and Registers Map



- | | | |
|--------------------|-------------------------------|--|
| Site Outline | Recorded Pollution Incident | RAS 3 & 4 Authorisations |
| Search Buffers (m) | Dangerous Substances (List 1) | Part A(1) Authorised Processes and Historic IPC Authorisations |
| | Dangerous Substances (List 2) | Part A(2) and Part B Authorised Processes |
| | Water Industry Referrals | COMAH / NIHHS Sites |
| | Licenced Discharge Consents | Sites Determined as Contaminated Land |
| | Red List Discharge Consents | Hazardous Substance Consents and Enforcements |

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

0

Database searched and no data found.

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site:

0

Database searched and no data found.

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

1

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1	375	SW	469730 108890	Incident Date: 01-Mar-2004 Incident Identification: 219859 Pollutant: Sewage Materials Pollutant Description: Crude Sewage	Water Impact: Category 2 (Significant) Land Impact: Category 3 (Minor) Air Impact: Category 3 (Minor)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

Database searched and no data found.

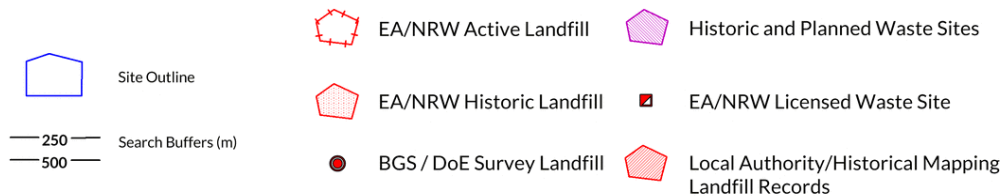
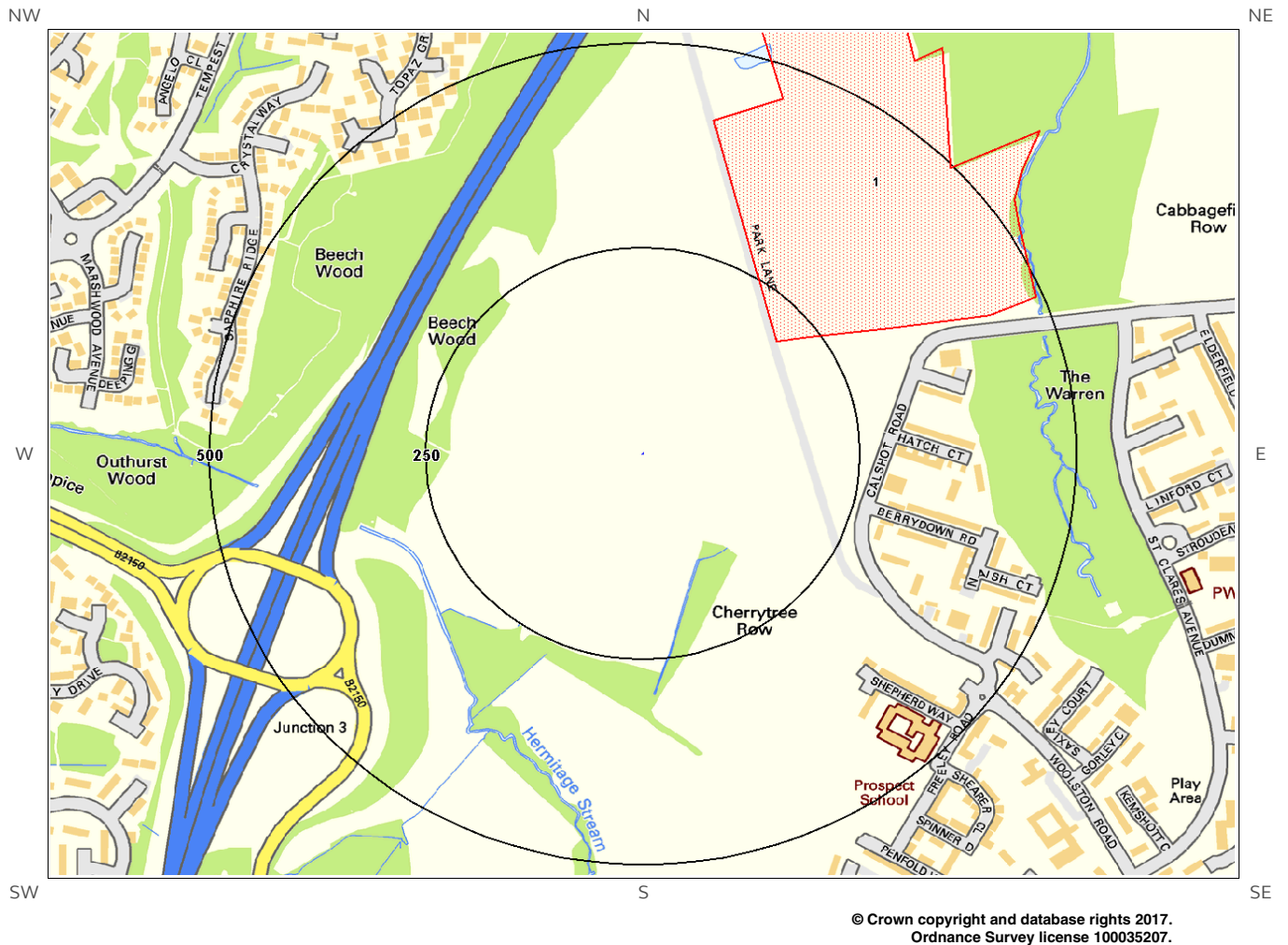
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site?

0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

2

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
1	205	NE	470200 109600	Site Address: Dunsbury Hill Farm, Cowplain, Hampshire Waste Licence: Yes Site Reference: 13/3, FHA17 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: Haredon House, London Road, North Cheam, Sutton, Surrey Operator: - Licence Holder: Gleeson Civil Engineering Limited First Recorded: - Last Recorded: -
Not shown	1178	W	468700 109100	Site Address: Old Council Depot, South Of Cemetery, Hulbert Road, Waterloooville Waste Licence: - Site Reference: FHA11 Waste Type: Household Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

0

Database searched and no data found.

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

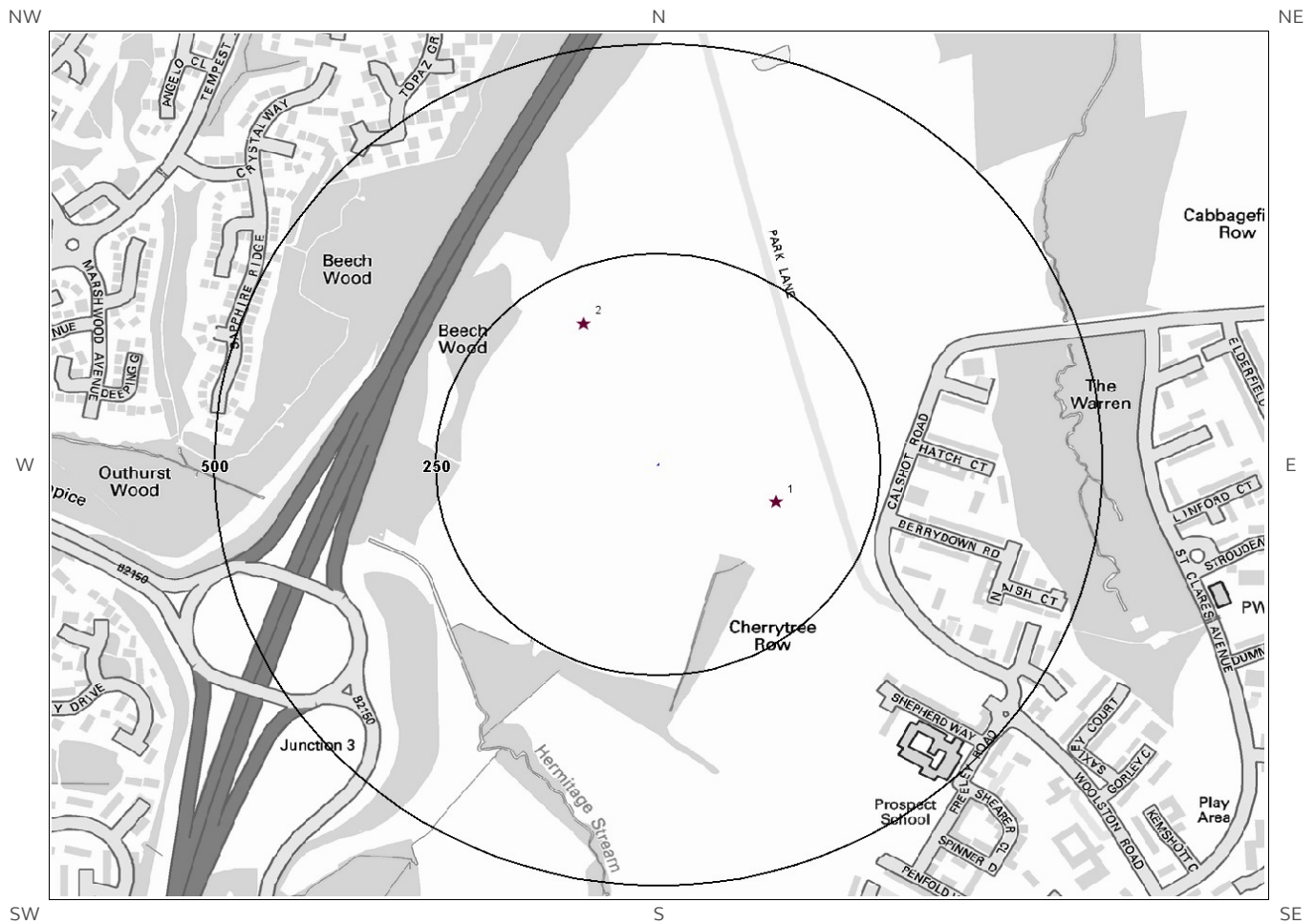
Database searched and no data found.

3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

0

Database searched and no data found.

4. Current Land Use Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



Site Outline

 Current Industrial Sites

 Electricity Transmission Cables

 Search Buffers (m)

 Petrol & Fuel Sites

 Gas Transmission Pipelines

4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 2

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	139	E	Pylon	470104 109134	Pylon, PO9	Electrical Features	Infrastructure and Facilities
2	188	NW	Electricity Pole	469887 109346	Electricity Pole, PO9	Electrical Features	Infrastructure and Facilities

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 0

Database searched and no data found.

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.3 Bedrock and Solid Geology

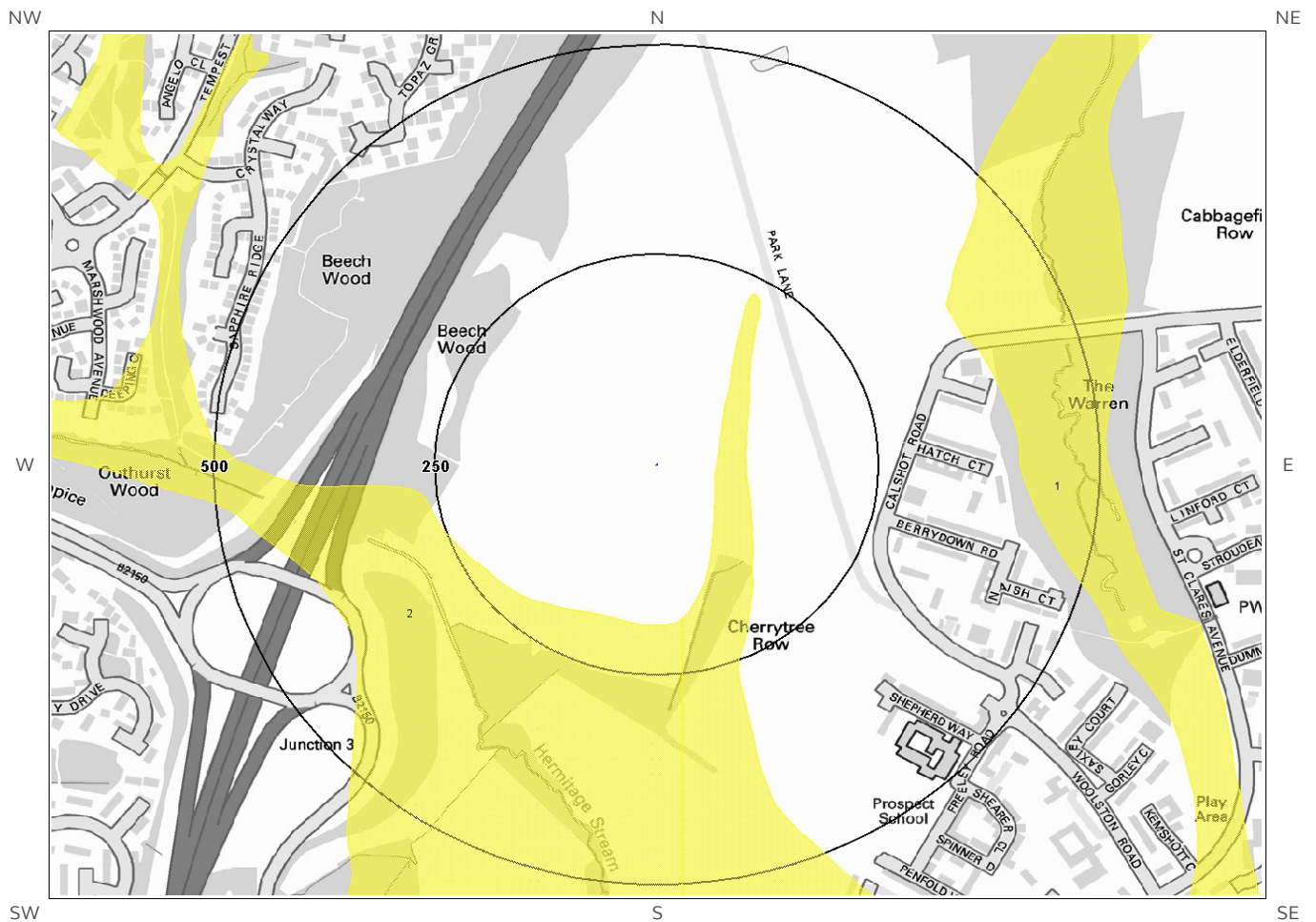
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
BOSA-S	BOGNOR SAND MEMBER	SAND

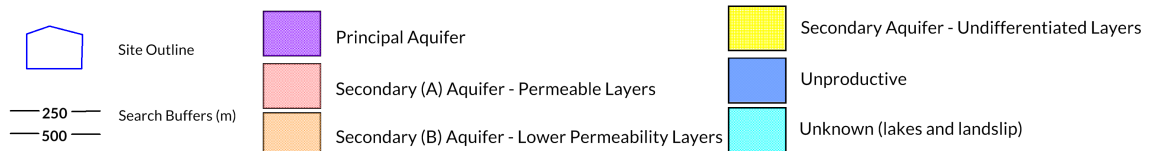
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

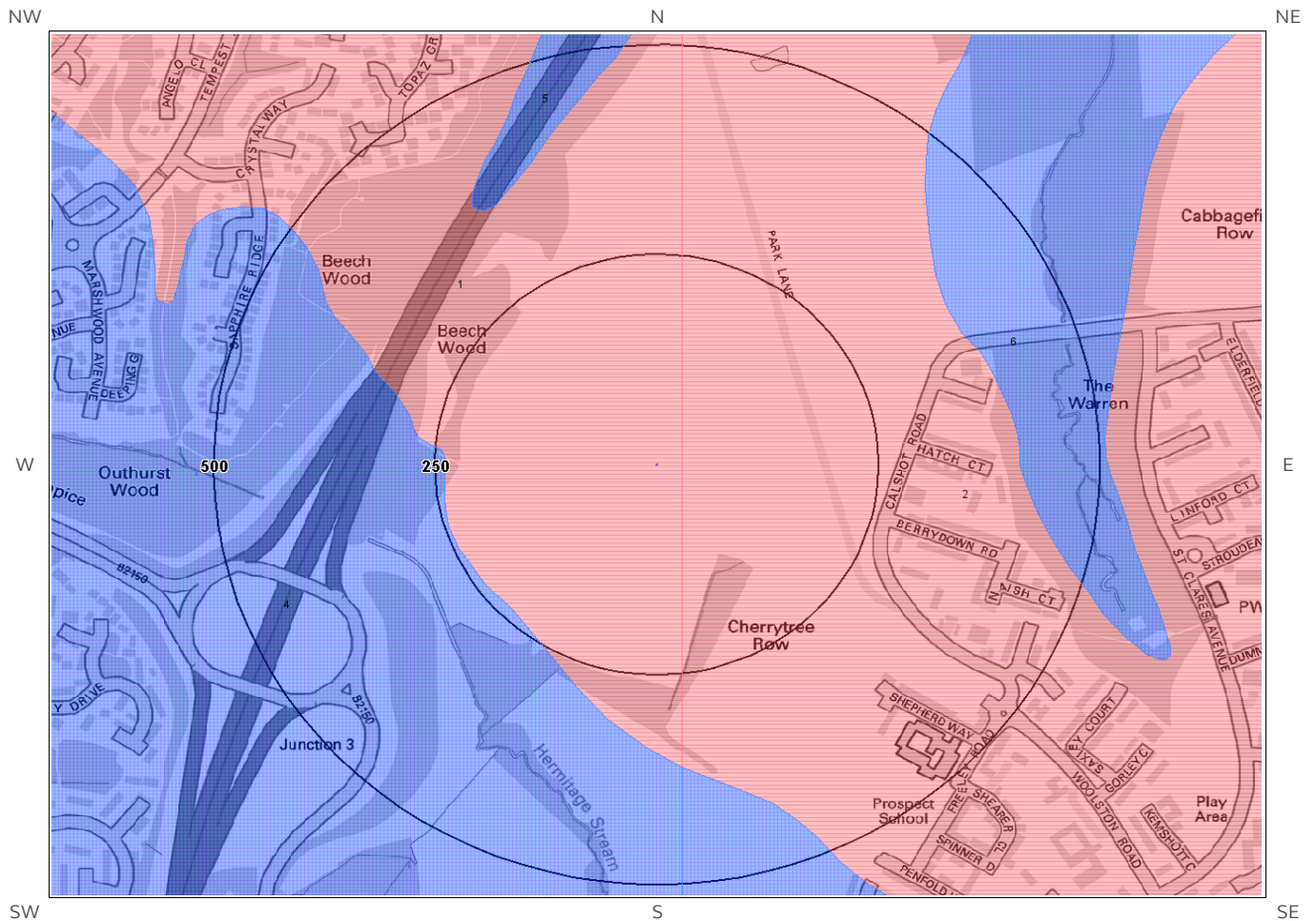
6a. Aquifer Within Superficial Geology



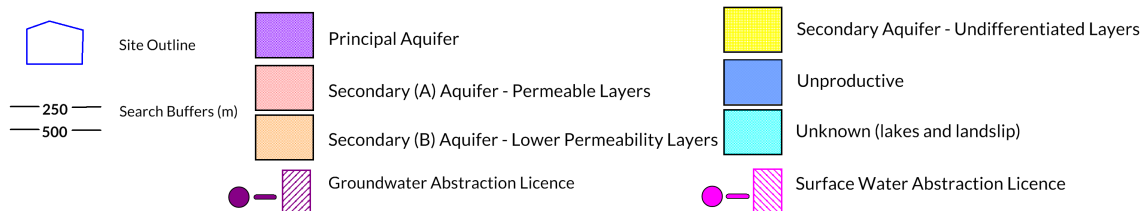
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



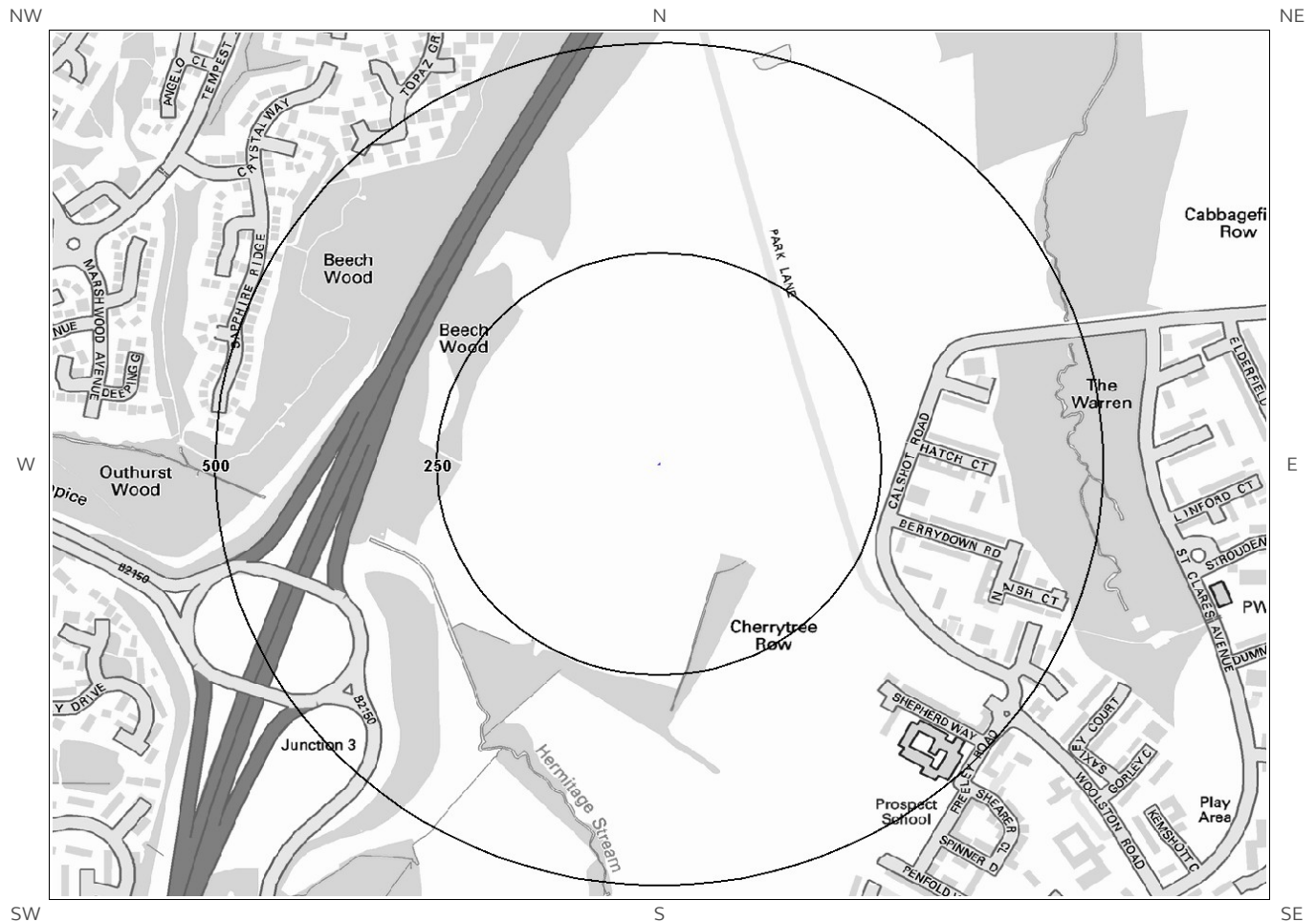
6b. Aquifer Within Bedrock Geology and Abstraction Licenses



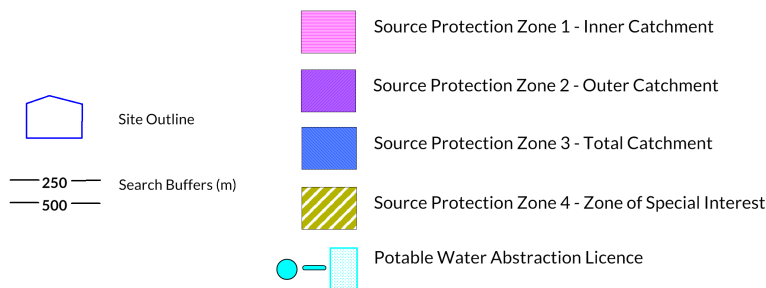
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



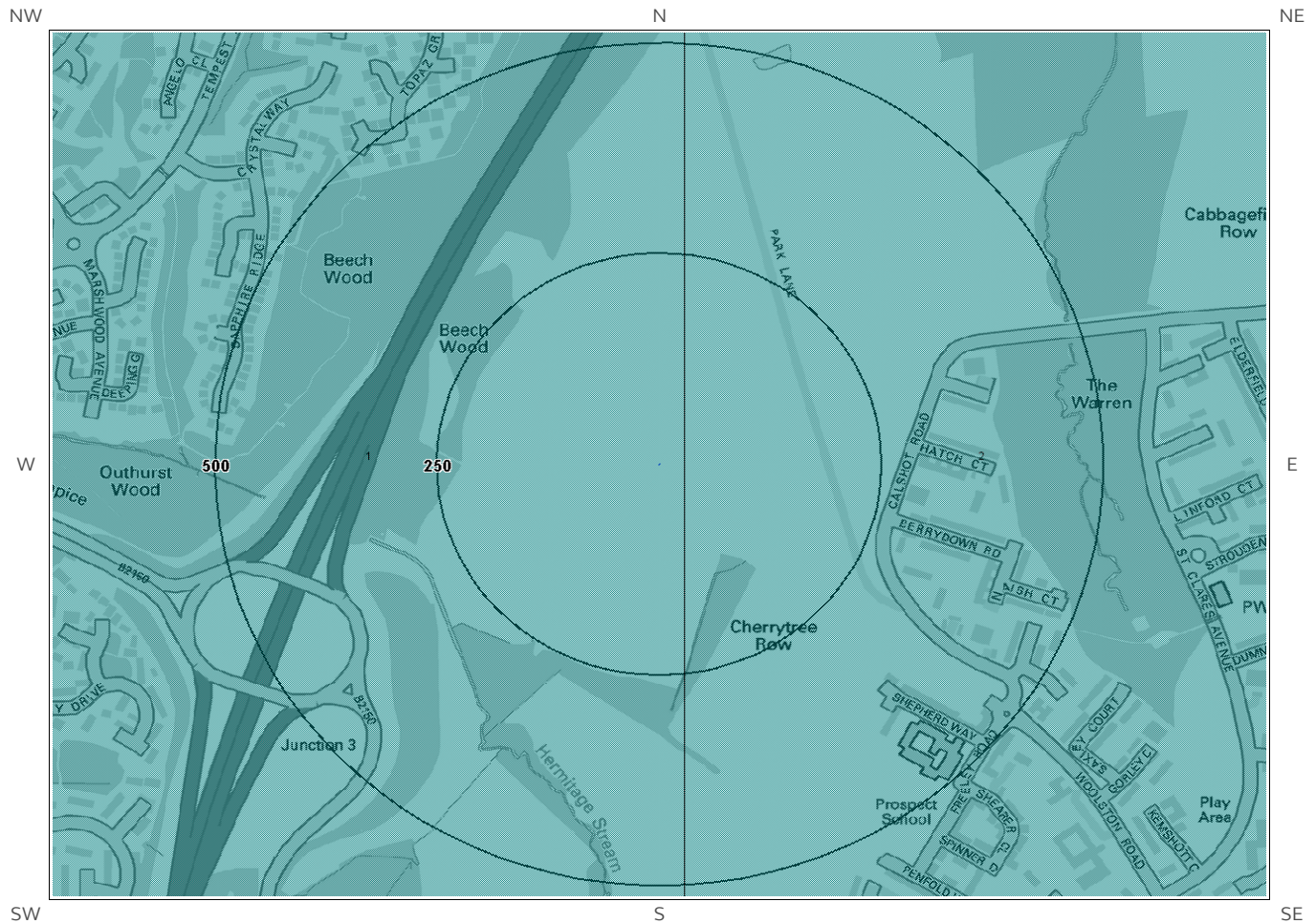
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



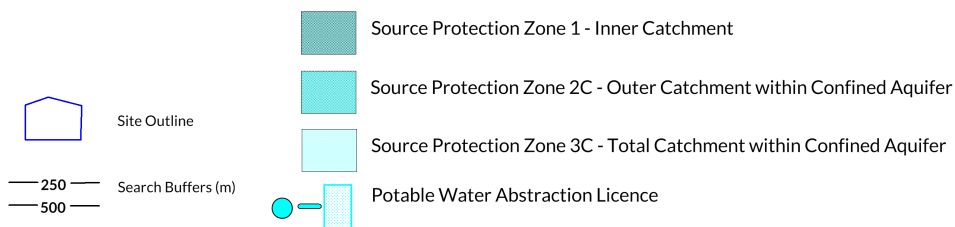
© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



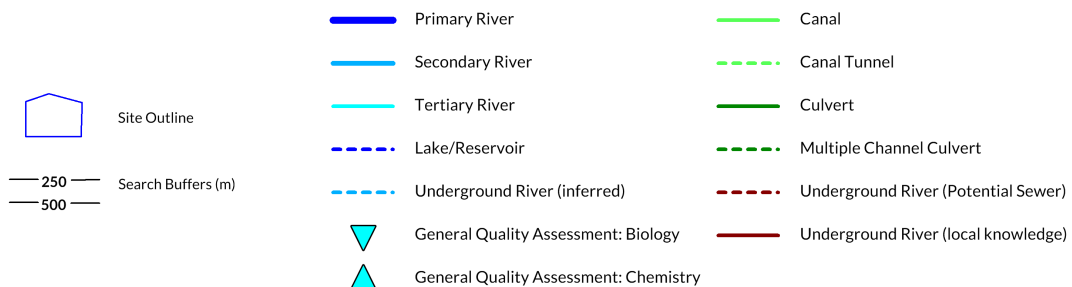
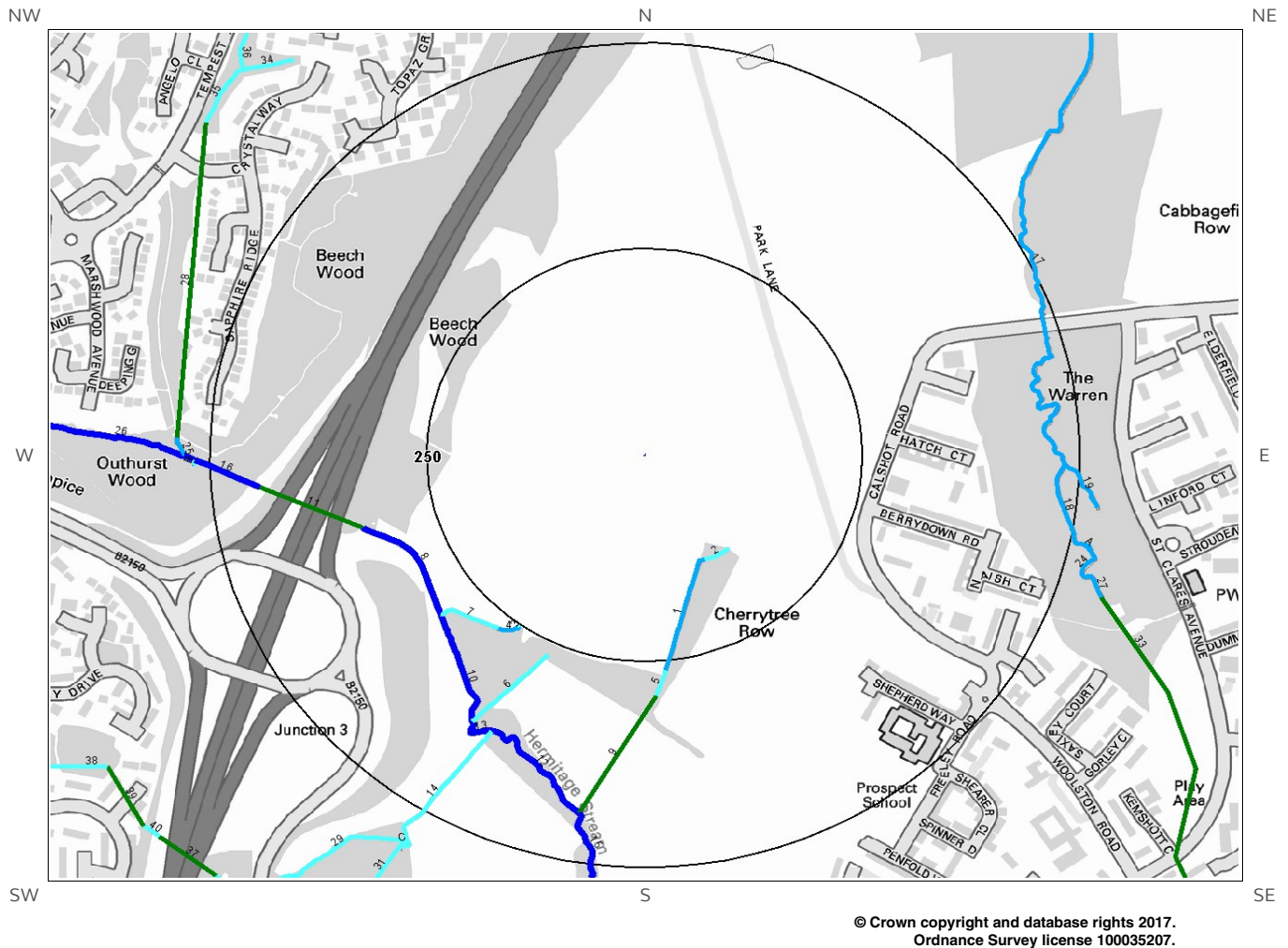
6d. Hydrogeology – Source Protection Zones within confined aquifer



© Crown copyright and database rights 2017
Ordnance Survey license 100035207.



6e. Hydrology – Detailed River Network and River Quality



6. Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	66	E	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
2	185	S	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	28	E	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	237	SW	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
5	359	NW	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
6	361	S	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? Yes

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

The following Source Protection Zones records are represented on the SPZ within Confined Aquifer and Potable Water Abstraction Map(6d):

ID	Distance	Direction	Type	Description
1	0	On Site	1c	Inner catchment within confined aquifer
2	28	E	1c	Inner catchment within confined aquifer

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	H1	Soils which readily transmit liquid discharges because they are shallow or susceptible to rapid flow directly to rock, gravel or groundwater.
249	SE	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? Yes

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAH). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (6e):

ID	Distance (m)	Direction	NGR	River Quality Grade	Chemical Quality Grade				
					2005	2006	2007	2008	2009
Not shown	1440	NW	468910 110150	River Name: Hermitage Stream Reach: Tidal Limit - Source End/Start of Stretch: Start of Stretch NGR	B	B	B	B	B

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	142	SE	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
2	144	SE	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
3	250	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
4	252	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
5	262	S	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	265	SW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7	269	SW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
8	288	SW	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
9	292	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
10	303	SW	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
11	336	W	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
12	373	SW	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
13	377	SW	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
14	377	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
15	441	S	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
16	444	W	River Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
17	453	E	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
18	474	E	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
19	483	E	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

6.11 Surface Water Features

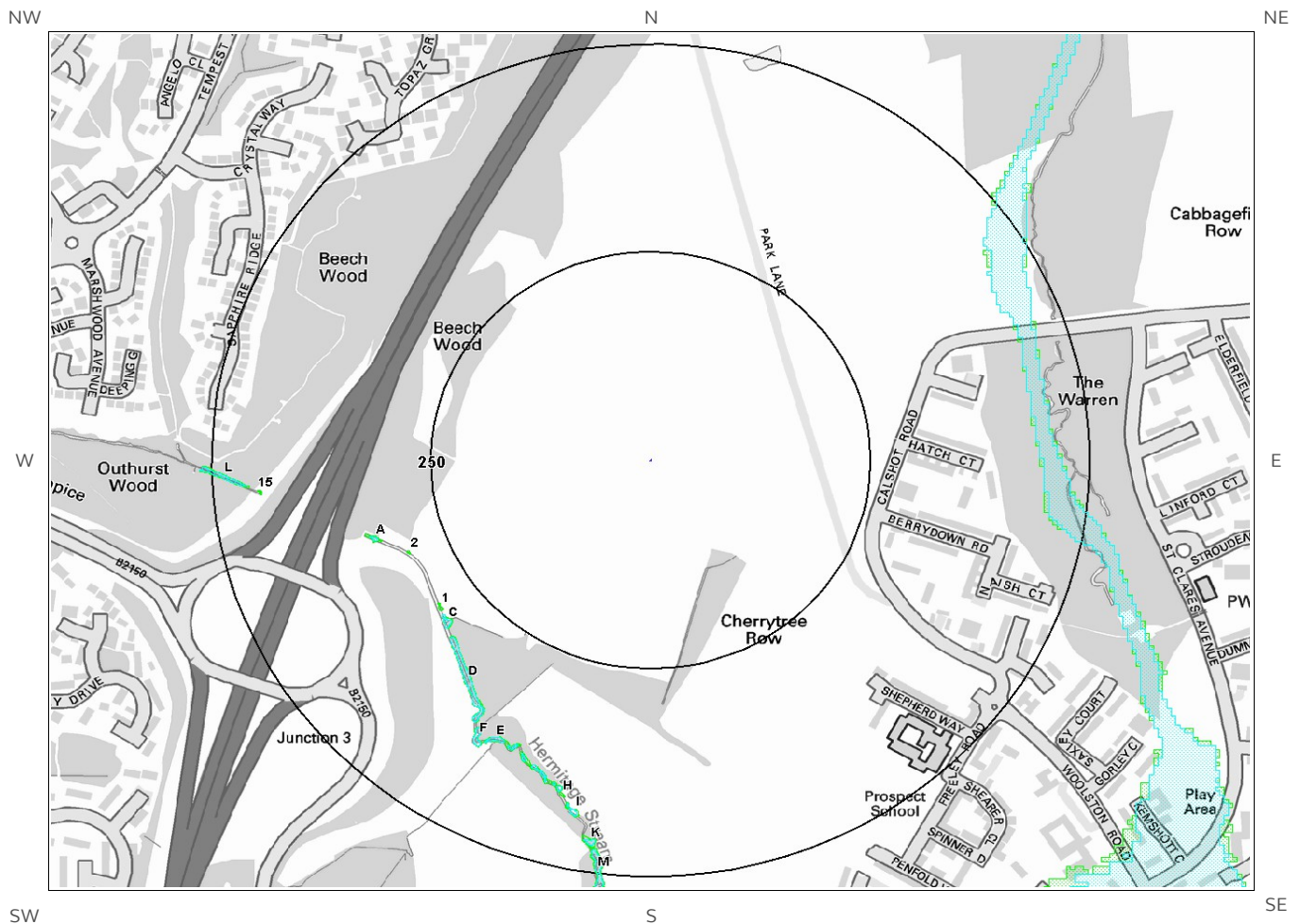
Are there any surface water features within 250m of the study site?

Yes

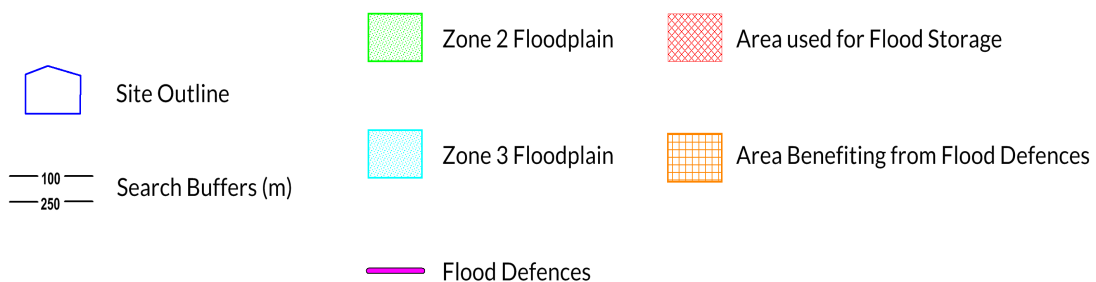
The following surface water records are not represented on mapping:

Distance (m)	Direction
144	SE

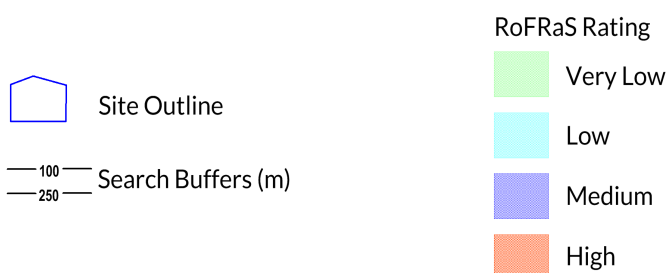
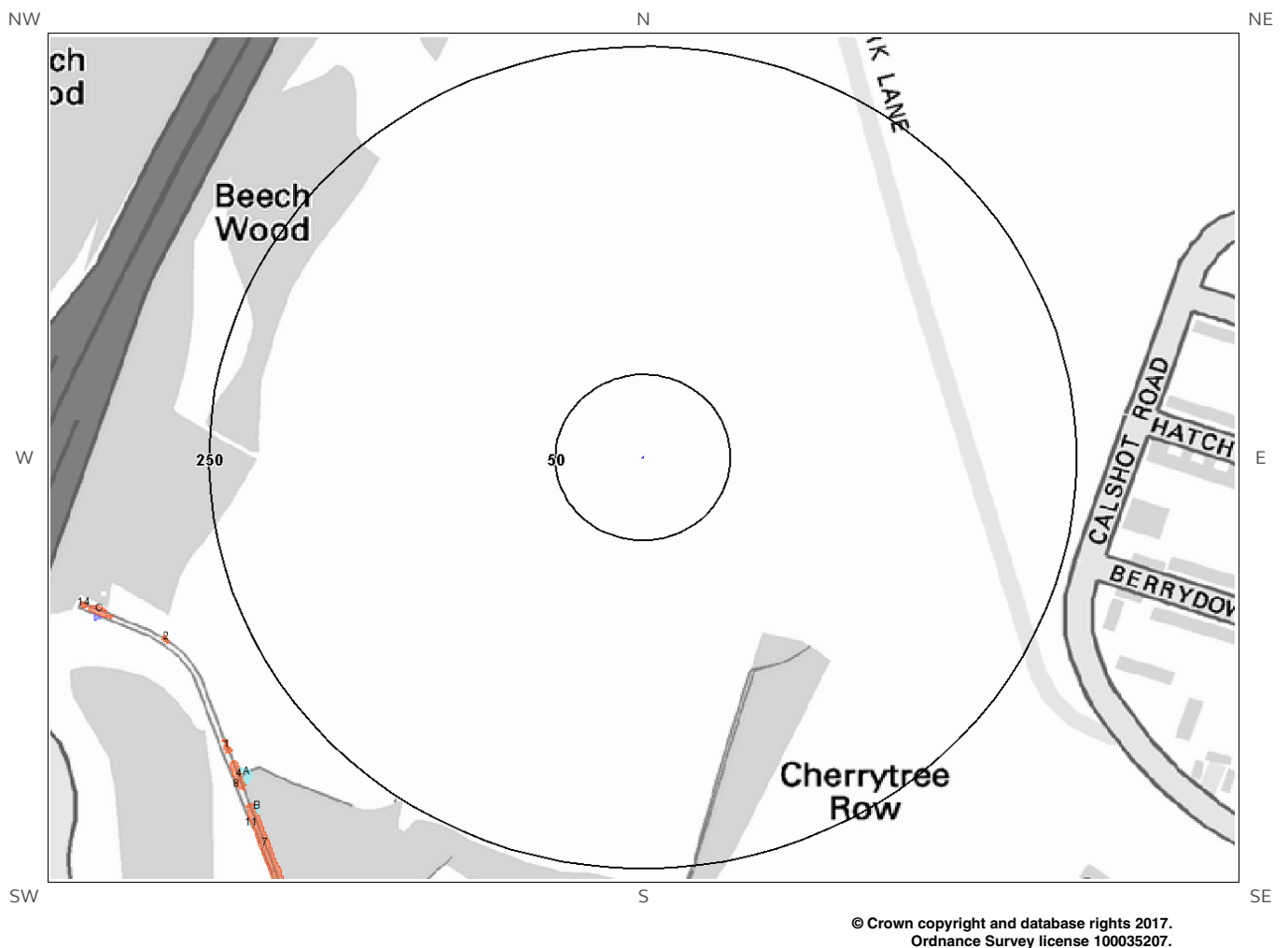
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No
Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site?

No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding?

Clearwater Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Limited potential

Where limited potential for groundwater flooding to occur is indicated, this means that although given the geological conditions there may be a groundwater flooding hazard, unless other relevant information, e.g. records of previous flooding, suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard.

7.8 Groundwater Flooding Confidence Areas

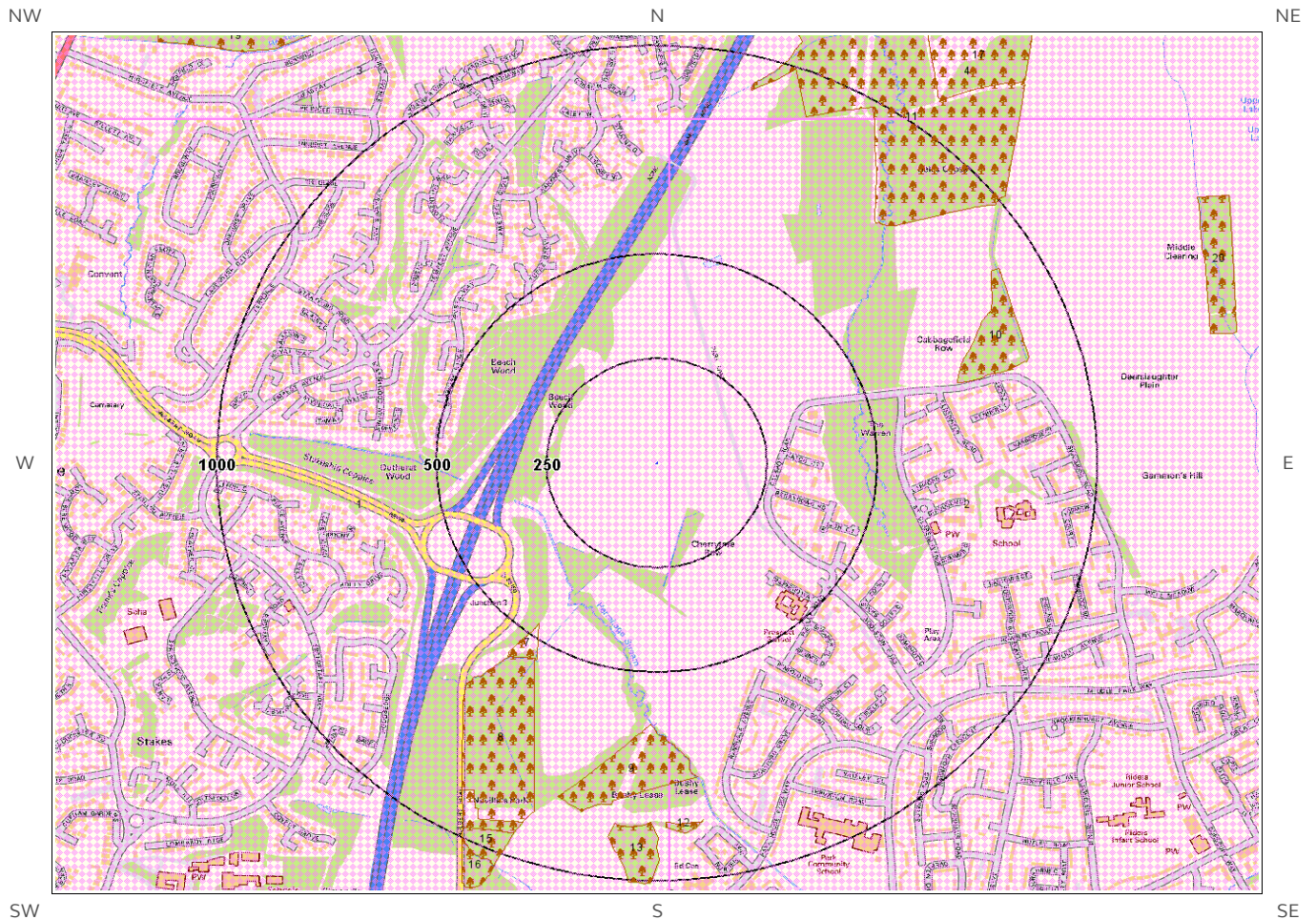
What is the British Geological Survey confidence rating in this result?

Low

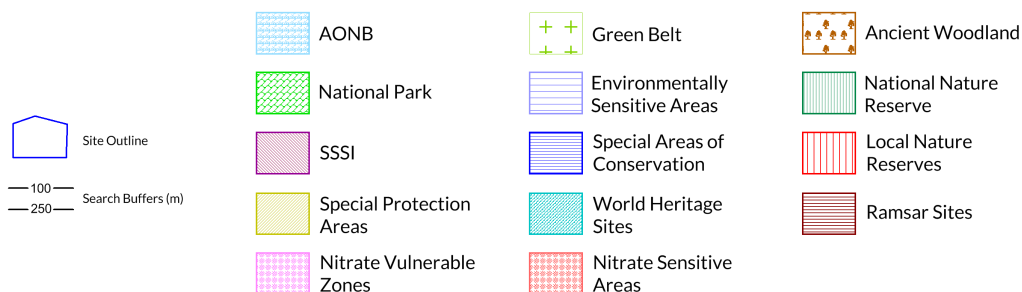
Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

31

The following records of Designated Ancient Woodland provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
7	467	SW	UNKNOWN	Ancient and Semi-Natural Woodland
8	543	SW	UNKNOWN	Ancient and Semi-Natural Woodland
9	625	S	UNKNOWN	Ancient and Semi-Natural Woodland
10	708	E	UNKNOWN	Ancient and Semi-Natural Woodland
11	760	NE	UNKNOWN	Ancient and Semi-Natural Woodland
12	859	S	UNKNOWN	Ancient and Semi-Natural Woodland
13	860	S	UNKNOWN	Ancient and Semi-Natural Woodland
14	886	SW	UNKNOWN	Ancient and Semi-Natural Woodland
15	944	S	UNKNOWN	Ancient and Semi-Natural Woodland
16	1010	SW	UNKNOWN	Ancient Replanted Woodland
17	1083	NE	UNKNOWN	Ancient Replanted Woodland
Not shown	1219	N	UNKNOWN	Ancient and Semi-Natural Woodland
19	1271	NW	UNKNOWN	Ancient Replanted Woodland
20	1294	E	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1305	SW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1396	E	UNKNOWN	Ancient Replanted Woodland
Not shown	1434	SW	UNKNOWN	Ancient Replanted Woodland
Not shown	1473	N	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1493	NE	UNKNOWN	Ancient Replanted Woodland
Not shown	1505	E	UNKNOWN	Ancient Replanted Woodland
Not shown	1518	N	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1599	E	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1700	SW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1732	E	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1743	NW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1758	SW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1778	SW	UNKNOWN	Ancient Replanted Woodland
Not shown	1848	S	UNKNOWN	Ancient and Semi-Natural Woodland

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
Not shown	1873	SW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1906	S	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1949	E	UNKNOWN	Ancient and Semi-Natural Woodland

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

6

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
1	0	On Site	Existing	DEFRA
2	28	E	Existing	DEFRA
3	822	N	Existing	DEFRA
4	822	N	Existing	DEFRA
Not shown	1170	NE	Existing	DEFRA
Not shown	1967	N	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from our **website**. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing

ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site? No

Database searched and no data found.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No

Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:

Web: www.bgs.ac.uk

BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Environment Agency

National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 03708 506 506

Web: www.environment-agency.gov.uk

Email: enquiries@environment-agency.gov.uk

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe

Email: enquiries@phe.gov.uk
Main switchboard: 020 7654 8000

The Coal Authority

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey

Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority

Authority: Havant Borough Council
Phone: 023 9247 4174

Web: <http://www.havant.gov.uk/>

Address: Civic Centre, Civic Centre Road, Havant, Hampshire, PO9

Gemapping PLC

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444



Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.

PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].

This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
<https://www.groundsure.com/terms-and-conditions-sept-2016>

Ridge & Partners LLP

The Cowyards, Blenheim Park,
Woodstock, OX20 1QR

Groundsure
Reference:

GS-3789472

Your Reference: 5002713_-_602182

Report Date 7 Apr 2017

Report Delivery Method: Email - pdf

Groundsure Geo Insight

Address: DUNSBURY HILL FARM, HAVANT, PO9 4EE

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight

Groundsure Geo Insight

Address: DUNSBURY HILL FARM, HAVANT, PO9 4EE
Date: 7 Apr 2017
Reference: GS-3789472
Client: Ridge & Partners LLP



Aerial Photograph Capture date: 20-Aug-2013
Grid Reference: 469972,109178
Site Size: 0.00ha

Contents Page

Contents Page.....	3
Overview of Findings.....	5
1:10,000 Scale Availability.....	8
Availability of 1:10,000 Scale Geology Mapping.....	9
1 Geology (1:10,000 scale).....	10
1.1 Artificial Ground Map (1:10,000 scale).....	10
1. Geology 1:10,000 scale.....	11
1.1 Artificial Ground.....	11
1.2 Superficial Deposits and Landslips Map (1:10,000 scale).....	12
1.2 Superficial Deposits and Landslips.....	13
1.2.1 Superficial Deposits/ Drift Geology.....	13
1.2.2 Landslip.....	13
1.3 Bedrock and Faults Map (1:10,000 scale).....	14
1.3 Bedrock and Faults.....	15
1.3.1 Bedrock/ Solid Geology.....	15
1.3.2 Faults.....	15
2 Geology 1:50,000 Scale.....	16
2.1 Artificial Ground Map.....	16
2. Geology 1:50,000 scale.....	17
2.1 Artificial Ground.....	17
2.1.1 Artificial/ Made Ground	17
2.1.2 Permeability of Artificial Ground.....	17
2.2 Superficial Deposits and Landslips Map (1:50,000 scale).....	18
2.2 Superficial Deposits and Landslips.....	19
2.2.1 Superficial Deposits/ Drift Geology.....	19
2.2.2 Permeability of Superficial Ground	19
2.2.3 Landslip.....	19
2.2.4 Landslip Permeability.....	19
2.3 Bedrock and Faults Map (1:50,000 scale).....	20
2.3 Bedrock, Solid Geology & Faults.....	21
2.3.1 Bedrock/Solid Geology.....	21
2.3.2 Permeability of Bedrock Ground.....	21
2.3.3 Faults.....	21
3 Radon Data.....	22
3.1 Radon Affected Areas.....	22
3.2 Radon Protection.....	22
4 Ground Workings Map.....	23
4 Ground Workings.....	24
4.1 Historical Surface Ground Working Features derived from Historical Mapping.....	24
4.2 Historical Underground Working Features derived from Historical Mapping.....	24
4.3 Current Ground Workings.....	24
5 Mining, Extraction & Natural Cavities.....	26
5.1 Historical Mining.....	26
5.2 Coal Mining.....	26
5.3 Johnson Poole and Bloomer.....	26
5.4 Non-Coal Mining.....	26
5.5 Non-Coal Mining Cavities.....	27
5.6 Natural Cavities.....	27
5.7 Brine Extraction.....	27
5.8 Gypsum Extraction.....	27
5.9 Tin Mining.....	28
5.10 Clay Mining.....	28
6 Natural Ground Subsidence.....	29
6.1 Shrink-Swell Clay Map.....	29
6.2 Landslides Map.....	30
6.3 Ground Dissolution of Soluble Rocks Map.....	31
6.4 Compressible Deposits Map.....	32
6.5 Collapsible Deposits Map.....	33
6.6 Running Sand Map.....	34

6 Natural Ground Subsidence.....	35
6.1 Shrink-Swell Clays.....	35
6.2 Landslides.....	35
6.3 Ground Dissolution of Soluble Rocks.....	36
6.4 Compressible Deposits.....	36
6.5 Collapsible Deposits.....	36
6.6 Running Sands.....	37
7 Borehole Records.....	39
8 Estimated Background Soil Chemistry.....	40
9 Railways and Tunnels Map.....	41
9 Railways and Tunnels.....	42
9.1 Tunnels	42
9.2 Historical Railway and Tunnel Features	42
9.3 Historical Railways.....	43
9.4 Active Railways.....	43
9.5 Railway Projects.....	43

Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	No
	1.2.2 Are there any records of landslide within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale

2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	No
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	No
	2.2.3 Are there any records of landslide within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults

2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.

2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?

Yes

2.3.3 Are there any records of faults within 500m of the study site boundary?

No

Section 3: Radon

3. Radon

3.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?

The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

No radon protective measures are necessary.

Section 4: Ground Workings

	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	0	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
4.3 Current Ground Workings	0	0	0	0	1

Section 5: Mining, Extraction & Natural Cavities

	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	0
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	0	0	0	0	3
5.5 Non-Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

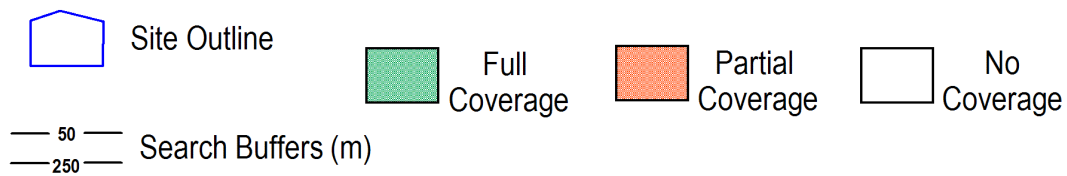
Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-site				
6.1 Shrink-Swell Clay	Negligible				
6.2 Landslides	Very Low				
6.3 Ground Dissolution of Soluble Rocks	Negligible				
6.4 Compressible Deposits	Negligible				
6.5 Collapsible Deposits	Very Low				
6.5 Running Sand	Low				
Section 7: Borehole Records	On-site	0-50m	51-250		
7 BGS Recorded Boreholes	0	0	0		
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250		
8 Records of Background Soil Chemistry	1	2	0		
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searched	
9.2 Historical Railway and Tunnel Features	0	0	0	Not Searched	
9.3 Historical Railways	0	0	0	Not Searched	
9.4 Active Railways	0	0	0	Not Searched	
9.5 Railway Projects	0	0	0	0	

1:10,000 Scale Availability



1_10,000 Availability Legend

© Crown copyright and database rights 2017.
 Ordnance Survey license 100035207.



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	No coverage
2	28.0	Some deposits are mapped	Full	Full	No coverage
3	822.0	Some deposits are mapped	Full	Full	No coverage
4	822.0	Some deposits are mapped	Full	Full	Some deposits are mapped

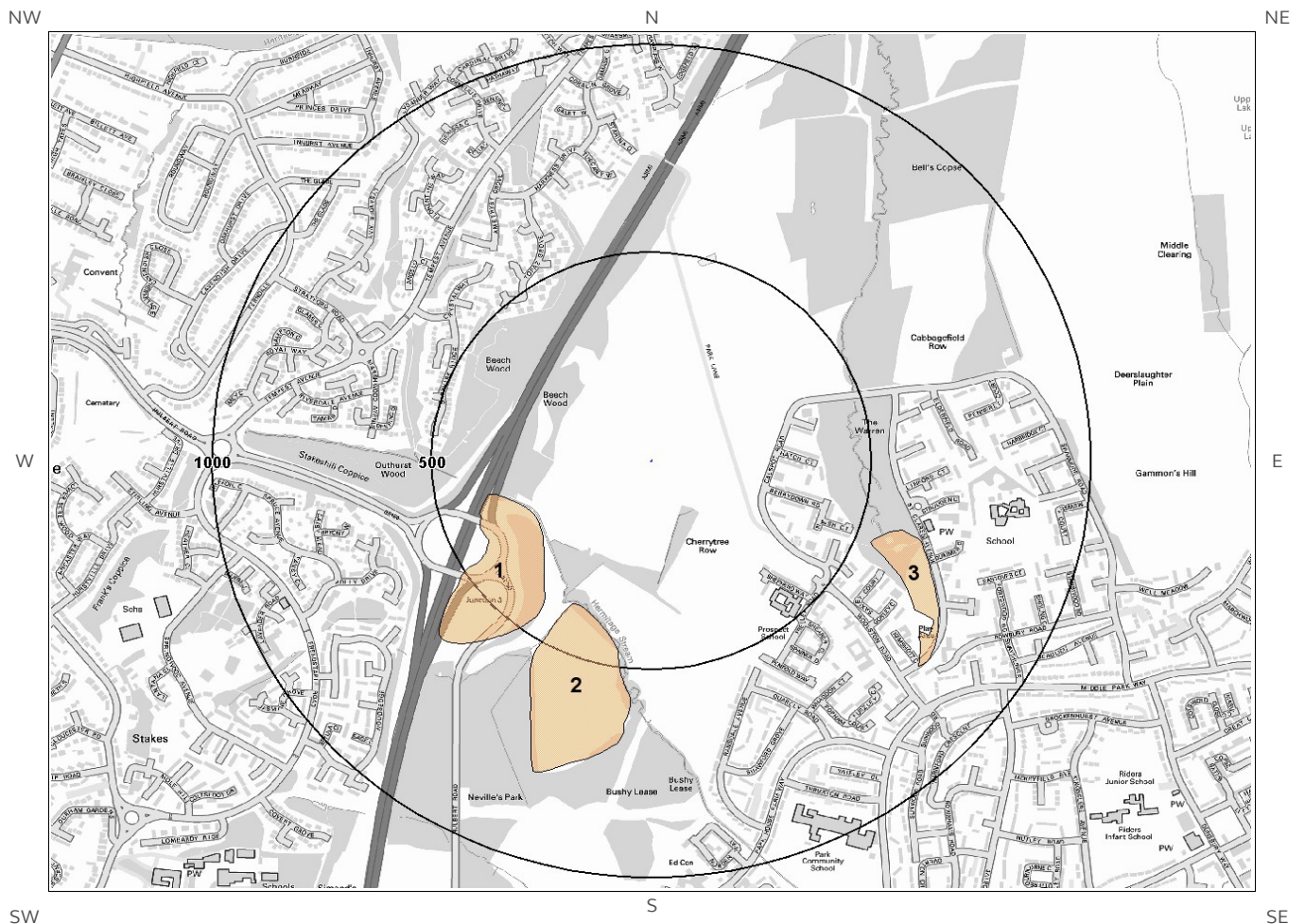
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

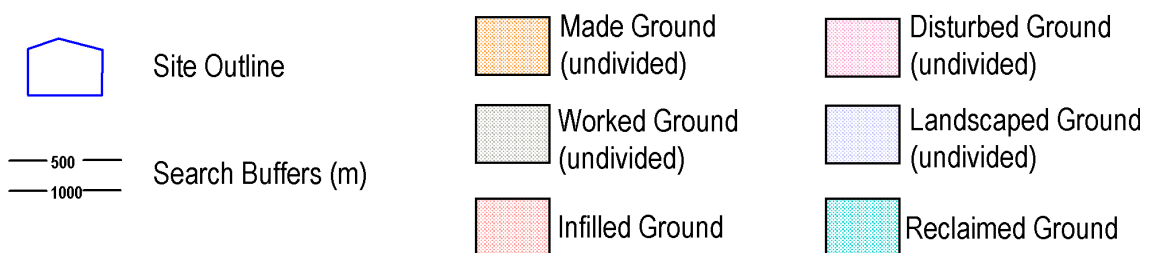
1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



1. Geology 1:10,000 scale

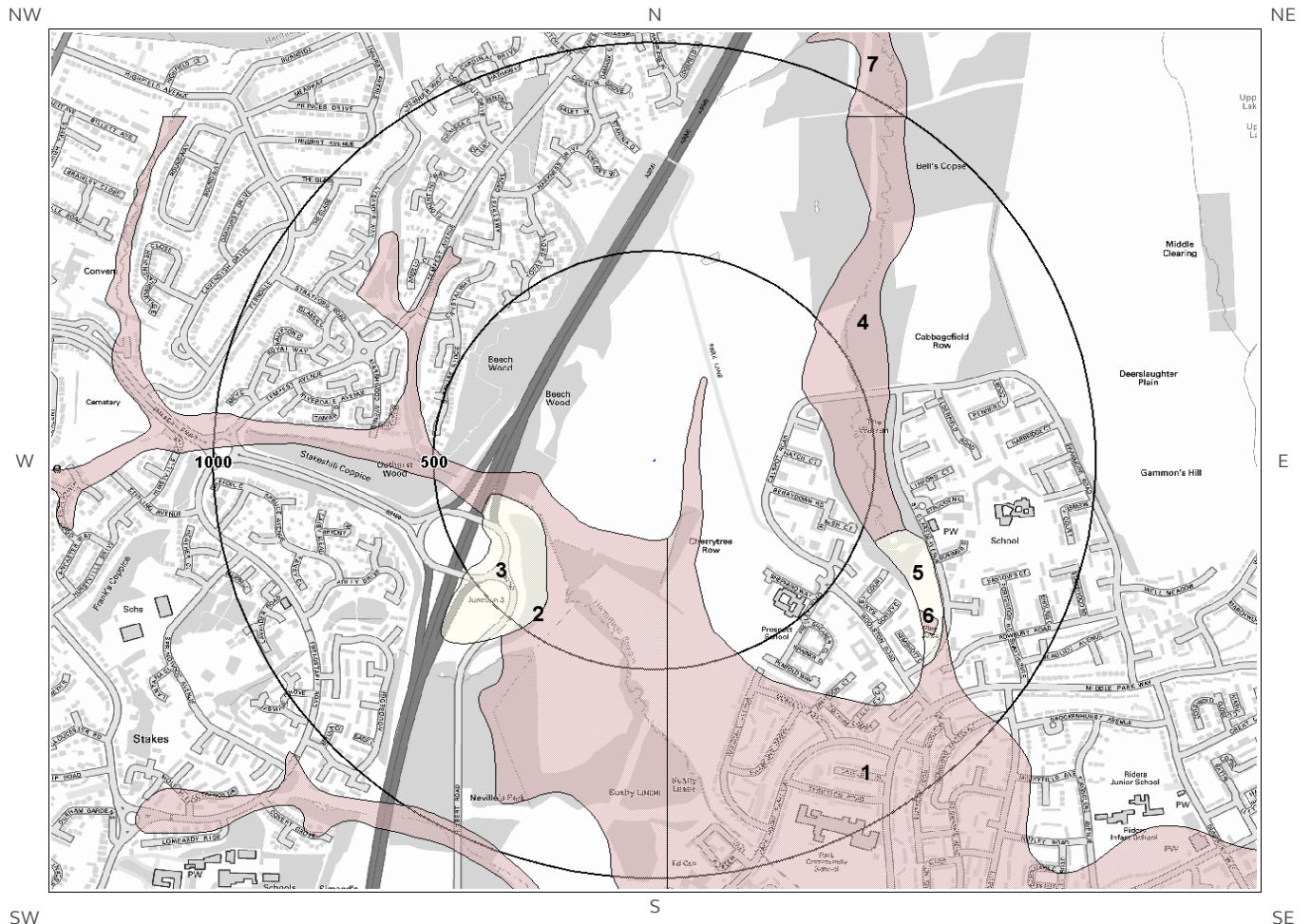
1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

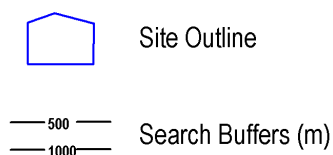
ID	Distance	Direction	LEX Code	Description	Rock Description
1	294.0	SW	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	382.0	SW	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)



Artificial Ground Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	66.0	E	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
2	188.0	S	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
3	294.0	SW	SUPNM-UNKNOWN	Superficial Theme Not Mapped [for Digital Map Use Only] - Unknown/unclassified Entry	Unknown/unclassified Entry
4	375.0	NE	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel

1.2.2 Landslip

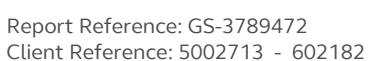
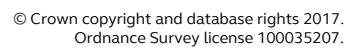
Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.



1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	BOSA-SANDU	Bognor Sand Member - Sand	Eocene Epoch
2	28.0	E	BOSA-SANDU	Bognor Sand Member - Sand	Eocene Epoch
3	235.0	W	LC-CLSISA	London Clay Formation - Clay, Silt And Sand	Eocene Epoch
4	355.0	NW	LC-CLSISA	London Clay Formation - Clay, Silt And Sand	Eocene Epoch
5	364.0	S	LC-CLSISA	London Clay Formation - Clay, Silt And Sand	Eocene Epoch

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

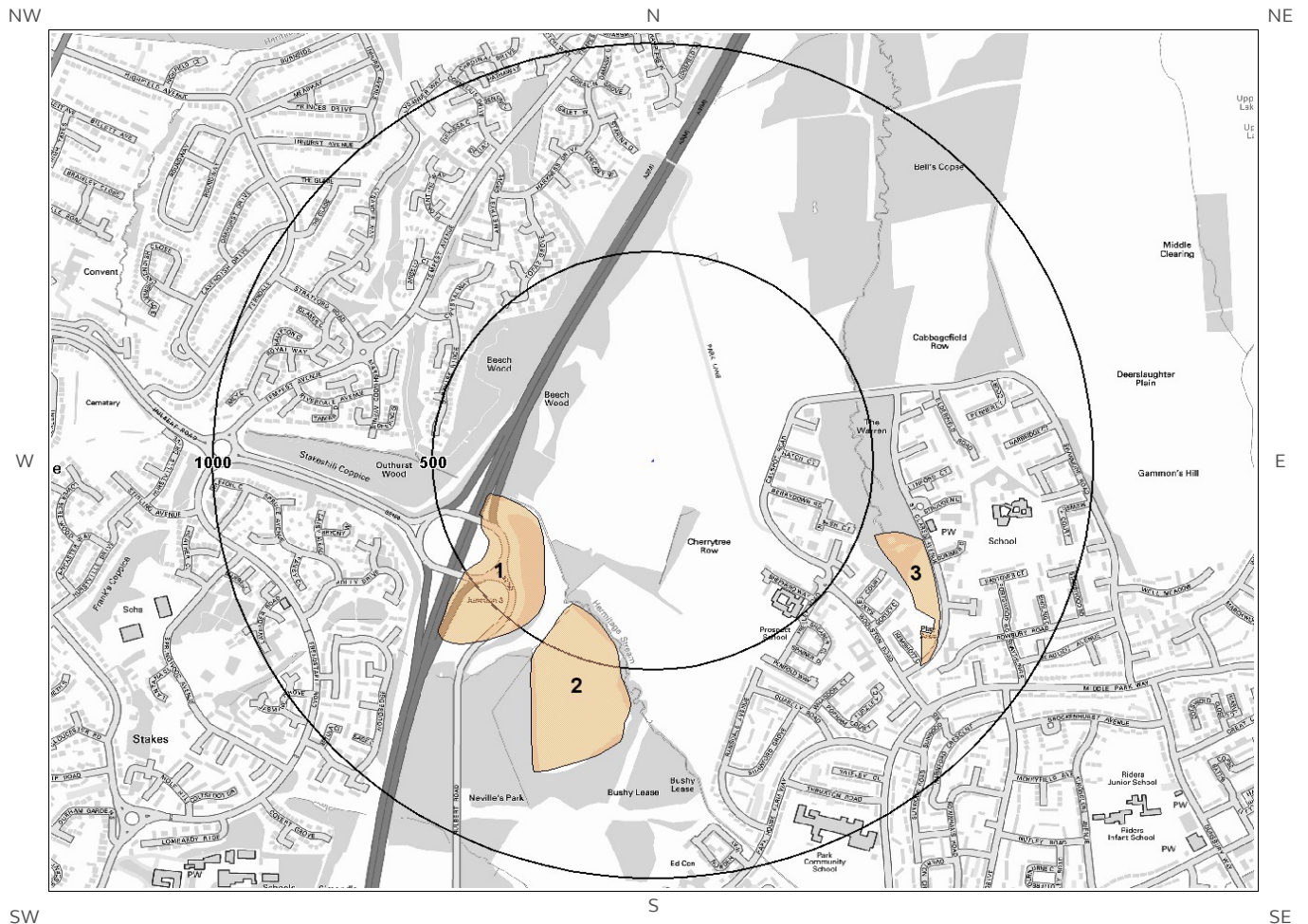
Database searched and no data found at this scale.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

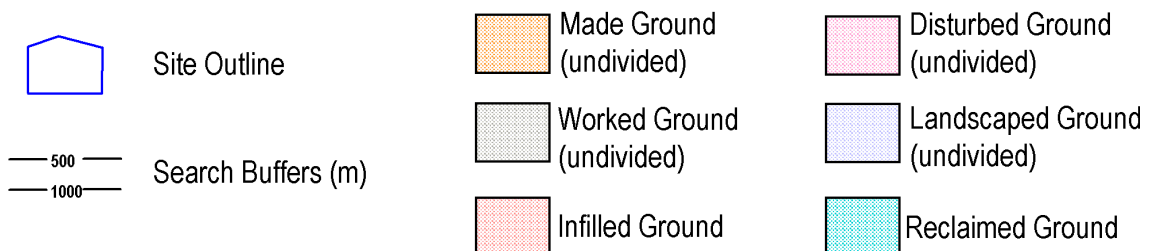
2 Geology 1:50,000 Scale

2.1 Artificial Ground Map



Ground Workings Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 316

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

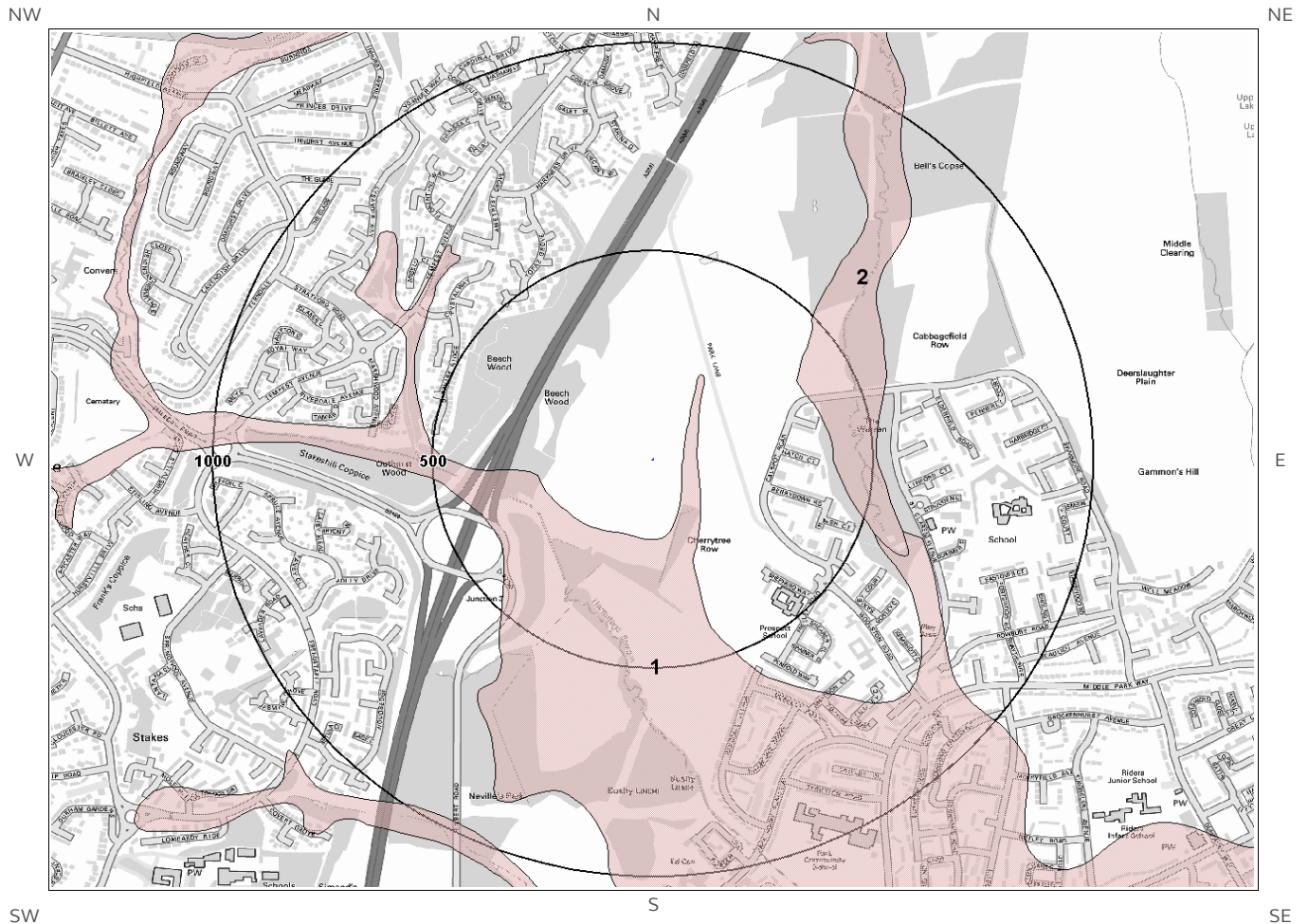
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	296.0	SW	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
2	385.0	SW	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)

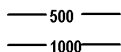


Ground Workings Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



Site Outline



Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	66.0	E	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL
2	377.0	NE	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? No

Database searched and no data found.

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

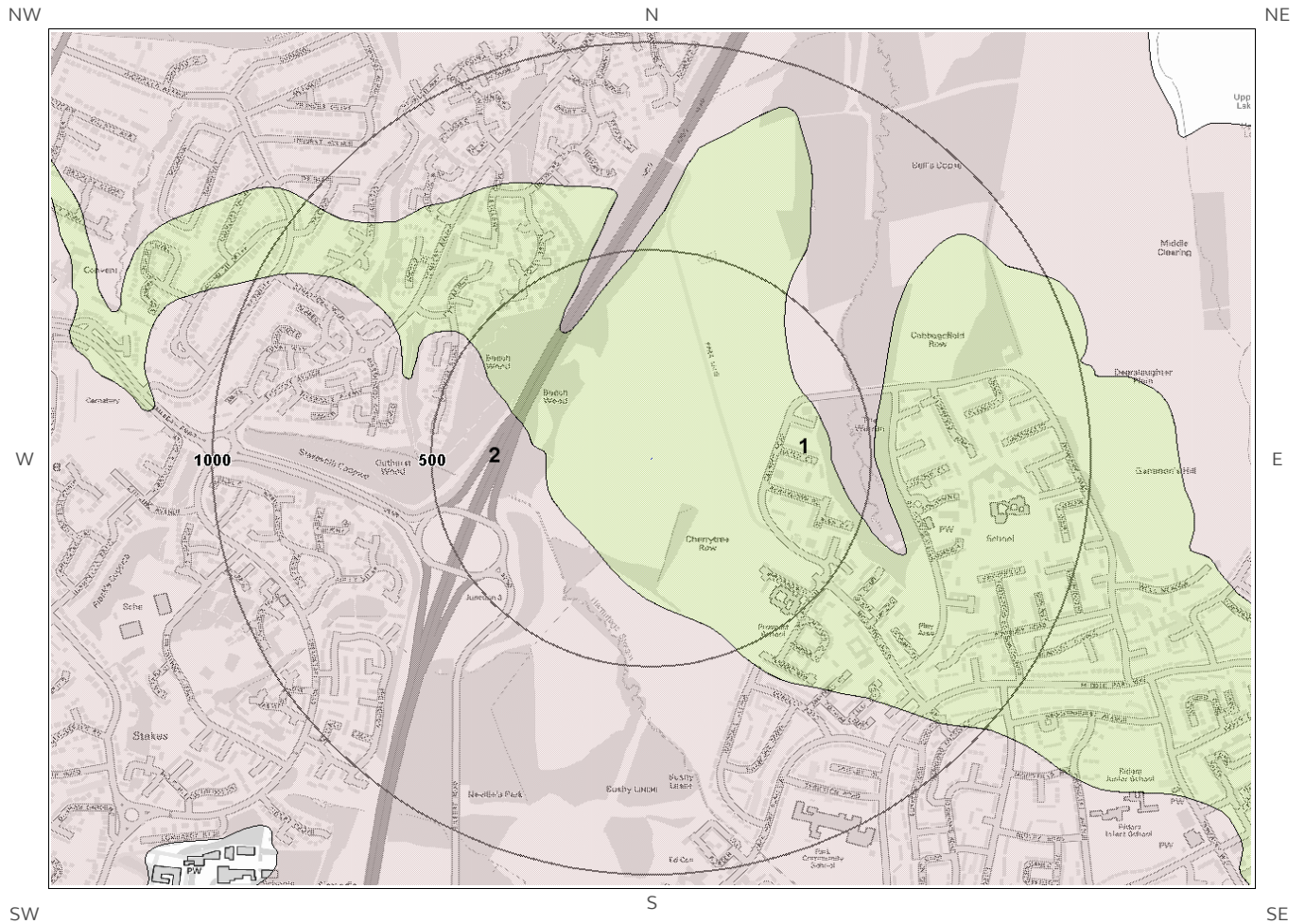
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

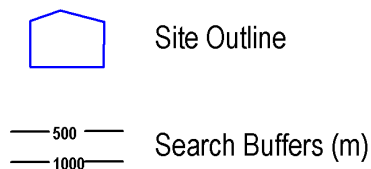
Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.



2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 316

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	BOSA-S	BOGNOR SAND MEMBER - SAND	-
2	237.0	SW	LC-XCZS	LONDON CLAY FORMATION - CLAY, SILT AND SAND	YPRESIAN

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Intergranular	High	High
28.0	E	Intergranular	High	High

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

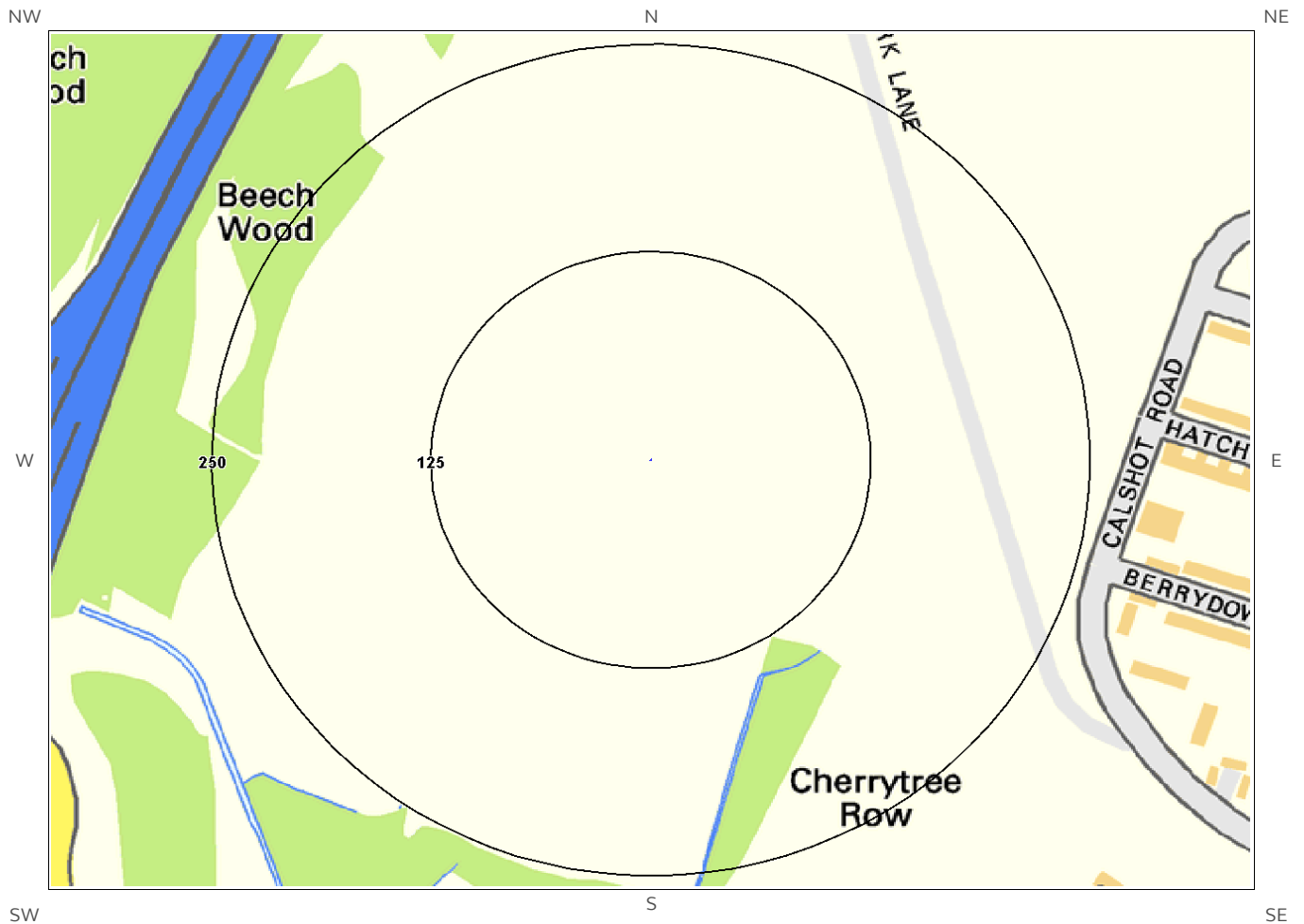
3.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

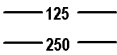
Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

4 Ground Workings Map



Ground Workings Legend

© Crown copyright and database rights 2017.
 Ordnance Survey license 100035207.

- | | | | |
|---|--------------------|---|----------------------------------|
|  | Site Outline |  | Historic Surface Ground Workings |
|  | Search Buffers (m) |  | Historic Underground Workings |
| | |  | Current Ground Workings |

4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? No

Database searched and no data found.

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

4.3 Current Ground Workings

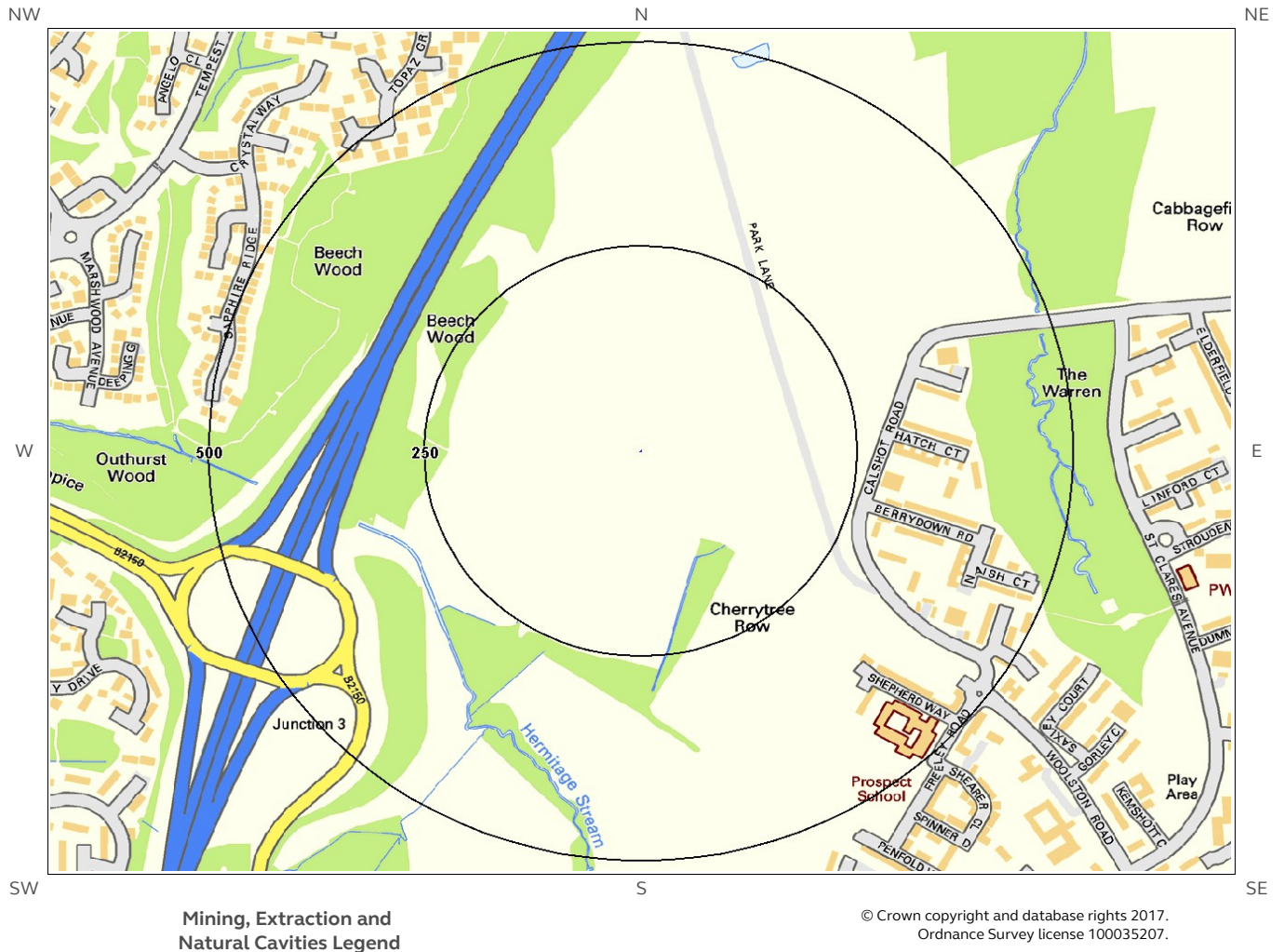
This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
Not shown	771.0	NE	470353 109848	Clay & Shale	Dunsbury Hill Brick Yard	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

5 Mining, Extraction & Natural Cavities Map



5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? Yes

The following non-coal mining information is provided by the BGS:

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
Not shown	670.0	NE	Not available	Chalk	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
Not shown	824.0	N	Not available	Chalk	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered
Not shown	888.0	N	Not available	Chalk	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled “Review of mining instability in Great Britain, 1990” PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.10 Clay Mining

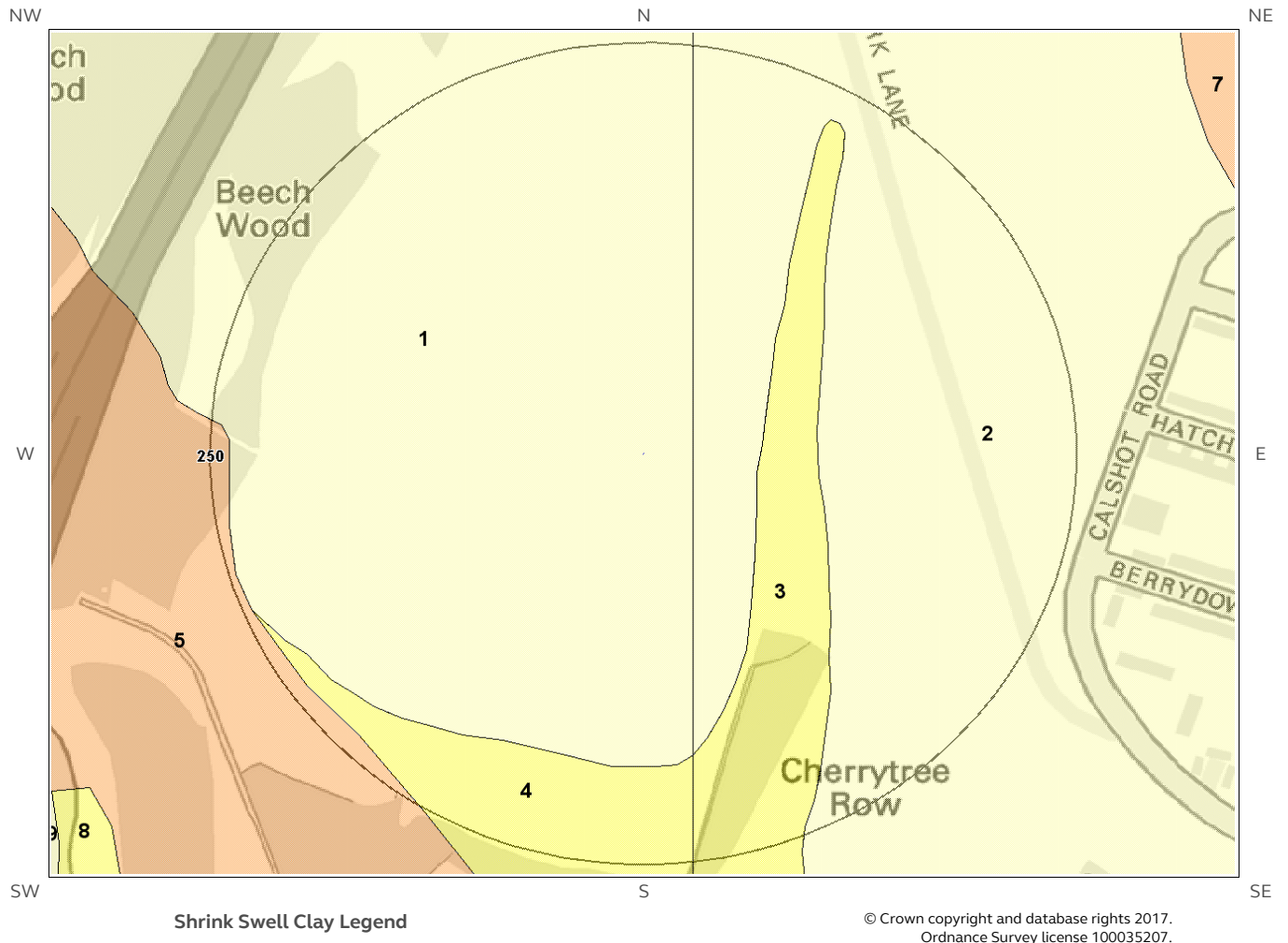
This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary? No

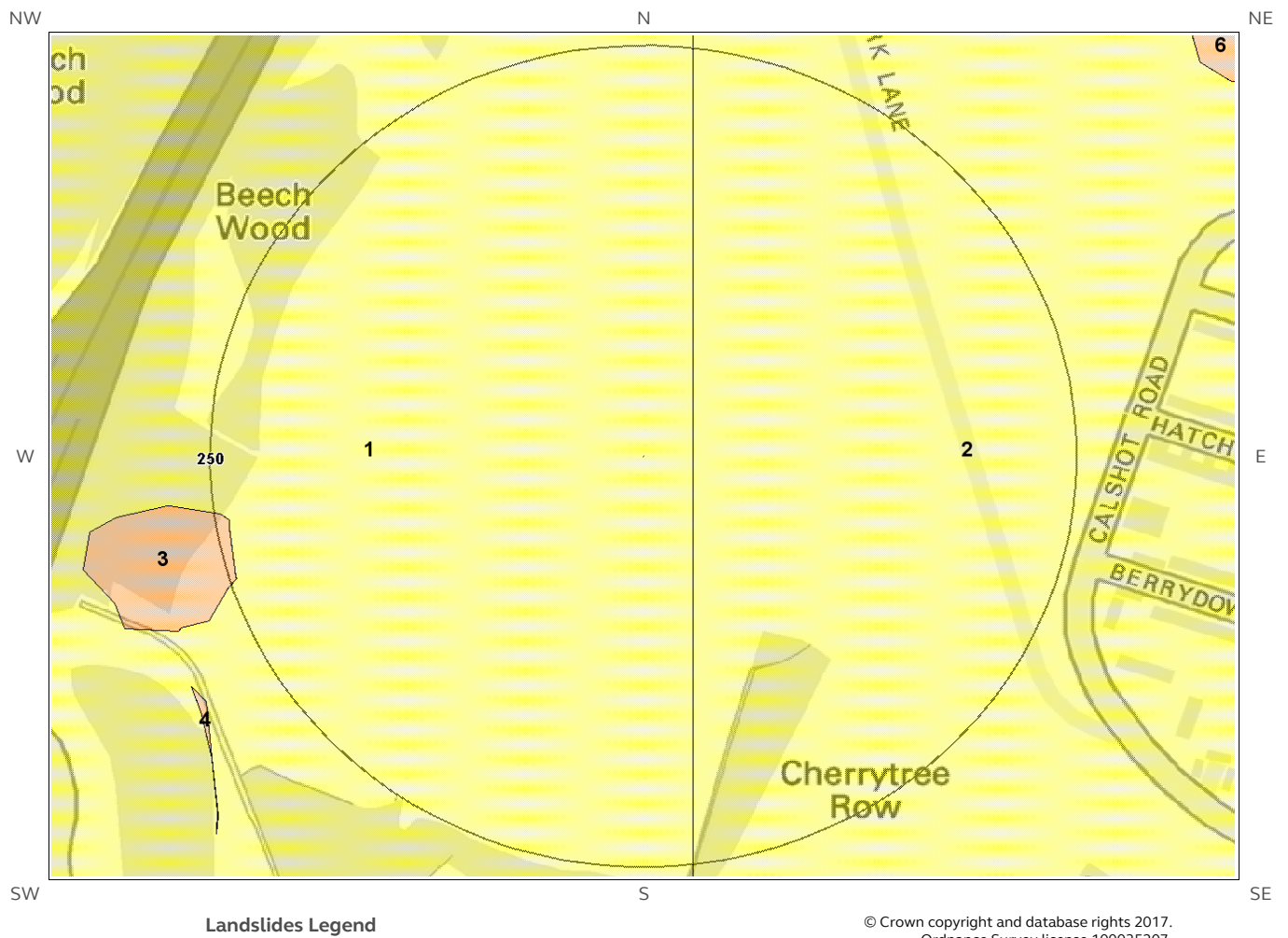
Database searched and no data found.

6 Natural Ground Subsidence

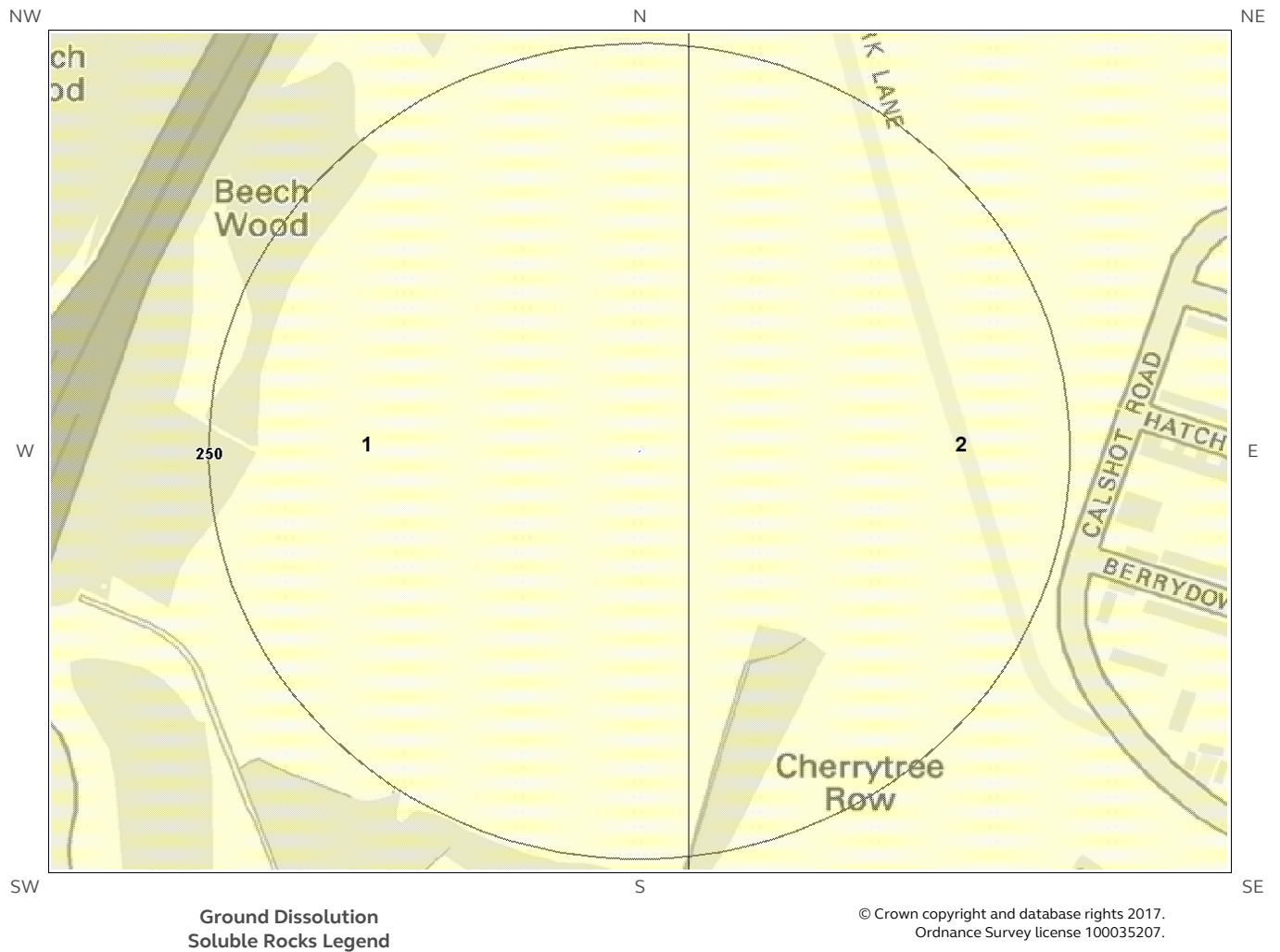
6.1 Shrink-Swell Clay Map



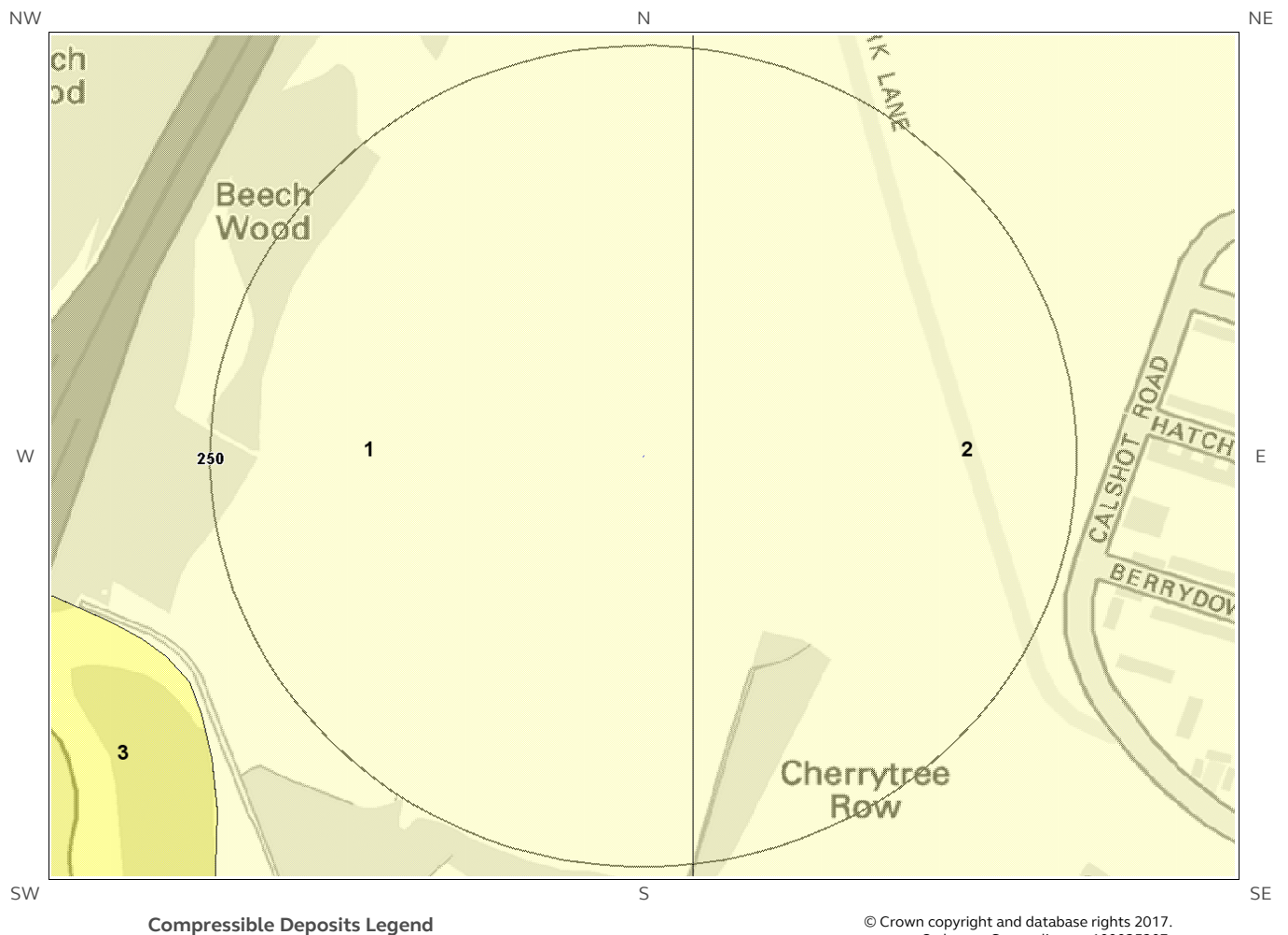
6.2 Landslides Map



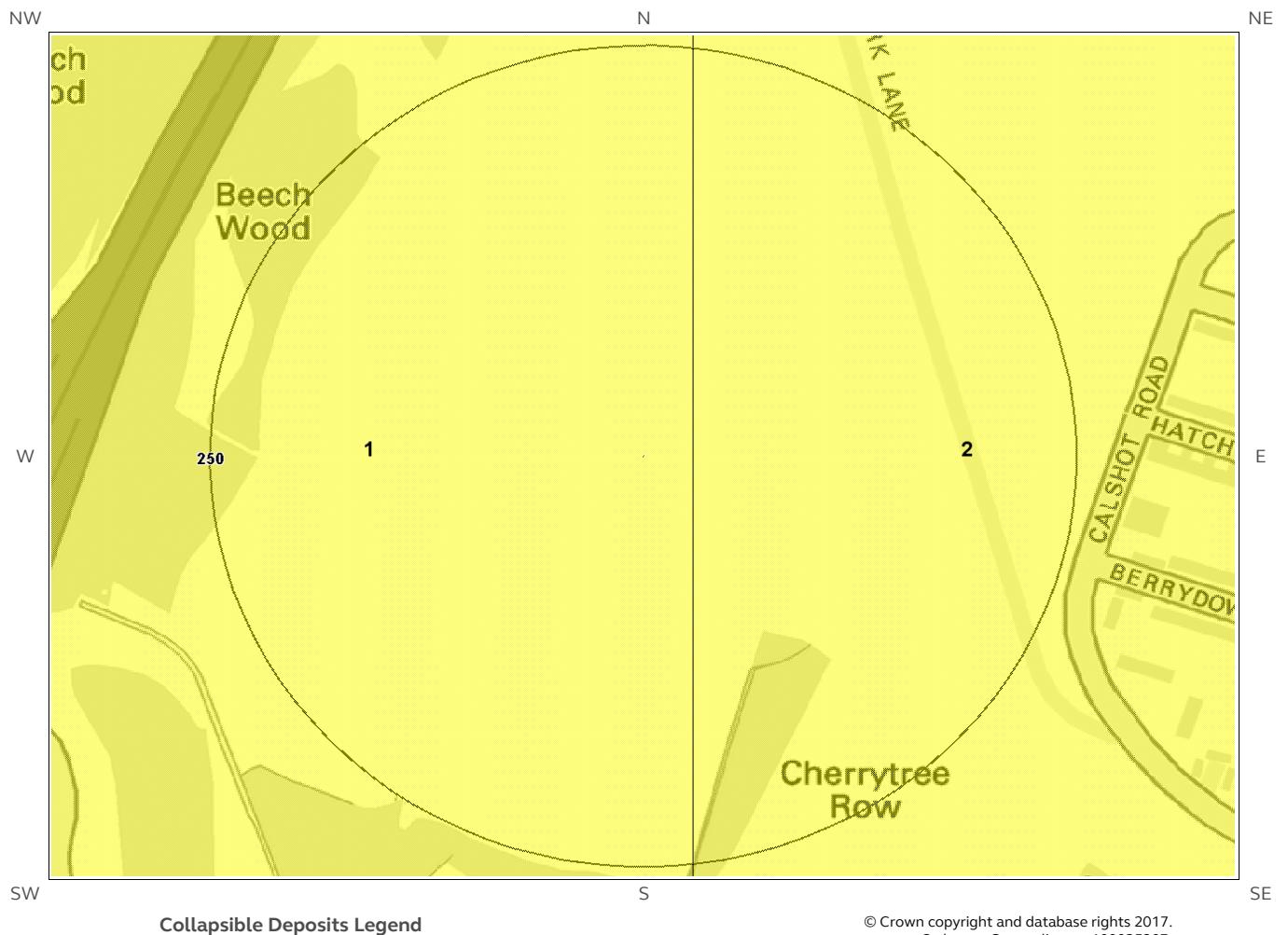
6.3 Ground Dissolution of Soluble Rocks Map



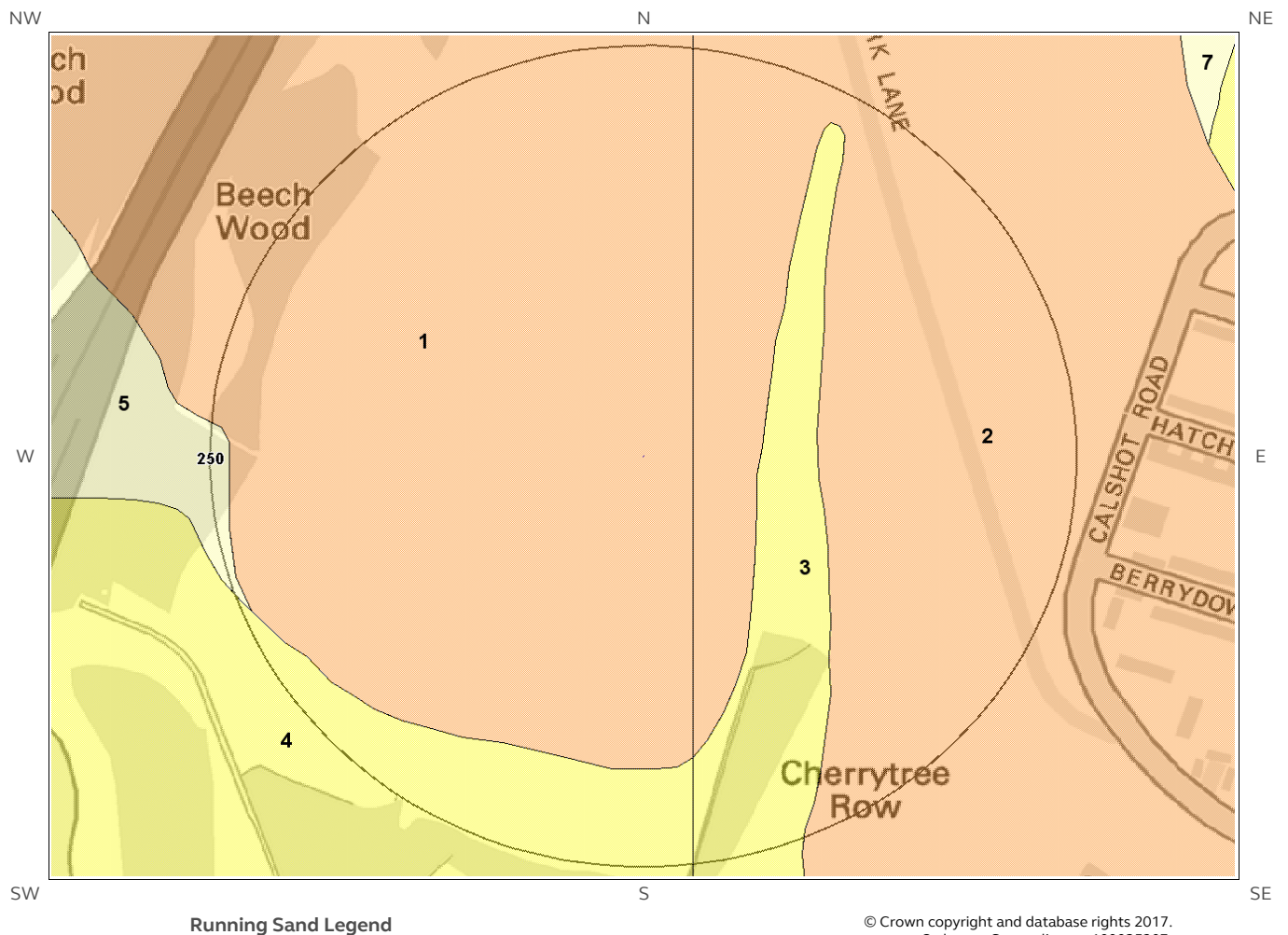
6.4 Compressible Deposits Map



6.5 Collapsible Deposits Map



6.6 Running Sand Map



6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site* boundary? Low

6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
2	28.0	E	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.
2	28.0	E	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

* This includes an automatically generated 50m buffer zone around the site

6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
2	28.0	E	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
2	28.0	E	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

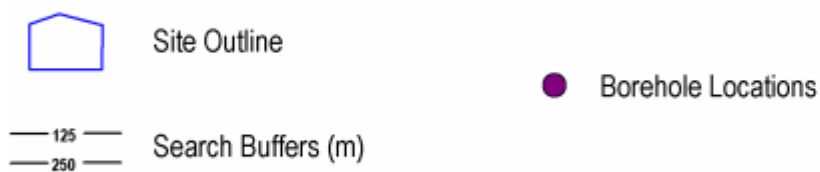
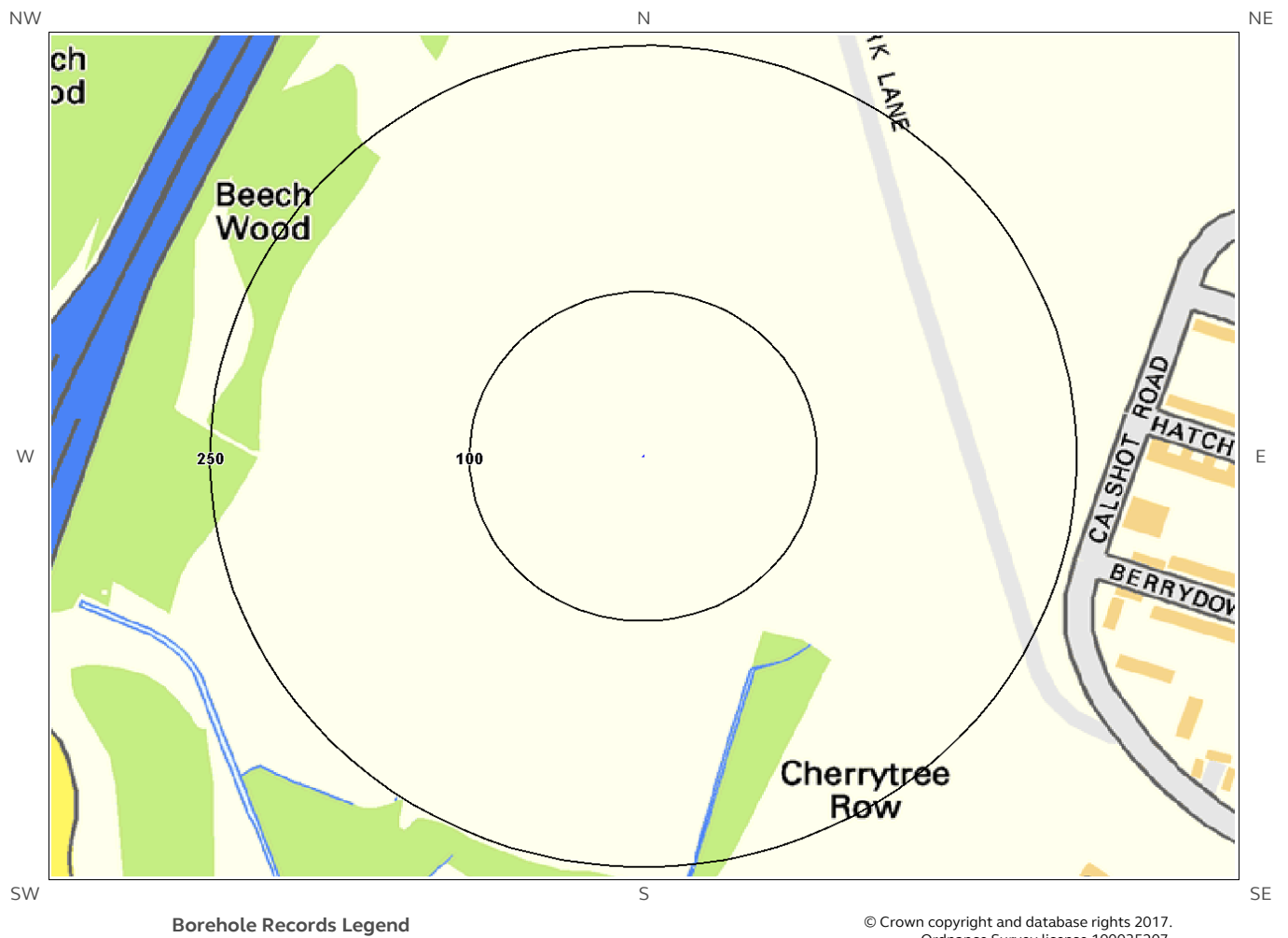
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
2	28.0	E	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
2	28.0	E	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.

7 Borehole Records Map



7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary:

0

Database searched and no data found.

8 Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary:

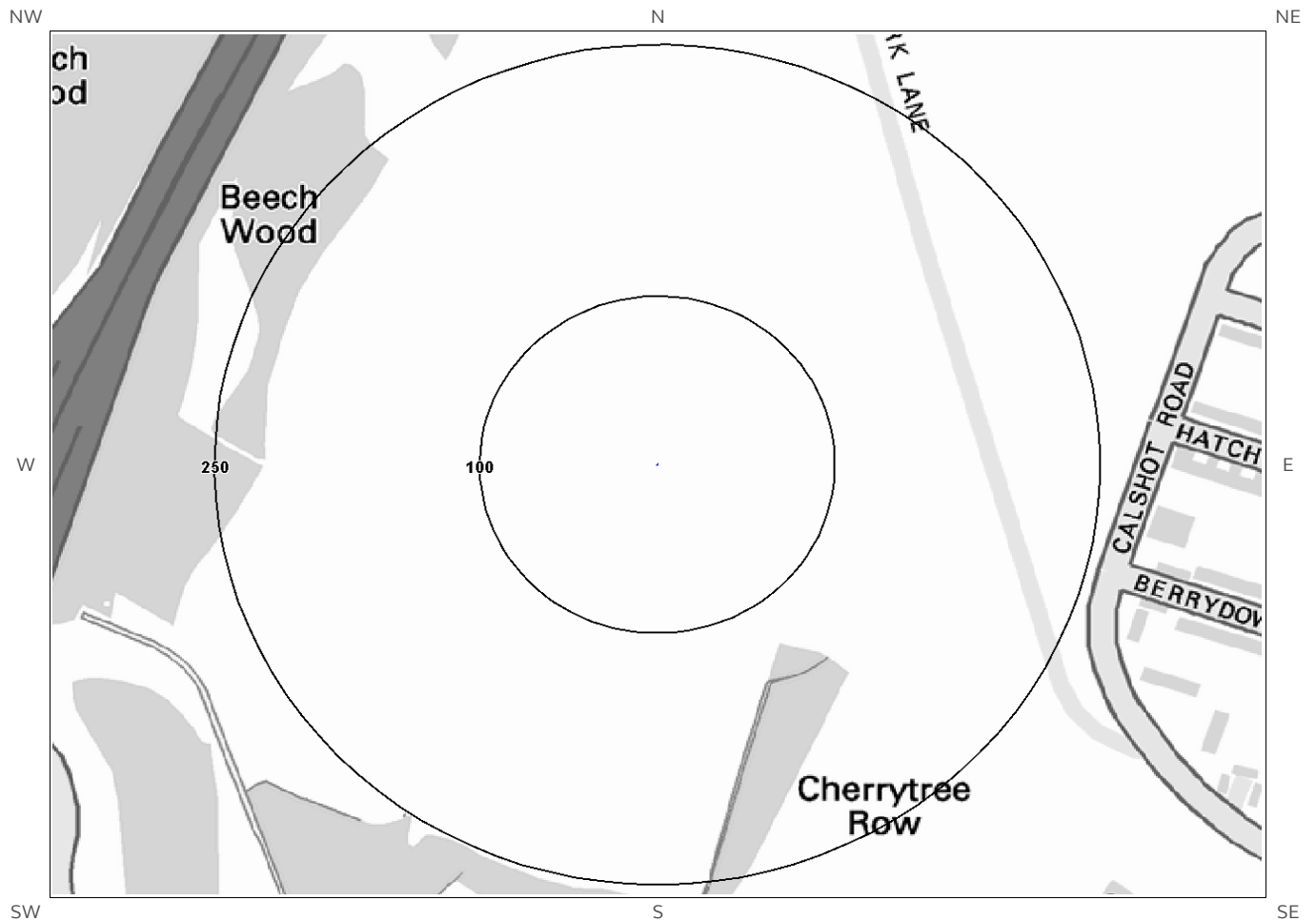
3

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
28.0	E	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
28.0	E	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

9 Railways and Tunnels Map



Railways and Tunnels Legend

© Crown copyright and database rights 2017.
Ordnance Survey license 100035207.
© OpenStreetMapContributors

	Site Outline		Underground or Partially Underground Railway / Subway System		Railway Track (OpenStreetMap)
	Search Buffers (m)		Railway Tunnel (OS Mapping)		High Speed 2
			Abandoned or Dismantled Railway (OpenStreetMap)		High Speed 2 Revised Proposed Route
			Railway Track (OS Mapping)		Crossrail 1
					Railway and/or Tunnel Feature from Historical Mapping

9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? No

Have any historical railway or tunnel features been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project? No

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com



British Geological Survey Enquiries

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk

BGS Geological Hazards Reports and general geological enquiries



British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Gypsum

British Gypsum Ltd
East Leake
Loughborough
Leicestershire
LE12 6HX



The Coal Authority

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk



The Coal
Authority

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
<https://www.gov.uk/government/organisations/public-health-england>
Email: enquiries@phe.gov.uk
Main switchboard: 020 7654 8000



Public Health
England

Johnson Poole & Bloomer Limited

Harris and Pearson Building, Brettell Lane
Brierley Hill, West Midlands
DY5 3LH
Tel: +44 (0) 1384 262 000
Email: enquiries.gs@jpb.co.uk
Website: www.jpb.co.uk



Ordnance Survey

Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505
Website: <http://www.ordnancesurvey.co.uk/>



Getmapping PLC

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444
Website: <http://www1.getmapping.com/>



Peter Brett Associates
Caversham Bridge House
Waterman Place
Reading
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail: reading@pba.co.uk
Website: <http://www.peterbrett.com/home>



Acknowledgements: Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].
This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
<https://www.groundsure.com/terms-and-conditions-sept-2016/>

Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1859

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1859
Revised 1859
Edition N/A
Copyright N/A
Levelled N/A

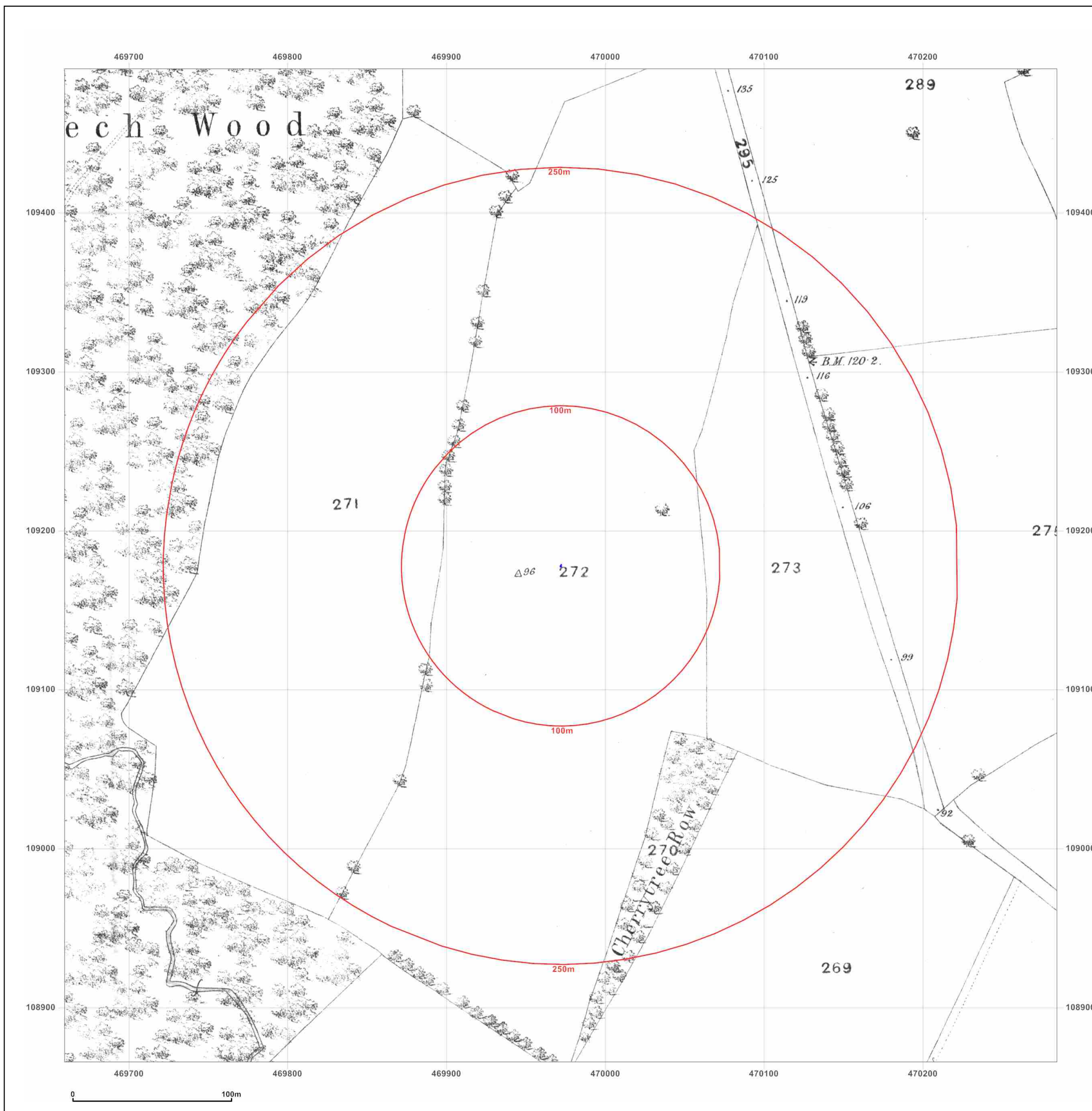


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1868

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1868
Revised 1868
Edition N/A
Copyright N/A
Levelled N/A

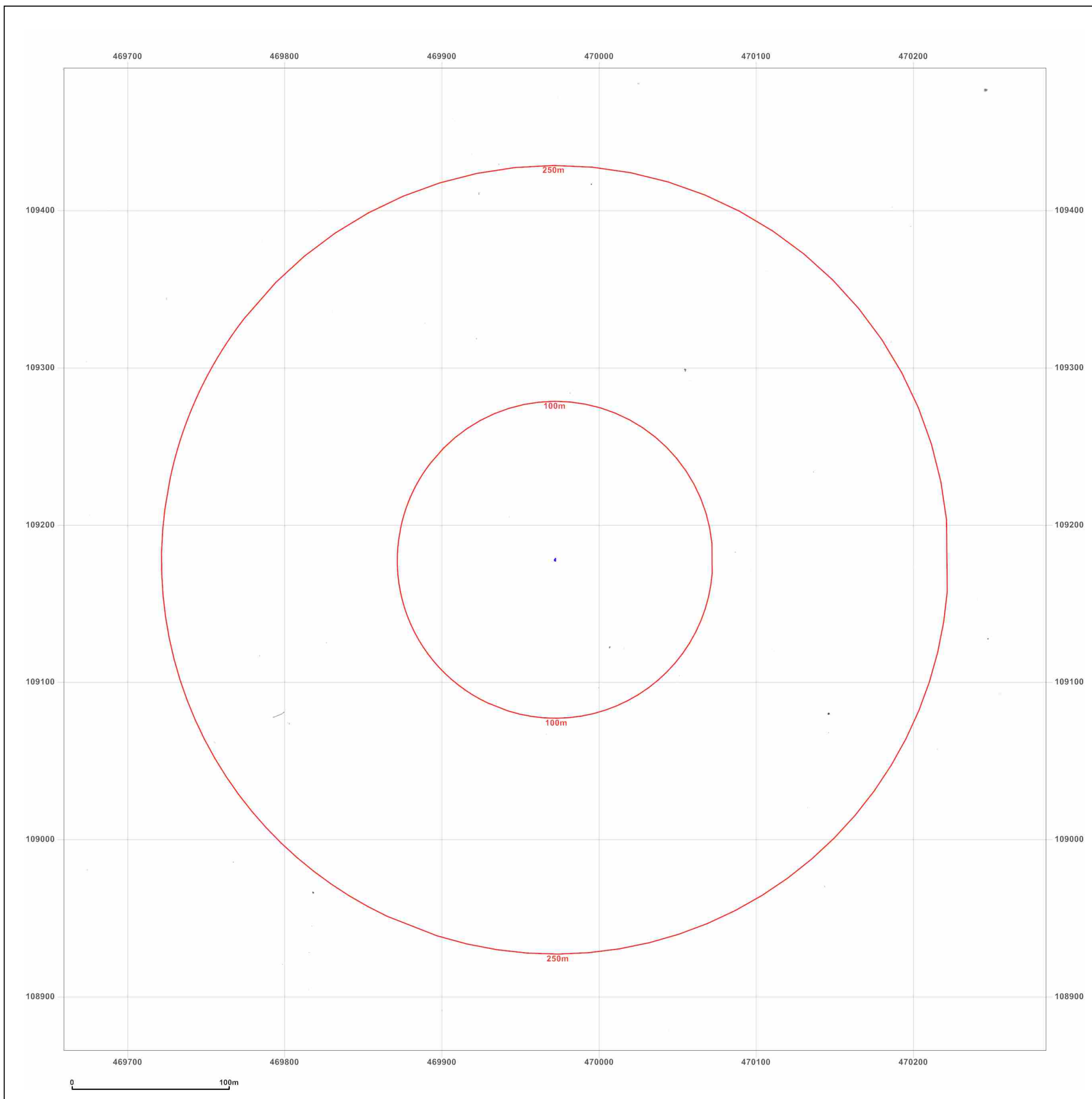


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1868

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1868
Revised 1868
Edition N/A
Copyright N/A
Levelled N/A

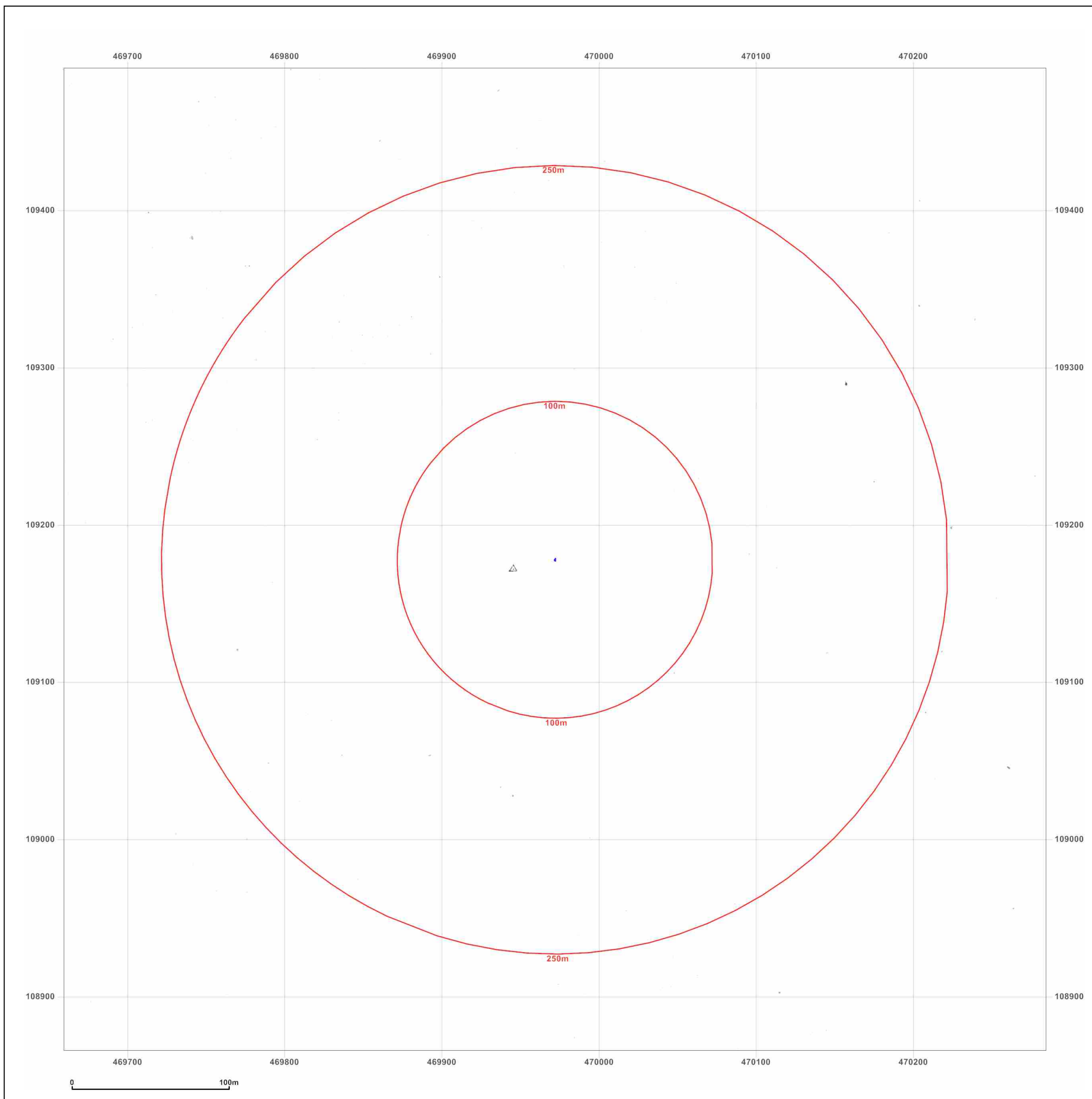


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1868

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1868
Revised 1868
Edition N/A
Copyright N/A
Levelled N/A

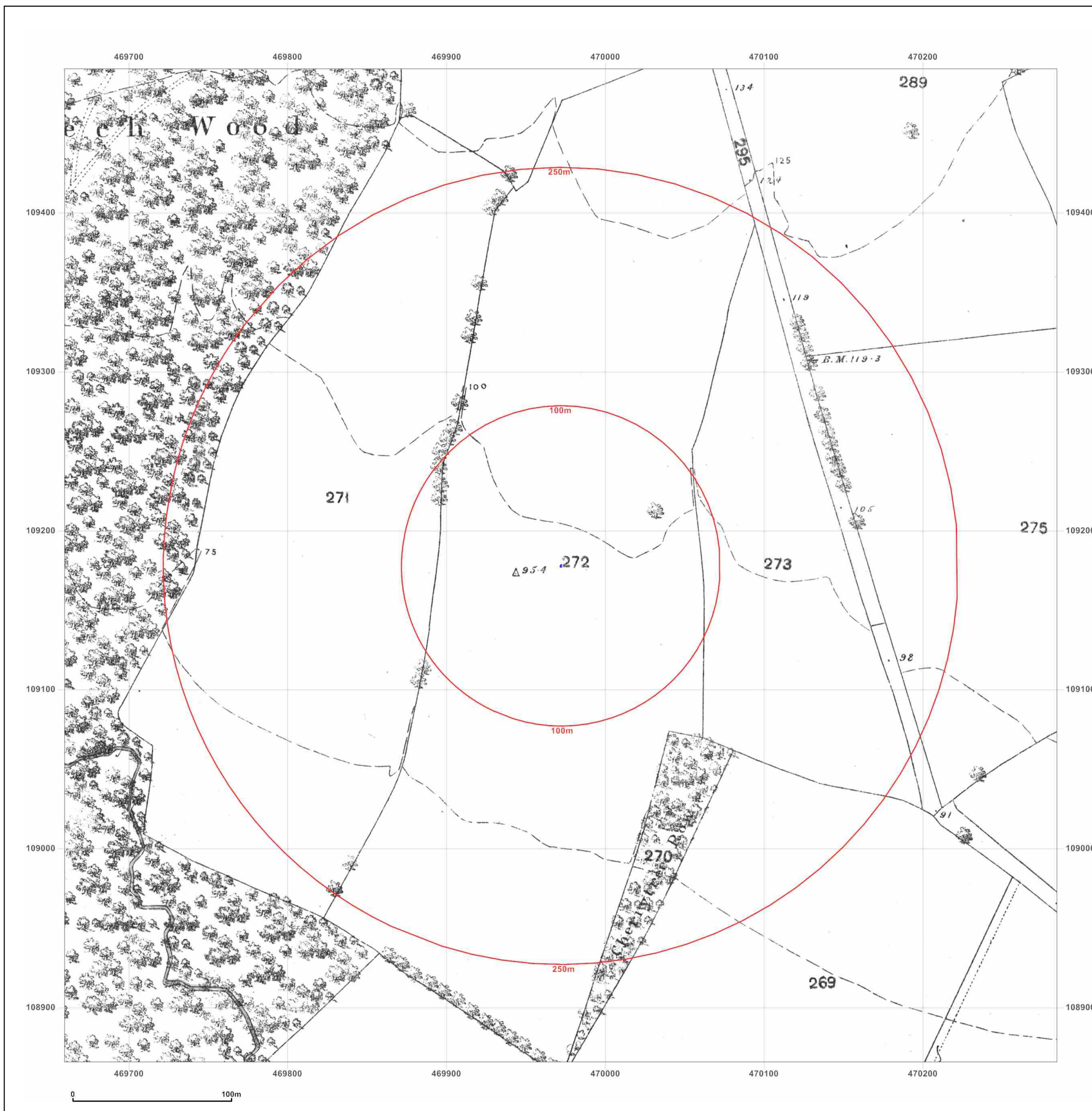


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1897

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1897
Revised 1897
Edition N/A
Copyright N/A
Levelled N/A

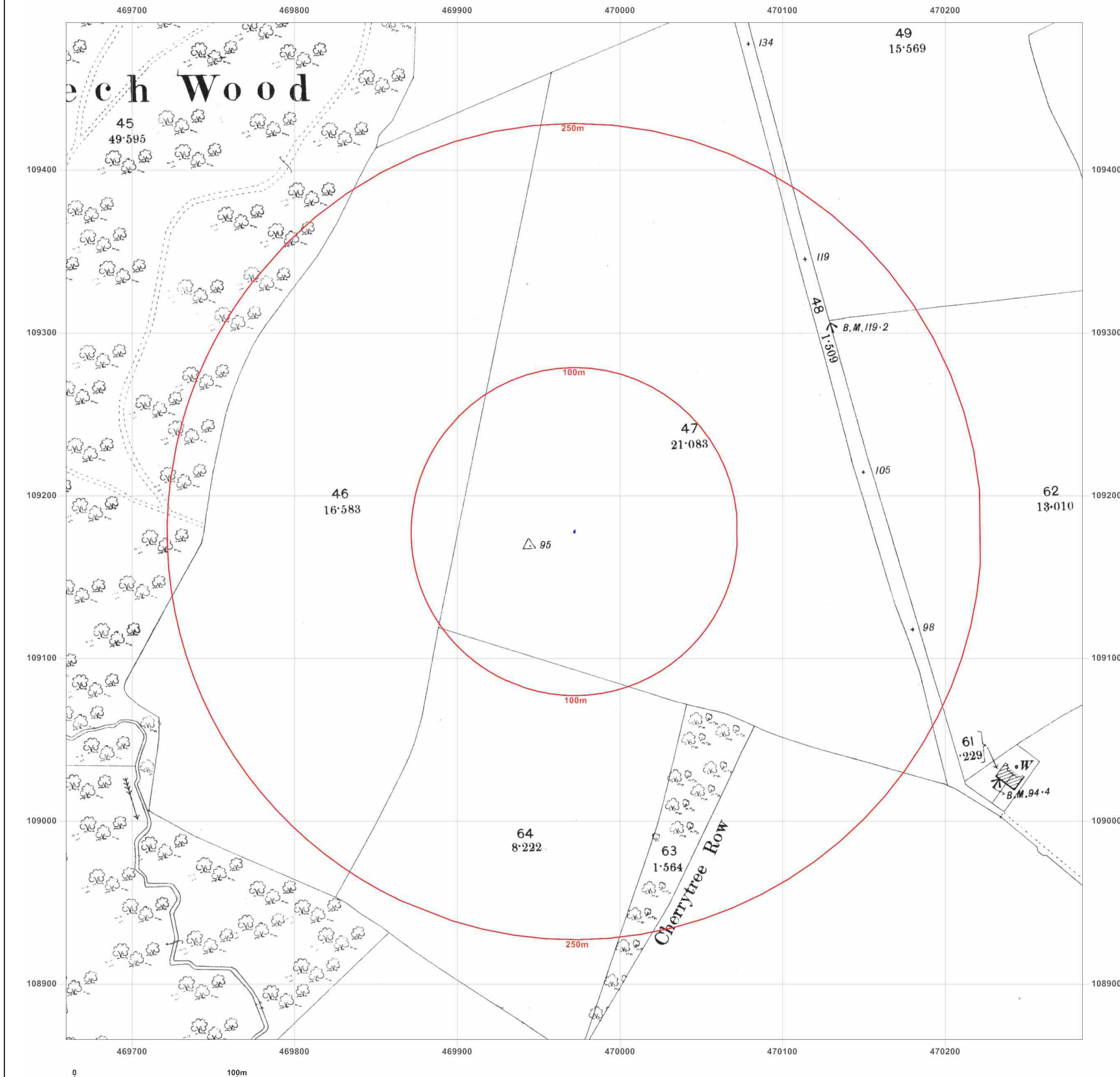


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1908

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1908
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

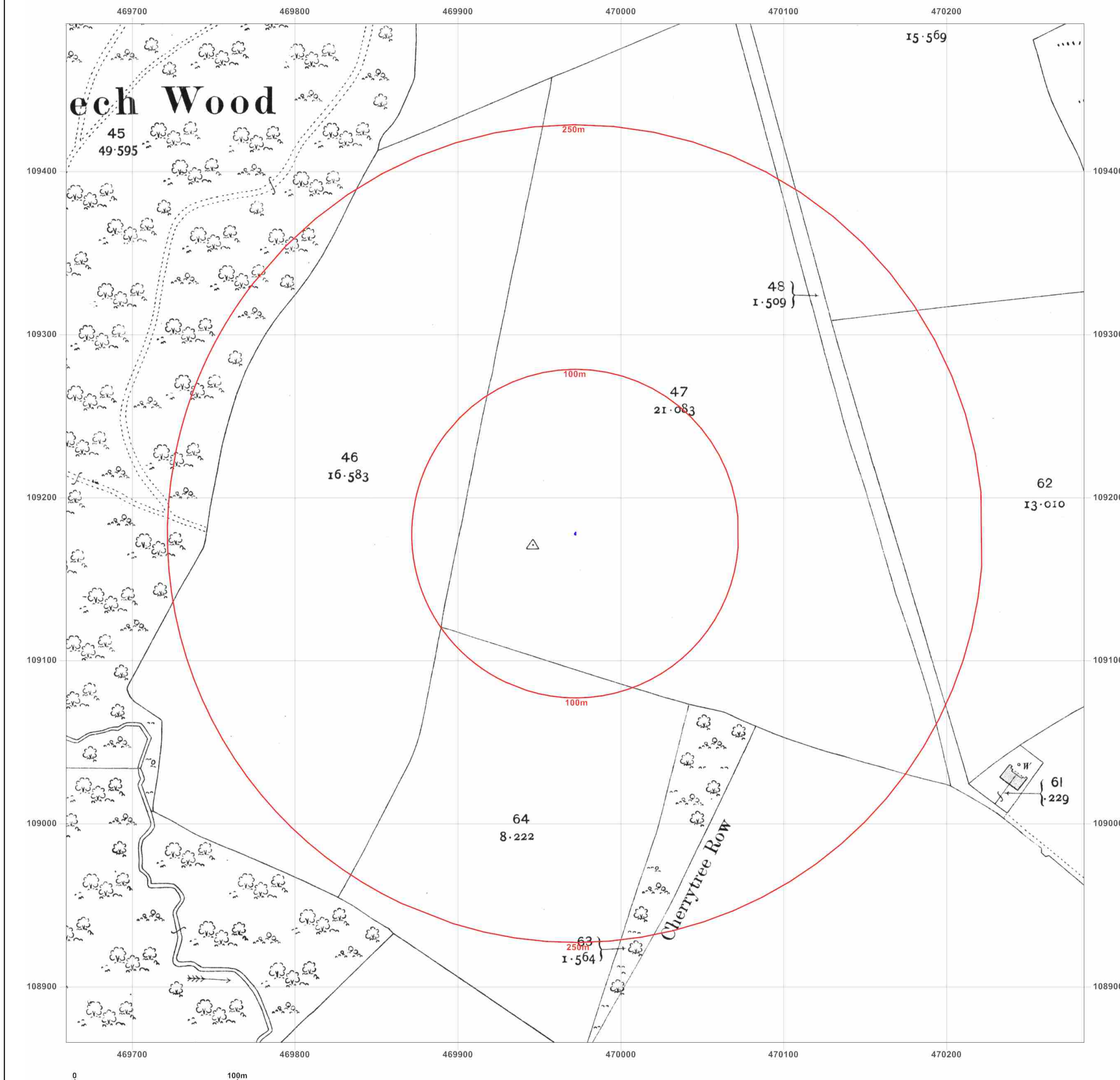


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1932

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1932
Revised 1932
Edition N/A
Copyright N/A
Levelled N/A

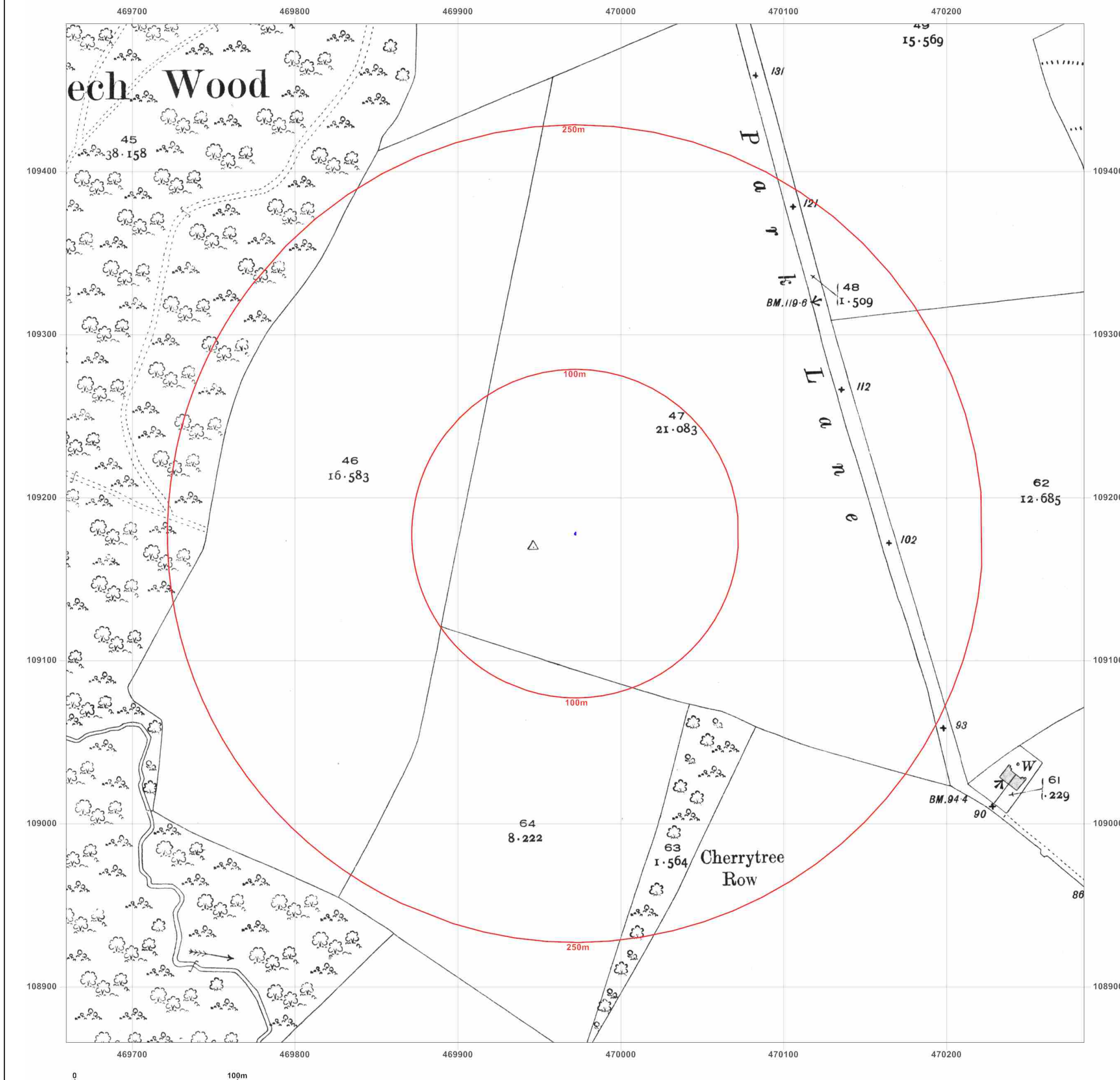


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1939

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1939
Revised 1939
Edition N/A
Copyright N/A
Levelled N/A

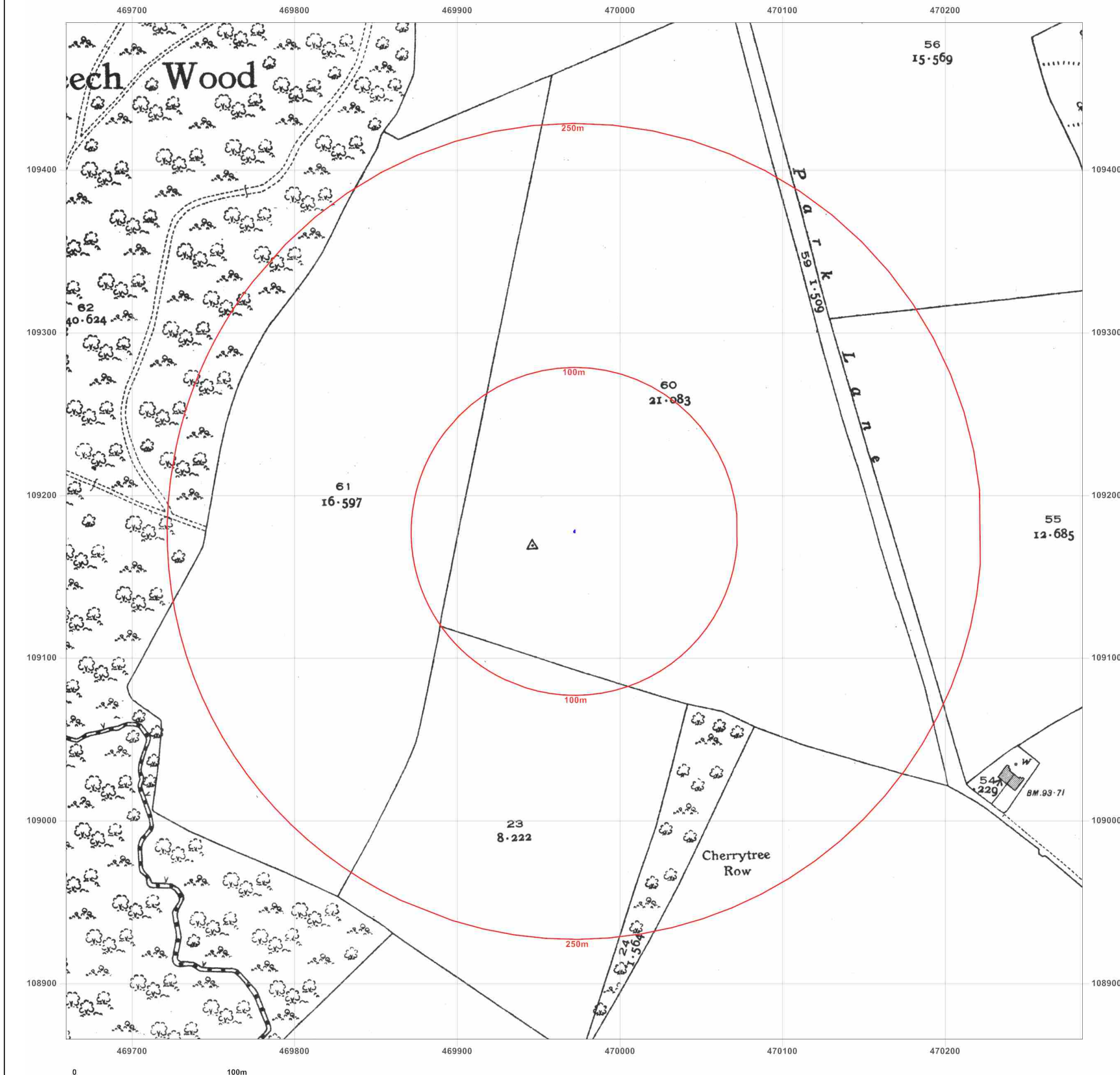


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

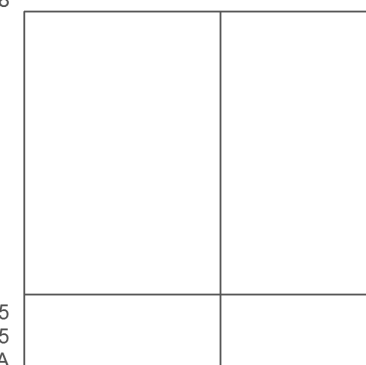
Map date: 1962-1965

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1952
Revised 1965
Edition N/A
Copyright 1966
Levelled 1958



Surveyed 1965
Revised 1965
Edition N/A
Copyright 1966
Levelled 1958

Surveyed 1962
Revised 1962
Edition 1964
Copyright 1964
Levelled 1958

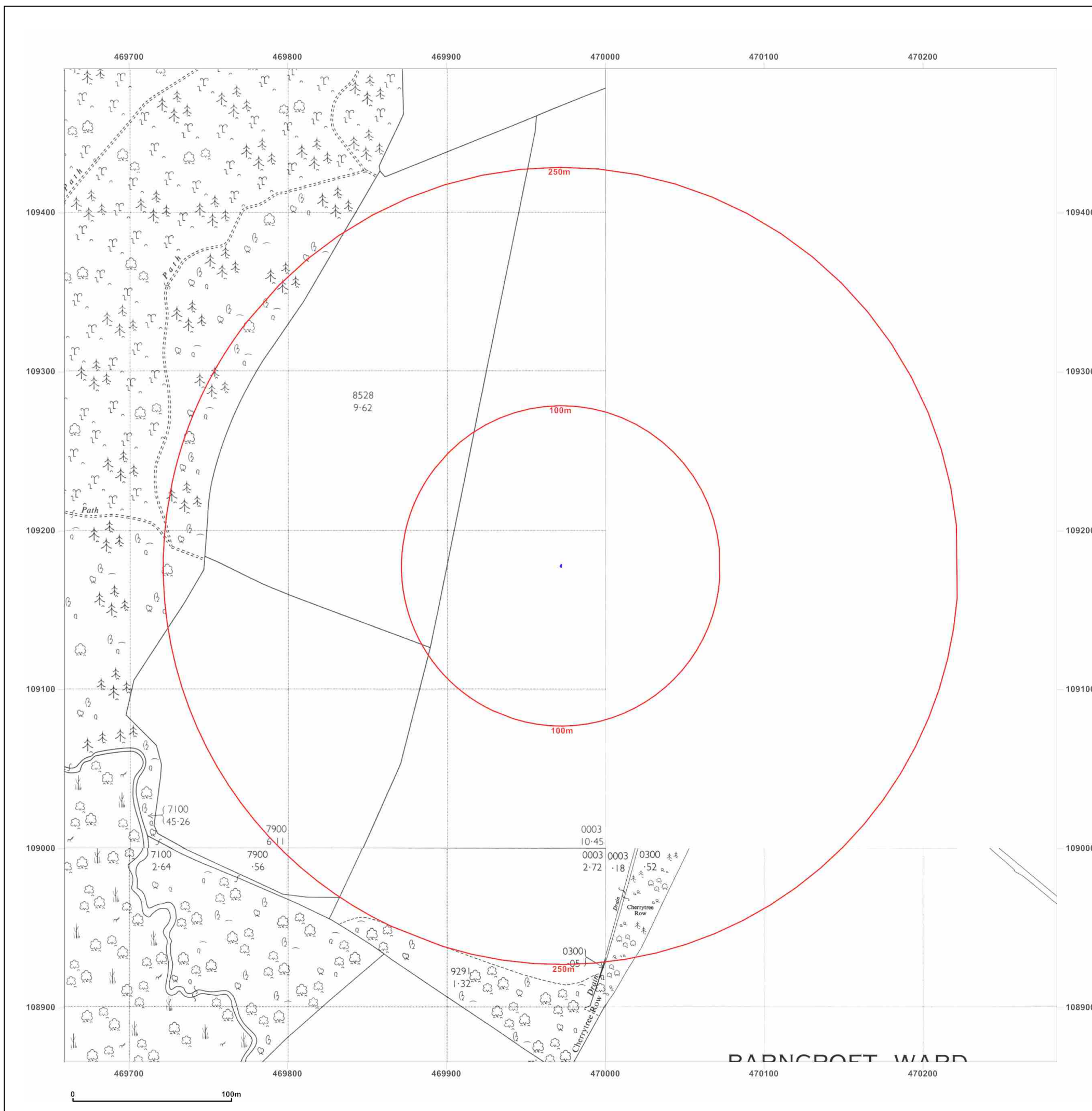


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1972

Scale: 1:2,500

Printed at: 1:2,500



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

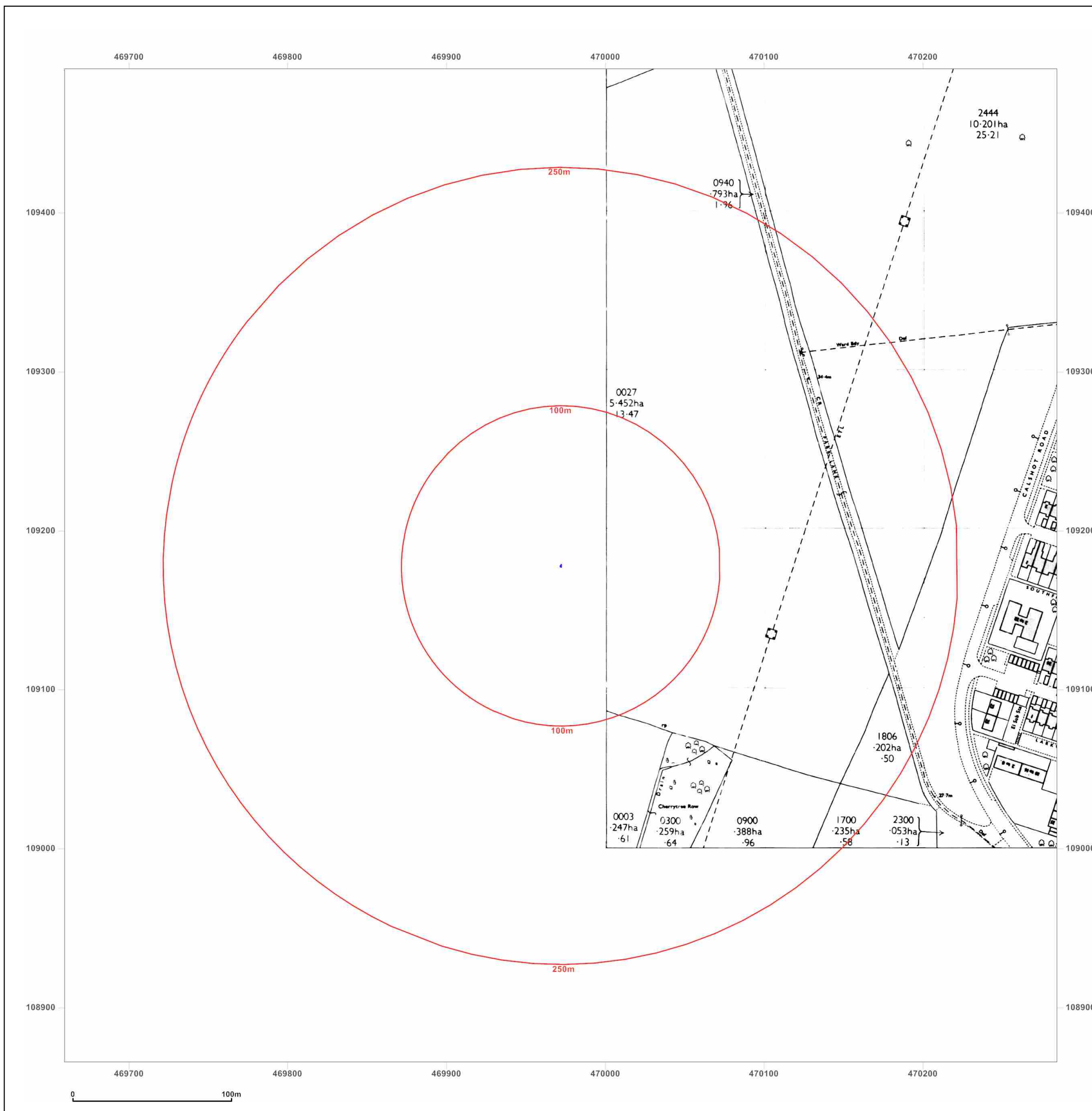


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1970-1973

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1973
Revised 1973
Edition N/A
Copyright 1973
Levelled 1958

Surveyed 1970
Revised 1970
Edition N/A
Copyright 1971
Levelled 1958

Surveyed 1973
Revised 1973
Edition N/A
Copyright 1973
Levelled 1958

Surveyed 1970
Revised 1970
Edition N/A
Copyright N/A
Levelled N/A

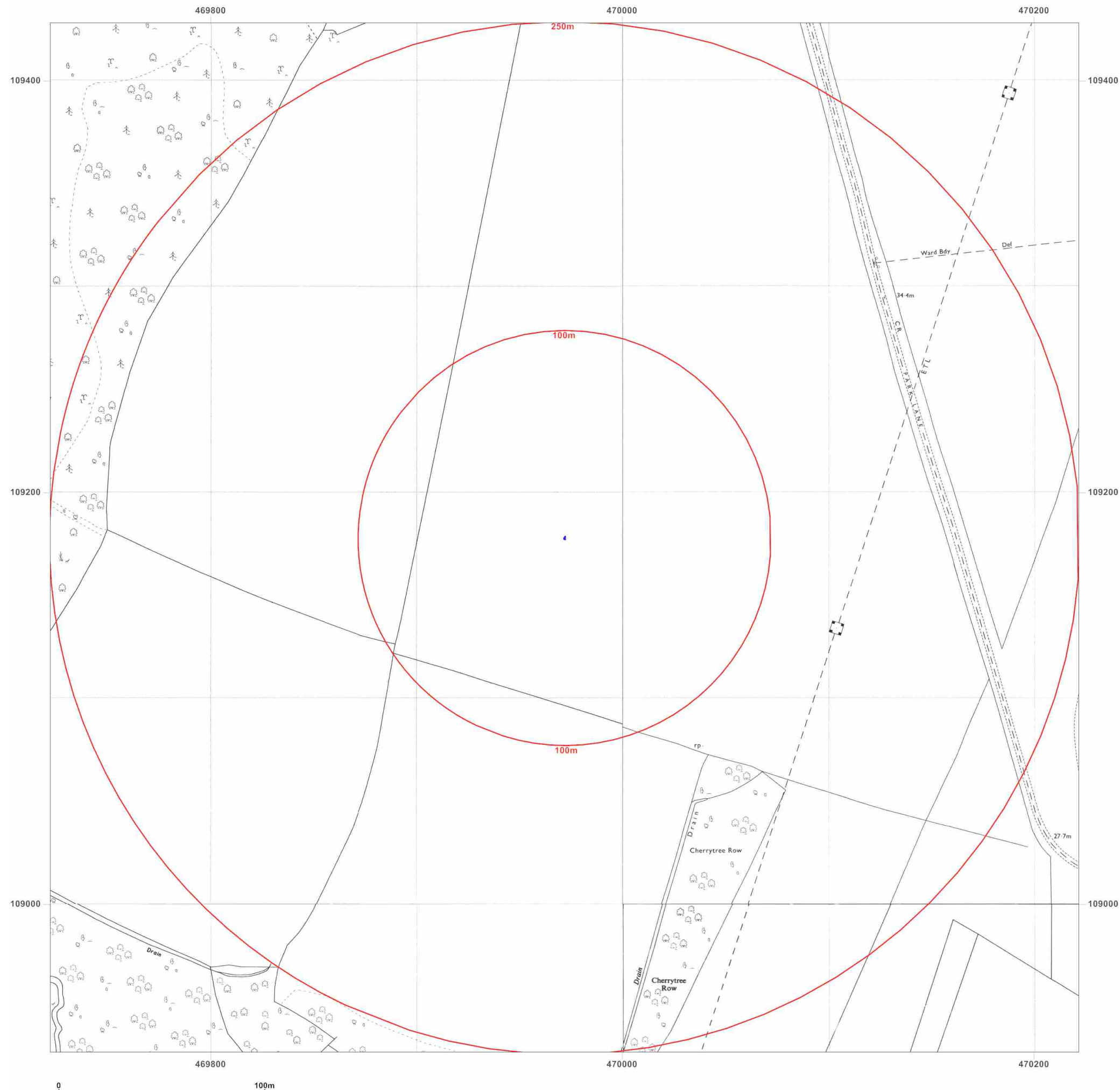


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1980

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1980
Revised 1980
Edition N/A
Copyright 1980
Levelled N/A

Surveyed 1958
Revised 1980
Edition N/A
Copyright 1980
Levelled 1958

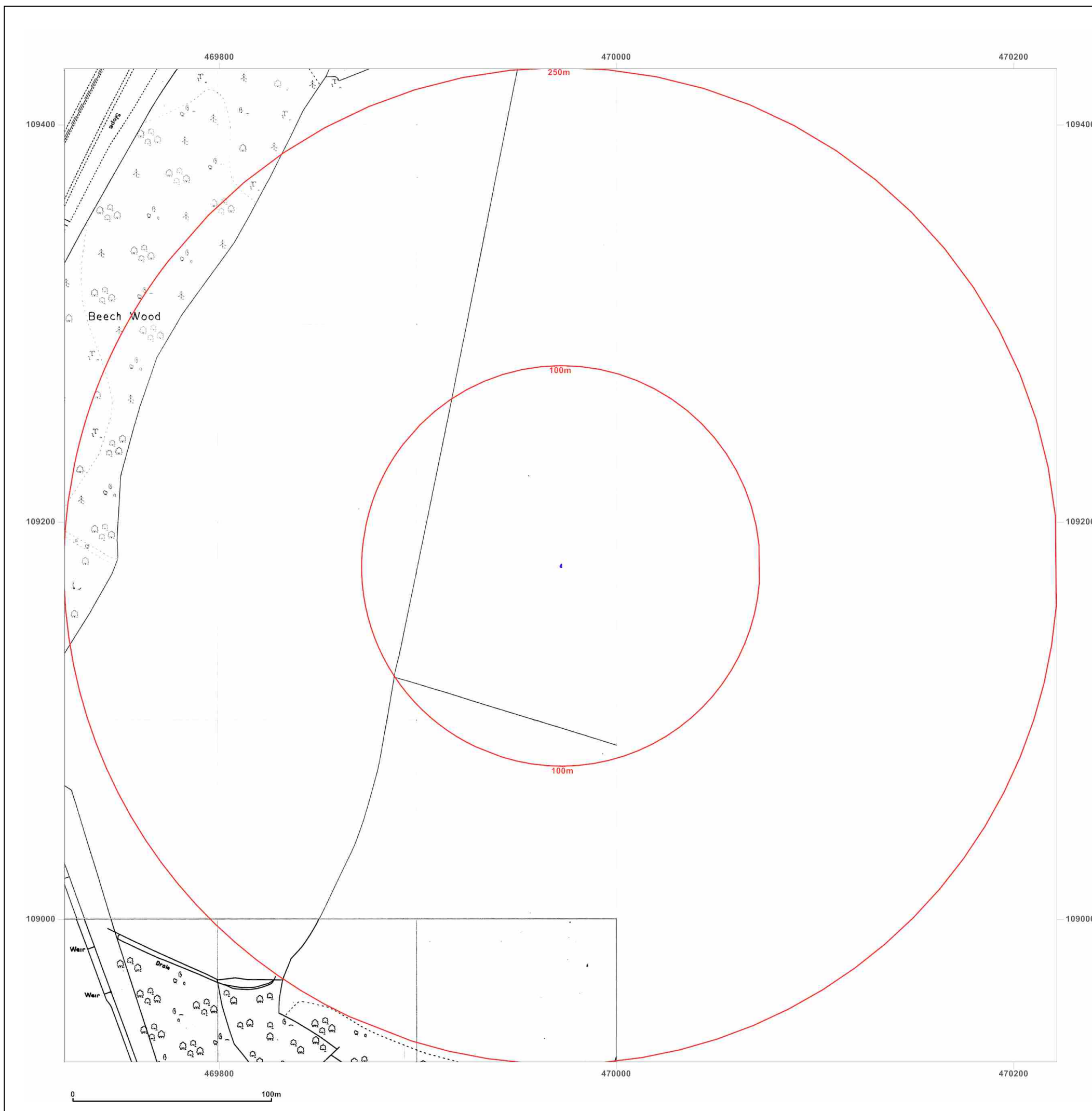


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1985

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1958
Revised 1985
Edition N/A
Copyright 1985
Levelled 1958

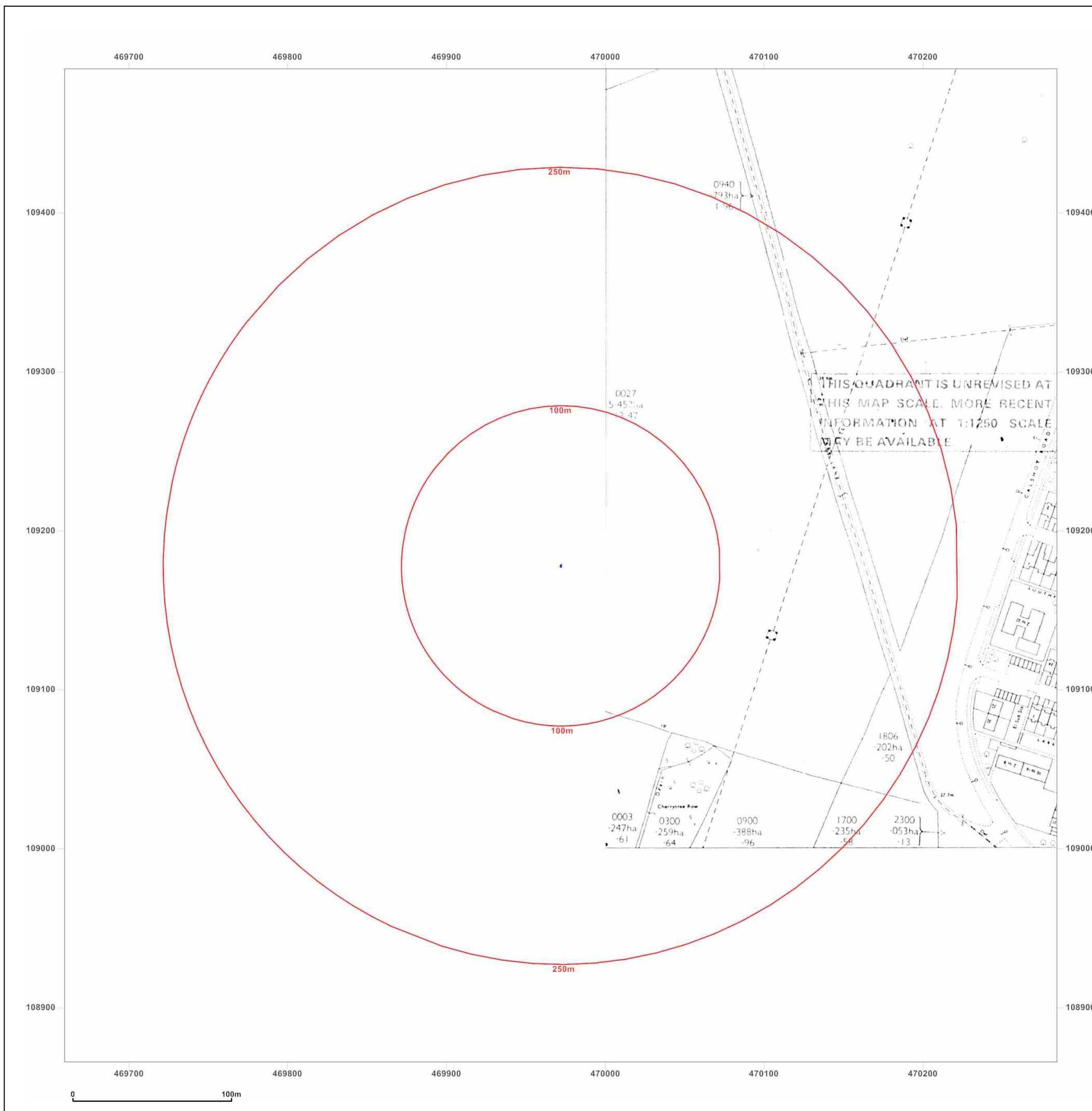


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1985-1989

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised 1989
Edition N/A
Copyright 1989
Levelled N/A

Surveyed 1968
Revised 1985
Edition N/A
Copyright 1985
Levelled 1968

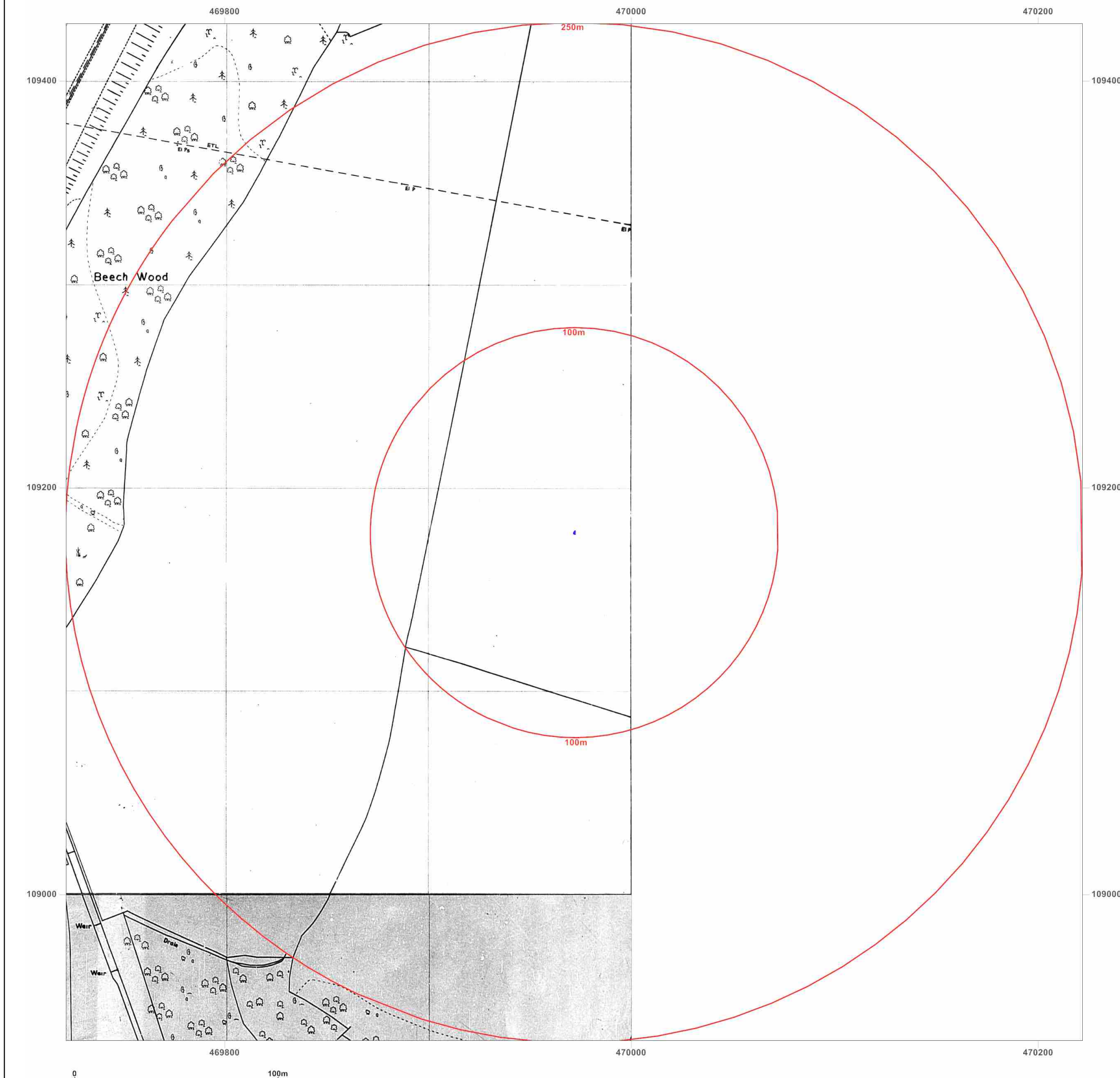


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

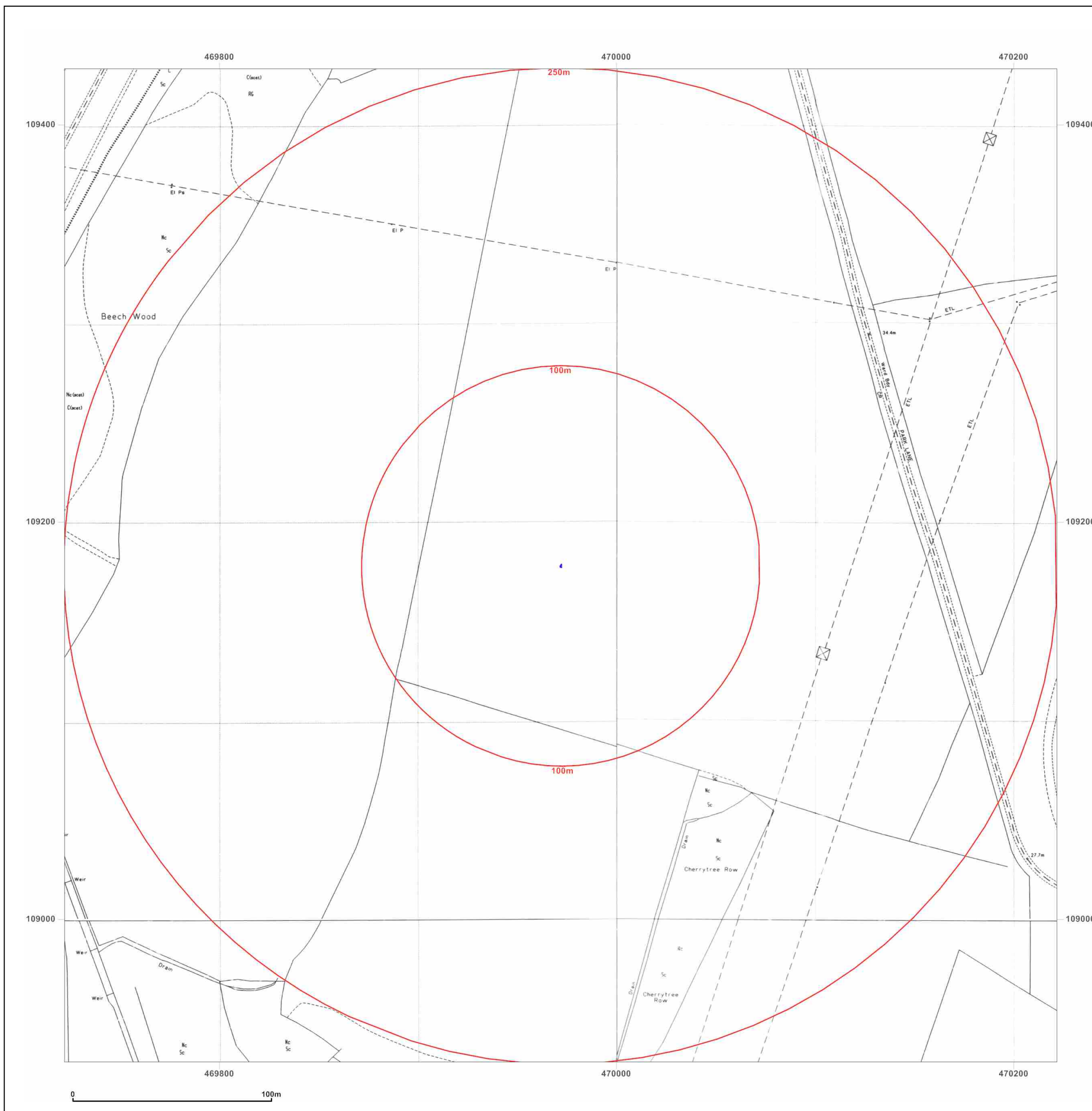


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1866-1867

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1867
Revised 1867
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1866
Revised 1866
Edition N/A
Copyright N/A
Levelled N/A

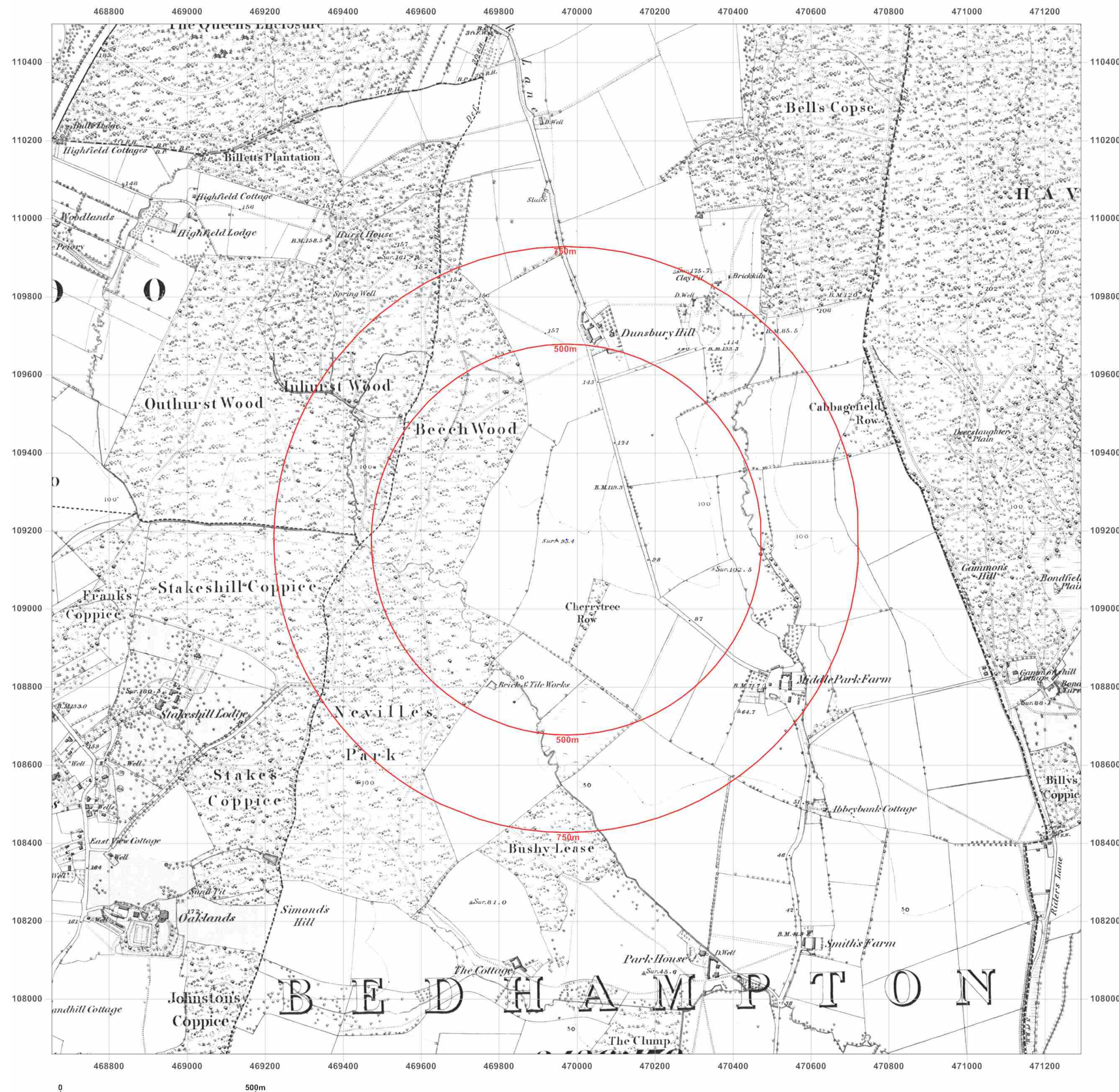


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1895-1898

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1872
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1867
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1872
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

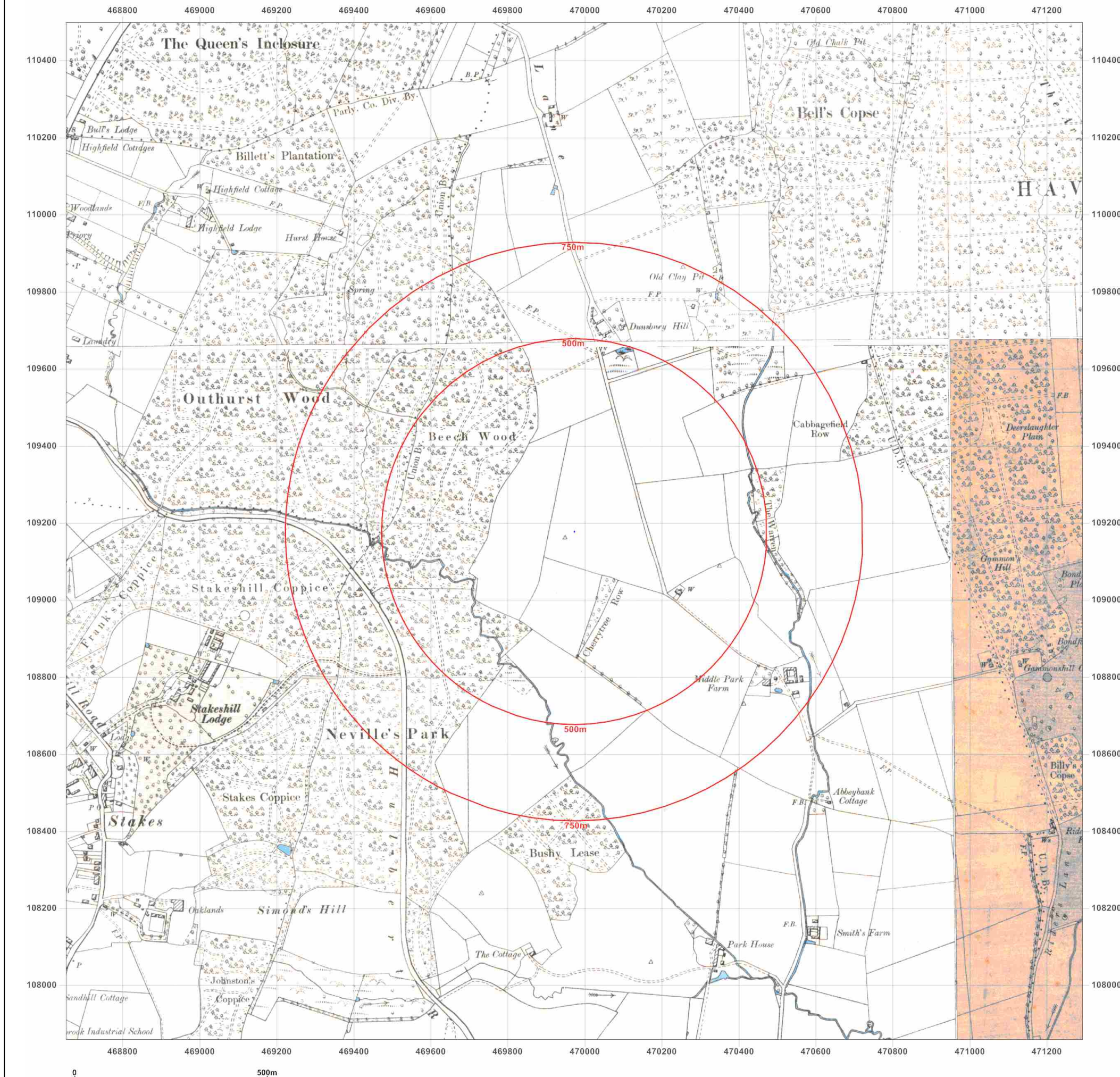


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1895-1898

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1867
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1867
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1873
Revised 1895
Edition 1898
Copyright N/A
Levelled N/A

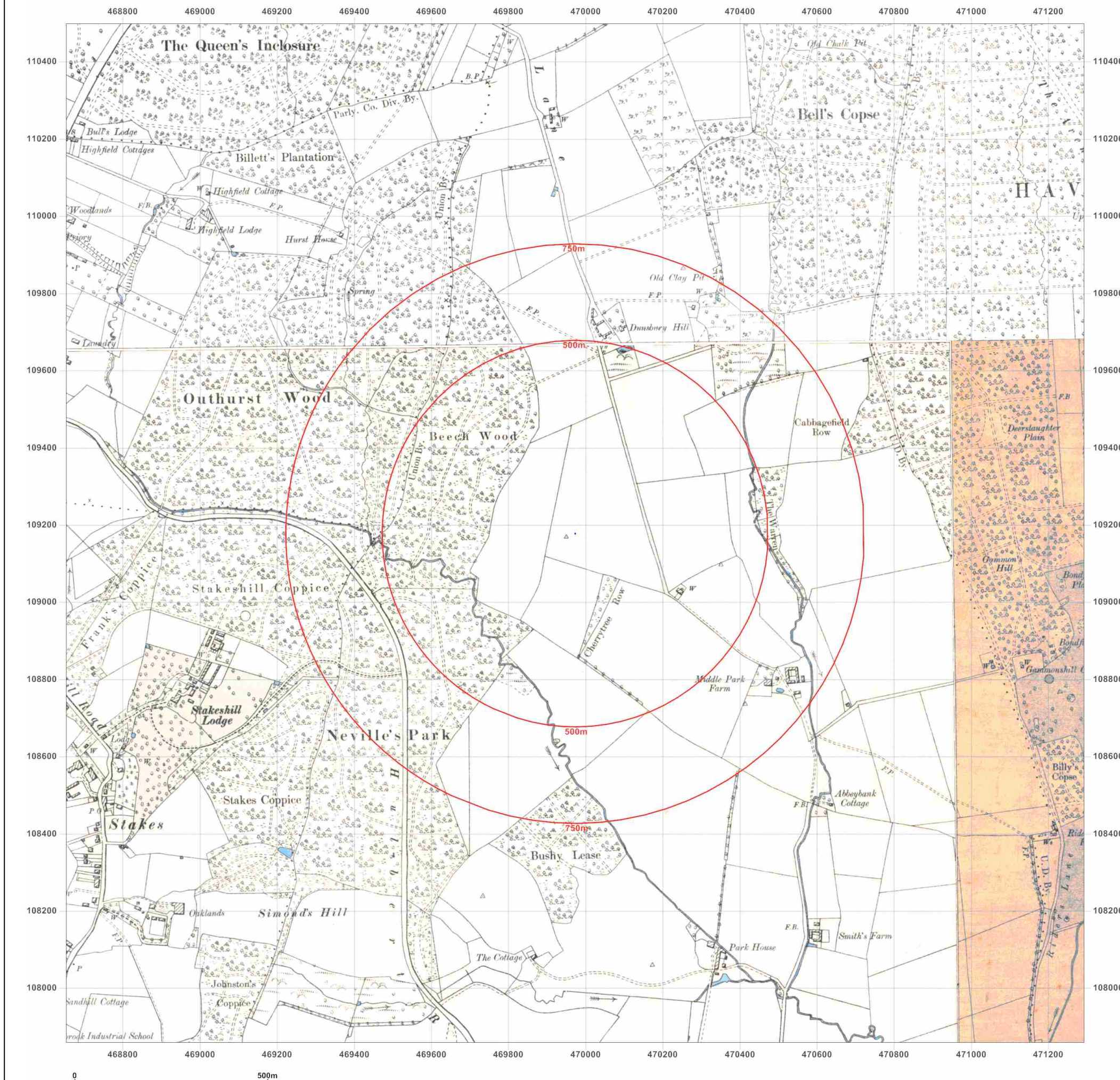


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1907

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1859
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

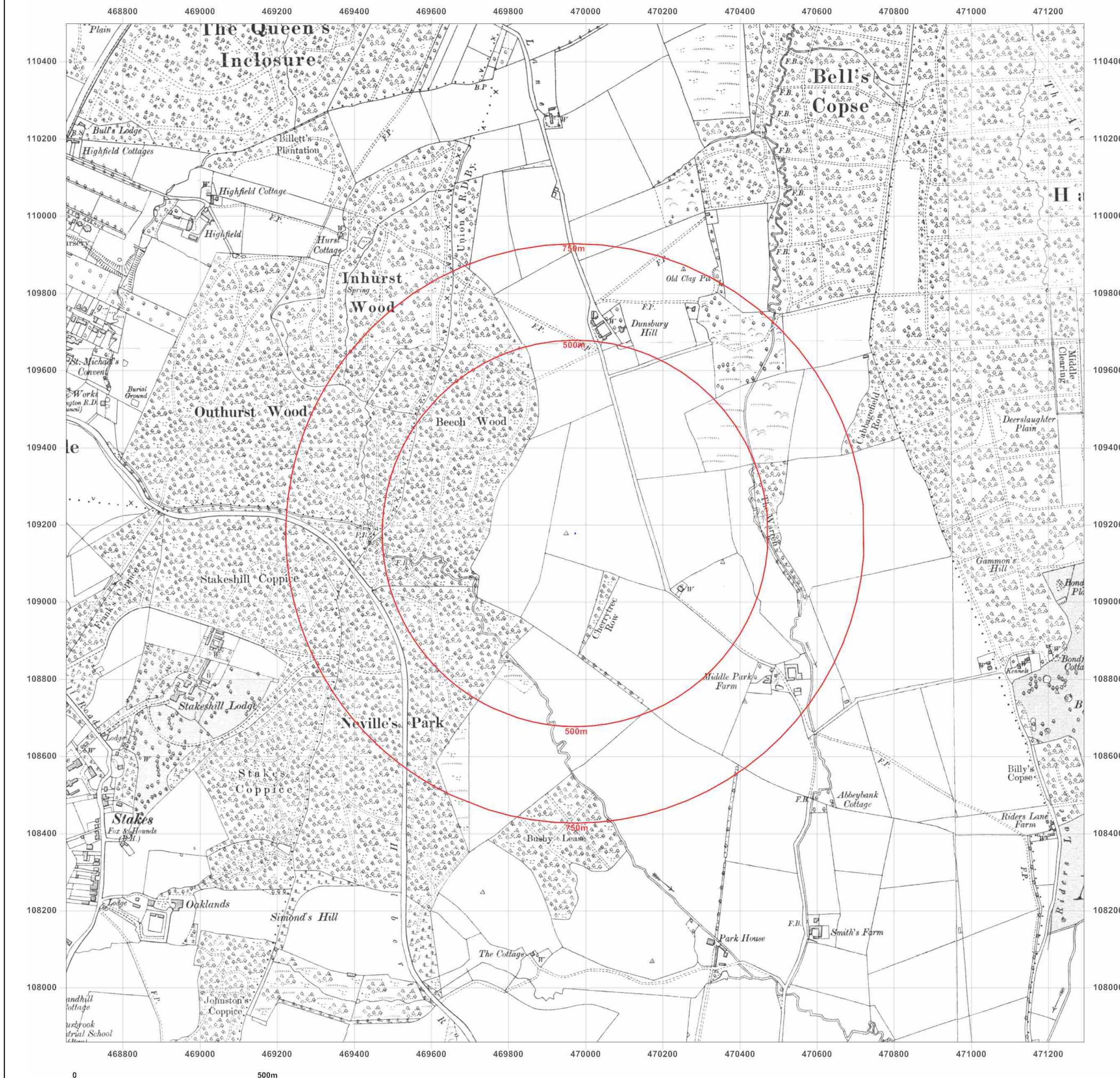


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1930-1931

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1859
Revised 1930
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1931
Edition N/A
Copyright N/A
Levelled N/A

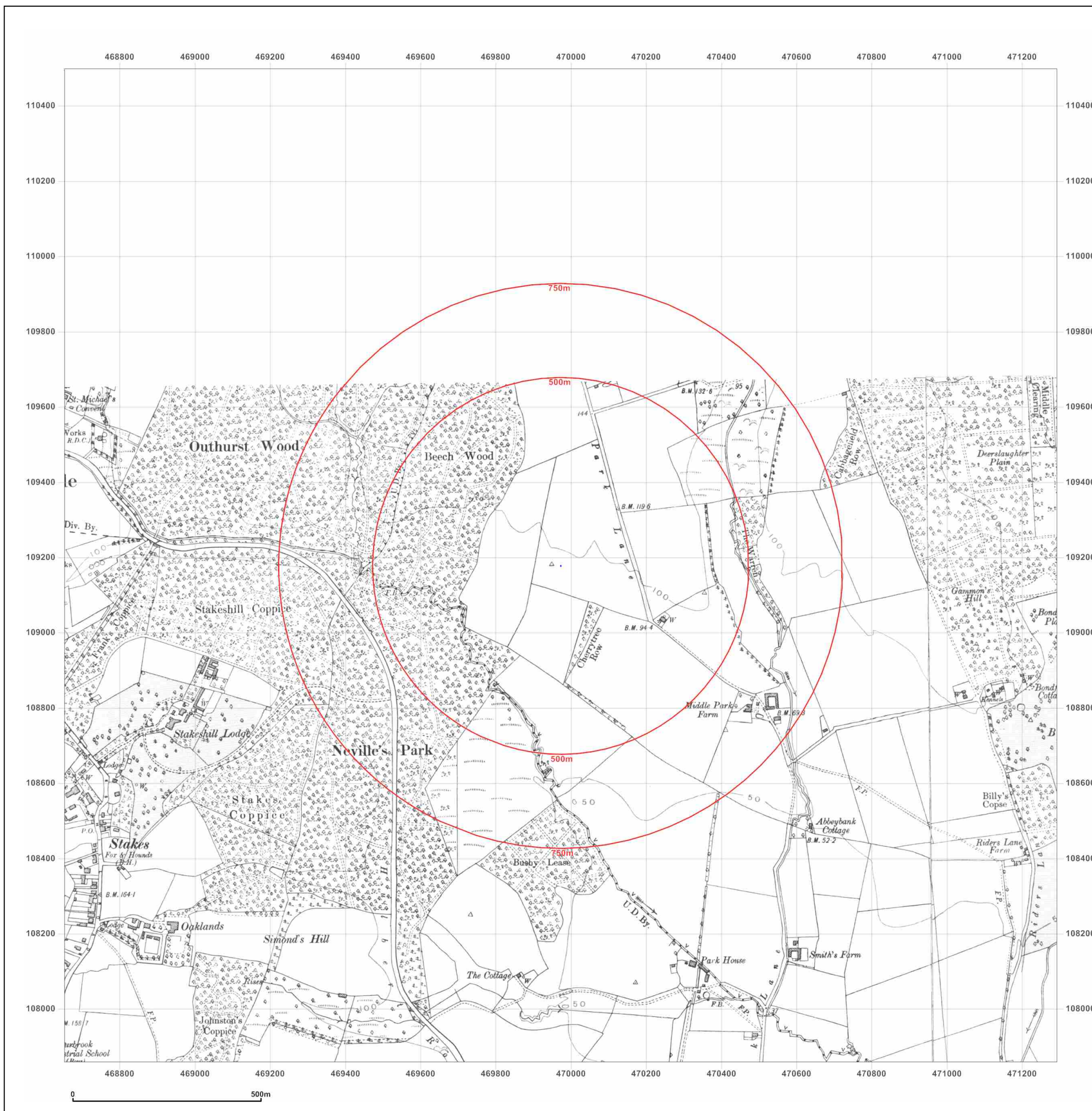


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1930-1933

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised 1933
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1931
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1859
Revised 1930
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1931
Edition N/A
Copyright N/A
Levelled N/A

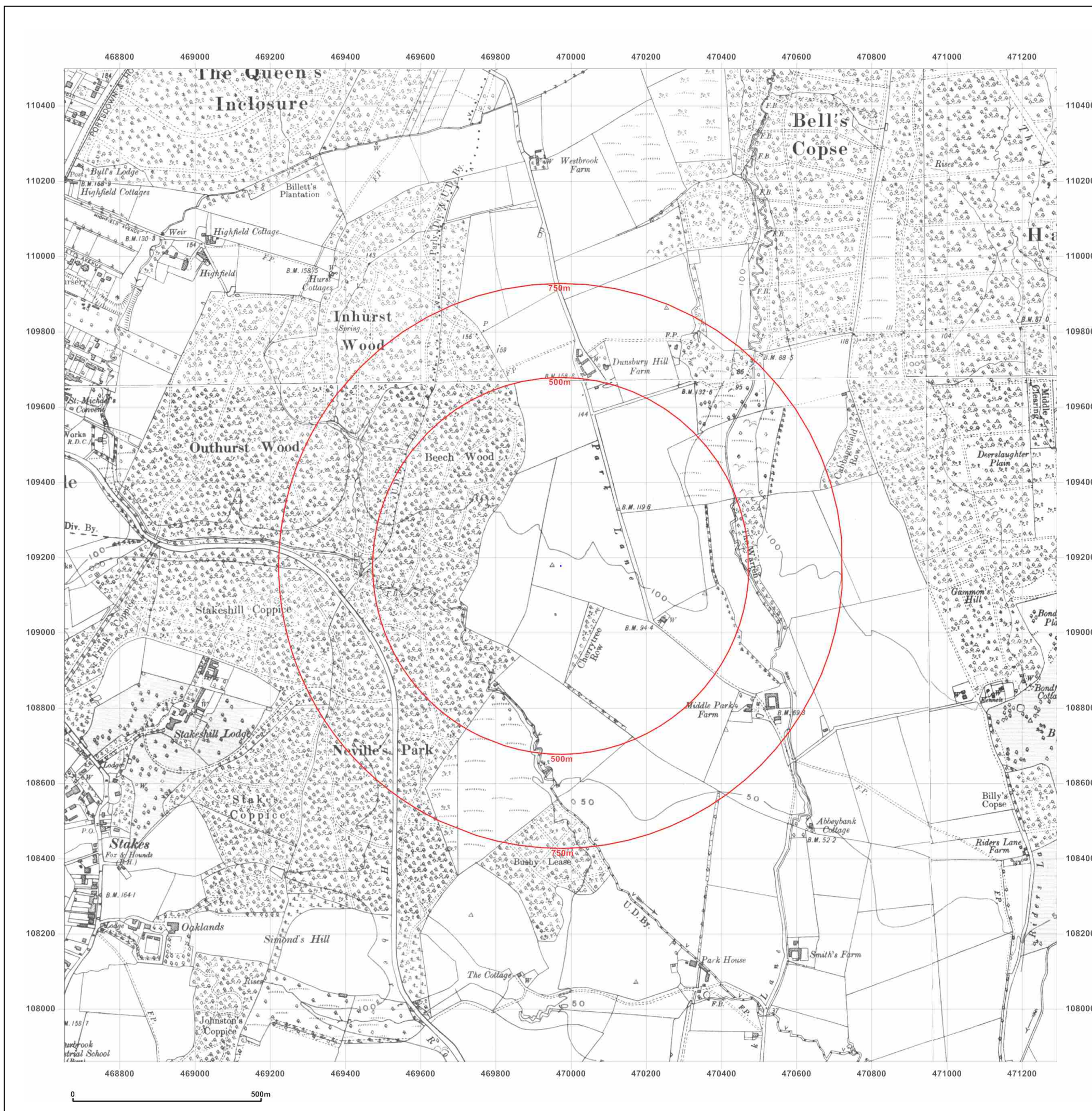


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: County Series

Map date: 1938-1942

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised 1942
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1859
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1865
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

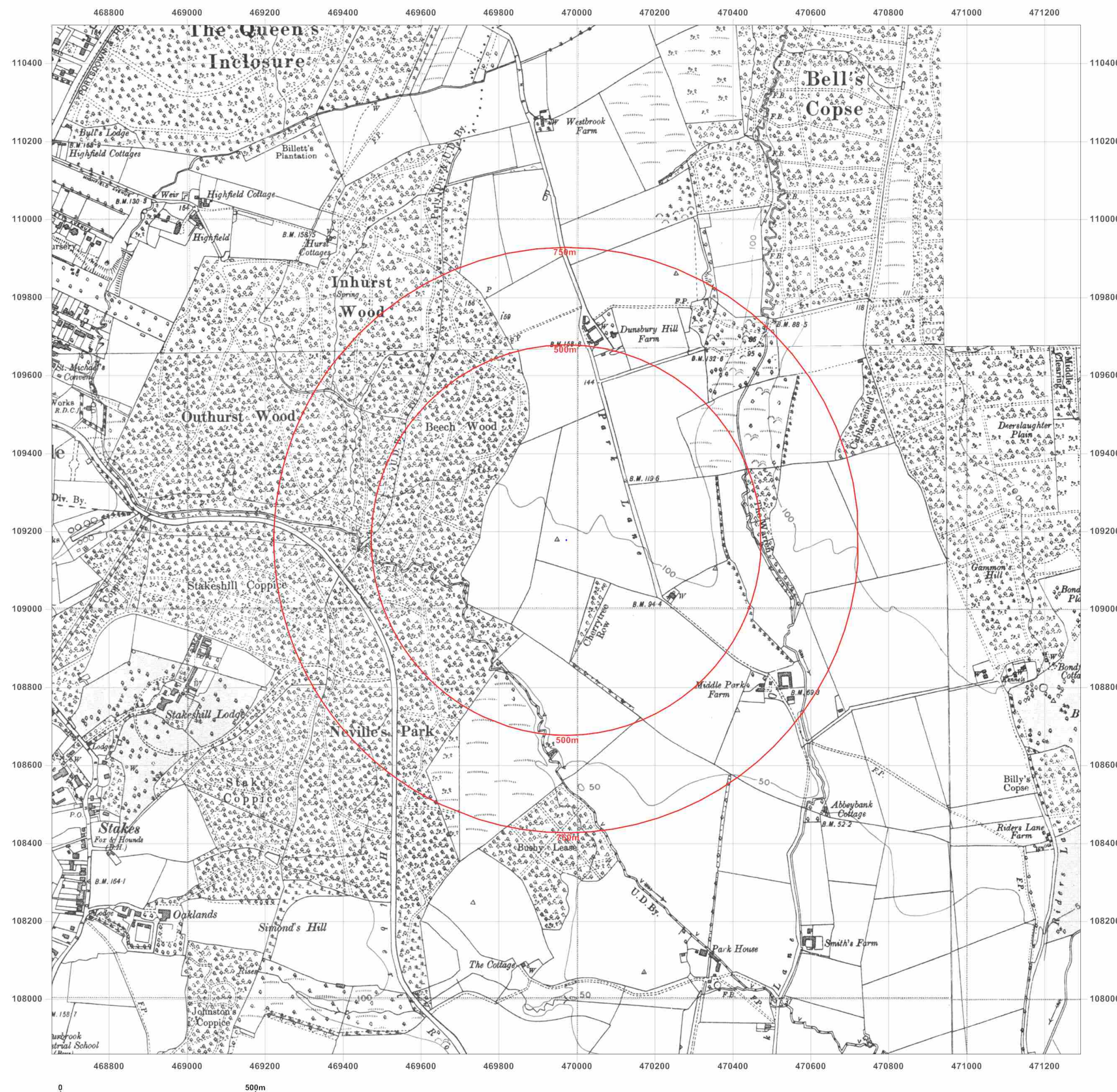


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: Provisional

Map date: 1959-1963

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1959
Revised 1959
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1961
Edition N/A
Copyright 1962
Levelled N/A

Surveyed 1865
Revised 1957
Edition N/A
Copyright 1963
Levelled N/A

Surveyed 1873
Revised 1957
Edition N/A
Copyright 1963
Levelled N/A



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1975-1980

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1973
Revised 1979
Edition N/A
Copyright 1980
Levelled 1973

Surveyed 1980
Revised 1980
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1980
Revised 1980
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1973
Revised 1975
Edition N/A
Copyright 1975
Levelled 1962



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 1991-1992

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1990
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1989
Revised 1991
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1988
Revised 1991
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1989
Revised 1991
Edition N/A
Copyright N/A
Levelled N/A



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNS BURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: 1:10,000 Raster

Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000



2002



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000



2010

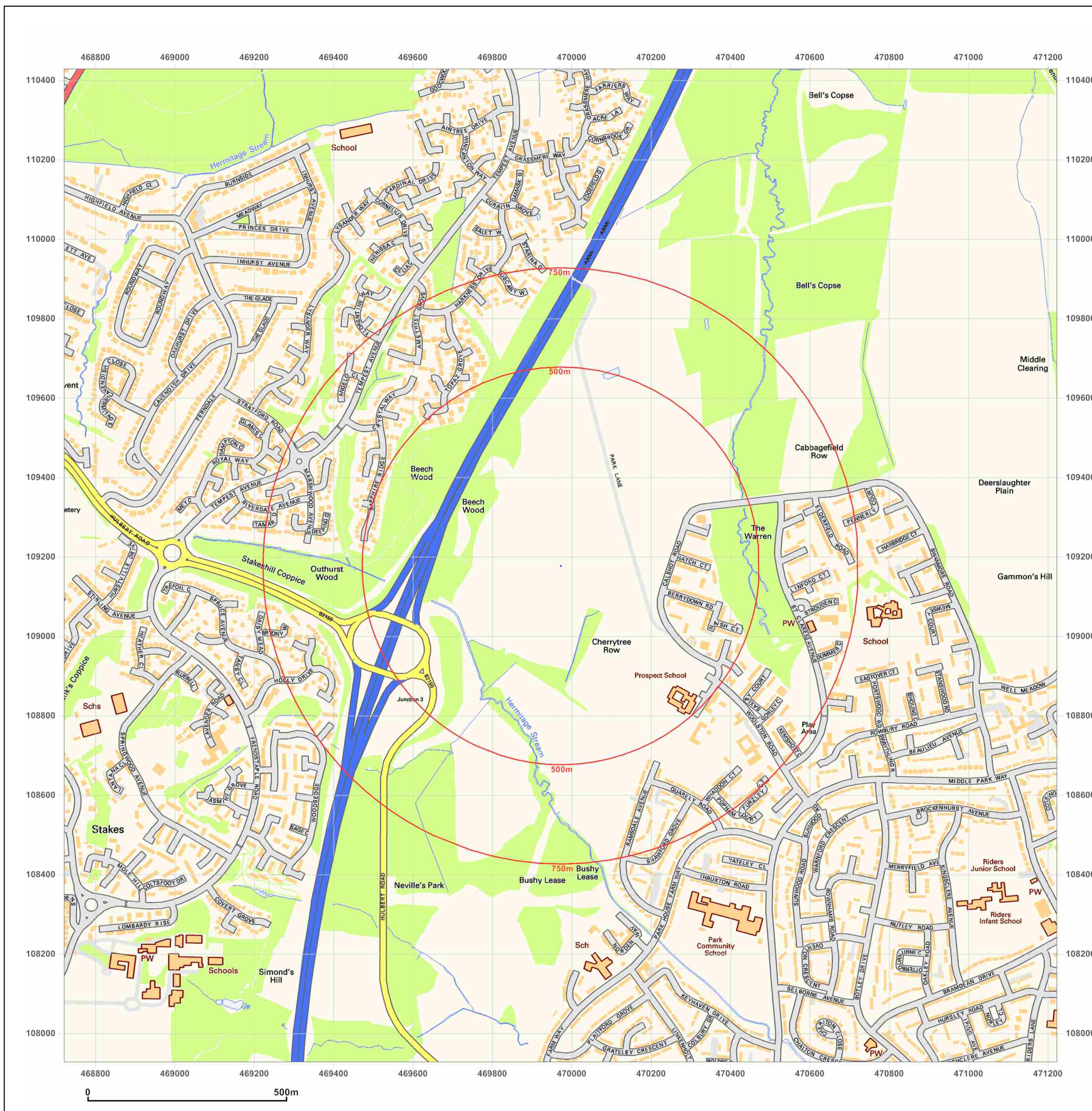


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



Site Details:

DUNSBURY HILL FARM,
HAVANT, PO9 4EE

Client Ref: 5002713_-_602182
Report Ref: GS-3789473
Grid Ref: 469972, 109178

Map Name: National Grid

Map date: 2014

Scale: 1:10,000

Printed at: 1:10,000



2014

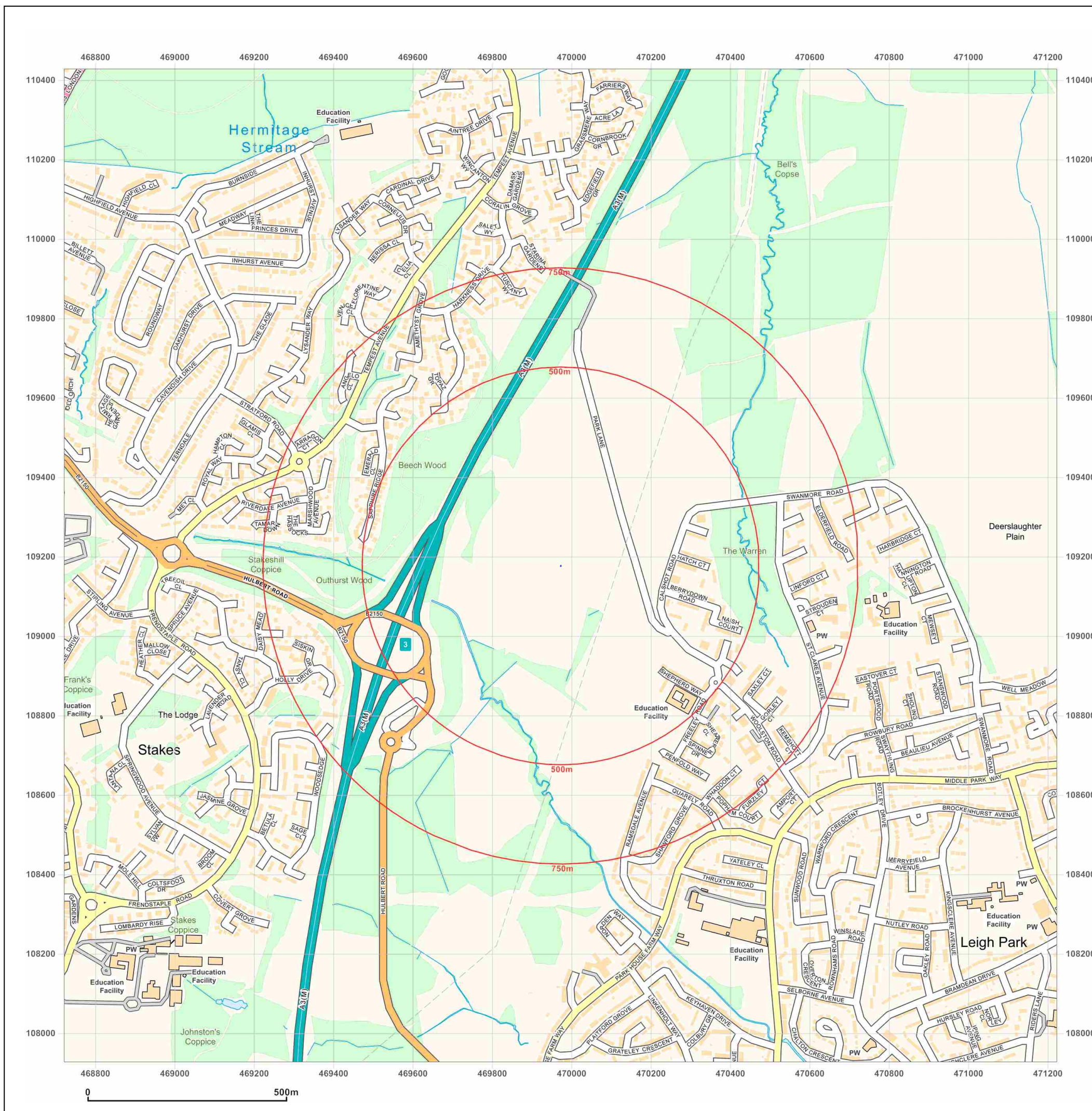


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2015 Ordnance Survey 100035207

Production date: 07 April 2017

To view map legend click here [Legend](#)



APPENDIX 2 – ENGINEERING LOGS

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH501	
Job No 5002713	Date 14-02-17 16-02-17	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 3	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)			DESCRIPTION		
0.25 0.40-0.70	D1 B2	40 blows				0.10 (0.55) 0.65	Soft brown sandy slightly gravelly SILT with roots. Gravel is of fine to coarse angular to sub angular flint. TOPSOIL Soft brown sandy SILT				
1.00 1.20-1.65	D3 U4					(2.25)	Soft orange mottled grey slightly clayey very sandy SILT. Sand is fine. Locally black organic material fragments and thin bedding apparent with grey, orange and brown coloured bedding.				
1.65	D5										
2.00 2.00	D6										
	N9					2.90					
2.90 3.00-3.45	D7 U8	40 blows				3.20	Firm light brown mottled orange brown silty slightly sandy CLAY				
3.45	D9					(0.50) 3.70	Firm grey silty slightly to very sandy CLAY. Sand is fine. Fissures of up to 1mm infilled with orange brown silty sand.				
4.00 4.00	D10	N18					Firm to stiff grey silty sandy CLAY with rare bivalve shell and shell fragments. 10.0m Siltsone horizon with possible bioturbation infilled burrow features.				
4.50	D11										
5.00-5.40	U12				55 blows						
5.40	D13										
6.00	D14										
6.50 6.50	D15	N28									
7.50	D16										
8.00-8.40	U17	75 blows							(8.10)		
8.40	D18										
9.00	D19										
9.50 9.50	D20	N36									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH501
Job No 5002713	Date 14-02-17 16-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 3

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
10.50	D21	80 blows			11.80	Firm to stiff grey silty sandy CLAY with rare bivalve shell and shell fragments.			
11.00-11.35	U22					10.0m Siltsone horizon with possible bioturbation infilled burrow features. (continued)			
11.35	D23								
12.00	D24	N29				Stiff grey silty closely fissured CLAY locally slightly sandy.			
12.50	D25					Thin claystone band of approximately 30mm noted at 19.30			
12.50									
13.50	D26	80 blows							
14.00-14.30	U27								
14.30	D28								
15.00	D29	N35							
15.50	D30								
15.50									
16.50	D31	75 blows							
17.00-17.35	U32								
17.35	D33								
18.00	D34	N32			(13.20)				
18.50	D35								
18.50									
19.50	D36								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH501
Job No 5002713	Date 14-02-17 16-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 3 of 3

SAMPLES & TESTS			Water	STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION			
20.00-20.45	U37	80 blows			25.00	Stiff grey silty closely fissured CLAY locally slightly sandy.				
20.45	D38	N34				Thin claystone band of approximately 30mm noted at 19.30				
20.45	D39					(continued)				
21.50	D40									
21.50										
21.50										
22.50	D41									
23.00-23.40	U42	80 blows								
23.40	D43									
24.00	D44									
24.50	D45	N44								
24.50										
24.50										

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH502
Job No 5002713	Date 16-02-17 17-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 3

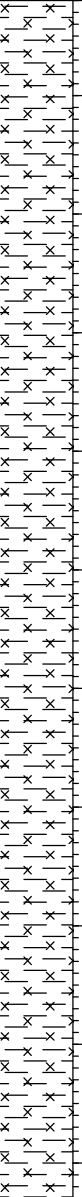
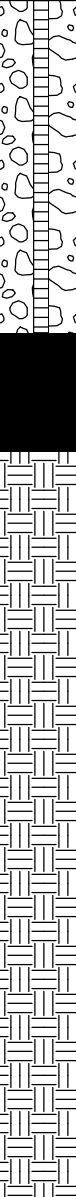
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
0.25	D1	N4			0.20	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL		
0.40-0.60	B2				0.40	Soft brown sandy SILT		
0.50-1.00	ES1				(1.30)	Soft orange mottled grey slightly clayey sandy SILT. Sand is fine. Locally black organic material fragments and thin bedding apparent.		
1.00	D3				1.70	Firm orange brown mottled grey silty slightly sandy CLAY becoming firm brown silty sandy CLAY		
1.20	D4							
1.20		40 blows			3.00	Firm grey silty slightly to very sandy CLAY. Sand is fine. Fissures of up to 1mm infilled with orange brown silty sand.		
1.70-2.20	ES2				(1.30)	Firm to stiff grey silty sandy CLAY with rare bivalve shell and shell fragments.		
2.00-2.45	U5				3.40			
2.45	D6	N14			3.00	Firm grey silty slightly to very sandy CLAY. Sand is fine. Fissures of up to 1mm infilled with orange brown silty sand.		
3.00	D7				3.40	Firm to stiff grey silty sandy CLAY with rare bivalve shell and shell fragments.		
3.00	D8				(3.20)			
3.50		50 blows			6.60	Strong grey slightly sandy SILTSTONE		
4.00-4.50	ES3				7.00	Stiff grey silty slightly sandy to very sandy CLAY with rare medium sub angular to rounded siltsone clasts and shell fragments.		
4.00-4.45	U9				(2.60)			
4.45	D10	N23			9.60	Stiff to very stiff grey silty CLAY with occasional shell fragments		
5.00	D11							
5.00								
6.00	D12	80 blows						
6.50	B13							
6.90	D13A							
7.10-7.50	U14	N34						
7.50	D15							
8.00	D16							
8.50	D17	N34						
8.50								
9.50	D18	70 blows						
10.00-	U19							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH502	
Job No 5002713	Date 16-02-17 17-02-17	Ground Level (m)	Co-Ordinates ()	Sheet 2 of 3	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result					DESCRIPTION		
10.40 10.40	D20	N34				(14.00)	Stiff to very stiff grey silty CLAY with occasional shell fragments <i>(continued)</i>		
11.00	D21								
11.50 11.50	D22								
12.50	D23								
13.00- 13.40 13.40	U24 D25	75 blows							
14.00	D26								
14.50 14.50	D27	N31							
15.50	D28								
16.00- 16.35 16.35	U29 D30	80 blows							
17.00	D31								
17.50 17.50	D32	N36							
18.50	D33								
19.00- 19.45 19.45	U34 D35	80 blows							
20.00	D36								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH502
Job No 5002713	Date 16-02-17 17-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 3 of 3

SAMPLES & TESTS			Water			Depth (Thick- ness)	STRATA		Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend					
20.50 20.50	D37	N38					Stiff to very stiff grey silty CLAY with occasional shell fragments <i>(continued)</i>			
21.50	D38	80 blows								
22.00- 22.45	U39									
22.45	D40									
23.00	D41									
23.50	D42					23.60				
23.50 23.60- 24.00	B43			N50			(1.40)	Stiff to very stiff grey silty CLAY with interbeds of upto 20mm of hard grey SILTSTONE		
24.60	D44									
24.70- 25.00	B45						25.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH503
Job No 5002713	Date 20-02-17 21-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.25	D1	25 blows			0.10	Soft brown sandy slightly gravelly SILT with rootlets and roots.		
0.50-1.00	ES1				0.42	Gravel is of fine to coarse angular to sub angular flint. TOPSOIL		
0.50-0.70	B2					Soft brown sandy SILT		
1.00	D3				(1.53)	Soft orange mottled grey slightly clayey very sandy SILT. Sand is fine. Locally black organic material fragments and thin bedding apparent with grey, orange and brown coloured bedding.		
1.20-1.60	U4							
1.60	D5	N10			1.95			
2.10	D6				2.20	Becoming soft brown mottled orange brown silty sandy CLAY		
2.10	ES2				(0.50)	Soft to firm light brown silty sandy CLAY with occasional organic fragments		
2.30-2.60						2.70		
2.80	D7				3.00	Firm grey silty sandy to very sandy CLAY with orange brown silty sand partings or infilled fissures.		
3.00	B8	N17				Firm to stiff grey silty sandy to very sandy CLAY with occasional vitreous and calcitic shell fragments and tube worm sections. Rare sandy siltstone fragments and pyritised nodules.		
4.00	D9					4.80mbgl Crinoid sections		
4.00								
5.00-5.40	U10				50 blows			5.50-6.50mbgl Razor clam shell, crinoid sections, bivalve shell fragments and mother of pearl oyster shell, fossil rich horizon.
5.50	D11				N31			
6.00	D12							
6.50	D13	(8.50)						
6.50								
7.50	D14	75 blows						
8.00-8.45	U15							
8.45	D16							
9.00	D17							
9.50	D18				N33			
9.50								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH503
Job No 5002713	Date 20-02-17 21-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000					Logged By DAP	

BOREHOLE LOG

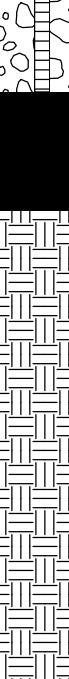
Project Dunsbury Hill				BOREHOLE No BH504	
Job No 5002713	Date 22-02-17 22-02-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 2	

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
						0.10	Soft brown sandy slightly gravelly SILT with rootlets and roots.	
0.25	D1					0.30	Gravel is of fine to coarse angular to sub angular flint. TOPSOIL	
0.40-0.70	B2						Soft brown sandy SILT	
0.50-1.00	ES1						Soft orange brown mottled grey slightly clayey very sandy SILT. Sand is fine. Locally black organic material fragments.	
1.00	D3					(1.60)		
1.20-1.50	U4	40 blows						
1.60-1.80	B5					1.90		
2.00	D6					(1.00)	Firm light brown mottled orange brown silty slightly sandy CLAY	
2.00		N13						
2.50	D7					2.90		
2.90	D8						Firm grey silty sandy CLAY with some brown mottling or partings to 3.20m.	
3.00-3.45	U9	50 blows					3.45mbgl mother of pearl shell fragments and siltstone fragments	
3.50	D10					(2.10)	3.90mbgl crinoid stems	
4.00	D11					5.00		
4.00		N18						
4.50	D12							
5.00-5.45	U13	65 blows				(0.60)	Stiff to very stiff grey silty slightly sandy CLAY	
5.45	D14					5.60		
6.00	D15					(1.20)	Firm to stiff silty sandy to very sandy CLAY with occasional silty clay bands	
6.50	D16					6.80		
6.50		N50						
6.70	B17					7.00	Strong grey slightly sandy SILTSTONE	
							Firm to stiff silty sandy to very sandy CLAY with occasional silty clay bands and siltstone bands	
8.00-8.40	U18	80 blows						
8.40	D19							
9.00	D20							
9.50	D21							
9.50		N36						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH504
Job No 5002713	Date 22-02-17 22-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result							
10.50	D22	70 blows				(7.20)	Firm to stiff silty sandy to very sandy CLAY with occasional silty clay bands and siltstone bands <i>(continued)</i>		
11.00-11.40	U23								
11.40	D24								
12.00	D25	N33							
12.50	D26								
12.50									
13.50	D27	80 blows				14.20	Stiff to very stiff grey silty CLAY with occasional light grey silty sandy partings.		
14.00-14.40	B28								
14.50	D29								
14.50		N35							
15.50	D30								
16.00-16.30	U31								
16.30	D32	80 blows							
17.00	D33								
17.50	D34								
17.50		N37				(5.80)			
18.50	D35								
19.00-19.40	U36								
19.40	D37	80 blows							
19.50	D38								
19.50									
		N40							
						20.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill										BOREHOLE No BH505			
Job No 5002713		Date 23-02-17 24-02-17		Ground Level (m)		Co-Ordinates ()		Contractor DJ Drilling		Sheet 1 of 3			
SAMPLES & TESTS													
Depth		Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	STRATA DESCRIPTION		Geology	Instrument/ Backfill		
0.25		D1				x x x	0.20	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to coarse angular to sub angular flint. TOPSOIL					
0.50-0.70		B2				x x x	0.50	Soft brown to orange brown sandy SILT with occasional roots					
0.70-1.00		ES1				x x x	(0.50) 1.00	Pale yellow to light grey slightly clayey silty fine SAND					
1.00		D3				x x x		Loose light grey to yellow silty fine SAND					
1.20		D4				x x x							
1.20						x x x	(1.60)						
2.10-2.50		ES2				x x x							
2.10-2.55		U5				x x x	2.60						
2.55		D6				x x x	2.90	Loose to medium dense light grey to yellow silty fine SAND					
3.00		D7				x x x		Firm to stiff grey silty sandy to very sandy CLAY with ocasional bivalve fossils and light grey partings of silty fine sand.					
3.00						x x x							
4.00-4.40		U8				x x x							
4.40		D9				x x x							
5.00		D10				x x x							
5.00						x x x							
6.00		ES3				x x x							
6.00		D11				x x x							
6.50-6.95		U12				x x x							
6.95		D13				x x x							
7.50		D14				x x x	(9.10)						
8.00		D15				x x x							
8.00						x x x							
9.00		D16				x x x							
9.50-9.95		U17				x x x							
9.95		D18				x x x							
Boring Progress and Water Observations								Chiselling		Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To			
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000				Logged By DAP			

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH505
Job No 5002713	Date 23-02-17 24-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 3

SAMPLES & TESTS			Water			Depth (Thick- ness)	STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend		DESCRIPTION		
10.50	D19	N39				12.00	Firm to stiff grey silty sandy to very sandy CLAY with ocasional bivalve fossils and light grey partings of silty fine sand. <i>(continued)</i>		
11.00	D20								
11.00									
12.00	D21	N37				(13.00)	Stiff grey silty CLAY with occasional shell fragments and partings of light grey silty fine sand.		
12.50-	U22								
12.95									
12.95	D23								
13.50	D24								
14.00	D25								
14.00		N37				(13.00)			
15.00	D26								
15.50-	U27								
15.90									
15.90	D28								
16.50	D29								
17.00	D30	N35				(13.00)			
17.00									
18.00	D31								
18.50-	U32								
18.90									
18.90	D33								
19.50	D34					(13.00)			
20.00	D35								
20.00									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH505	
Job No 5002713	Date 23-02-17 24-02-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 3 of 3	

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result					DESCRIPTION		
21.00	D36	N25				25.00	Stiff grey silty CLAY with occasional shell fragments and partings of light grey silty fine sand. <i>(continued)</i>		
21.50-21.95	U37								
21.95	D38								
22.50	D39								
23.00	D40								
23.00	D40								
24.00	D41								
24.50-24.95	U42								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Client BAM			Method/ Plant Used Dando 4000		Logged By DAP

BOREHOLE LOG

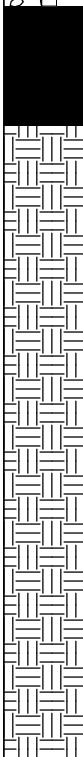
Project Dunsbury Hill				BOREHOLE No BH506	
Job No 5002713	Date 27-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 3	

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA DESCRIPTION	Geology	Instrument/ Backfill
Depth	Type No	Test Result							
0.25	D1					0.10	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to coarse angular to sub angular flint. TOPSOIL		
0.40-0.70	B2					0.40	Soft brown to orange brown sandy slightly gravelly SILT with occasional roots. Gravel is of medium rounded flint.		
0.90-1.10	B3						Pale yellow to orange brown slightly clayey silty slightly gravelly fine SAND. Gravel is of medium sub rounded to rounded flint.		
1.20	D4					(2.10)			
1.20		N9							
2.00-2.45	U5	45 blows				2.50			
2.50	D6					2.80	Firm grey brown silty sandy CLAY		
3.00	D7						Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone.		
3.00		N14							
3.20-3.60	B8					(2.40)			
4.00-4.45	U9	60 blows							
4.50	D10					5.20			
5.00	D11					5.50	Strong grey sandy SILTSTONE		
5.00		N50							
5.30-5.60	B12						Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone.		
6.00	D13								
6.50-6.90	U14	80 blows							
6.90	D15								
7.50	D16								
8.00	D17								
8.00		N30				(7.50)			
9.00	D18								
9.50-9.90	U19	80 blows							
9.90	D20								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Client BAM		Method/ Plant Used Dando 4000		Logged By DAP	

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH506
Job No 5002713	Date 27-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 3

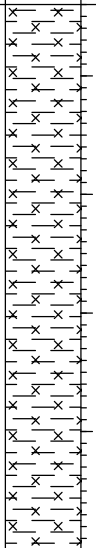
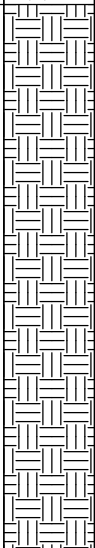
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
10.50	D21	N35				13.00	Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone. <i>(continued)</i>		
11.00	D22								
11.00									
12.00	D23								
12.50	B24								
13.00-13.35	U25	80 blows					Stiff grey silty CLAY		
13.35	D26								
14.00	D27								
14.50	D28								
14.50									
15.50	D29								
16.00-16.30	U30	80 blows							
16.30	D31								
17.00	D32								
17.50	D33								
17.50									
18.50	D34								
19.00-19.35	U35	80 blows							
19.35	D36								
20.00	D37								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH506	
Job No 5002713	Date 27-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	Sheet 3 of 3	
Contractor DJ Drilling					

SAMPLES & TESTS			Water				STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
20.50 20.50	D38	N31					Stiff grey silty CLAY (<i>continued</i>)		
21.50	D39								
22.00- 22.30	U40	80 blows							
22.30	D41								
23.00	D42								
23.50- 23.85	U43	80 blows							
23.85	D44								
24.50	D45								
24.50		N39				25.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH507
Job No 5002713	Date 01-03-17 01-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

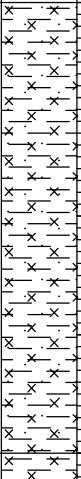
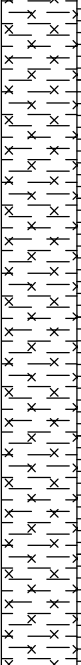
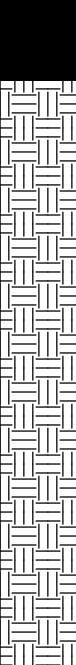
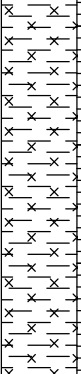
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.25 0.40-0.70	D1 B2	N6			0.10 0.40	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to coarse angular to sub angular flint. TOPSOIL			
1.00 1.20 1.20	D3 D4				(2.00)	Soft brown to orange brown sandy slightly gravelly SILT with occasional roots. Pale yellow to orange brown slightly clayey silty slightly gravelly fine SAND. Gravel is of medium sub rounded to rounded flint.			
2.00-2.45	U5			20 blows		2.40			
2.45	D6				2.80	Firm orange brown to grey brown silty sandy CLAY			
2.90 3.00 3.00	D7 D8			N11			Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone.		
4.00-4.45	U9	55 blows	 		(3.80)				
4.50	D10	N17							
5.00 5.00	D11								
5.60-6.00	B12								
6.50-6.90	B13	80 blows			6.60 6.80	Strong grey sandy SILTSTONE			
7.00-7.40	U14				Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone.				
7.40	D15								
8.00	D16								
8.50 8.50	D17		N34						
9.50	D18	70 blows							
10.00-	U19								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH507
Job No 5002713	Date 01-03-17 01-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill								
Depth	Type No	Test Result					DESCRIPTION										
10.45	D20	N42				(7.20)	Firm to stiff grey silty sandy CLAY with occasional shell fragments and rare pyritised nodules and siltstone. (continued)										
10.45																	
11.00	D21																
11.50	D22																
11.50																	
12.50	D23																
13.00-13.30	U24									80 blows							
13.30	D25																
14.00	D26									N40				14.00	Stiff grey silty CLAY		
14.50	D27																
14.50																	
15.50	D28																
16.00-16.30	U29	80 blows															
16.30	D30																
17.00	D31	N35				(6.00)											
17.50	D32																
17.50																	
18.50	D33																
19.00-19.45	U34	80 blows															
19.45	D35																
19.50		D36	N37														
19.50																	

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH508
Job No 5002713	Date 02-03-17 02-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

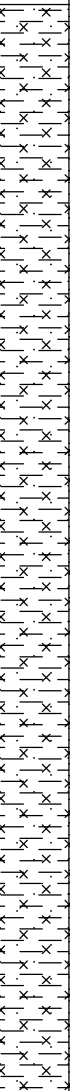
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)		
0.25	D1	N15	1			0.15	Soft brown sandy slightly gravelly SILT with rootlets and roots. Gravel is of fine to coarse angular to sub angular to sub rounded flint. TOPSOIL Soft brown silty sandy slightly gravelly CLAY locally clayey sandy silt. Gravel is fine to medium angular to sub rounded flint. Yellow to orange brown slightly clayey silty fine SAND	
0.40-0.70	B2					0.40		
0.60-1.00	ES2							
1.00	D3							
1.20	D4	N19	1			(2.20)		
1.20								
1.50-1.90	B5							
2.00	D6	N12	1			2.60	Firm brown silty sandy to very sandy CLAY	
2.00						2.90		
2.50	D7	N23	2			(1.10)	Firm to stiff grey silty sandy CLAY with partings of light grey fine sand. Occasional shell fragments.	
3.00	D8							
3.00						4.00		
3.50	D9	N31	2			4.30	Strong grey sandy SILTSTONE	
4.00	D10							
4.10-4.40	B11							
4.50-4.95	U12	80 blows	2				Firm to stiff grey silty sandy CLAY with occasional shell fragments	
4.95	D13							
5.00-5.50	ES2							
5.50	D14							
5.50		N23	2			(5.10)		
6.50	D15							
7.00-7.40	U16			80 blows				
7.50	D17	N31	2					
8.00	D18							
8.50	D19							
8.50		N31	2			9.40		
9.50-9.90	B20					9.70		
10.00-	U21			80 blows				

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH508	
Job No 5002713	Date 02-03-17 02-03-17	Ground Level (m)	Co-Ordinates ()	Sheet 2 of 2	
Contractor DJ Drilling					

SAMPLES & TESTS			Water		Legend	Depth (Thick- ness)	STRATA	Geology	Instrument/ Backfill							
Depth	Type No	Test Result					DESCRIPTION									
10.30 10.30	D22	N41				(10.30)	Firm to stiff grey silty sandy CLAY with occasional shell fragments <i>(continued)</i>									
11.00	D23															
11.50 11.50	D24															
12.50	D25															
13.00- 13.30 13.30	U26 D27															
14.00	D28	N41														
14.50 14.50	D29															
15.50	D30															
16.00- 16.30 16.50	U31 D32															
17.00	D33															
17.50 17.50	D34	N38														
18.50	D35															
19.00- 19.40 19.40 19.50 19.50	U36 D37 D38	N39														

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH509	
Job No 5002713	Date 03-03-17 06-03-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 2	

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION
0.10-0.30 0.25 0.50-0.80	ES1 D1 B2	N13			0.10	Soft brown sandy slightly gravelly SILT with roots. TOPSOIL			
1.20 1.20	D3	N26				(2.60)			
2.00 2.00	D4	N26				2.70			
2.80 3.00-3.45	D5 U6	35 blows				(1.30)	Soft to firm grey silty slightly sandy CLAY		
3.45	D7	N18				4.00			
4.00-4.50 4.00 4.00 4.50	ES2 D8 D9	N18					Firm grey silty CLAY with occasional slightly sandy horizons shell fragments and tube worms.		
5.00-5.45	U10	80 blows			(3.60)				
5.45	D11	N28							
6.00	D12	N28			7.60				
6.50-7.00 6.50 6.50	ES3 D13	N28			7.70	Strong grey sandy SILTSTONE arising as angular fragments			
7.50	D14	80 blows				Firm to stiff grey silty sandy CLAY with occasional bivalve shells and shell fragments.			
8.00-8.40	U15	N28							
8.40	D16	N28							
9.00	D17	N28							
9.50 9.50	D18	N28							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Client BAM		Method/ Plant Used Dando 4000		Logged By DAP	

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH509
Job No 5002713	Date 03-03-17 06-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill							
Depth	Type No	Test Result					DESCRIPTION									
10.50	D19	80 blows				(10.30)	Firm to stiff grey silty sandy CLAY with occasional bivalve shells and shell fragments. (continued)									
11.00-11.30	U20															
11.30	D21															
12.00	D22	N42														
12.50	D23															
12.50																
13.50	D24	80 blows														
14.00-14.45	U25															
14.45	D26															
15.00	D27	N35														
15.50	D28															
15.50																
16.50	D29	80 blows														
17.00-17.30	U30															
17.30	D31															
18.00	D32	N37								18.00	Firm to stiff grey silty CLAY					
18.50	D33															
18.50																
19.50	D34	80 blows											20.00			
19.60-19.95	U35															
19.95	D36															

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH510
Job No 5002713	Date 06-03-17 07-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.10-0.30	ES1	N18			0.10	Soft brown very sandy SILT with roots and rootlets. TOPSOIL		
0.25	D1			0.35	Soft brown clayey very sandy slightly gravelly SILT. Gravel is of fine to coarse angular to rounded flint.			
0.40-0.70	B2			0.55	Orange silty fine SAND			
1.00	D3	N18			(2.10)	Orange and grey silty fine SAND		
1.20	D4							
1.20								
1.60-1.80	B5	N18			(3.40)	Firm light brown silty very sandy CLAY		
2.00	D6							
2.00								
3.00	D7	N19			(3.40)	Firm to stiff grey silty sandy to very sandy CLAY with occasional bivalve shell fragments and siltstone fragments		
3.00								
3.50	D8							
4.00-4.50	ES2	55 blows			(3.40)	Strong grey sandy SILTSTONE arising as angular fragments		
4.00-4.45	U9							
4.45	D10							
5.00	D11	N18		(1.40)	Stiff grey silty sandy CLAY			
5.00								
6.00	D12							
6.40	D13	75 blows		(1.40)	Strong grey sandy SILTSTONE arising as angular fragments			
6.40	U14							
6.50-6.95	D15							
6.95	D16	N34		(1.40)	Stiff grey silty sandy CLAY with occasional worm tubes			
7.50	D18							
8.00-8.30	B17							
8.50	D19	80 blows		(1.40)	Strong grey sandy SILTSTONE arising as angular fragments			
8.50								
9.50	D20							
10.00-	U20			(1.40)	Strong grey sandy SILTSTONE arising as angular fragments			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH510
Job No 5002713	Date 06-03-17 07-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/Backfill
Depth	Type No	Test Result							
10.35	D21						Stiff grey silty sandy CLAY with occasional worm tubes <i>(continued)</i>		
10.35									
11.00	D22								
11.50	D23	N34							
11.50									
12.50	D24								
13.00-13.45	U25	80 blows				(9.70)			
13.45	D26								
14.00	D27								
14.50	D28	N40							
14.50									
15.50	D29								
16.00-16.25	U30	80 blows							
16.25	D31								
17.00	D32								
17.50	D33	N39				18.00			
17.50									
18.50	D34						Stiff grey silty slightly sandy CLAY		
19.00-19.40	U35	80 blows				(2.00)			
19.40	D36 D37	N43				20.00			
19.50									
19.50									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000					Logged By DAP

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH511
Job No 5002713	Date 08-03-17 08-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

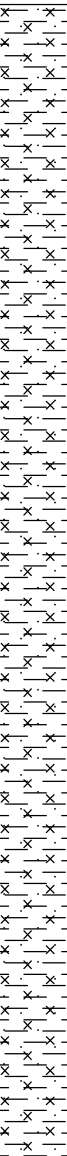
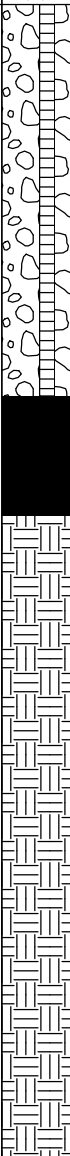
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.25 0.40-0.70	D1 B2	N10	<					

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH511	
Job No 5002713	Date 08-03-17 08-03-17	Ground Level (m)	Co-Ordinates ()	Sheet 2 of 2	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thick-ness)	STRATA	Geology	Instrument/ Backfill							
Depth	Type No	Test Result					DESCRIPTION									
10.50	D23	N37					Stiff grey silty sandy CLAY <i>(continued)</i>									
11.00	D24															
11.00																
12.00	D25															
12.50-12.95	U26	80 blows														
12.95	D27															
13.50	D28															
14.00	D29	N41														
14.00																
15.00	D30	80 blows														
15.50-15.90	U31															
15.90	D32															
16.50	D33															
17.00	D34	N46														
17.00																
18.00	D35	80 blows														
18.50-18.85	U36															
18.85	D37															
19.50	D38	N45														
19.50																
												20.00				

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH512
Job No 5002713	Date 09-03-17 09-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill		
Depth	Type No	Test Result								DESCRIPTION	
0.25	D1	N10	50 blows			0.10	Concrete or grout mix with metal fragments, flint and char fill material or temporary surfacing. MADE GROUND				
0.40-0.60	B2					0.25	Soft brown silty sandy slightly gravelly CLAY. Gravel is of fine to medium angular flint. Appearance is reworked or placed. MADE GROUND				
0.80-1.00	ES1					0.60	Dark brown clayey silty slightly gravelly SAND. Gravel is of fine to medium angular to sub rounded flint. Occasional root or organic fragments. Possible placed material. MADE GROUND				
0.80-1.00	B3										
1.20	D4										
1.20											
1.60-1.80	ES2										
1.60-1.80	B5	N11	50 blows			(2.40)	Orange brown to grey yellow slightly clayey silty SAND				
2.00-2.45	U6										
2.50	D7										
3.00	D8					3.00					
3.00						3.40	Soft brown silty sandy to very sandy CLAY				
3.40-3.70	ES3			N19	50 blows				Firm grey silty sandy locally very sandy or sandy partings CLAY with occasional shell fragments, worm tubes and rare pyritised nodules.		
3.40-3.70	B9										
3.80	D10										
4.00-4.40	U11										
4.40	D12										
5.00	D13										
5.00											
6.00	D14	N39	80 blows			(5.60)					
6.50-6.95	U15										
6.95	D16										
7.00-7.30	ES4										
7.00-7.30	B17										
7.50	D18										
8.00	D19										
8.00											
9.00-9.30	B20	N39	80 blows			9.00					
								9.30	Strong grey SILTSTONE arising as angular fragments		
9.50-9.95	U21								Firm grey silty sandy locally very sandy or sandy partings CLAY with occasional shell fragments and worm tubes.		
9.95	D22										

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

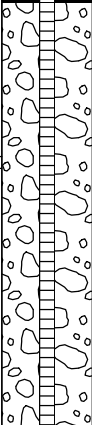
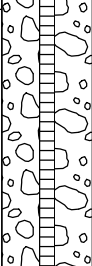
Project Dunsbury Hill				BOREHOLE No BH512
Job No 5002713	Date 09-03-17 09-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill																		
Depth	Type No	Test Result																									
10.50	D23	N41				Firm grey silty sandy locally very sandy or sandy partings CLAY with occasional shell fragments and worm tubes. <i>(continued)</i>																					
11.00	D24																										
11.00																											
12.00	D25																										
12.50-12.90	U26	80 blows																									
12.90	D27																										
13.50	D28																										
14.00	D29																										
14.00		N45									(9.20)																
15.00	D30																										
15.50-15.90	U31													75 blows													
15.90	D32																										
16.50	D33																										
17.00	D34																										
17.00		N46																									
18.00	D35																										
18.50-18.90	B36																										
19.00-19.35	U37																							80 blows			
19.35	D38																										
19.50	D39																										
19.50		N38																									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000				Logged By DAP	

BOREHOLE LOG

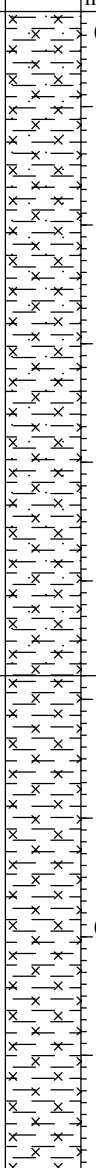
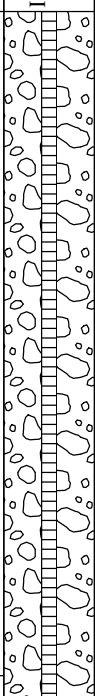
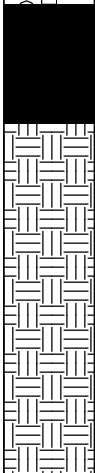
Project Dunsbury Hill				BOREHOLE No BH513	
Job No 5002713	Date 10-03-17 13-03-17	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 2	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION
0.25	D1	30 blows			0.15	Concrete or grout mix with metal fragments, flint and char fill material or temporary surfacing. MADE GROUND Soft light brown clayey sandy slightly gravelly SILT. Gravel is of medium sub angular flint. Soft orange silty CLAY locally slightly sandy.			
0.50-0.70	ES1				0.25				
0.50-0.70	B2								
1.00	D3								
1.20-1.80	U4								
1.60	D5	N24			(2.05)				
2.00	D6								
2.00					2.30				
2.50-3.00	ES2				2.40				
2.50-2.90	B7								
3.00	D8	N40			(2.20)	Soft ornage brown silty sandy gravelly CLAY. Gravel is medium rounded flint. Dense orange to yellow slightly silty to silty fine SAND			
3.00									
									
									
									
4.00	D9	N33			4.60	Dense brown slightly clayey silty fine SAND			
4.00-4.50	B10								
4.00									4.90
									
									
5.00	D11	N32				Firm to stiff silty sandy to very sandy CLAY locally a clayey silty sand. Occasional bivalve shells and shell fragments.			
5.00									
									
									
									
6.00	D12	75 blows							
									
									
									
									
6.70-7.20	ES3								
6.70-7.20	B13								
7.20-7.65	U14								
7.65	D15								
8.00	D16								
8.50	D17	N34							
8.50									
									
9.50	D18								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH513	
Job No 5002713	Date 10-03-17 13-03-17	Ground Level (m)	Co-Ordinates ()	Sheet 2 of 2	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
10.30-10.70	U19	80 blows			(10.90)	Firm to stiff silty sandy to very sandy CLAY locally a clayey silty sand. Occasional bivalve shells and shell fragments. (continued)		
10.70	D20							
11.00	D21							
11.50	D22	N29						
11.50								
12.50	D23							
13.00-13.30	U24	70 blows						
13.30	D25							
14.00	D26							
14.50	D27	N32						
14.50								
15.50	D28							
16.00-16.30	U29	80 blows				Stiff grey silty CLAY locally slightly sandy.		
16.30	D30							
17.00	D31							
17.50	D32	N49						
17.50								
18.50	D33							
19.00-19.35	U34	80 blows						
19.35	D35							
19.50	D36							
19.50		N43						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill										BOREHOLE No BH514						
Job No 5002713		Date 14-03-17 14-03-17		Ground Level (m)		Co-Ordinates ()		Contractor DJ Drilling		Sheet 1 of 2						
SAMPLES & TESTS																
Depth		Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	STRATA			Geology	Instrument/Backfill				
DESCRIPTION																
0.20		D1					0.17	6F5 Crush fill material placed for access. MADE GROUND								
0.40-0.70		ES1					(0.58)	Soft orange sandy gravelly SILT. Gravel is of fine to coarse angular to sub angular concrete fragments, brick metal, plastic and occasional wood. MADE GROUND								
0.40-0.70		B2					0.75	Orange grey silty slightly gravelly fine SAND. Gravel is of medium rounded to well rounded flint.								
1.00-1.20		B3					(1.25)	Grey clayey silty fine SAND with pockets or partings of orange silty sand.								
1.20		D4					2.00	Soft to firm grey silty sandy to very sandy CLAY with occasional shell fragments and pyritised nodules.								
1.20																
1.60-1.90		ES2														
1.60-1.90		B5														
2.00-2.45		U6	45 blows				(0.80)									
2.45		D7					2.80									
2.80		D8														
3.00		D9														
3.00																
3.40-3.70		ES3														
3.40-3.70		B10														
4.00-4.45		U11	50 blows													
4.45		D12														
5.00		D13														
5.00																
5.50-5.90		B14					(5.10)									
6.00		D15														
6.50-6.95		U16	60 blows													
6.95		D17														
7.90-8.20		B18					7.90									
8.30		D19					8.30									
8.30																
9.00		D20														
9.50-9.85		U21	80 blows													
9.85		D22														
Boring Progress and Water Observations										Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To						
All dimensions in metres Scale 1:63.75										Client	BAM	Method/ Plant Used	Dando 4000	Logged By	DAP	

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH514
Job No 5002713	Date 14-03-17 14-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

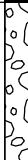
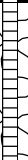
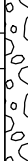
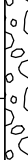
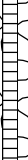
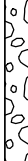
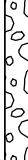
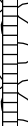
[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH515
Job No 5002713	Date 15-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.25	D1	N13			0.10	Soft light brown clayey sandy SILT with rootlets. TOPSOIL		
0.40-0.70	ES1				0.40	Soft to firm orange brown to grey clayey sandy SILT		
0.40-0.70	B2				(0.60)	Firm orange brown to grey clayey sandy gravelly cobbly SILT. Gravel is of medium to coarse rounded to well rounded flint. Cobbles are of rounded flint.		
1.00	D3				1.00	Orange brown to grey silty locally clayey fine SAND		
1.20	D4	N11			(1.60)			
1.20	D4							
1.40-1.70	B5	N11			(1.60)			
2.00	D6							
2.00		N20			2.60			
2.60	D7							
		N18			2.90	Light brown to grey silty fine SAND		
3.00	D8							
3.00		N22			(1.60)	Grey clayey silty fine SAND		
3.40-3.70	ES2							
3.40-3.70	B9	N18			(1.60)			
4.00	D10							
4.00		65 blows			4.50	Stiff to very stiff grey silty sandy CLAY with bivalve fossils and shell fragments and rare dextral helix conch shell. Locally very sandy or very silty.		
4.50	D11							
5.00-5.45	U12	N22						
5.45	D13							
5.50-5.90	B14	80 blows						
6.00	D15							
6.50	D16	N31						
6.50								
7.00-7.40	B17	80 blows						
7.50	D18							
8.00-8.40	U19	N31						
8.50	D20							
9.00	D21	N31						
9.50	D22							
9.50								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH515
Job No 5002713	Date 15-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill	
Depth	Type No	Test Result					DESCRIPTION			
10.50	D23	80 blows				(15.50)	Stiff to very stiff grey silty sandy CLAY with bivalve fossils and shell fragments and rare dextral helix conch shell. Locally very sandy or very silty. <i>(continued)</i>			
11.00-11.35	U24									
11.50	D25									
12.00	D26									
12.50-12.50	D27									N37
13.50	D28									
14.00-14.35	U29	80 blows								
14.50	D30									
15.00	D31									
15.50-15.50	D32									N46
16.50	D33									
17.00-17.30	U34	80 blows								
17.30	D35									
18.00	D36									
18.50-18.85	U37									80 blows
18.85	D38									
19.50-19.50	D39	N48								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH516
Job No 5002713	Date 16-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
0.25	D1	N12			0.10	Soft light brown clayey sandy SILT with rootlets. TOPSOIL		
0.40-0.70	B2				0.40	Soft to firm brown to grey clayey sandy SILT		
1.00	D3				(2.40)	Firm orange brown to grey clayey sandy slightly gravelly SILT. Gravel is of medium to coarse rounded to well rounded flint. Occasional organic fragments.		
1.20	D4							
1.20								
1.50-1.80	B5	N18		2.80	Medium dense grey clayey silty fine SAND			
2.10	D6							
2.10								
2.60	D7	N20		(1.00)	Firm to stiff grey silty sandy to very sandy CLAY with occasional shell fragments			
3.00	D8							
3.00								
3.40-3.60	B9	60 blows		3.80	Firm to stiff grey silty sandy to very sandy CLAY with occasional shell fragments			
4.00-4.45	U10							
4.45	D11							
4.60	D12							
5.00	D13							
5.00		N18		(6.20)	Firm to stiff grey silty sandy to very sandy CLAY with occasional shell fragments			
6.00	D14							
6.50-6.95	U15							
6.95	D16	80 blows		10.00	Strong grey sandy SILTSTONE arising as angular fragments			
7.50	D17							
8.00	D18							
8.00		N31			Firm to stiff grey silty sandy to very sandy CLAY with occasional shell fragments			
9.00	D19							
9.50-9.95	U20							
10.00	D21	80 blows						

[illegible]

All dimensions in metres
Scale 1:63.75

Client	BAM
--------	-----

Method/
Plant Used

Dando 4000

Logged By	DAP
-----------	-----

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH516
Job No 5002713	Date 16-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

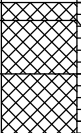
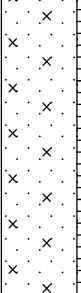
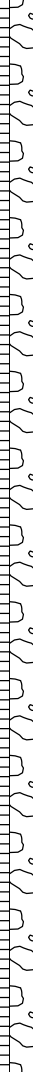
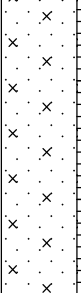
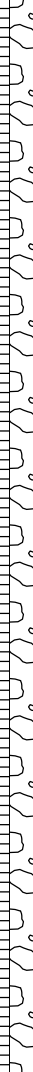
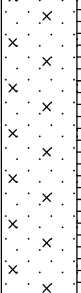
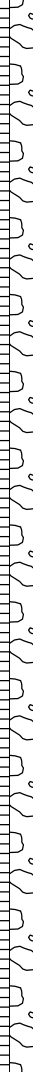
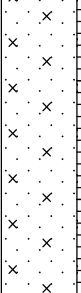
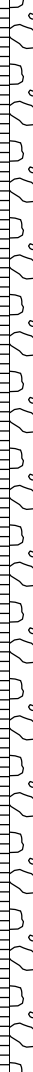
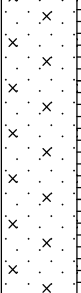
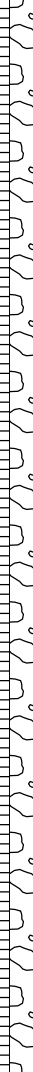
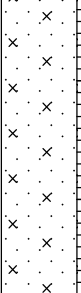
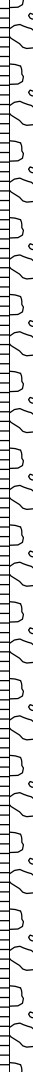
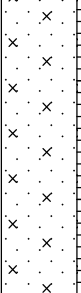
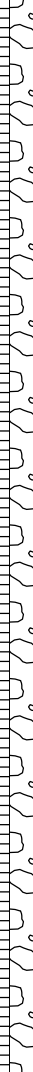
[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH517
Job No 5002713	Date 20-03-17 21-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.25	D1	N9			0.15	Soft brown clayey sandy gravelly SILT. Gravel is of fine angular brick fragments and occasional flin. <u>MADE GROUND</u>		
0.40-0.60	ES1				0.60	Soft orange brown and grey clayey sandy gravelly SILT. Gravel is of fine to coarse angular to sub rounded concrete, brick and flint. <u>MADE GROUND</u>		
0.40-0.60	B2				(0.60)			
1.00	D3				1.20	Firm orange brown clayey sandy slightly gravelly SILT. Gravel is of medium to coarse angular to sub angular brick and flint. <u>MADE GROUND</u>		
1.20	D4	N12			(2.70)	Orange brown to grey silty fine SAND. Locally clayey.		
1.20								
1.50-1.70	B5							
2.10	D6							
2.10		N20						
2.60	D7							
3.00	D8							
3.00								
3.30-3.60	ES2	N14			3.90			
3.30-3.60	B9							
4.00	D10							
4.00								
4.50	D11	N10			4.10	Firm grey brown silty sandy CLAY		
5.00	D12							
5.00								
5.50-5.80	B13							
6.00	D14	75 blows						
6.50-6.95	U15							
6.95	D16							
7.00-7.30	B17							
7.50	D18	N27			(6.50)			
8.00	D19							
8.00								
9.00	D20							
9.50-9.95	U21	80 blows						
9.95	D22							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH517	
Job No 5002713	Date 20-03-17 21-03-17	Ground Level (m)	Co-Ordinates ()	Sheet 2 of 2	
Contractor DJ Drilling					

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
10.50	D23	N37				10.60			
10.60-10.90	B24					10.90	Strong grey slightly sandy SILTSTONE arising as angular fragments		
11.00	D25						Firm to stiff grey silty sandy to very sandy CLAY with occasional shell fragments and rare pyritised nodules		
11.00									
12.00	D26	75 blows							
12.50-12.95	U27								
12.95	D28								
13.50	D29	N42							
14.00	D30								
14.00									
15.00	D31	80 blows				(9.10)			
15.50-15.85	U32								
15.85	D33								
16.50	D34	N40							
17.00	D35								
17.00									
18.00	D36	80 blows							
18.50-18.90	U37								
18.90	D38								
19.50	D39	N43							
19.50					20.00				

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Method/ Plant Used Dando 4000			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH518
Job No 5002713	Date 22-03-17 23-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA DESCRIPTION	Geology	Instrument/ Backfill
Depth	Type No	Test Result							
0.25	D1	N10				0.15	Brown clayey sandy slightly gravelly SILT with rootlets and roots. Gravel is of fine to medium angular to sub angular flint. TOPSOIL Soft brown sandy to very sandy SILT Orange brown silty fine SAND with occasional organic material		
0.40-0.60	B2					0.35			
0.50-1.00	ES1								
1.00	D3								
1.20	D4	N12				2.00	Firm grey silty very sandy CLAY locally a clayey silty sand. Occasional to frequent tube worms. Occasional shell fragments. Rare pyritised nodules.		
2.00-2.45	U5								
2.50	D6								
3.00	D7								
3.00		N23							
4.00-5.00	ES2								
4.00-4.45	U8								
4.45	D9								
5.00	D10	N33				6.00	Strong grey slightly sandy SILTSTONE arising as angular fragments		
5.00									
6.00-6.40	B11					6.40			
6.50-6.95	U12								
6.95	D13	N33					Firm grey silty slightly sandy to sandy CLAY. Occasional shells and shell fragments		
7.50	D14								
8.00	D15								
8.00									
9.00	D16	N33							
9.50-9.95	U17								
9.95	D18								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75						Client BAM		Method/ Plant Used Dando 4000		Logged By DAP	

BOREHOLE LOG

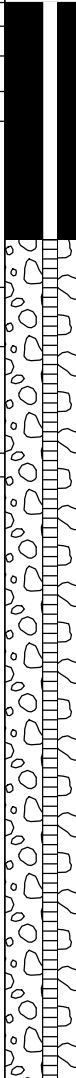
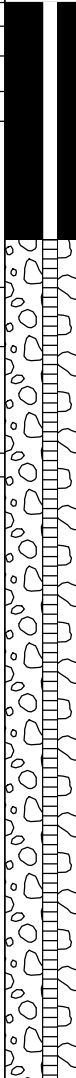
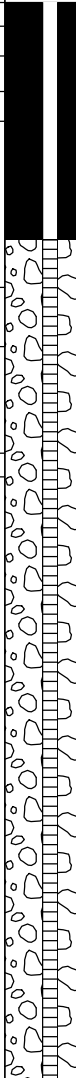
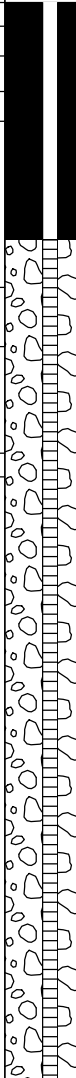
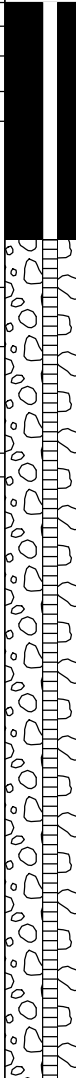
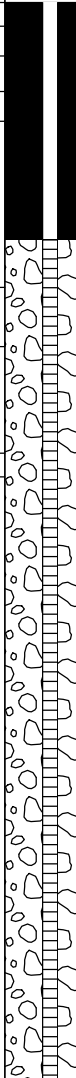
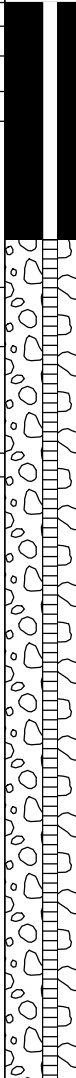
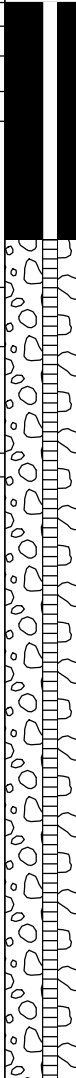
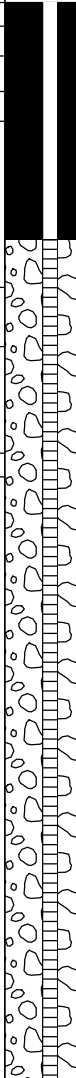
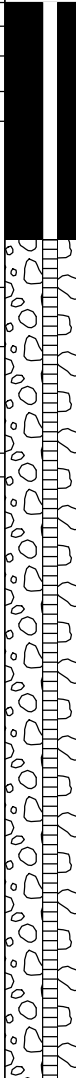
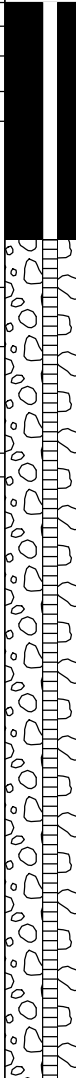
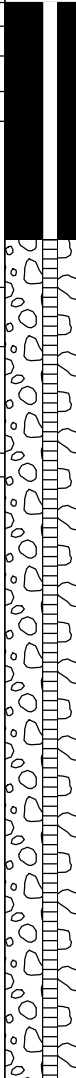
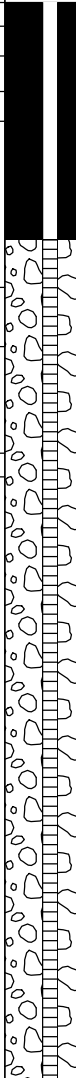
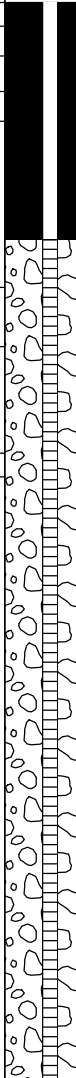
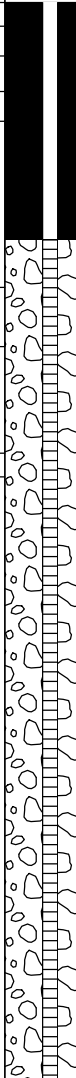
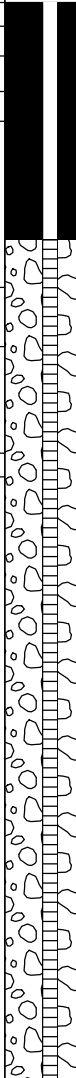
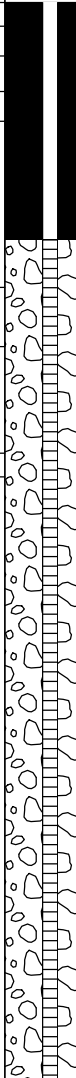
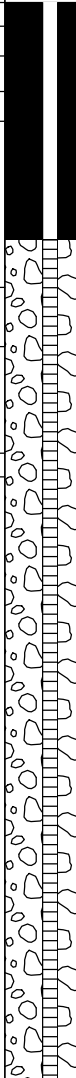
Project Dunsbury Hill				BOREHOLE No BH518
Job No 5002713	Date 22-03-17 23-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

SAMPLES & TESTS			Water			Depth (Thick- ness)	STRATA DESCRIPTION		Geology	Instrument/ Backfill		
Depth	Type No	Test Result		Reduced Level	Legend							
10.50	D19	N36				(12.40)	Firm grey silty slightly sandy to sandy CLAY . Occasional shells and shell fragments (<i>continued</i>)					
11.00	D20											
11.00												
12.00	D21											
12.50-	U22	N40				(12.40)						
12.95												
12.95	D23											
13.50	D24											
14.00	D25											
14.00												
15.00	D26	N39										
15.50-	U27											
15.95												
15.95	D28											
16.50	D29											
17.00	D30											
17.00												
18.00	D31	N38										
18.50-	U32											
18.80												
18.80	D33											
19.50	D34											
19.50												
							Strong grey slightly sandy SILTSTONE arising as angular fragments					
								(0.70)			Firm grey silty slightly sandy to sandy CLAY .	
							Strong grey slightly sandy SILTSTONE arising as angular fragments					
												Firm grey silty slightly sandy to sandy CLAY .

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH519
Job No 5002713	Date 24-03-17 27-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	Reduced Level	Legend	Depth (Thickness)	STRATA	Geology	Instrument/ Backfill
Depth	Type No	Test Result							
0.00-0.20	ES1	25 blows			0.20	Soft brown clayey sandy slightly gravelly SILT. Gravel is of fine to medium angular to sub angular flint and brick fragments. MADE GROUND			
0.25	D1				0.45				
0.40-0.60	B2				0.75				
					1.00				
1.00	D3	25 blows			(1.40)	Soft orange brown to grey clayey sandy SILT. Reworked. MADE GROUND.			
1.20-1.65	U4								
1.65	D5								
2.00	D6								
2.00		N9			2.40	Soft orange brown mottled grey very silty sandy slightly gravelly CLAY. Gravel is of fine to coarse sub rounded to rounded flint.			
				(0.50)	Orange brown clayey silty fine SAND				
				2.90					
3.00-3.45	U7	50 blows			(0.90)	Grey clayey silty fine SAND. Locally silty very sandy clay.			
3.45	D8								
3.80	D9								
4.00	D10								
4.00		N20			4.00	Strong grey SILTSTONE arising as angular fragments.			
					Firm to stiff grey silty very sandy CLAY with occasional bivalve shells tube worms and shell fragments. Rare pyrite nodules. Locally clayey silty sand.				
5.00-5.45	U11	75 blows			(10.50)				
5.45	D12								
6.00	D13								
6.50	D14								
6.50		N30							
7.50	D15	80 blows			(10.50)				
8.00-8.45	U16								
8.45	D17								
9.00	D18								
9.50	D19	N38			(10.50)				
9.50									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75			Client BAM			Method/ Plant Used Dando 4000					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No BH519
Job No 5002713	Date 24-03-17 27-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

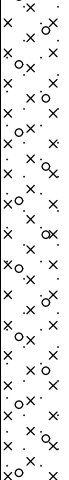
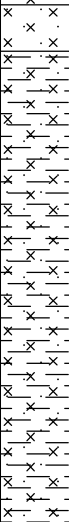
SAMPLES & TESTS			Water	STRATA					Geology	Instrument/ Backfill					
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION								
10.50	D20	80 blows				14.50	Firm to stiff grey silty very sandy CLAY with occasional bivalve shells tube worms and shell fragments. Rare pyrite nodules. Locally clayey silty sand. (continued)								
11.00-11.40	U21														
11.40	D22														
12.00	D23														
12.50-12.50	D24														
13.50	D25	N32				14.50	Stiff grey silty slightly sandy CLAY								
	14.00-14.35								U26						
14.35	D27														
15.00	D28														
15.50-15.50	D29														
16.50	D30	N35				14.50	Stiff grey silty slightly sandy CLAY								
	17.00-17.35								U31						
17.35	D32														
18.00	D33														
18.50-18.50	D34														
19.50-19.95	U35	80 blows				20.00									
	19.95								D36						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:63.75		Client BAM				Method/ Plant Used Dando 4000				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS501
Job No 5002713	Date 27-02-17 27-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

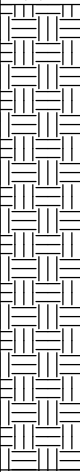
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.50-1.00	ES1	N12			0.15	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL			
					(0.35) 0.50	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.			
1.00-2.00 1.00	B2	N14			(2.20)	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.			
2.00-2.50 2.00	ES3					2.70 2.90	Soft light brown clayey very sandy SILT		
3.00	ES4	N15			(2.10)	Firm grey silty sandy to very sandy CLAY Partial recovery 3.0-5.0mbgl			
4.00-5.00 4.00		N18				5.00			
5.00		N20							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS502	
Job No 5002713	Date 27-02-17 27-02-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
1.00		N17			0.15	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL		
					(0.35) 0.50	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.		
					(1.50) 2.00	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint. Location collapsing to 0.6m		
2.00		N28						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5						Method/ Plant Used Terrier Mk.2			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS502A
Job No 5002713	Date 27-02-17 27-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-1.00	ES1	N13			0.15	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL			
					(0.35) 0.50	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.			
			(2.00)	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.					
			2.50						
			(0.40) 2.90	Soft light brown clayey very sandy SILT					
3.00				Firm grey silty sandy to very sandy CLAY					
3.50-4.00	ES4								
4.00			N18			(2.10)			
						5.00			
5.00			N20						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS503
Job No 5002713	Date 27-02-17 27-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50-1.00	ES1	N11			0.10	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL			
					(0.30)	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.			
					0.40	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.			
1.00-2.00	B2	N19			(1.80)				
1.00									
2.00						2.20			
2.60-3.00	ES3	N19			(0.30)	Soft light brown clayey very sandy SILT			
					2.50	Firm grey silty sandy to very sandy CLAY			
3.00		N21			(2.50)				
4.00									
4.50-5.00	U4					5.00			
5.00		N26							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5			Client BAM			Method/ Plant Used Terrier Mk.2					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS504
Job No 5002713	Date 27-02-17 27-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.50-1.00	ES1	N22			0.10	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL		
					(0.35) 0.45			
1.00-2.00 1.00	B2	N20			(2.05)	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.		
2.00								
2.50-3.00	ES3	N13			2.50	Soft light brown clayey very sandy SILT		
3.00					(0.50) 3.00			
3.50-4.00	U4	N18			(2.00)	Firm grey silty sandy to very sandy CLAY		
4.00								
4.50-5.00	ES5	N20			5.00			
5.00								

[illegible]

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS505
Job No 5002713	Date 28-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION
0.40-0.70	ES1	N13				0.10	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL		
						0.32	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.		
1.00-2.00 1.00	B2	N13				(2.13)	Orange brown to grey brown very sandy SILT locally silty SAND.		
2.00	N12								
2.50-2.80	ES3					2.45	Firm brown mottled grey silty sandy to very sandy CLAY		
						(0.45)			
3.00		N18				2.90	Firm grey silty very sandy CLAY. Locally clayey silty sand.		
3.50-4.00	U4								
4.00		N23				(2.10)			
4.50-5.00	U5								
5.00		N30				5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS506
Job No 5002713	Date 28-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.40-1.00	B1	N8				0.14	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to coarse angular to sub rounded flint. TOPSOIL		
						0.35	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.		
1.00					(2.05)	Soft orange brown clayey very sandy slightly gravelly SILT. Gravel is of fine sub angular flint.			
1.50-2.00	ES2					1.70m Wood/root sections. Organic odour.			
2.00		N14							
2.50-2.80	B3					Soft orange brown mottled grey clayey sandy SILT with dark grey peaty pockets with large wood/root sections and strong organic odour.			
3.00		N16				Firm to stiff grey silty sandy to very sandy CLAY			
3.50-4.00	ES4				(2.10)				
4.00		N19							
4.50-5.00	U5								
5.00		N29							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS507
Job No 5002713	Date 28-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.60-1.00	ES1				0.10	Very soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to coarse angular to sub rounded flint. TOPSOIL		
					(0.25) 0.35	Very soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.		
1.00-2.00	B2	N0				Very soft orange brown mottled grey slightly clayey very sandy SILT locally a slightly clayey very silty sand. Occasional organic fragments.		
1.00								
2.00		N0			(2.65)			
3.00-3.80	ES3	N0			3.00	Very soft orange brown mottled grey clayey sandy SILT with dark grey peaty pockets with large wood/root sections and strong organic odour.		
				(0.85) 3.85				
4.00		N17			(1.15) 5.00	Firm to stiff grey silty sandy to very sandy CLAY		
5.00		N25						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS508
Job No 5002713	Date 28-02-17 28-02-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

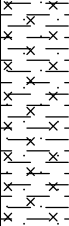
SAMPLES & TESTS			Water	STRATA					
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	Geology	Instrument/ Backfill
0.60-1.00	ES1					0.10	Soft brown sandy slightly gravelly SILT with rootlets. Gravel is of fine to medium angular to sub angular flint. TOPSOIL		
1.00-2.00 1.00	B2	N13				(0.30) 0.40	Soft brown clayey sandy slightly gravelly SILT. Gravel is of medium sub rounded to rounded flint.		
2.00-3.00 2.00	B3	N17				(2.70)	Soft to firm orange brown clayey very sandy slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.		
3.00		N17				3.10			
3.50-4.00	U4					(0.30) 3.40	Soft light brown clayey very sandy SILT		
4.00		N50				(1.60)	Stiff to very stiff grey silty sandy to very sandy CLAY		
5.00		N18				5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS509
Job No 5002713	Date 16-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

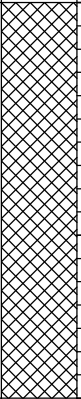
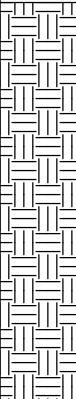
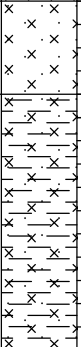
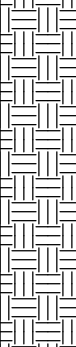
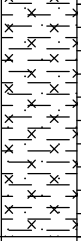
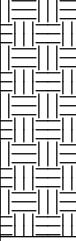
SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		
0.40-0.70	ES1					(0.32) 0.32	Light brown to orange brown clayey sand slightly gravelly SILT. Gravel is of medium to coarse sub rounded to rounded flint.	
						(0.46) 0.78	Grey clayey sandy SILT with roots and organic material.	
1.20		N11	 		(1.92)	Soft orange brown clayey sandy gravelly SILT. Gravel is of medium to coarse sub angular to rounded flint. Becoming very sandy with depth. Occasional organic fragments.		
1.50-2.00	ES2							
2.00-2.70	B3							
2.00	N11							
3.00		N19			(1.00)	Soft grey silty very sandy CLAY with partings of silty sand		
4.00		N17			3.70 3.75	Strong grey SILTSTONE band arising as angular fragments		
					(0.25) 4.00	Soft grey silty very sandy CLAY with partings of silty sand.		
						Hole collapsing to 2.50m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS510
Job No 5002713	Date 16-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION			
0.40-1.00	ES1	N0			(1.70)	Orange brown to grey locally clayey sandy gravelly SILT fill material (stockpile). Gravel is of fine to coarse angular to sub rounded concrete fragments, plastic, tile, metal and asphalt chippings. MADE GROUND				
1.20					1.70					
2.00					(0.80)				2.50	
					(0.40)				2.90	
3.00-4.00	ES2	N12			(2.10)	Firm grey silty sandy CLAY with large pockets of silty sand				
3.00					5.00					
4.00-5.00	B3	N17			5.00					
4.00										
5.00		N25								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS511
Job No 5002713	Date 16-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

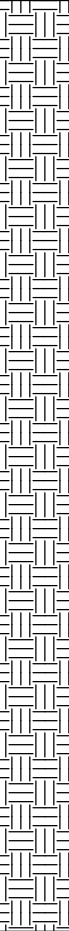
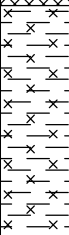
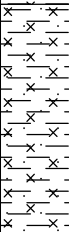
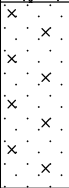
SAMPLES & TESTS			Water	STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.20-0.50	ES1				0.10	Brown clayey sandy SILT. Placed soil. MADE GROUND				
					(0.50)	Grey brown clayey sandy gravelly SILT. Gravel is of fine to coarse angular to sub rounded brick fragments, aggregates and flint. MADE GROUND				
					0.60					
1.00-2.00 1.00	B2	N16			0.80	Firm light brown silty slightly sandy slightly gravelly CLAY. Gravel is of medium to coarse angular brick fragments and aggregates. MADE GROUND				
					(2.00)	Firm light brown silty slightly sandy CLAY				
2.00		N10								
2.50-2.70	ES3				2.80					
3.00		N50			(0.40)	Firm light grey silty sandy CLAY with light brown silty clay infill features or partings.				
3.20-4.00	B4				3.20					
4.00	N39				(1.40)	Dense orange brown to light brown silty fine SAND				
					4.60					
5.00	N50				(0.40)	Dense to very dense grey slightly clayey slightly silty fineSAND				
					5.00					

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS512
Job No 5002713	Date 16-03-17 16-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

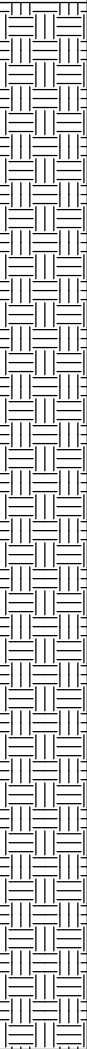
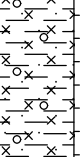
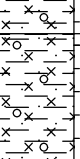
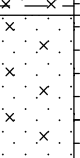
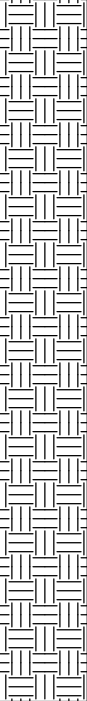
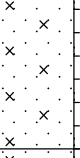
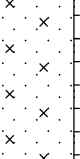
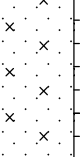
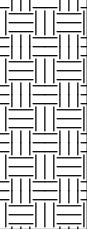
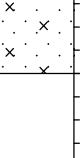
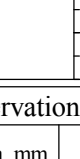
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.40-0.70	ES1	N3	 			(0.35) 0.35	Grey brown clayey sandy gravelly SILT. Gravel is of fine to coarse angular to sub angular brick fragments, plastic and occasional wood. MADE GROUND		
1.00						(0.75) 1.10	Soft grey very clayey sandy gravelly SILT. Gravel is of fine to medium angular brick fragments and flint. MADE GROUND		
2.00						(1.00) 2.10	Firm grey mottled orange brown silty CLAY		
2.10-3.00	B2	N15				(1.00) 3.10	Firm light brown ot orange brown silty slightly sandy CLAY		
3.00						3.20	Firm light brown to orange brown silty sandy gravelly CLAY. Gravel is of medium rounded flint.		
3.20-4.00	B3					(0.80) 4.00	Dense to very dense grey to orange brown silty fine SAND locally clayey		
4.00		N50					Hole collapsing to 3.10m		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2				Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS513	
Job No 5002713	Date 17-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.30-0.50	ES1	N14				0.10	Light brown clayey slightly sandy SILT with rootlets. TOPSOIL		
						(0.85)	Soft to firm light brown to orange brown mottled grey silty sandy slightly gravelly CLAY. Gravel is of medium sub angular to rounded flint.		
1.00						0.95			
1.60-2.00	ES2	N25				(0.60)	Soft to firm light brown to orange brown mottled grey silty sandy gravelly CLAY. Gravel is of medium sub angular to rounded flint.		
2.00-2.80	B3					1.55	Medium dense grey to orange brown silty fine to medium SAND. Locally clayey		
2.00						(1.25)			
3.00-4.00	B4	N35				2.80	Dense grey silty fine SAND. Locally clayey.		
3.00						(1.70)	Partial recovery 3.0-4.0m Hole collapsing to 3.0m		
4.00						4.50			
		N49							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5			Client BAM			Method/ Plant Used Terrier Mk.2			Logged By DAP		

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS514
Job No 5002713	Date 17-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

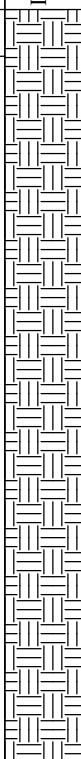
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.50-1.00	ES1	N21				0.10	Light brown clayey slightly sandy SILT with rootlets. TOPSOIL		
						(0.35) 0.45	Soft to firm light brown to orange brown mottled grey silty sandy slightly gravelly CLAY. Gravel is of medium sub angular to rounded flint.		
1.00 1.10-2.00	B2	N29				(0.60) 1.05	Soft to firm light brown to orange brown mottled grey silty sandy gravelly slightly cobbly CLAY. Gravel is of medium to coarse sub angular to well rounded flint.		
2.00-2.50 2.00	B3					(1.85) 2.90	Medium dense orange brown silty fine to medium SAND. Locally clayey		
2.50-2.80	ES4	N35				(1.10) 4.00	Dense grey silty fine SAND. Locally clayey. Partial recovery 3.0-4.0m Hole collapsing to 2.5m		
3.00	N37								
4.00									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS515
Job No 5002713	Date 17-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)		
0.50-1.00	B1	N16	 		0.20	Light brown clayey slightly sandy SILT with rootlets. TOPSOIL		
					(3.10)	Loose to medium dense orange brown to grey silty fine SAND		
1.00-2.00 1.00	B2	N16		(3.10)				
2.00-3.00 2.00-3.00 2.00	B3 ES4	N15						
3.00	B5	N21	 				3.30	Loose to medium dense grey clayey silty fine SAND. Locally very sandy CLAY
3.30-4.00		N14		(1.70)				
4.00	N18	N18						
5.00								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To		
All dimensions in metres Scale 1:32.5		Client BAM				Method/ Plant Used Terrier Mk.2					Logged By DAP	

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

BOREHOLE LOG

Project Dunsbury Hill				BOREHOLE No WS516
Job No 5002713	Date 17-03-17 17-03-17	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)			DESCRIPTION
0.10-0.35	ES1	N14				0.10	Soft brown clayey slightly sandy SILT with rootlets. TOPSOIL		
					(0.30) 0.40	Dense brown silty slightly gravelly SAND. Gravel is of medium sub rounded to rounded flint.			
1.00					(1.20) 1.60	Orange brown to grey slightly clayey very sandy SILT			
					(0.40) 2.00	Loose to medium dense grey silty fine SAND with occasional brown sand partings and organic remains of roots.			
2.00-3.00 2.00	B2	N11	 			Loose to medium dense grey clayey silty SAND			
				(3.00)					
3.00									
				5.00					
4.00		N14							
5.00		N15							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:32.5			Client BAM			Method/ Plant Used Terrier Mk.2					Logged By DAP

Report ID: AGS4 UK BH || Project: 5002713 - DUNSBURY HILL LOGS FEB 2017.GPJ || Library: GINT STD AGS 4 0.GLB || Date: 5 April 2017

APPENDIX 3 – GENERIC ASSESSMENT CRITERIA

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date		
ISSUE	Residential with Homegrown Produce	1	June 2015		
Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1%	2.5 %	6 %	
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/ METALLOIDS					
Arsenic	mg/kg		37		S4UL
Cadmium	mg/kg		11		S4UL
Chromium (III)	mg/kg		910		S4UL
Chromium (VI)	mg/kg		6		S4UL
Lead	mg/kg		200		S4UL
Mercury (Elemental)	mg/kg		1.2		S4UL
Mercury (Inorganic)	mg/kg		40		S4UL
Mercury (Methyl)	mg/kg		11		S4UL
Nickel	mg/kg		180		S4UL
Selenium	mg/kg		250		S4UL
Beryllium	mg/kg		1.7		S4UL
Boron	mg/kg		290		S4UL
Vanadium	mg/kg		410		S4UL
Copper	mg/kg		2,400		S4UL
Zinc	mg/kg		3,700		S4UL
GENERAL INORGANICS					
Easily Liberatable Cyanide (free)	mg/kg		36		Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	210	510	1100	S4UL
Acenaphthylene	mg/kg	170	420	920	S4UL
Anthracene	mg/kg	2,400	5,400	11000	S4UL
Benzo(a)anthracene	mg/kg	72	11	13	S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	S4UL
Benzo(k)fluoranthene	mg/kg	77	93	100.0	S4UL
Benzo(g,h,i)perylene	mg/kg	320	340	350	S4UL
Benzo(a)pyrene	mg/kg	2.20	2.7	3	S4UL
Chrysene	mg/kg	15	22	27.0	S4UL
Di-benzo(a,h)anthracene	mg/kg	0.24	0.28	0.30	S4UL
Fluoranthene	mg/kg	280	560	890	S4UL
Fluorene	mg/kg	170	400	860	S4UL
Indeno(1,2,3-cd)pyrene	mg/kg	27.0	36	41.0	S4UL
Naphthalene	mg/kg	2.3	5.6	13.0	S4UL
Phenanthrene	mg/kg	95	220	440	S4UL
Pyrene	mg/kg	620	1200	2000	S4UL
Total PAHs	mg/kg	No Sum	No Sum	No Sum	
Chlorinated Solvents/VOCs					
1,2-Dichloroethane (DCE)	mg/kg	0.0071	0.011	0.019	S4UL
1,1,1-Trichloroethane (111 TCA)	mg/kg	8.8	18	39	S4UL
1,1,1,2-Tetrachloroethane (1112 PCA)	mg/kg	1.2	2.8	6.40	S4UL
1,1,2,2-Tetrachloroethane (1122 PCA)	mg/kg	1.60	3.4	7.5	S4UL
Tetrachloroethene (PCE)	mg/kg	0.18	0.39	0.9	S4UL
Tetrachloroethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	S4UL
Trichloroethene (TCE)	mg/kg	0.016	0.034	0.075	S4UL
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	S4UL
Vinyl Chloride	mg/kg	0.00064	0.00087	0.0014	S4UL
Chlorobenzene	mg/kg	0.46	1	2.4	S4UL
1,2-Dichlorobenzene	mg/kg	23	55	130	S4UL
1,3-Dichlorobenzene	mg/kg	0.4	1	2.3	S4UL
1,4-Dichlorobenzene	mg/kg	61	150	350	S4UL
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	S4UL
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	S4UL
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	S4UL
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	S4UL
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	S4UL
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	S4UL
Pentachlorobenzene	mg/kg	5.8	12	22	S4UL
Hexachlorobenzene	mg/kg	1.8	3.3	4.9	S4UL
Carbon Disulphide	mg/kg	0.14	0.29	0.62	S4UL
Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	S4UL
Phenolics					
Phenol	mg/kg	280	550	1100	S4UL
Chlorophenols	mg/kg	0.87	2.00	4.50	S4UL
Pentachlorophenol	mg/kg	0.22	0.52	1.20	S4UL
Explosives					
2,4,6-Trinitrotoluene (TNT)	mg/kg	1.6	3.7	8.1	S4UL
RDX	mg/kg	120.0	250.0	540.0	S4UL
HMX	mg/kg	5.7	13.0	26.0	S4UL
Insecticides/ Herbicides					
Aldrin	mg/kg	5.70	6.60	7.10	S4UL
Dieldrin	mg/kg	0.97	2.00	3.50	S4UL
Atrazine	mg/kg	3.30	7.60	17.40	S4UL
Dichlorvos	mg/kg	0.032	0.066	0.140	S4UL
Alpha-Endosulfan	mg/kg	7.4	18.0	41.0	S4UL
Beta-Endosulfan	mg/kg	7.0	17.0	39.0	S4UL
Alpha-Hexachlorocyclohexane	mg/kg	0.23	0.55	1.20	S4UL
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.200	0.460	S4UL
Gamma-Hexachlorocyclohexanes (Lindane)	mg/kg	0.06	0.14	0.33	S4UL
TPH					
TPH Aliphatic >C5-6	mg/kg	42	78	160	S4UL
TPH Aliphatic >C6-8	mg/kg	100	230	530	S4UL
TPH Aliphatic >C8-10	mg/kg	27	65	150	S4UL
TPH Aliphatic >C10-12	mg/kg	130	330	760	S4UL
TPH Aliphatic >C12-15	mg/kg	1100	2,400	4,300	S4UL
TPH Aliphatic >C16-35	mg/kg	65,000	92,000	110,000	S4UL
TPH Aliphatic >C35-44	mg/kg	65,000	92,000	110,000	S4UL
TPH Aromatic >EC5-7 (Benzene)	mg/kg	70	140.00	300	S4UL
TPH Aromatic >EC7-8	mg/kg	130	290	660	S4UL
TPH Aromatic >EC8-10	mg/kg	34	83	190	S4UL
TPH Aromatic >EC10-12	mg/kg	74	180	390	S4UL
TPH Aromatic >EC12-16	mg/kg	140	330	660	S4UL
TPH Aromatic >EC16-21	mg/kg	260	540	930	S4UL
TPH Aromatic >EC21-35	mg/kg	1100	1,500	1,700	S4UL
TPH Aromatic >EC35-44	mg/kg	1100	1,500	1,700	S4UL
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,600	1,800	1,900	S4UL
Total TPH	mg/kg	No Sum	No Sum	No Sum	
BTEX					
Benzene	mg/kg	0.087	0.17	0.37	S4UL
Toluene	mg/kg	130	290	660	S4UL
Ethylbenzene	mg/kg	47	110	260	S4UL
m-Xylene	mg/kg	60	140	330	S4UL
p-Xylene	mg/kg	59	140	320	S4UL
o-Xylene	mg/kg	56	130	310	S4UL

NOTES

- Compare individual samples values against Soil Screening Values (SSV). If exceedences are noted consider further in relation to averaging areas and statistical analysis.
- These values are for initial screening for potential **risk to human health only**. They are **not remediation thresholds**. Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.
- Screening criteria denoted with an asterisk (*) were capped at the lower vapour/aqueous saturation limits for Tier 1 human health risk assessment purposes and considered **conservative**. Where concentrations are recorded at levels greater than the SSV, free phase (NAPL) contamination may be present and should be considered qualitatively. Further information to support the interpretation of assessment criteria that exceed theoretical soil saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
- Screening criteria denoted with hash (#) were capped at 1000000mg/kg. It is noted that aesthetic (e.g. odour) and other site specific factors may also be relevant when providing advice relating to these compounds.
- LQM/CIEH S4ULs November 2014 - Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3439. All rights reserved.
- SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is the responsibility of the project engineer to check with the laboratory that appropriate detection limits can be achieved. As a target, a LoD would be no larger than 10% of the SSV, but this is not practicable for some constituents. Clearly an LoD greater than the SSV would prevent use of this SSV screening and/or be interpreted as if all samples exceeded the SSV.
- Human Health Soil Screening Values (SSV)** were calculated using a Soil Organic Matter (SOM) value of 1.0%, 2.5% and 6%. This is equivalent to an Fraction Organic Carbon (FOC) values of approx. 0.6%, 1.45% and 3.5% respectively (For reference FOC = 0.58*SOM). **Note that some soils have different SOM/FOC, which may give require more stringent SSVs for organic compounds. It is the responsibility of the project engineer to check the SOM with the site specific conditions.**
- In general, SSVs above 100mg/kg are rounded down to 3 significant figures. Similarly, SSVs below 100mg/kg are rounded down to 2 significant figures

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date	
ISSUE	Commercial / Industrial	1	June 2015	
	SOIL ORGANIC MATTER			
	1%	2.5%	6%	SOURCE
Determinand	Units			
pH		<5, >9		
Asbestos	%	Presence		
HEAVY METALS/METALLOIDS				
Arsenic	mg/kg	640		SAUL
Cadmium	mg/kg	190		SAUL
Chromium (III)	mg/kg	8,600		SAUL
Chromium (VI)	mg/kg	23		SAUL
Lead	mg/kg	2300		SAUL
Mercury (Elemental)	mg/kg	58		SAUL
Mercury (Inorganic)	mg/kg	1100		SAUL
Mercury (Methyl)	mg/kg	320		SAUL
Nickel	mg/kg	980		SAUL
Selenium	mg/kg	12000		SAUL
Beryllium	mg/kg	12		SAUL
Boron	mg/kg	240000		SAUL
Vanadium	mg/kg	9000		SAUL
Copper	mg/kg	68,000		SAUL
Zinc	mg/kg	730,000		SAUL
GENERAL INORGANICS				
Easily Liberatable Cyanide (free)	mg/kg			Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs				
Acenaphthene	mg/kg	84,000	97,000	100,000
Acenaphthylene	mg/kg	83,000	97,000	100,000
Anthracene	mg/kg	520,000	540,000	540,000
Benzo(a)Anthracene	mg/kg	170	170	180
Benzo(b)Fluoranthene	mg/kg	44	44	45
Benzo(k)Fluoranthene	mg/kg	1200	1,200	1,200
Benzo(a,h)Perylene	mg/kg	3900	4,000	4,000
Benzo(a)Pyrene	mg/kg	35	35	36
Chrysene	mg/kg	350	350	350
Di-benzo(a,h)anthracene	mg/kg	3.5	4	4
Fluoranthene	mg/kg	23,000	23,000	23,000
Fluorene	mg/kg	63,000	68,000	71,000
Indeno(1,2,3-cd)pyrene	mg/kg	500	510	510
Naphthalene	mg/kg	190	460	1,100
Phenanthrene	mg/kg	22,000	22,000	23,000
Pyrene	mg/kg	54,000	54,000	54,000
Total PAHs	mg/kg	No Sum	No Sum	No Sum
Chlorinated Solvents				
1,2-Dichloroethane (DCE)	mg/kg	0.67	0.97	1.7
1,1,1-Trichloroethane (111 TCA)	mg/kg	660	1,300	3,000
1,1,1,2-Tetrachloroethane (1112 PCA)	mg/kg	110	250	560
1,1,2,2-Tetrachloroethane (1122 PCA)	mg/kg	270	550	1,100
Tetrachloroethane (TCE)	mg/kg	18	42	95
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	2.9	6.3	14
Trichloroethane (TCE)	mg/kg	1.2	2.6	5.7
Trichloromethane (Chloroform)	mg/kg	98	170	350
Vinyl Chloride	mg/kg	0.059	0.077	0.12
Chlorobenzene	mg/kg	56	130	290
1,2-Dichlorobenzene	mg/kg	2000	4800	11000
1,3-Dichlorobenzene	mg/kg	30	73	170
1,4-Dichlorobenzene	mg/kg	4400	10000	25000
1,2,3-Trichlorobenzene	mg/kg	102	250	590
1,2,4-Trichlorobenzene	mg/kg	220	530	1300
1,3,5-Trichlorobenzene	mg/kg	23	55	130
1,2,3,4-Tetrachlorobenzene	mg/kg	1700	3800	4400
1,2,3,5-Tetrachlorobenzene	mg/kg	49	120	240
1,2,4,5-Tetrachlorobenzene	mg/kg	42	72	96
Pentachlorobenzene	mg/kg	640	770	830
Hexachlorobenzene	mg/kg	110	120	120
Carbon Disulfide	mg/kg	11	22	47
Hexachlorobutadiene	mg/kg	31	66	120
Phenolics				
Phenol	mg/kg	760	1500	3200
Chlorophenols	mg/kg	2500	4900	4300
Pentachlorophenol	mg/kg	400	400	400
Explosives				
2,4,6-Trinitrotoluene (TNT)	mg/kg	1000	1000	1000
RDX	mg/kg	210000	210000	210000
HMX	mg/kg	110000	110000	110000
Insecticides/Herbicides				
Aldrin	mg/kg	170.0	170.0	170.0
Dieldrin	mg/kg	170.0	170.0	170.0
Atrazine	mg/kg	9300.0	9400.0	9400.0
Dichloros	mg/kg	140.0	140.0	140.0
Alpha-Endosulfan	mg/kg	5600	7400	8400
Beta-Endosulfan	mg/kg	6300	7800	8700
Alpha-Hexachlorocyclohexane	mg/kg	170	180	180
Beta-Hexachlorocyclohexane	mg/kg	65	65	65
Gamma-Hexachlorocyclohexanes (Lindane)	mg/kg	67	69	70
TPH				
TPH Aliphatic >C5-6	mg/kg	3,200	5,900	12,000
TPH Aliphatic >C6-8	mg/kg	7,800	17,000	40,000
TPH Aliphatic >C8-10	mg/kg	2,600	5,400	11,000
TPH Aliphatic >C10-12	mg/kg	9,700	23,000	47,000
TPH Aliphatic >C12-16	mg/kg	59,000	82,000	90,000
TPH Aliphatic >C16-25	mg/kg	1,600,000	1,700,000	1,800,000
TPH Aliphatic >C25-44	mg/kg	1,600,000	1,700,000	1,800,000
TPH Aromatic >EC5-7 (Benzene)	mg/kg	26,000	46,000	86,000
TPH Aromatic >EC7-8	mg/kg	56,000	110,000	180,000
TPH Aromatic >EC9-10	mg/kg	1,500	8,100	17,000
TPH Aromatic >EC10-12	mg/kg	16,000	28,000	34,000
TPH Aromatic >EC12-16	mg/kg	36,000	37,000	38,000
TPH Aromatic >EC16-21	mg/kg	28,000	28,000	28,000
TPH Aromatic >EC21-35	mg/kg	28,000	28,000	28,000
TPH Aromatic >EC35-44	mg/kg	28,000	28,000	28,000
TPH Aliphatic & Aromatic >EC44-70	mg/kg	28,000	28,000	28,000
Total TPH	mg/kg	No Sum	No Sum	No Sum
BTEX				
Benzene	mg/kg	27	47	90
Toluene	mg/kg	56000 SM (869)	110000 SM (1920)	180000 SM (4360)
Ethylbenzene	mg/kg	5700 SM (518)	13000 SM (1220)	27000 SM (2840)
m-Xylene	mg/kg	6,600	15,000	33000
p-Xylene	mg/kg	6,200	14,000	31000
o-Xylene	mg/kg	5,900	14,000	30000

NOTES

- Compare individual samples values against Soil Screening Values (SSV). If exceedences are noted consider further in relation to averaging areas and statistical analysis.
- These values are for initial screening for potential **risk to human health only**. They are **not remediation thresholds**. Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.
- Screening criteria denoted with an asterix (*) were capped at the lower vapour/aqueous saturation limits for Tier 1 human health risk assessment purposes and considered **conservative**. Where concentrations are recorded at levels greater than the SSV, free phase (NAPL) contamination may be present and should be considered qualitatively. Further information to support the interpretation of assessment criteria that exceed theoretical soil saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
- Screening criteria denoted with hash (#) were capped at 1000000mg/kg. It is noted that aesthetic (e.g. odour) and other site specific factors may also be relevant when providing advice relating to these compounds.
- LQM/CIEH S4ULs November 2014 - Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3439. All rights reserved.
- SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is the responsibility of the project engineer to check with the laboratory that appropriate detection limits can be achieved. As a target, an LoD would be no larger than 10% of the SSV, but this is not practicable for some constituents. Clearly an LoD greater than the SSV would prevent use of this SSV screening and/or be interpreted as if all samples exceeded the SSV.
- Human Health Soil Screening Values (SSV)** were calculated using a Soil Organic Matter (SOM) value of 1.0%, 2.5% and 6%. This is equivalent to an Fraction Organic Carbon (FOC) values of approx. 0.6%, 1.45% and 3.5% respectively (For reference FOC = 0.58*SQM). **Note that some soils have different SOM/FOC, which may give require more stringent SSVs for organic compounds. It is the responsibility of the project engineer to check the SOM with the site specific conditions.**
- In general, SSVs above 100mg/kg are rounded down to 3 significant figures. Similarly, SSVs below 100mg/kg are rounded down to 2 significant figures

APPENDIX 4 – SOIL SCREENING SUMMARIES

GAC Comparison: Residential with Homegrown Produce (1% SOM)

[illegible]

GAC Comparison: Residential with Homgeg

[illegible]

C Comparison: Residential with Homgeg

[illegible]

APPENDIX 5 – CHEMICAL ANALYSIS RESULTS

FINAL ANALYTICAL TEST REPORT

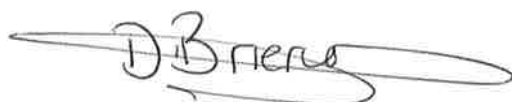
Envirolab Job Number: 17/02030
Issue Number: 1

Date: 03 April, 2017

Client: Ridge and Partners Ltd
Partnership House
Moorside Road
Winchester
UK
SO23 7RX

Project Manager: Antony Platt
Project Name: Dunsbury Hill
Project Ref: 5002713
Order No: 602070
Date Samples Received: 17/03/17
Date Instructions Received: 20/03/17
Date Analysis Completed: 03/04/17

Prepared by:



Danielle Brierley
Administrative Assistant

Approved by:



Gill Walker
Laboratory Manager

Envirolab Job Number: 17/02030

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02030/1	17/02030/2	17/02030/4	17/02030/5	17/02030/7	17/02030/8			Units	Method ref
Client Sample No										
Client Sample ID	BH513	BH513	BH514	BH514	BH515	BH515				
Depth to Top	0.50	2.50	0.40	1.60	0.40	3.40				
Depth To Bottom	0.70	3.00	0.70	1.90	0.70	3.70				
Date Sampled	13-Mar-17	13-Mar-17	14-Mar-17	14-Mar-17	15-Mar-17	15-Mar-17				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	3A	5A	1A	1A	3A	5A				
% Stones >10mm _A [#]	<0.1	1.0	4.0	<0.1	23.6	1.2			% w/w	A-T-044
pH _D ^{M#}	8.05	7.50	11.17	7.62	6.51	7.70			pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1			mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	0.4	<0.2	0.4	<0.2			mg/kg	A-T-050s
Organic matter _D ^{M#}	0.5	<0.1	0.6	<0.1	0.5	<0.1			% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.27	<0.03	0.33	<0.03	0.33	0.04			% w/w	A-T-032s
Antimony _D	<5	<5	<5	<5	<5	<5			mg/kg	A-T-024s
Arsenic _D ^{M#}	8	6	4	1	11	3			mg/kg	A-T-024s
Cadmium _D ^{M#}	0.6	<0.5	0.6	<0.5	0.8	<0.5			mg/kg	A-T-024s
Copper _D ^{M#}	20	5	7	4	5	4			mg/kg	A-T-024s
Chromium _D ^{M#}	53	22	25	23	28	19			mg/kg	A-T-024s
Lead _D ^{M#}	17	5	12	6	8	4			mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17			mg/kg	A-T-024s
Nickel _D ^{M#}	26	11	12	18	11	12			mg/kg	A-T-024s
Selenium _D	<1	<1	<1	<1	2	<1			mg/kg	A-T-024s
Zinc _D ^{M#}	70	26	36	33	24	25			mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD				A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A				

Envirolab Job Number: 17/02030

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02030/1	17/02030/2	17/02030/4	17/02030/5	17/02030/7	17/02030/8			Units	Method ref
Client Sample No										
Client Sample ID	BH513	BH513	BH514	BH514	BH515	BH515				
Depth to Top	0.50	2.50	0.40	1.60	0.40	3.40				
Depth To Bottom	0.70	3.00	0.70	1.90	0.70	3.70				
Date Sampled	13-Mar-17	13-Mar-17	14-Mar-17	14-Mar-17	15-Mar-17	15-Mar-17				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	3A	5A	1A	1A	3A	5A				
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08			mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07			mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06			mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07			mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08			mg/kg	A-T-019s

Envirolab Job Number: 17/02030

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02030/1	17/02030/2	17/02030/4	17/02030/5	17/02030/7	17/02030/8			Units	Method ref
Client Sample No										
Client Sample ID	BH513	BH513	BH514	BH514	BH515	BH515				
Depth to Top	0.50	2.50	0.40	1.60	0.40	3.40				
Depth To Bottom	0.70	3.00	0.70	1.90	0.70	3.70				
Date Sampled	13-Mar-17	13-Mar-17	14-Mar-17	14-Mar-17	15-Mar-17	15-Mar-17				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	3A	5A	1A	1A	3A	5A				
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	0.05			mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	2.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	3.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	1.2	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	6.4	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	6.4	<0.1	<0.1	<0.1			mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	A-T-022s

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

FINAL ANALYTICAL TEST REPORT

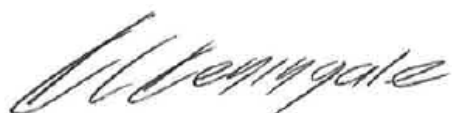
Envirolab Job Number: 17/02170
Issue Number: 1

Date: 04 April, 2017

Client: Ridge and Partners Ltd
Partnership House
Moorside Road
Winchester
UK
SO23 7RX

Project Manager: Antony Platt
Project Name: Dunsbury Hill
Project Ref: 5002713
Order No: 602124
Date Samples Received: 23/03/17
Date Instructions Received: 27/03/17
Date Analysis Completed: 04/04/17

Prepared by:



Kate Keningale
Administrative Assistant

Approved by:



Georgia King
Client Service Manager

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/1	17/02170/2	17/02170/3	17/02170/4	17/02170/5	17/02170/6	17/02170/7	17/02170/8	Units	Method ref
Client Sample No										
Client Sample ID	WS509	WS509	WS510	WS510	WS511	WS511	WS512	WS513		
Depth to Top	0.40	1.50	0.40	3.00	0.20	2.50	0.40	0.30		
Depth To Bottom	0.70	2.00	1.00	4.00	0.50	2.70	0.70	0.50		
Date Sampled	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	17-Mar-17		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	5E	5A	5AE	5	6AE	6	6	5		
% Stones >10mm _A [#]	5.8	21.7	28.2	<0.1	7.6	<0.1	<0.1	<0.1	% w/w	A-T-044
pH _D ^{M#}	6.91	7.28	8.85	8.02	7.92	8.26	7.76	7.04	pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Organic matter _D ^{M#}	2.0	0.2	0.4	0.3	3.0	0.4	1.9	0.3	% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	1.13	0.13	0.25	0.18	1.78	0.20	1.12	0.20	% w/w	A-T-032s
Antimony _D	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	A-T-024s
Arsenic _D ^{M#}	4	22	4	4	6	14	6	9	mg/kg	A-T-024s
Cadmium _D ^{M#}	<0.5	1.4	0.5	0.6	0.8	0.9	1.0	1.0	mg/kg	A-T-024s
Copper _D ^{M#}	4	6	29	8	15	18	22	17	mg/kg	A-T-024s
Chromium _D ^{M#}	20	29	22	32	37	40	36	43	mg/kg	A-T-024s
Lead _D ^{M#}	13	15	15	9	20	15	27	16	mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	A-T-024s
Nickel _D ^{M#}	8	34	12	21	23	42	27	37	mg/kg	A-T-024s
Selenium _D	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	28	37	80	44	65	63	102	69	mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/1	17/02170/2	17/02170/3	17/02170/4	17/02170/5	17/02170/6	17/02170/7	17/02170/8	Units	Method ref
Client Sample No										
Client Sample ID	WS509	WS509	WS510	WS510	WS511	WS511	WS512	WS513		
Depth to Top	0.40	1.50	0.40	3.00	0.20	2.50	0.40	0.30		
Depth To Bottom	0.70	2.00	1.00	4.00	0.50	2.70	0.70	0.50		
Date Sampled	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	17-Mar-17		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	5E	5A	5AE	5	6AE	6	6	5		
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/1	17/02170/2	17/02170/3	17/02170/4	17/02170/5	17/02170/6	17/02170/7	17/02170/8	Units	Method ref
Client Sample No										
Client Sample ID	WS509	WS509	WS510	WS510	WS511	WS511	WS512	WS513		
Depth to Top	0.40	1.50	0.40	3.00	0.20	2.50	0.40	0.30		
Depth To Bottom	0.70	2.00	1.00	4.00	0.50	2.70	0.70	0.50		
Date Sampled	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	16-Mar-17	17-Mar-17		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	5E	5A	5AE	5	6AE	6	6	5		
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/9	17/02170/10	17/02170/11						Units	Method ref
Client Sample No										
Client Sample ID	WS513	WS514	WS514							
Depth to Top	1.60	0.50	2.50							
Depth To Bottom	2.00	1.00	2.80							
Date Sampled	17-Mar-17	17-Mar-17	17-Mar-17							
Sample Type	Soil	Soil	Soil							
Sample Matrix Code	1	5A	1							
% Stones >10mm _A [#]	<0.1	19.0	<0.1						% w/w	A-T-044
pH _D ^{M#}	6.78	6.58	6.22						pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1						mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	0.4						mg/kg	A-T-050s
Organic matter _D ^{M#}	<0.1	0.4	<0.1						% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	<0.03	0.23	0.03						% w/w	A-T-032s
Antimony _D	<5	<5	<5						mg/kg	A-T-024s
Arsenic _D ^{M#}	2	10	2						mg/kg	A-T-024s
Cadmium _D ^{M#}	<0.5	0.9	<0.5						mg/kg	A-T-024s
Copper _D ^{M#}	1	8	1						mg/kg	A-T-024s
Chromium _D ^{M#}	16	41	20						mg/kg	A-T-024s
Lead _D ^{M#}	3	11	4						mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17						mg/kg	A-T-024s
Nickel _D ^{M#}	8	16	12						mg/kg	A-T-024s
Selenium _D	<1	<1	<1						mg/kg	A-T-024s
Zinc _D ^{M#}	18	37	25						mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil _A [#]	NAD	NAD	NAD							A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A							

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/9	17/02170/10	17/02170/11						Units	Method ref
Client Sample No										
Client Sample ID	WS513	WS514	WS514							
Depth to Top	1.60	0.50	2.50							
Depth To Bottom	2.00	1.00	2.80							
Date Sampled	17-Mar-17	17-Mar-17	17-Mar-17							
Sample Type	Soil	Soil	Soil							
Sample Matrix Code	1	5A	1							
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03						mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01						mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01						mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01						mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03						mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02						mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08						mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07						mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04						mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06						mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05						mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07						mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04						mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03						mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04						mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05						mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	<0.08	<0.08	<0.08						mg/kg	A-T-019s

Envirolab Job Number: 17/02170

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02170/9	17/02170/10	17/02170/11						Units	Method ref
Client Sample No										
Client Sample ID	WS513	WS514	WS514							
Depth to Top	1.60	0.50	2.50							
Depth To Bottom	2.00	1.00	2.80							
Date Sampled	17-Mar-17	17-Mar-17	17-Mar-17							
Sample Type	Soil	Soil	Soil							
Sample Matrix Code	1	5A	1							
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1						mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1						mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1						mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01						mg/kg	A-T-022s

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

FINAL ANALYTICAL TEST REPORT

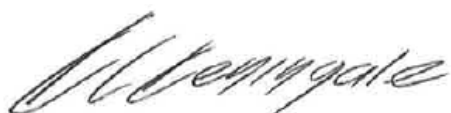
Envirolab Job Number: 17/02290
Issue Number: 1

Date: 07 April, 2017

Client: Ridge and Partners Ltd
Partnership House
Moorside Road
Winchester
UK
SO23 7RX

Project Manager: Antony Platt
Project Name: Dunsbury Hill
Project Ref: 5002713
Order No: 602151
Date Samples Received: 29/03/17
Date Instructions Received: 30/03/17
Date Analysis Completed: 06/04/17

Prepared by:



Kate Keningale
Administrative Assistant

Approved by:



Georgia King
Client Service Manager

Envirolab Job Number: 17/02290

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02290/1	17/02290/2	17/02290/3	17/02290/4	17/02290/5	17/02290/6	17/02290/7		Units	Method ref
Client Sample No										
Client Sample ID	BH517	BH517	BH518	BH518	BH519	WS515	WS516			
Depth to Top	0.40	3.30	0.50	4.00	0.00	2.00	0.10			
Depth To Bottom	0.60	3.60	1.00	5.00	0.20	3.00	0.35			
Date Sampled	21-Mar-17	21-Mar-17	22-Mar-17	22-Mar-17	24-Mar-17	17-Mar-17	17-Mar-17			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6A	1A	1A	6A	6AE	1	6AE			
% Stones >10mm ^A	2.8	<0.1	<0.1	<0.1	7.6	<0.1	1.0		% w/w	A-T-044
pH _D ^{M#}	9.49	6.77	7.17	8.11	7.80	4.86	6.02		pH	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1		mg/kg	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2		mg/kg	A-T-050s
Organic matter _D ^{M#}	0.8	<0.1	0.2	0.5	2.8	<0.1	2.1		% w/w	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.48	0.04	0.12	0.26	1.60	<0.03	1.19		% w/w	A-T-032s
Antimony _D	12	<5	<5	<5	<5	<5	<5		mg/kg	A-T-024s
Arsenic _D ^{M#}	4	2	2	2	4	2	3		mg/kg	A-T-024s
Cadmium _D ^{M#}	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		mg/kg	A-T-024s
Copper _D ^{M#}	1200	4	2	7	11	2	2		mg/kg	A-T-024s
Chromium _D ^{M#}	39	19	26	29	19	21	10		mg/kg	A-T-024s
Lead _D ^{M#}	72	4	5	6	17	4	14		mg/kg	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17		mg/kg	A-T-024s
Nickel _D ^{M#}	27	11	13	20	8	9	4		mg/kg	A-T-024s
Selenium _D	<1	<1	<1	<1	<1	<1	<1		mg/kg	A-T-024s
Zinc _D ^{M#}	983	30	25	42	49	21	18		mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil _A [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A			

Envirolab Job Number: 17/02290

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02290/1	17/02290/2	17/02290/3	17/02290/4	17/02290/5	17/02290/6	17/02290/7		Units	Method ref
Client Sample No										
Client Sample ID	BH517	BH517	BH518	BH518	BH519	WS515	WS516			
Depth to Top	0.40	3.30	0.50	4.00	0.00	2.00	0.10			
Depth To Bottom	0.60	3.60	1.00	5.00	0.20	3.00	0.35			
Date Sampled	21-Mar-17	21-Mar-17	22-Mar-17	22-Mar-17	24-Mar-17	17-Mar-17	17-Mar-17			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6A	1A	1A	6A	6AE	1	6AE			
PAH-16MS										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01		mg/kg	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	0.16	<0.03	<0.03		mg/kg	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02		mg/kg	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08	0.37	<0.08	<0.08		mg/kg	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	0.30	<0.07	<0.07		mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	0.14	<0.04	<0.04		mg/kg	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06	0.17	<0.06	<0.06		mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	0.16	<0.05	<0.05		mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	0.12	<0.04	<0.04		mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	0.08	<0.03	<0.03		mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05		mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	<0.08	<0.08	<0.08	<0.08	1.60	<0.08	<0.08		mg/kg	A-T-019s

Envirolab Job Number: 17/02290

Client Project Name: Dunsbury Hill

Client Project Ref: 5002713

Lab Sample ID	17/02290/1	17/02290/2	17/02290/3	17/02290/4	17/02290/5	17/02290/6	17/02290/7		Units	Method ref
Client Sample No										
Client Sample ID	BH517	BH517	BH518	BH518	BH519	WS515	WS516			
Depth to Top	0.40	3.30	0.50	4.00	0.00	2.00	0.10			
Depth To Bottom	0.60	3.60	1.00	5.00	0.20	3.00	0.35			
Date Sampled	21-Mar-17	21-Mar-17	22-Mar-17	22-Mar-17	24-Mar-17	17-Mar-17	17-Mar-17			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	6A	1A	1A	6A	6AE	1	6AE			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Total Aliphatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C16-C21 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Total Aromatics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
TPH (Ali & Aro) _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX 6 – MONITORING RECORDS

GROUND GAS AND GROUNDWATER MONITORING RESULTS

SITE/REF:		Dunsbury Hill					General Site comments		 www.ridge.co.uk	
DATE:		11/04/2017		...1..... of ...2.....			The response zones in some wells were submerged at the time of this monitoring round. The ground gas measurements are therefore not considered to be representative of the ground gas regime as the site as they only represent trapped gas at the head of each well.			
OPERATOR(S):		DAP								
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)				
Before Monitoring		1028	<0.1	<0.1	21.5	-	EQUIPMENT			
After Monitoring		1026	<0.1	<0.1	21.8	-	Instrument / Model Type	Serial Number	Comments	
Atmospheric Pressure Trend:		Falling					GA2000 Gas Analyser		GA12820	
Ground Conditions:		Dry, damp in places					Standard Dipmeter		79301	
Weather Conditions:		Clear, Warm, Slight Breeze								

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			
BH501	09:09	<0.1	0.25	<0.1	0.6	16.4	<0.1	<1	<1	<1	82.9	-	1	13	HD/BSM/LC	0.0001	0.0006
BH502	09:15	<0.1	0.25	0.1	2.5	10.4	0.1	1	<1	<1	86.8	-	1	13	HD/BSM/LC	0.0001	0.0025
BH503	09:20	<0.1	0.25	<0.1	0.5	17.4	<0.1	<1	<1	<1	82.1	-	1	13	HD/BSM/LC	0.0001	0.0005
BH504	09:27	<0.1	0.25	<0.1	<0.1	21	<0.1	<1	<1	<1	79.1	-	1	15	HD/BSM/LC	0.0001	0.0001
BH505	08:48	<0.1	0.25	<0.1	0.6	20.6	<0.1	<1	<1	<1	78.9	-	1	13	HD/BSM/LC	0.0001	0.0006
BH506	09:01	<0.1	0.25	<0.1	0.5	19.9	<0.1	<1	<1	<1	79.6	-	1	14	HD/BSM/LC	0.0001	0.0005
BH507	08:55	0.2	0.25	<0.1	1.5	19.7	<0.1	<1	<1	<1	79.8	-	1	14	HD/BSM/LC	0.0002	0.0030
BH508	08:39	0.7	0.25	<0.1	2.7	18.1	<0.1	<1	<1	<1	79.2	-	1	15	HD/BSM/LC	0.0007	0.0189
BH509	08:30	<0.1	0.25	<0.1	0.2	19.9	<0.1	<1	<1	<1	79.9	-	1	15	HD/BSM/LC	0.0001	0.0002
BH510	10:55	<0.1	0.05	<0.1	1.0	18.9	<0.1	<1	<1	<1	80.1	-	1	15.5	HD/BSM/LC	0.0001	0.0010

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
BH501	1.45	13	-	-	-	-	-	-	-	-	-	
BH502	1.07	13	-	-	-	-	-	-	-	-	-	
BH503	1.23	13	-	-	-	-	-	-	-	-	-	
BH504	1.41	15	-	-	-	-	-	-	-	-	-	
BH505	1.22	13	-	-	-	-	-	-	-	-	-	
BH506	0.66	14	-	-	-	-	-	-	-	-	-	
BH507	0.56	14	-	-	-	-	-	-	-	-	-	
BH508	0.84	15	-	-	-	-	-	-	-	-	-	
BH509	0.89	15	-	-	-	-	-	-	-	-	-	
BH510	1.22	15.5	-	-	-	-	-	-	-	-	-	

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS

SITE/REF:		Dunsbury Hill					General Site comments			
DATE:		11/04/2017		...2..... of ...2.....				The response zones in some wells were submerged at the time of this monitoring round. The ground gas measurements are therefore not considered to be representative of the ground gas regime as the site as they only represent trapped gas at the head of each well.		
OPERATOR(S):		DAP								
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)				
Before Monitoring		1028	<0.1	<0.1	21.5	-	EQUIPMENT			
After Monitoring		1026	<0.1	<0.1	21.8	-	Instrument / Model Type	Serial Number	Comments	
Atmospheric Pressure Trend:		Falling					GA2000 Gas Analyser		GA12820	
Ground Conditions:		Dry, damp in places					Standard Dipmeter		79301	
Weather Conditions:		Clear, Warm, Slight Breeze								

APPENDIX 7 – GEOTECHNIAL TEST CERTIFICATES



Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No.	Project Name	Programme	
22398	Dunsbury Hill	Samples received	22/02/2017
		Schedule received	27/02-08/03/2017
Project No.	Client	Project started	01/03/2017
-	Ridge	Testing Started	20/03/2017

Hole No.	Sample				Soil Description	Test Type	Density		w	Length	Diameter	σ3	At failure					Remarks
	Ref	Top	Base	Type			bulk	dry					Axial strain	σ1 - σ3	cu	Mode		
																	Mg/m3	
BH501	4	1.20	1.65	U	Medium strength light brown, orange and bluish grey mottled silty sandy CLAY	UU	2.07	1.63	27	198	102	28	20	146	73	P		
BH501	12	5.00	5.40	U	Very high strength slightly fissured dark grey silty sandy CLAY	UU	2.08	1.70	22	198	102	105	14	393	196	C		
BH501	27	14.00	-	U	Very high strength slightly fissured dark grey silty CLAY	UU	2.11	1.70	24	198	102	290	13	337	169	C		
BH501	37	20.00	20.45	U	High strength fissured dark grey silty CLAY	UU	2.08	1.64	27	198	102	400	12	261	130	C		
BH502	14	7.10	7.50	U	Very high strength slightly fissured dark grey slightly sandy silty CLAY	UU	2.14	1.73	23	198	102	145	17	458	229	C		
BH502	29	16.00	16.35	U	High strength slightly fissured dark grey silty CLAY	UU	2.08	1.68	23	198	102	325	2.0	224	112	B		
BH503	4	1.20	-	U	Medium strength orangish brown and pale grey silty sandy CLAY	UU	2.03	1.62	26	198	102	25	20	142	71	P		
BH503	15	8.00	-	U	Very high strength slightly fissured dark grey slightly sandy silty CLAY with occasional light grey silty fine sand partings	UU	2.07	1.71	21	198	102	160	13	389	194	C		
BH503	20	11.00	-	U	Low strength dark grey silty CLAY	UU	1.88	1.41	33	198	102	220	20	57	29	P		
BH503	30	17.00	-	U	Very high strength fissured dark grey silty CLAY with light grey silty fine sandy partings	UU	2.05	1.72	19	198	102	340	6.6	334	167	B	Slightly disturbed	
BH504	9	3.00	-	U	High strength slightly fissured dark grey sandy silty CLAY	UU	2.07	1.66	25	198	102	60	19	192	96	C		
BH504	13	5.00	-	U	Very high strength slightly fissured dark grey sandy silty CLAY	UU	2.13	1.76	21	198	102	100	7.6	447	223	B		
BH504	36	19.00	-	U	High strength fissured dark grey silty CLAY	UU	2.05	1.65	24	198	102	380	4.5	286	143	B		

Legend	UU - single stage test (single and multiple specimens)	σ_3 Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	$\sigma_1 - \sigma_3$ Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	cu Undrained shear strength, $\frac{1}{2}(\sigma_1 - \sigma_3)$		C - Compound



Test Report by K4 SOILS LABORATORY

Unit 8 Olds Close Olds Approach

Watford Herts WD18 9RU

Tel: 01923 711 288

Email: james@k4soils.com

Checked and Approved

Initials: J.P

Date: 28/03/2017

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R7b

APPENDIX 8 – ULS BEARING RESISTANCE CALCULATIONS

Project Title:		Dunsbury Hill - Preliminary			
Shallow Foundation		Strip Foundation			
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP
Design Approach 1		Characteristic Geotechnical Parameters			
Combination 1 A1 + M1 + R1		Unit Weight	21		
		Undrained Cohesion	55		
		Cohesion	12		
		Shearing Resistance	26		
<u>Material Properties and Resistance</u>		Foundation Size			
Partial factors set M1: $\gamma_{cu} = 1$ $\gamma_{\phi} = 1$ and $\gamma_c = 1$		depth	1.00		
		breadth	0.75		
		$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} = 55$			
Design shearing resistance is		$\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_{\phi}} \right) = 26$			
Design cohesion is		$c'_d = \frac{c_k}{\gamma_c} = 12$			
<u>Drained Bearing Capacity Factors</u>					
For overburden		$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 11.84$			
For cohesion		$N_c = [(N_q - 1) \times \cot(\phi_d)] = 22.24$			
For self-weight		$N_{\gamma} = [2(N_q - 1) \times \tan(\phi_d)] = 10.58$			
<u>Depth and Shape Factors</u>					
Solgado's depth factor for undrained loading:		$d_c = 1 + 0.27 \sqrt{\frac{d}{B}} = 1.31$			
Ignore depth factors for drained loading					
Solgado's shape factor for undrained loading:		$s_c = 1 + 0.17 \sqrt{\frac{d}{B}} = 1.20$			
Shape factors are all 1.0 for drained loading and so can be ignored					
<u>Undrained Bearing Resitance</u>					
Total overburden at foundation base is		$\sigma_{vk,b} = \gamma_k \times d = 21$			
Partial factors set R1: $\gamma_{Rv} = 1$					
Ultimate resistance is		$q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} = 465$			
Design Resistance is		$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 465$			

Project Title:		Dunsbury Hill - Preliminary				
Shallow Foundation		Strip Foundation				
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP	
<u>Drained Bearing Resistance</u>		Depth to Groundwater		0	coincident with ground surface	
Effective overburden at foundation base is		$\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} = 11.19$				
From overburden	$q'_{ult_1} = N_q \times \sigma'_{wk,b} =$	133				
From cohesion	$q'_{ult_2} = N_c \times c'_d =$	266.8265				
From self-weight	$q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right] =$	44				
Total resistance is	$q'_{ult} = \sum_{i=1}^3 q'_{ult_i} =$	444				
Design resistance is	$q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} =$	444				
<u>Design Approach 1</u>						
Combination 2 A2 + M2 + R1						
<u>Material Properties and Resistance</u>						
Partial factors set M2: $\gamma_{cu} = 1.4$ $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$						
Design undrained strength is	$c_{ud} = \frac{c_{uk}}{\gamma_{cu}} =$	39				
Design shearing resistance is	$\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) =$	21				
Design cohesion is	$c'_d = \frac{c_k}{\gamma_c} =$	9.6				
<u>Drained Bearing Capacity Factors</u>						
For overburden	$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] =$	7.29				
For cohesion	$N_c = [(N_q - 1) \times \cot(\phi_d)] =$	16.13				
For self-weight	$N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] =$	4.91				

Project Title:		Dunsbury Hill - Preliminary		RIDGE www.ridge.co.uk	
Shallow Foundation		Strip Foundation			
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP
<u>Depth and Shape Factors</u>					
Solgado's depth factor for undrained loading:		$d_c = 1 + 0.27\sqrt{\frac{d}{B}}$		1.31	
Ignore depth factors for drained loading					
Solgado's shape factor for undrained loading:		$s_c = 1 + 0.17\sqrt{\frac{d}{B}}$		1.20	
Shape factors are all 1.0 for drained loading and so can be ignored					
<u>Undrained Bearing Resitance</u>					
Total overburden at foundation base is		$\sigma_{vk,b} = \gamma_k \times d =$		21	
Partial factors set R1: $\gamma_{Rv} = 1$					
Ultimate resistance is		$q_{ult} = (\pi + 2) \times c_{ud} \times d_c \times s_c + \sigma_{vk,b} =$		338	
Design Resistance is		$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} =$		338	
<u>Drained Bearing Resistance</u>					
Effective overburden at foundation base is		$\sigma'_{vk,b} = \sigma_{vk,b} - u_{k,b} =$		11.19	
From overburden		$q'_{ult_1} = N_q \times \sigma'_{wk,b} =$		82	
From cohesion		$q'_{ult_2} = N_c \times c'_d =$		154.84604	
From self-weight		$q'_{ult_3} = \left[N_\gamma \times (\gamma_k - \gamma_w) \times \frac{B}{2} \right]$		21	
Total resistance is		$q'_{ult} = \sum_{i=1}^3 q'_{ult_i} =$		257	
Design Resistance is		$q'_{Rd} = \frac{q'_{ult}}{\gamma_{Rv}} =$		257	
Design Approach	Combination	Design Resistance			
		ULS (kN/m ²)			
		undrained	drained		
DA1	Combination 1	465	444		
	Combination 2	338	257		

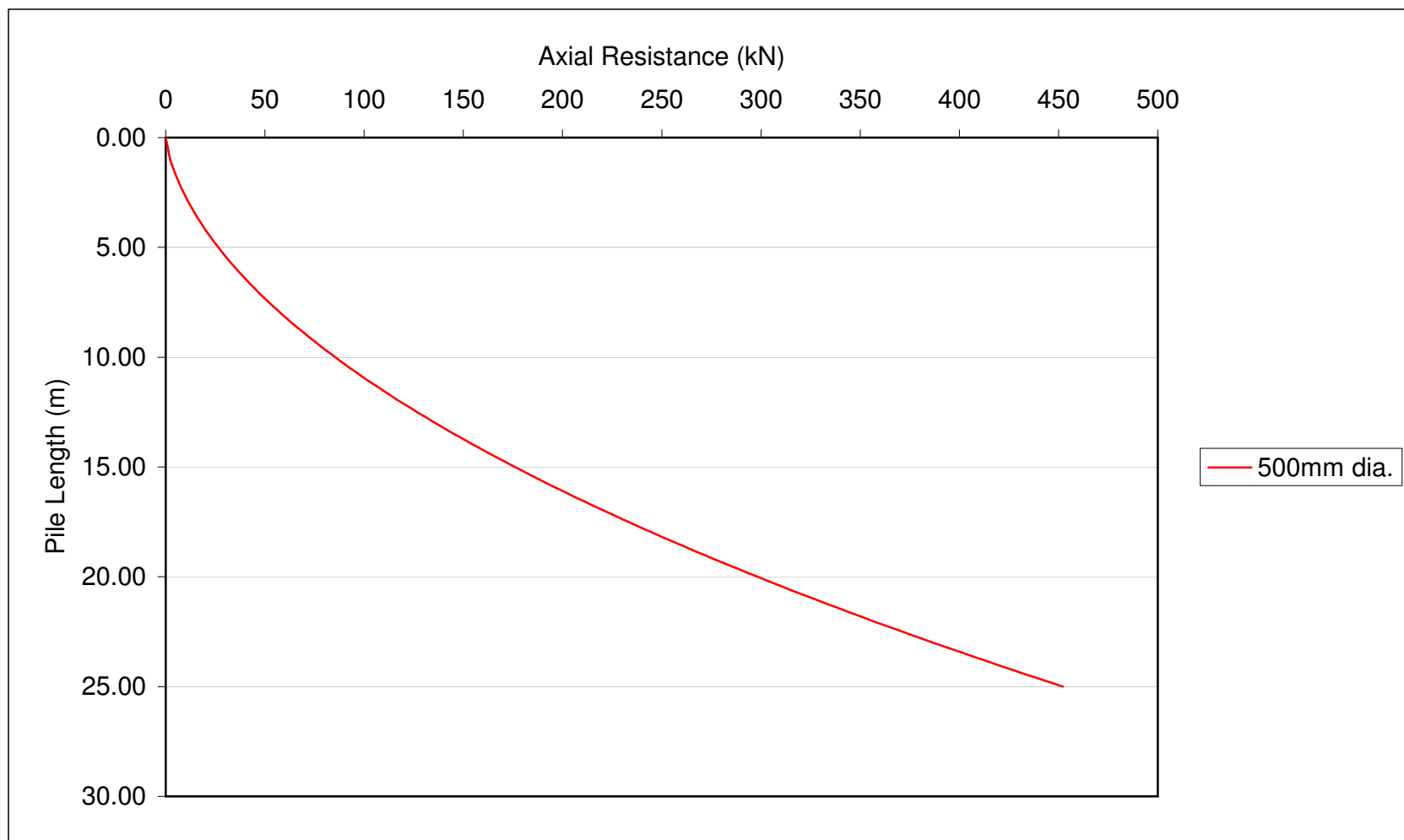
APPENDIX 9 – AXIAL PILE CAPACITY WORKSHEETS

General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	200	0	-	-	-	0	0	200	0	0	0	0
0	200	0	26	10	-	0	0	200	0	0	0	0
0.2020202	200	0.99155133	26	10	-	0	6.50370707	200.991551	0	0	0.45607139	0.45607139
0.4040404	200	1.98310266	26	10	-	0	13.0074141	201.983103	0	0	0.91214278	0.91214278
0.60606061	200	2.974654	26	10	-	0	19.5111212	202.974654	0	0	1.36821418	1.36821418
0.80808081	200	3.96620533	26	10	-	0	26.0148283	203.966205	0	0	1.82428557	1.82428557
1	200	4.90817909	26	10	-	0	32.19335	204.908179	0	0	2.25755339	2.25755339
1.001	200	4.91308727	26	10	-	1.81074086	32.2255434	204.913087	-0.00050791	0.00063489	2.25981094	2.26044583
1.01010101	200	4.95775666	26	10	-	1.82720397	32.5185354	204.957757	-0.00979496	0.0122437	2.28035696	2.29260066
1.21212121	200	5.94930799	26	10	-	2.19264476	39.0222424	205.949308	-0.23758585	0.29698231	2.73642835	3.03341067
1.41414141	200	6.94085932	26	10	-	2.55808555	45.5259495	206.940859	-0.50679327	0.63349159	3.19249974	3.82599133
1.61616162	200	7.93241065	26	10	-	2.92352635	52.0296566	207.932411	-0.81741722	1.02177153	3.64857113	4.67034266
1.81818182	200	8.92396199	26	10	-	3.28896714	58.5333636	208.923962	-1.1694577	1.46182212	4.10464253	5.56646465
2.02020202	200	9.91551332	26	10	-	3.65440793	65.0370707	209.915513	-1.5629147	1.95364337	4.56071392	6.51435729
2.22222222	200	10.9070646	26	10	-	4.01984873	71.5407778	210.907065	-1.99778822	2.49723528	5.01678531	7.51402059
2.42424242	200	11.898616	26	10	-	4.38528952	78.0444848	211.898616	-2.47407828	3.09259785	5.4728567	8.56545455
2.62626263	200	12.8901673	26	10	-	4.75073031	84.5481919	212.890167	-2.99178486	3.73973107	5.92892809	9.66865917
2.82828283	200	13.8817186	26	10	-	5.11617111	91.051899	213.881719	-3.55090796	4.43863495	6.38499949	10.8236344
3.03030303	200	14.87327	26	10	-	5.4816119	97.5556061	214.87327	-4.1514476	5.1893095	6.84107088	12.0303804
3.23232323	200	15.8648213	26	10	-	5.84705269	104.059313	215.864821	-4.79340376	5.99175469	7.29714227	13.288897
3.43434343	200	16.8563726	26	10	-	6.21249349	110.56302	216.856373	-5.47677644	6.84597055	7.75321366	14.5991842
3.63636364	200	17.847924	26	10	-	6.57793428	117.066727	217.847924	-6.20156565	7.75195707	8.20928505	15.9612421
3.83838384	200	18.8394753	26	10	-	6.94337507	123.570434	218.839475	-6.96777139	8.70971424	8.66535644	17.3750707
4.04040404	200	19.8310266	26	10	-	7.30881587	130.074141	219.831027	-7.77539366	9.71924207	9.12142784	18.8406699
4.24242424	200	20.822578	26	10	-	7.67425666	136.577848	220.822578	-8.62443245	10.7805406	9.57749923	20.3580398
4.44444444	200	21.8141293	26	10	-	8.03969745	143.081556	221.814129	-9.51488776	11.8936097	10.0335706	21.9271803
4.64646465	200	22.8056806	26	10	-	8.40513825	149.585263	222.805681	-10.4467596	13.0584495	10.489642	23.5480915
4.84848485	200	23.797232	26	10	-	8.77057904	156.08897	223.797232	-11.420048	14.27506	10.9457134	25.2207734
5.05050505	200	24.7887833	26	10	-	9.13601983	162.592677	224.788783	-12.4347529	15.5434411	11.4017848	26.9452259
5.25252525	200	25.7803346	26	10	-	9.50146063	169.096384	225.780335	-13.4908743	16.8635929	11.8578562	28.7214491

5.45454545	200	26.771886	26	10	-	9.86690142	175.600091	226.771886	-14.5884122	18.2355153	12.3139276	30.5494429
5.65656566	200	27.7634373	26	10	-	10.2323422	182.103798	227.763437	-15.7273667	19.6592084	12.769999	32.4292074
5.85858586	200	28.7549886	26	10	-	10.597783	188.607505	228.754989	-16.9077377	21.1346722	13.2260704	34.3607425
6.06060606	200	29.74654	26	10	-	10.9632238	195.111212	229.74654	-18.1295253	22.6619066	13.6821418	36.3440483
6.26262626	200	30.7380913	26	10	-	11.3286646	201.614919	230.738091	-19.3927293	24.2409116	14.1382131	38.3791248
6.46464646	200	31.7296426	26	10	-	11.6941054	208.118626	231.729643	-20.6973499	25.8716874	14.5942845	40.4659719
6.66666667	200	32.7211939	26	10	-	12.0595462	214.622333	232.721194	-22.043387	27.5542337	15.0503559	42.6045897
6.86868687	200	33.7127453	26	10	-	12.424987	221.12604	233.712745	-23.4308406	29.2885508	15.5064273	44.7949781
7.07070707	200	34.7042966	26	10	-	12.7904278	227.629747	234.704297	-24.8597108	31.0746385	15.9624987	47.0371372
7.27272727	200	35.6958479	26	10	-	13.1558686	234.133455	235.695848	-26.3299975	32.9124969	16.4185701	49.331067
7.47474747	200	36.6873993	26	10	-	13.5213094	240.637162	236.687399	-27.8417007	34.8021259	16.8746415	51.6767674
7.67676768	200	37.6789506	26	10	-	13.8867501	247.140869	237.678951	-29.3948204	36.7435255	17.3307129	54.0742384
7.87878788	200	38.6705019	26	10	-	14.2521909	253.644576	238.670502	-30.9893567	38.7366959	17.7867843	56.5234802
8.08080808	200	39.6620533	26	10	-	14.6176317	260.148283	239.662053	-32.6253095	40.7816369	18.2428557	59.0244925
8.28282828	200	40.6536046	26	10	-	14.9830725	266.65199	240.653605	-34.3026788	42.8783485	18.6989271	61.5772756
8.48484848	200	41.6451559	26	10	-	15.3485133	273.155697	241.645156	-36.0214647	45.0268308	19.1549985	64.1818293
8.68686869	200	42.6367073	26	10	-	15.7139541	279.659404	242.636707	-37.781667	47.2270838	19.6110698	66.8381536
8.88888889	200	43.6282586	26	10	-	16.0793949	286.163111	243.628259	-39.5832859	49.4791074	20.0671412	69.5462486
9.09090909	200	44.6198099	26	10	-	16.4448357	292.666818	244.61981	-41.4263214	51.7829017	20.5232126	72.3061143
9.29292929	200	45.6113613	26	10	-	16.8102765	299.170525	245.611361	-43.3107733	54.1384666	20.979284	75.1177507
9.49494949	200	46.6029126	26	10	-	17.1757173	305.674232	246.602913	-45.2366418	56.5458022	21.4353554	77.9811576
9.6969697	200	47.5944639	26	10	-	17.5411581	312.177939	247.594464	-47.2039268	59.0049085	21.8914268	80.8963353
9.8989899	200	48.5860153	26	10	-	17.9065989	318.681646	248.586015	-49.2126283	61.5157854	22.3474982	83.8632836
10.1010101	200	49.5775666	26	10	-	18.2720397	325.185354	249.577567	-51.2627464	64.078433	22.8035696	86.8820026
10.3030303	200	50.5691179	26	10	-	18.6374805	331.689061	250.569118	-53.354281	66.6928512	23.259641	89.9524922
10.5050505	200	51.5606692	26	10	-	19.0029213	338.192768	251.560669	-55.4872321	69.3590401	23.7157124	93.0747525
10.7070707	200	52.5522206	26	10	-	19.368362	344.696475	252.552221	-57.6615997	72.0769996	24.1717838	96.2487834
10.9090909	200	53.5437719	26	10	-	19.7338028	351.200182	253.543772	-59.8773839	74.8467298	24.6278552	99.474585
11.1111111	200	54.5353232	26	10	-	20.0992436	357.703889	254.535323	-62.1345845	77.6682307	25.0839266	102.752157
11.3131313	200	55.5268746	26	10	-	20.4646844	364.207596	255.526875	-64.4332018	80.5415022	25.5399979	106.0815
11.5151515	200	56.5184259	26	10	-	20.8301252	370.711303	256.518426	-66.7732355	83.4665444	25.9960693	109.462614
11.7171717	200	57.5099772	26	10	-	21.195566	377.21501	257.509977	-69.1546858	86.4433572	26.4521407	112.895498
11.9191919	200	58.5015286	26	10	-	21.5610068	383.718717	258.501529	-71.5775526	89.4719407	26.9082121	116.380153
12.1212121	200	59.4930799	26	10	-	21.9264476	390.222424	259.49308	-74.0418359	92.5522949	27.3642835	119.916578
12.3232323	200	60.4846312	26	10	-	22.2918884	396.726131	260.484631	-76.5475357	95.6844197	27.8203549	123.504775

12.5252525	200	61.4761826	26	10	-	22.6573292	403.229838	261.476183	-79.0946521	98.8683151	28.2764263	127.144741
12.7272727	200	62.4677339	26	10	-	23.02277	409.733545	262.467734	-81.683185	102.103981	28.7324977	130.836479
12.9292929	200	63.4592852	26	10	-	23.3882108	416.237253	263.459285	-84.3131344	105.391418	29.1885691	134.579987
13.1313131	200	64.4508366	26	10	-	23.7536516	422.74096	264.450837	-86.9845004	108.730625	29.6446405	138.375266
13.3333333	200	65.4423879	26	10	-	24.1190924	429.244667	265.442388	-89.6972829	112.121604	30.1007119	142.222315
13.5353535	200	66.4339392	26	10	-	24.4845332	435.748374	266.433939	-92.4514819	115.564352	30.5567833	146.121136
13.7373737	200	67.4254906	26	10	-	24.8499739	442.252081	267.425491	-95.2470974	119.058872	31.0128546	150.071726
13.9393939	200	68.4170419	26	10	-	25.2154147	448.755788	268.417042	-98.0841295	122.605162	31.468926	154.074088
14.1414141	200	69.4085932	26	10	-	25.5808555	455.259495	269.408593	-100.962578	126.203223	31.9249974	158.12822
14.3434343	200	70.4001446	26	10	-	25.9462963	461.763202	270.400145	-103.882443	129.853054	32.3810688	162.234123
14.5454545	200	71.3916959	26	10	-	26.31117371	468.266909	271.391696	-106.843725	133.554656	32.8371402	166.391796
14.7474747	200	72.3832472	26	10	-	26.6771779	474.770616	272.383247	-109.846423	137.308029	33.2932116	170.60124
14.9494949	200	73.3747985	26	10	-	27.0426187	481.274323	273.374799	-112.890538	141.113172	33.749283	174.862455
15.1515152	200	74.3663499	26	10	-	27.4080595	487.77803	274.36635	-115.976069	144.970086	34.2053544	179.17544
15.3535354	200	75.3579012	26	10	-	27.7735003	494.281737	275.357901	-119.103017	148.878771	34.6614258	183.540197
15.5555556	200	76.3494525	26	10	-	28.1389411	500.785444	276.349453	-122.271381	152.839226	35.1174972	187.956723
15.7575758	200	77.3410039	26	10	-	28.5043819	507.289152	277.341004	-125.481162	156.851452	35.5735686	192.425021
15.959596	200	78.3325552	26	10	-	28.8698227	513.792859	278.332555	-128.732359	160.915449	36.02964	196.945089
16.1616162	200	79.3241065	26	10	-	29.2352635	520.296566	279.324107	-132.024973	165.031216	36.4857113	201.516927
16.3636364	200	80.3156579	26	10	-	29.6007043	526.800273	280.315658	-135.359003	169.198754	36.9417827	206.140537
16.5656566	200	81.3072092	26	10	-	29.9661451	533.30398	281.307209	-138.73445	173.418063	37.3978541	210.815917
16.7676768	200	82.2987605	26	10	-	30.3315858	539.807687	282.298761	-142.151314	177.689142	37.8539255	215.543067
16.969697	200	83.2903119	26	10	-	30.6970266	546.311394	283.290312	-145.609593	182.011992	38.3099969	220.321989
17.1717172	200	84.2818632	26	10	-	31.0624674	552.815101	284.281863	-149.10929	186.386612	38.7660683	225.152681
17.3737374	200	85.2734145	26	10	-	31.4279082	559.318808	285.273415	-152.650403	190.813004	39.2221397	230.035143
17.5757576	200	86.2649659	26	10	-	31.793349	565.822515	286.264966	-156.232933	195.291166	39.6782111	234.969377
17.7777778	200	87.2565172	26	10	-	32.1587898	572.326222	287.256517	-159.856879	199.821098	40.1342825	239.955381
17.979798	200	88.2480685	26	10	-	32.5242306	578.829929	288.248069	-163.522241	204.402801	40.5903539	244.993155
18.1818182	200	89.2396199	26	10	-	32.8896714	585.333636	289.23962	-167.22902	209.036275	41.0464253	250.082701
18.3838384	200	90.2311712	26	10	-	33.2551122	591.837343	290.231171	-170.977216	213.72152	41.5024967	255.224017
18.5858586	200	91.2227225	26	10	-	33.620553	598.341051	291.222723	-174.766828	218.458535	41.958568	260.417103
18.7878788	200	92.2142738	26	10	-	33.9859938	604.844758	292.214274	-178.597857	223.247321	42.4146394	265.66196
18.989899	200	93.2058252	26	10	-	34.3514346	611.348465	293.205825	-182.470302	228.087877	42.8707108	270.958588
19.1919192	200	94.1973765	26	10	-	34.7168754	617.852172	294.197377	-186.384164	232.980205	43.3267822	276.306987
19.3939394	200	95.1889278	26	10	-	35.0823162	624.355879	295.188928	-190.339442	237.924303	43.7828536	281.707156

19.5959596	200	96.1804792	26	10	-	35.447757	630.859586	296.180479	-194.336137	242.920171	44.238925	287.159096
19.7979798	200	97.1720305	26	10	-	35.8131977	637.363293	297.172031	-198.374248	247.96781	44.6949964	292.662807
20	200	98.1635818	26	10	-	36.1786385	643.867	298.163582	-202.453776	253.06722	45.1510678	298.218288
20.2020202	200	99.1551332	26	10	-	36.5440793	650.370707	299.155133	-206.57472	258.2184	45.6071392	303.82554
20.4040404	200	100.146685	26	10	-	36.9095201	656.874414	300.146685	-210.737081	263.421352	46.0632106	309.484562
20.6060606	200	101.138236	26	10	-	37.2749609	663.378121	301.138236	-214.940859	268.676073	46.519282	315.195355
20.8080808	200	102.129787	26	10	-	37.6404017	669.881828	302.129787	-219.186053	273.982566	46.9753534	320.957919
21.010101	200	103.121338	26	10	-	38.0058425	676.385535	303.121338	-223.472663	279.340829	47.4314248	326.772254
21.2121212	200	104.11289	26	10	-	38.3712833	682.889242	304.11289	-227.80069	284.750863	47.8874961	332.638359
21.4141414	200	105.104441	26	10	-	38.7367241	689.392949	305.104441	-232.170134	290.212667	48.3435675	338.556235
21.6161616	200	106.095992	26	10	-	39.1021649	695.896657	306.095992	-236.580994	295.726242	48.7996389	344.525881
21.8181818	200	107.087544	26	10	-	39.4676057	702.400364	307.087544	-241.03327	301.291588	49.2557103	350.547298
22.020202	200	108.079095	26	10	-	39.8330465	708.904071	308.079095	-245.526963	306.908704	49.7117817	356.620486
22.2222222	200	109.070646	26	10	-	40.1984873	715.407778	309.070646	-250.062073	312.577591	50.1678531	362.745444
22.4242424	200	110.062198	26	10	-	40.5639281	721.911485	310.062198	-254.638599	318.298249	50.6239245	368.922174
22.6262626	200	111.053749	26	10	-	40.9293689	728.415192	311.053749	-259.256542	324.070677	51.0799959	375.150673
22.8282828	200	112.0453	26	10	-	41.2948096	734.918899	312.0453	-263.915901	329.894876	51.5360673	381.430944
23.030303	200	113.036852	26	10	-	41.6602504	741.422606	313.036852	-268.616677	335.770846	51.9921387	387.762985
23.2323232	200	114.028403	26	10	-	42.0256912	747.926313	314.028403	-273.358869	341.698586	52.4482101	394.146797
23.4343434	200	115.019954	26	10	-	42.391132	754.43002	315.019954	-278.142478	347.678097	52.9042815	400.582379
23.6363636	200	116.011506	26	10	-	42.7565728	760.933727	316.011506	-282.967503	353.709379	53.3603528	407.069732
23.8383838	200	117.003057	26	10	-	43.1220136	767.437434	317.003057	-287.833945	359.792431	53.8164242	413.608856
24.040404	200	117.994608	26	10	-	43.4874544	773.941141	317.994608	-292.741804	365.927254	54.2724956	420.19975
24.2424242	200	118.98616	26	10	-	43.8528952	780.444848	318.98616	-297.691078	372.113848	54.728567	426.842415
24.4444444	200	119.977711	26	10	-	44.218336	786.948556	319.977711	-302.68177	378.352212	55.1846384	433.536851
24.6464646	200	120.969262	26	10	-	44.5837768	793.452263	320.969262	-307.713878	384.642347	55.6407098	440.283057
24.8484848	200	121.960814	26	10	-	44.9492176	799.95597	321.960814	-312.787402	390.984253	56.0967812	447.081034
25	200	122.704477	26	10	-	45.2232982	804.83375	322.704477	-316.619725	395.774657	56.4388347	452.213491

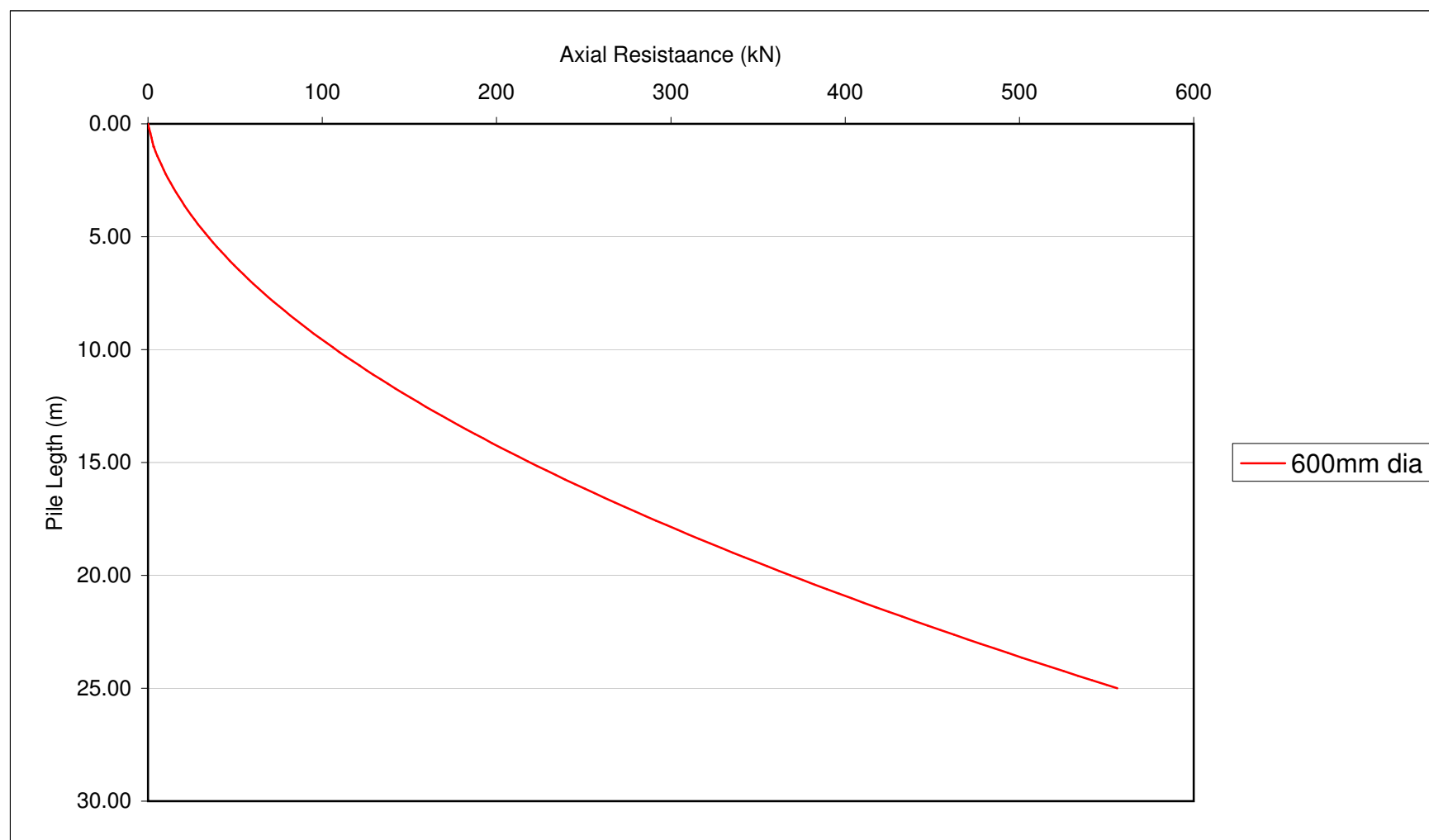


General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	200	0	-	-	-	0	0	200	0	0	0	0
0	200	0	26	10	-	0	0	200	0	0	0	0
0.2020202	200	1.42783392	26	10	-	0	6.50370707	201.427834	0	0	0.6567428	0.6567428
0.4040404	200	2.85566784	26	10	-	0	13.0074141	202.855668	0	0	1.31348561	1.31348561
0.60606061	200	4.28350175	26	10	-	0	19.5111212	204.283502	0	0	1.97022841	1.97022841
0.80808081	200	5.71133567	26	10	-	0	26.0148283	205.711336	0	0	2.62697122	2.62697122
1	200	7.06777789	26	10	-	0	32.19335	207.067778	0	0	3.25087688	3.25087688
1.001	200	7.07484567	26	10	-	1.81074086	32.2255434	207.074846	-0.00060949	0.00076187	3.25412776	3.25488963
1.01010101	200	7.13916959	26	10	-	1.82720397	32.5185354	207.13917	-0.01175395	0.01469244	3.28371402	3.29840646
1.21212121	200	8.56700351	26	10	-	2.19264476	39.0222424	208.567004	-0.28510302	0.35637878	3.94045683	4.2968356
1.41414141	200	9.99483742	26	10	-	2.55808555	45.5259495	209.994837	-0.60815193	0.76018991	4.59719963	5.35738954
1.61616162	200	11.4226713	26	10	-	2.92352635	52.0296566	211.422671	-0.98090067	1.22612583	5.25394243	6.48006827
1.81818182	200	12.8505053	26	10	-	3.28896714	58.5333636	212.850505	-1.40334923	1.75418654	5.91068524	7.66487178
2.02020202	200	14.2783392	26	10	-	3.65440793	65.0370707	214.278339	-1.87549764	2.34437204	6.56742804	8.91180009
2.22222222	200	15.7061731	26	10	-	4.01984873	71.5407778	215.706173	-2.39734587	2.99668234	7.22417085	10.2208532
2.42424242	200	17.134007	26	10	-	4.38528952	78.0444848	217.134007	-2.96889393	3.71111742	7.88091365	11.5920311
2.62626263	200	18.5618409	26	10	-	4.75073031	84.5481919	218.561841	-3.59014183	4.48767729	8.53765646	13.0253337
2.82828283	200	19.9896748	26	10	-	5.11617111	91.051899	219.989675	-4.26108956	5.32636195	9.19439926	14.5207612
3.03030303	200	21.4175088	26	10	-	5.4816119	97.5556061	221.417509	-4.98173712	6.22717139	9.85114206	16.0783135
3.23232323	200	22.8453427	26	10	-	5.84705269	104.059313	222.845343	-5.75208451	7.19010563	10.5078849	17.6979905
3.43434343	200	24.2731766	26	10	-	6.21249349	110.56302	224.273177	-6.57213173	8.21516466	11.1646277	19.3797923
3.63636364	200	25.7010105	26	10	-	6.57793428	117.066727	225.701011	-7.44187878	9.30234848	11.8213705	21.123719
3.83838384	200	27.1288444	26	10	-	6.94337507	123.570434	227.128844	-8.36132567	10.4516571	12.4781133	22.9297704
4.04040404	200	28.5566784	26	10	-	7.30881587	130.074141	228.556678	-9.33047239	11.6630905	13.1348561	24.7979466
4.24242424	200	29.9845123	26	10	-	7.67425666	136.577848	229.984512	-10.3493189	12.9366487	13.7915989	26.7282476
4.44444444	200	31.4123462	26	10	-	8.03969745	143.081556	231.412346	-11.4178653	14.2723316	14.4483417	28.7206733
4.64646465	200	32.8401801	26	10	-	8.40513825	149.585263	232.84018	-12.5361115	15.6701394	15.1050845	30.7752239
4.84848485	200	34.268014	26	10	-	8.77057904	156.08897	234.268014	-13.7040576	17.130072	15.7618273	32.8918993
5.05050505	200	35.6958479	26	10	-	9.13601983	162.592677	235.695848	-14.9217035	18.6521293	16.4185701	35.0706994

5.25252525	200	37.1236819	26	10	-	9.50146063	169.096384	237.123682	-16.1890492	20.2363114	17.0753129	37.3116244
5.45454545	200	38.5515158	26	10	-	9.86690142	175.600091	238.551516	-17.5060947	21.8826184	17.7320557	39.6146741
5.65656566	200	39.9793497	26	10	-	10.2323422	182.103798	239.97935	-18.8728401	23.5910501	18.3887985	41.9798486
5.85858586	200	41.4071836	26	10	-	10.597783	188.607505	241.407184	-20.2892853	25.3616066	19.0455413	44.4071479
6.06060606	200	42.8350175	26	10	-	10.9632238	195.111212	242.835018	-21.7554303	27.1942879	19.7022841	46.896572
6.26262626	200	44.2628514	26	10	-	11.3286646	201.614919	244.262851	-23.2712752	29.089094	20.3590269	49.4481209
6.46464646	200	45.6906854	26	10	-	11.6941054	208.118626	245.690685	-24.8368199	31.0460248	21.0157697	52.0617946
6.66666667	200	47.1185193	26	10	-	12.0595462	214.622333	247.118519	-26.4520644	33.0650805	21.6725125	54.737593
6.86868687	200	48.5463532	26	10	-	12.424987	221.12604	248.546353	-28.1170088	35.1462609	22.3292553	57.4755163
7.07070707	200	49.9741871	26	10	-	12.7904278	227.629747	249.974187	-29.831653	37.2895662	22.9859981	60.2755643
7.27272727	200	51.402021	26	10	-	13.1558686	234.133455	251.402021	-31.595997	39.4949962	23.642741	63.1377372
7.47474747	200	52.829855	26	10	-	13.5213094	240.637162	252.829855	-33.4100408	41.762551	24.2994838	66.0620348
7.67676768	200	54.2576889	26	10	-	13.8867501	247.140869	254.257689	-35.2737845	44.0922307	24.9562266	69.0484572
7.87878788	200	55.6855228	26	10	-	14.2521909	253.644576	255.685523	-37.187228	46.484035	25.6129694	72.0970044
8.08080808	200	57.1133567	26	10	-	14.6176317	260.148283	257.113357	-39.1503714	48.9379642	26.2697122	75.2076764
8.28282828	200	58.5411906	26	10	-	14.9830725	266.65199	258.541191	-41.1632146	51.4540182	26.926455	78.3804732
8.48484848	200	59.9690245	26	10	-	15.3485133	273.155697	259.969025	-43.2257576	54.032197	27.5831978	81.6153948
8.68686869	200	61.3968585	26	10	-	15.7139541	279.659404	261.396858	-45.3380004	56.6725005	28.2399406	84.9124411
8.88888889	200	62.8246924	26	10	-	16.0793949	286.163111	262.824692	-47.4999431	59.3749289	28.8966834	88.2716123
9.09090909	200	64.2525263	26	10	-	16.4448357	292.666818	264.252526	-49.7115856	62.139482	29.5534262	91.6929082
9.29292929	200	65.6803602	26	10	-	16.8102765	299.170525	265.68036	-51.972928	64.96616	30.210169	95.1763289
9.49494949	200	67.1081941	26	10	-	17.1757173	305.674232	267.108194	-54.2839701	67.8549627	30.8669118	98.7218745
9.6969697	200	68.536028	26	10	-	17.5411581	312.177939	268.536028	-56.6447121	70.8058902	31.5236546	102.329545
9.8989899	200	69.963862	26	10	-	17.9065989	318.681646	269.963862	-59.055154	73.8189425	32.1803974	105.99934
10.1010101	200	71.3916959	26	10	-	18.2720397	325.185354	271.391696	-61.5152956	76.8941196	32.8371402	109.73126
10.3030303	200	72.8195298	26	10	-	18.6374805	331.689061	272.81953	-64.0251371	80.0314214	33.493883	113.525304
10.5050505	200	74.2473637	26	10	-	19.0029213	338.192768	274.247364	-66.5846785	83.2308481	34.1506258	117.381474
10.7070707	200	75.6751976	26	10	-	19.368362	344.696475	275.675198	-69.1939196	86.4923995	34.8073686	121.299768
10.9090909	200	77.1030316	26	10	-	19.7338028	351.200182	277.103032	-71.8528606	89.8160758	35.4641114	125.280187
11.1111111	200	78.5308655	26	10	-	20.0992436	357.703889	278.530865	-74.5615015	93.2018768	36.1208542	129.322731
11.3131313	200	79.9586994	26	10	-	20.4646844	364.207596	279.958699	-77.3198421	96.6498026	36.777597	133.4274
11.5151515	200	81.3865333	26	10	-	20.8301252	370.711303	281.386533	-80.1278826	100.159853	37.4343398	137.594193
11.7171717	200	82.8143672	26	10	-	21.195566	377.21501	282.814367	-82.9856229	103.732029	38.0910826	141.823111
11.9191919	200	84.2422011	26	10	-	21.5610068	383.718717	284.242201	-85.8930631	107.366329	38.7478255	146.114154

12.1212121	200	85.6700351	26	10	-	21.9264476	390.222424	285.670035	-88.8502031	111.062754	39.4045683	150.467322
12.3232323	200	87.097869	26	10	-	22.2918884	396.726131	287.097869	-91.8570429	114.821304	40.0613111	154.882615
12.5252525	200	88.5257029	26	10	-	22.6573292	403.229838	288.525703	-94.9135825	118.641978	40.7180539	159.360032
12.7272727	200	89.9535368	26	10	-	23.02277	409.733545	289.953537	-98.019822	122.524778	41.3747967	163.899574
12.9292929	200	91.3813707	26	10	-	23.3882108	416.237253	291.381371	-101.175761	126.469702	42.0315395	168.501241
13.1313131	200	92.8092046	26	10	-	23.7536516	422.74096	292.809205	-104.3814	130.476751	42.6882823	173.165033
13.3333333	200	94.2370386	26	10	-	24.1190924	429.244667	294.237039	-107.636739	134.545924	43.3450251	177.890949
13.5353535	200	95.6648725	26	10	-	24.4845332	435.748374	295.664872	-110.941778	138.677223	44.0017679	182.678991
13.7373737	200	97.0927064	26	10	-	24.8499739	442.252081	297.092706	-114.296517	142.870646	44.6585107	187.529157
13.9393939	200	98.5205403	26	10	-	25.2154147	448.755788	298.52054	-117.700955	147.126194	45.3152535	192.441448
14.1414141	200	99.9483742	26	10	-	25.5808555	455.259495	299.948374	-121.155094	151.443867	45.9719963	197.415863
14.3434343	200	101.376208	26	10	-	25.9462963	461.763202	301.376208	-124.658932	155.823665	46.6287391	202.452404
14.5454545	200	102.804042	26	10	-	26.3117371	468.266909	302.804042	-128.21247	160.265587	47.2854819	207.551069
14.7474747	200	104.231876	26	10	-	26.6771779	474.770616	304.231876	-131.815708	164.769634	47.9422247	212.711859
14.9494949	200	105.65971	26	10	-	27.0426187	481.274323	305.65971	-135.468645	169.335806	48.5989675	217.934774
15.1515152	200	107.087544	26	10	-	27.4080595	487.77803	307.087544	-139.171283	173.964103	49.2557103	223.219814
15.3535354	200	108.515378	26	10	-	27.7735003	494.281737	308.515378	-142.92362	178.654525	49.9124531	228.566978
15.5555556	200	109.943212	26	10	-	28.1389411	500.785444	309.943212	-146.725657	183.407071	50.5691959	233.976267
15.7575758	200	111.371046	26	10	-	28.5043819	507.289152	311.371046	-150.577394	188.221743	51.2259387	239.447681
15.959596	200	112.798879	26	10	-	28.8698227	513.792859	312.798879	-154.478831	193.098538	51.8826815	244.98122
16.1616162	200	114.226713	26	10	-	29.2352635	520.296566	314.226713	-158.429967	198.037459	52.5394243	250.576884
16.3636364	200	115.654547	26	10	-	29.6007043	526.800273	315.654547	-162.430804	203.038505	53.1961671	256.234672
16.5656566	200	117.082381	26	10	-	29.9661451	533.30398	317.082381	-166.48134	208.101675	53.8529099	261.954585
16.7676768	200	118.510215	26	10	-	30.3315858	539.807687	318.510215	-170.581576	213.22697	54.5096528	267.736623
16.969697	200	119.938049	26	10	-	30.6970266	546.311394	319.938049	-174.731512	218.41439	55.1663956	273.580786
17.1717172	200	121.365883	26	10	-	31.0624674	552.815101	321.365883	-178.931148	223.663935	55.8231384	279.487073
17.3737374	200	122.793717	26	10	-	31.4279082	559.318808	322.793717	-183.180484	228.975604	56.4798812	285.455486
17.5757576	200	124.221551	26	10	-	31.793349	565.822515	324.221551	-187.479519	234.349399	57.136624	291.486023
17.7777778	200	125.649385	26	10	-	32.1587898	572.326222	325.649385	-191.828254	239.785318	57.7933668	297.578685
17.979798	200	127.077219	26	10	-	32.5242306	578.829929	327.077219	-196.226689	245.283362	58.4501096	303.733471
18.1818182	200	128.505053	26	10	-	32.8896714	585.333636	328.505053	-200.674824	250.84353	59.1068524	309.950383
18.3838384	200	129.932887	26	10	-	33.2551122	591.837343	329.932887	-205.172659	256.465824	59.7635952	316.229419
18.5858586	200	131.36072	26	10	-	33.620553	598.341051	331.36072	-209.720194	262.150242	60.420338	322.57058
18.7878788	200	132.788554	26	10	-	33.9859938	604.844758	332.788554	-214.317428	267.896785	61.0770808	328.973866

18.989899	200	134.216388	26	10	-	34.3514346	611.348465	334.216388	-218.964362	273.705453	61.7338236	335.439277
19.1919192	200	135.644222	26	10	-	34.7168754	617.852172	335.644222	-223.660996	279.576246	62.3905664	341.966812
19.3939394	200	137.072056	26	10	-	35.0823162	624.355879	337.072056	-228.40733	285.509163	63.0473092	348.556472
19.5959596	200	138.49989	26	10	-	35.447757	630.859586	338.49989	-233.203364	291.504205	63.704052	355.208257
19.7979798	200	139.927724	26	10	-	35.8131977	637.363293	339.927724	-238.049098	297.561372	64.3607948	361.922167
20	200	141.355558	26	10	-	36.1786385	643.867	341.355558	-242.944531	303.680664	65.0175376	368.698202
20.2020202	200	142.783392	26	10	-	36.5440793	650.370707	342.783392	-247.889664	309.862081	65.6742804	375.536361
20.4040404	200	144.211226	26	10	-	36.9095201	656.874414	344.211226	-252.884498	316.105622	66.3310232	382.436645
20.6060606	200	145.63906	26	10	-	37.2749609	663.378121	345.63906	-257.92903	322.411288	66.987766	389.399054
20.8080808	200	147.066894	26	10	-	37.6404017	669.881828	347.066894	-263.023263	328.779079	67.6445088	396.423588
21.010101	200	148.494727	26	10	-	38.0058425	676.385535	348.494727	-268.167196	335.208995	68.3012516	403.510246
21.2121212	200	149.922561	26	10	-	38.3712833	682.889242	349.922561	-273.360828	341.701035	68.9579944	410.65903
21.4141414	200	151.350395	26	10	-	38.7367241	689.392949	351.350395	-278.60416	348.2552	69.6147373	417.869938
21.6161616	200	152.778229	26	10	-	39.1021649	695.896657	352.778229	-283.897192	354.871491	70.2714801	425.142971
21.8181818	200	154.206063	26	10	-	39.4676057	702.400364	354.206063	-289.239924	361.549905	70.9282229	432.478128
22.020202	200	155.633897	26	10	-	39.8330465	708.904071	355.633897	-294.632356	368.290445	71.5849657	439.875411
22.2222222	200	157.061731	26	10	-	40.1984873	715.407778	357.061731	-300.074488	375.09311	72.2417085	447.334818
22.4242424	200	158.489565	26	10	-	40.5639281	721.911485	358.489565	-305.566319	381.957899	72.8984513	454.85635
22.6262626	200	159.917399	26	10	-	40.9293689	728.415192	359.917399	-311.10785	388.884813	73.5551941	462.440007
22.8282828	200	161.345233	26	10	-	41.2948096	734.918899	361.345233	-316.699081	395.873852	74.2119369	470.085789
23.030303	200	162.773067	26	10	-	41.6602504	741.422606	362.773067	-322.340012	402.925015	74.8686797	477.793695
23.2323232	200	164.200901	26	10	-	42.0256912	747.926313	364.200901	-328.030643	410.038304	75.5254225	485.563726
23.4343434	200	165.628734	26	10	-	42.391132	754.43002	365.628734	-333.770974	417.213717	76.1821653	493.395882
23.6363636	200	167.056568	26	10	-	42.7565728	760.933727	367.056568	-339.561004	424.451255	76.8389081	501.290163
23.8383838	200	168.484402	26	10	-	43.1220136	767.437434	368.484402	-345.400734	431.750918	77.4956509	509.246569
24.040404	200	169.912236	26	10	-	43.4874544	773.941141	369.912236	-351.290164	439.112705	78.1523937	517.265099
24.2424242	200	171.34007	26	10	-	43.8528952	780.444848	371.34007	-357.229294	446.536618	78.8091365	525.345754
24.4444444	200	172.767904	26	10	-	44.218336	786.948556	372.767904	-363.218124	454.022655	79.4658793	533.488534
24.6464646	200	174.195738	26	10	-	44.5837768	793.452263	374.195738	-369.256653	461.570817	80.1226221	541.693439
24.8484848	200	175.623572	26	10	-	44.9492176	799.95597	375.623572	-375.344883	469.181103	80.7793649	549.960468
25	200	176.694447	26	10	-	45.2232982	804.83375	376.694447	-379.94367	474.929588	81.271922	556.20151

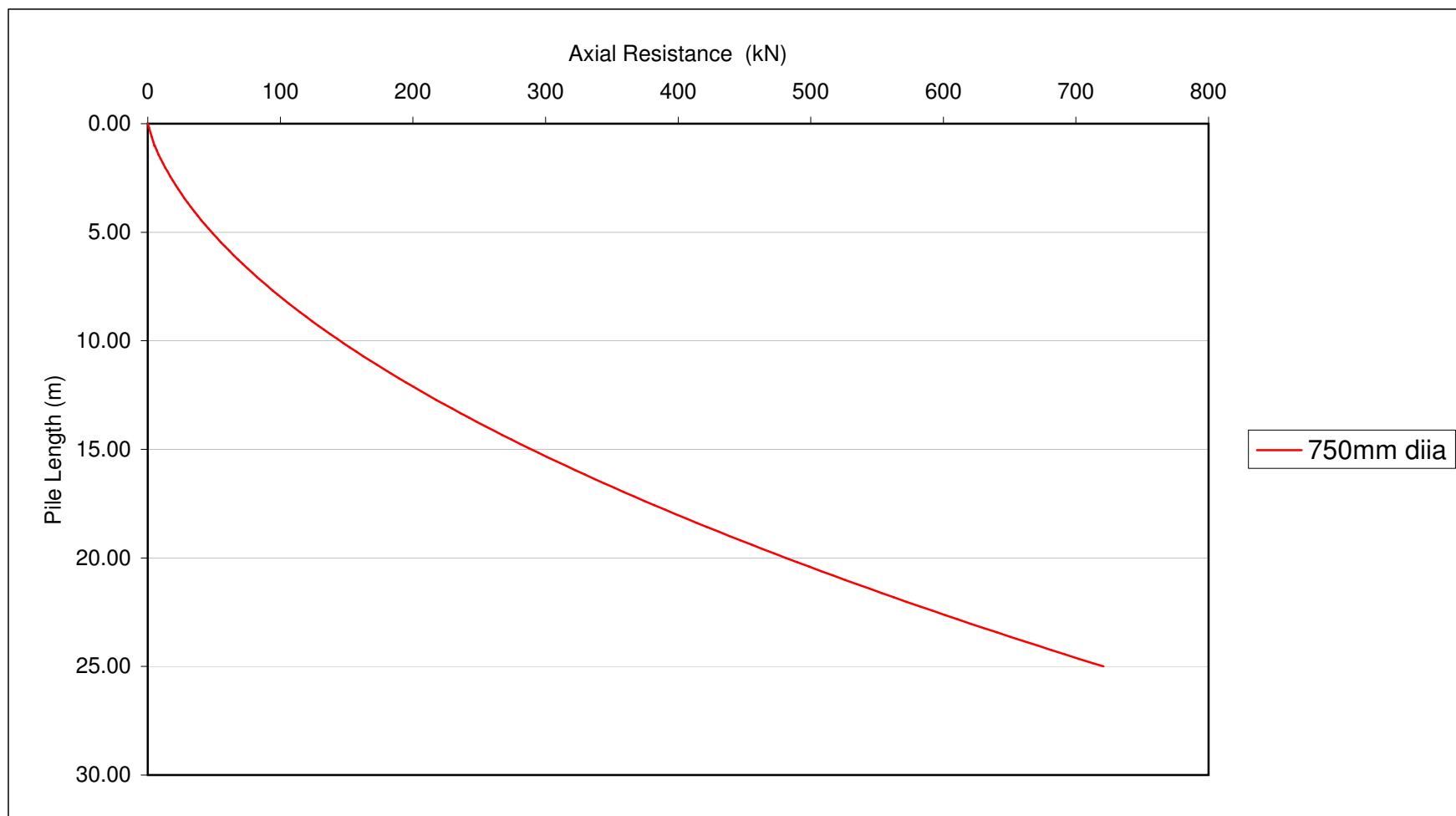


General	Actions		Material Properties			Calculation model		Effects of	Resistance			
	Design values		Design values					Design	Design values			
Depth (m)	F,d (kN)	W,d (kN)	phi,d (°)	c,d (kPa)	cu,d (kPa)	Skin friction (kPa)	Bearing pressure (kPa)	E,d (kN)	Rst,d (kN)	Rs,d (kN)	Rb,d (kN)	Rt,d (kN)
0	200	0	-	-	-	0	0	200	0	0	0	0
0	200	0	26	10	-	0	0	200	0	0	0	0
0.2020202	200	2.2309905	26	10	-	0	6.50370707	202.23099	0	0	1.02616063	1.02616063
0.4040404	200	4.46198099	26	10	-	0	13.0074141	204.461981	0	0	2.05232126	2.05232126
0.60606061	200	6.69297149	26	10	-	0	19.5111212	206.692971	0	0	3.07848189	3.07848189
0.80808081	200	8.92396199	26	10	-	0	26.0148283	208.923962	0	0	4.10464253	4.10464253
1	200	11.043403	26	10	-	0	32.19335	211.043403	0	0	5.07949513	5.07949513
1.001	200	11.0544464	26	10	-	1.81074086	32.2255434	211.054446	-0.00076187	0.00095233	5.08457462	5.08552696
1.01010101	200	11.1549525	26	10	-	1.82720397	32.5185354	211.154952	-0.01469244	0.01836554	5.13080316	5.1491687
1.21212121	200	13.385943	26	10	-	2.19264476	39.0222424	213.385943	-0.35637878	0.44547347	6.15696379	6.60243726
1.41414141	200	15.6169335	26	10	-	2.55808555	45.5259495	215.616933	-0.76018991	0.95023739	7.18312442	8.13336181
1.61616162	200	17.847924	26	10	-	2.92352635	52.0296566	217.847924	-1.22612583	1.53265729	8.20928505	9.74194234
1.81818182	200	20.0789145	26	10	-	3.28896714	58.5333636	220.078914	-1.75418654	2.19273318	9.23544568	11.4281789
2.02020202	200	22.309905	26	10	-	3.65440793	65.0370707	222.309905	-2.34437204	2.93046506	10.2616063	13.1920714
2.22222222	200	24.5408955	26	10	-	4.01984873	71.5407778	224.540895	-2.99668234	3.74585292	11.2877669	15.0336199
2.42424242	200	26.771886	26	10	-	4.38528952	78.0444848	226.771886	-3.71111742	4.63889677	12.3139276	16.9528243
2.62626263	200	29.0028765	26	10	-	4.75073031	84.5481919	229.002876	-4.48767729	5.60959661	13.3400882	18.9496848
2.82828283	200	31.2338669	26	10	-	5.11617111	91.051899	231.233867	-5.32636195	6.65795243	14.3662488	21.0242013
3.03030303	200	33.4648574	26	10	-	5.4816119	97.5556061	233.464857	-6.22717139	7.78396424	15.3924095	23.1763737
3.23232323	200	35.6958479	26	10	-	5.84705269	104.059313	235.695848	-7.19010563	8.98763204	16.4185701	25.4062021
3.43434343	200	37.9268384	26	10	-	6.21249349	110.56302	237.926838	-8.21516466	10.2689558	17.4447307	27.7136866
3.63636364	200	40.1578289	26	10	-	6.57793428	117.066727	240.157829	-9.30234848	11.6279356	18.4708914	30.098827
3.83838384	200	42.3888194	26	10	-	6.94337507	123.570434	242.388819	-10.4516571	13.0645714	19.497052	32.5616234
4.04040404	200	44.6198099	26	10	-	7.30881587	130.074141	244.61981	-11.6630905	14.5788631	20.5232126	35.1020757
4.24242424	200	46.8508004	26	10	-	7.67425666	136.577848	246.8508	-12.9366487	16.1708108	21.5493733	37.7201841
4.44444444	200	49.0817909	26	10	-	8.03969745	143.081556	249.081791	-14.2723316	17.8404146	22.5755339	40.4159485
4.64646465	200	51.3127814	26	10	-	8.40513825	149.585263	251.312781	-15.6701394	19.5876743	23.6016945	43.1893688
4.84848485	200	53.5437719	26	10	-	8.77057904	156.08897	253.543772	-17.130072	21.41259	24.6278552	46.0404451
5.05050505	200	55.7747624	26	10	-	9.13601983	162.592677	255.774762	-18.6521293	23.3151616	25.6540158	48.9691774

5.25252525	200	58.0057529	26	10	-	9.50146063	169.096384	258.005753	-20.2363114	25.2953893	26.6801764	51.9755657
5.45454545	200	60.2367434	26	10	-	9.86690142	175.600091	260.236743	-21.8826184	27.353273	27.7063371	55.05961
5.65656566	200	62.4677339	26	10	-	10.2323422	182.103798	262.467734	-23.5910501	29.4888126	28.7324977	58.2213103
5.85858586	200	64.6987244	26	10	-	10.597783	188.607505	264.698724	-25.3616066	31.7020082	29.7586583	61.4606666
6.06060606	200	66.9297149	26	10	-	10.9632238	195.111212	266.929715	-27.1942879	33.9928599	30.7848189	64.7776788
6.26262626	200	69.1607054	26	10	-	11.3286646	201.614919	269.160705	-29.089094	36.3613675	31.8109796	68.172347
6.46464646	200	71.3916959	26	10	-	11.6941054	208.118626	271.391696	-31.0460248	38.807531	32.8371402	71.6446713
6.66666667	200	73.6226864	26	10	-	12.0595462	214.622333	273.622686	-33.0650805	41.3313506	33.8633008	75.1946515
6.86868687	200	75.8536769	26	10	-	12.424987	221.12604	275.853677	-35.1462609	43.9328262	34.8894615	78.8222877
7.07070707	200	78.0846674	26	10	-	12.7904278	227.629747	278.084667	-37.2895662	46.6119577	35.9156221	82.5275798
7.27272727	200	80.3156579	26	10	-	13.1558686	234.133455	280.315658	-39.4949962	49.3687453	36.9417827	86.310528
7.47474747	200	82.5466484	26	10	-	13.5213094	240.637162	282.546648	-41.762551	52.2031888	37.9679434	90.1711322
7.67676768	200	84.7776389	26	10	-	13.8867501	247.140869	284.777639	-44.0922307	55.1152883	38.994104	94.1093923
7.87878788	200	87.0086294	26	10	-	14.2521909	253.644576	287.008629	-46.484035	58.1050438	40.0202646	98.1253084
8.08080808	200	89.2396199	26	10	-	14.6176317	260.148283	289.23962	-48.9379642	61.1724553	41.0464253	102.218881
8.28282828	200	91.4706103	26	10	-	14.9830725	266.65199	291.47061	-51.4540182	64.3175228	42.0725859	106.390109
8.48484848	200	93.7016008	26	10	-	15.3485133	273.155697	293.701601	-54.032197	67.5402462	43.0987465	110.638993
8.68686869	200	95.9325913	26	10	-	15.7139541	279.659404	295.932591	-56.6725005	70.8406257	44.1249072	114.965533
8.88888889	200	98.1635818	26	10	-	16.0793949	286.163111	298.163582	-59.3749289	74.2186611	45.1510678	119.369729
9.09090909	200	100.394572	26	10	-	16.4448357	292.666818	300.394572	-62.139482	77.6743525	46.1772284	123.851581
9.29292929	200	102.625563	26	10	-	16.8102765	299.170525	302.625563	-64.96616	81.2076999	47.2033891	128.411089
9.49494949	200	104.856553	26	10	-	17.1757173	305.674232	304.856553	-67.8549627	84.8187033	48.2295497	133.048253
9.6969697	200	107.087544	26	10	-	17.5411581	312.177939	307.087544	-70.8058902	88.5073627	49.2557103	137.763073
9.8989899	200	109.318534	26	10	-	17.9065989	318.681646	309.318534	-73.8189425	92.2736781	50.281871	142.555549
10.1010101	200	111.549525	26	10	-	18.2720397	325.185354	311.549525	-76.8941196	96.1176494	51.3080316	147.425681
10.3030303	200	113.780515	26	10	-	18.6374805	331.689061	313.780515	-80.0314214	100.039277	52.3341922	152.373469
10.5050505	200	116.011506	26	10	-	19.0029213	338.192768	316.011506	-83.2308481	104.03856	53.3603528	157.398913
10.7070707	200	118.242496	26	10	-	19.368362	344.696475	318.242496	-86.4923995	108.115499	54.3865135	162.502013
10.9090909	200	120.473487	26	10	-	19.7338028	351.200182	320.473487	-89.8160758	112.270095	55.4126741	167.682769
11.1111111	200	122.704477	26	10	-	20.0992436	357.703889	322.704477	-93.2018768	116.502346	56.4388347	172.941181
11.3131313	200	124.935468	26	10	-	20.4646844	364.207596	324.935468	-96.6498026	120.812253	57.4649954	178.277249
11.5151515	200	127.166458	26	10	-	20.8301252	370.711303	327.166458	-100.159853	125.199817	58.491156	183.690973
11.7171717	200	129.397449	26	10	-	21.195566	377.21501	329.397449	-103.732029	129.665036	59.5173166	189.182352
11.9191919	200	131.628439	26	10	-	21.5610068	383.718717	331.628439	-107.366329	134.207911	60.5434773	194.751388

12.1212121	200	133.85943	26	10	-	21.9264476	390.222424	333.85943	-111.062754	138.828442	61.5696379	200.39808
12.3232323	200	136.09042	26	10	-	22.2918884	396.726131	336.09042	-114.821304	143.52663	62.5957985	206.122428
12.5252525	200	138.321411	26	10	-	22.6573292	403.229838	338.321411	-118.641978	148.302473	63.6219592	211.924432
12.7272727	200	140.552401	26	10	-	23.02277	409.733545	340.552401	-122.524778	153.155972	64.6481198	217.804092
12.9292929	200	142.783392	26	10	-	23.3882108	416.237253	342.783392	-126.469702	158.087127	65.6742804	223.761407
13.1313131	200	145.014382	26	10	-	23.7536516	422.74096	345.014382	-130.476751	163.095938	66.7004411	229.796379
13.3333333	200	147.245373	26	10	-	24.1190924	429.244667	347.245373	-134.545924	168.182405	67.7266017	235.909007
13.5353535	200	149.476363	26	10	-	24.4845332	435.748374	349.476363	-138.677223	173.346529	68.7527623	242.099291
13.7373737	200	151.707354	26	10	-	24.8499739	442.252081	351.707354	-142.870646	178.588308	69.778923	248.367231
13.9393939	200	153.938344	26	10	-	25.2154147	448.755788	353.938344	-147.126194	183.907743	70.8050836	254.712826
14.1414141	200	156.169335	26	10	-	25.5808555	455.259495	356.169335	-151.443867	189.304834	71.8312442	261.136078
14.3434343	200	158.400325	26	10	-	25.9462963	461.763202	358.400325	-155.823665	194.779581	72.8574048	267.636986
14.5454545	200	160.631316	26	10	-	26.3117371	468.266909	360.631316	-160.265587	200.331984	73.8835655	274.215549
14.7474747	200	162.862306	26	10	-	26.6771779	474.770616	362.862306	-164.769634	205.962043	74.9097261	280.871769
14.9494949	200	165.093297	26	10	-	27.0426187	481.274323	365.093297	-169.335806	211.669758	75.9358867	287.605645
15.1515152	200	167.324287	26	10	-	27.4080595	487.77803	367.324287	-173.964103	217.455129	76.9620474	294.417176
15.3535354	200	169.555278	26	10	-	27.7735003	494.281737	369.555278	-178.654525	223.318156	77.988208	301.306364
15.5555556	200	171.786268	26	10	-	28.1389411	500.785444	371.786268	-183.407071	229.258839	79.0143686	308.273208
15.7575758	200	174.017259	26	10	-	28.5043819	507.289152	374.017259	-188.221743	235.277178	80.0405293	315.317707
15.959596	200	176.248249	26	10	-	28.8698227	513.792859	376.248249	-193.098538	241.373173	81.0666899	322.439863
16.1616162	200	178.47924	26	10	-	29.2352635	520.296566	378.47924	-198.037459	247.546824	82.0928505	329.639675
16.3636364	200	180.71023	26	10	-	29.6007043	526.800273	380.71023	-203.038505	253.798131	83.1190112	336.917142
16.5656566	200	182.941221	26	10	-	29.9661451	533.30398	382.941221	-208.101675	260.127094	84.1451718	344.272266
16.7676768	200	185.172211	26	10	-	30.3315858	539.807687	385.172211	-213.22697	266.533713	85.1713324	351.705045
16.969697	200	187.403202	26	10	-	30.6970266	546.311394	387.403202	-218.41439	273.017988	86.1974931	359.215481
17.1717172	200	189.634192	26	10	-	31.0624674	552.815101	389.634192	-223.663935	279.579919	87.2236537	366.803572
17.3737374	200	191.865183	26	10	-	31.4279082	559.318808	391.865183	-228.975604	286.219506	88.2498143	374.46932
17.5757576	200	194.096173	26	10	-	31.793349	565.822515	394.096173	-234.349399	292.936748	89.275975	382.212723
17.7777778	200	196.327164	26	10	-	32.1587898	572.326222	396.327164	-239.785318	299.731647	90.3021356	390.033783
17.979798	200	198.558154	26	10	-	32.5242306	578.829929	398.558154	-245.283362	306.604202	91.3282962	397.932498
18.1818182	200	200.789145	26	10	-	32.8896714	585.333636	400.789145	-250.84353	313.554413	92.3544568	405.90887
18.3838384	200	203.020135	26	10	-	33.2551122	591.837343	403.020135	-256.465824	320.58228	93.3806175	413.962897
18.5858586	200	205.251126	26	10	-	33.620553	598.341051	405.251126	-262.150242	327.687803	94.4067781	422.094581
18.7878788	200	207.482116	26	10	-	33.9859938	604.844758	407.482116	-267.896785	334.870981	95.4329387	430.30392

18.989899	200	209.713107	26	10	-	34.3514346	611.348465	409.713107	-273.705453	342.131816	96.4590994	438.590916
19.1919192	200	211.944097	26	10	-	34.7168754	617.852172	411.944097	-279.576246	349.470307	97.48526	446.955567
19.3939394	200	214.175088	26	10	-	35.0823162	624.355879	414.175088	-285.509163	356.886454	98.5114206	455.397874
19.5959596	200	216.406078	26	10	-	35.447757	630.859586	416.406078	-291.504205	364.380256	99.5375813	463.917838
19.7979798	200	218.637069	26	10	-	35.8131977	637.363293	418.637069	-297.561372	371.951715	100.563742	472.515457
20	200	220.868059	26	10	-	36.1786385	643.867	420.868059	-303.680664	379.60083	101.589903	481.190732
20.2020202	200	223.09905	26	10	-	36.5440793	650.370707	423.09905	-309.862081	387.327601	102.616063	489.943664
20.4040404	200	225.33004	26	10	-	36.9095201	656.874414	425.33004	-316.105622	395.132027	103.642224	498.774251
20.6060606	200	227.561031	26	10	-	37.2749609	663.378121	427.561031	-322.411288	403.01411	104.668384	507.682494
20.8080808	200	229.792021	26	10	-	37.6404017	669.881828	429.792021	-328.779079	410.973849	105.694545	516.668394
21.010101	200	232.023012	26	10	-	38.0058425	676.385535	432.023012	-335.208995	419.011243	106.720706	525.731949
21.2121212	200	234.254002	26	10	-	38.3712833	682.889242	434.254002	-341.701035	427.126294	107.746866	534.87316
21.4141414	200	236.484993	26	10	-	38.7367241	689.392949	436.484993	-348.2552	435.319001	108.773027	544.092028
21.6161616	200	238.715983	26	10	-	39.1021649	695.896657	438.715983	-354.871491	443.589363	109.799188	553.388551
21.8181818	200	240.946974	26	10	-	39.4676057	702.400364	440.946974	-361.549905	451.937382	110.825348	562.76273
22.020202	200	243.177964	26	10	-	39.8330465	708.904071	443.177964	-368.290445	460.363056	111.851509	572.214565
22.2222222	200	245.408955	26	10	-	40.1984873	715.407778	445.408955	-375.09311	468.866387	112.877669	581.744056
22.4242424	200	247.639945	26	10	-	40.5639281	721.911485	447.639945	-381.957899	477.447374	113.90383	591.351204
22.6262626	200	249.870936	26	10	-	40.9293689	728.415192	449.870936	-388.884813	486.106016	114.929991	601.036007
22.8282828	200	252.101926	26	10	-	41.2948096	734.918899	452.101926	-395.873852	494.842315	115.956151	610.798466
23.030303	200	254.332917	26	10	-	41.6602504	741.422606	454.332917	-402.925015	503.656269	116.982312	620.638581
23.2323232	200	256.563907	26	10	-	42.0256912	747.926313	456.563907	-410.038304	512.54788	118.008473	630.556352
23.4343434	200	258.794898	26	10	-	42.391132	754.43002	458.794898	-417.213717	521.517146	119.034633	640.551779
23.6363636	200	261.025888	26	10	-	42.7565728	760.933727	461.025888	-424.451255	530.564069	120.060794	650.624863
23.8383838	200	263.256879	26	10	-	43.1220136	767.437434	463.256879	-431.750918	539.688647	121.086955	660.775602
24.040404	200	265.487869	26	10	-	43.4874544	773.941141	465.487869	-439.112705	548.890882	122.113115	671.003997
24.2424242	200	267.71886	26	10	-	43.8528952	780.444848	467.71886	-446.536618	558.170772	123.139276	681.310048
24.4444444	200	269.94985	26	10	-	44.218336	786.948556	469.94985	-454.022655	567.528318	124.165436	691.693755
24.6464646	200	272.180841	26	10	-	44.5837768	793.452263	472.180841	-461.570817	576.963521	125.191597	702.155118
24.8484848	200	274.411831	26	10	-	44.9492176	799.95597	474.411831	-469.181103	586.476379	126.217758	712.694137
25	200	276.085074	26	10	-	45.2232982	804.83375	476.085074	-474.929588	593.661985	126.987378	720.649363



APPENDIX 10 – RETAINING WALL WORKSHEETS

Gabion analysis

Input data

Project

Task : Dunsbury Hill Gsbion Wall
Descript. : Preliminary Assessment
Author : Dr David Fall
Date : 21/05/2017

Settings

United Kingdom - EN 1997

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Verification methodology : according to EN 1997
Design approach : 1 - reduction of actions and soil parameters

Partial factors on actions (A)					
Permanent design situation					
		Combination 1		Combination 2	
		Unfavourable	Favourable	Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]	1.30 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]		1.00 [-]	

Partial factors for soil parameters (M)				
Permanent design situation				
		Combination 1		Combination 2
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]
Partial factor on Poisson's ratio :	$\gamma_v =$	1.00 [-]		1.00 [-]

Partial factors for variable actions		
Permanent design situation		
Factor for combination value :	$\psi_0 =$	0.70 [-]
Factor for frequent value :	$\psi_1 =$	0.50 [-]
Factor for quasi-permanent value :	$\psi_2 =$	0.30 [-]

Material of blocks - filling

No.	Name	γ [kN/m ³]	ϕ [°]	c [kPa]
1	Class 6G Fill	16.00	35.00	0.00

Material of blocks - mesh

No.	Name	Strength overh. R_t [kN/m]	Spacing of vert. meshes v [m]	Bear.cap. of front joint R_s [kN/m]
1	Class 6G Fill	40.00	1.00	40.00

Geometry of structure

No.	Width b [m]	Height h [m]	Offset a [m]	Material
5	1.20	1.00	0.20	Class 6G Fill
4	1.40	1.00	0.20	Class 6G Fill
3	1.60	1.20	0.20	Class 6G Fill
2	1.80	1.20	0.20	Class 6G Fill
1	2.00	1.20	-	Class 6G Fill

No.	Mesh extension	Length l [m]	Bear.cap. R_t [kN/m ²]	Material
5	NO	-	-	Class 6G Fill
4	YES	5.00	40.00	Class 6G Fill
3	YES	4.00	40.00	Class 6G Fill
2	YES	3.00	40.00	Class 6G Fill
1	YES	2.00	40.00	Class 6G Fill

No.	Mesh extension	Coefficient C [-]	Anchor. length l_k [m]	Bearing capacity T_p [kN/m ²]	Material
5	NO	-	-	-	Class 6G Fill
4	YES	0.80	-	-	Class 6G Fill
3	YES	0.80	-	-	Class 6G Fill
2	YES	0.80	-	-	Class 6G Fill
1	YES	0.80	-	-	Class 6G Fill

Gabion slope = 10.00 °
Overall height = 5.38 m
Overall wall volume = 9.08 m³/m

Soil parameters

London Clay Formation / BSM

Unit weight : γ = 21.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 10.00 kPa
Angle of friction struc.-soil : δ = 16.00 °
Soil : cohesive
Poisson's ratio : ν = 0.30
Saturated unit weight : γ_{sat} = 21.00 kN/m³

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	20.00	London Clay Formation / BSM	
2	-	London Clay Formation / BSM	

Terrain profile

Terrain behind the structure is flat.

Water influence

GWT behind the structure lies at a depth of 1.00 m

GWT in front of the structure lies at a depth of 6.00 m
Subgrade at the heel is permeable.
Hydraulic gradient = 1.11

Input surface surcharges

No.	Surcharge new	change	Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
1	YES		permanent	50.00				on terrain

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction - combination 1

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.350
Active pressure	40.06	-0.85	4.21	2.18	1.350	1.350	1.350
Water pressure	101.92	-1.16	-17.97	2.23	1.350	1.350	1.350
Surch.1 - surface	66.33	-2.05	8.17	2.46	1.350	1.350	1.350
Mesh extension	-40.00	-0.83	0.00	2.89	1.000	1.000	1.000
Mesh extension	-40.00	-2.02	0.00	3.81	1.000	1.000	1.000
Mesh extension	-40.00	-3.20	0.00	4.73	1.000	1.000	1.000
Mesh extension	-36.68	-4.18	0.00	5.50	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 611.09$ kNm/m

Overturning moment $M_{ovr} = 388.56$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 266.65$ kN/m

Active horizontal force $H_{act} = 253.04$ kN/m

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 117.28 kPa

Forces acting on construction - combination 2

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.000
Active pressure	66.42	-1.03	3.62	2.21	1.000	1.000	1.000
Water pressure	101.92	-1.16	-17.97	2.23	1.000	1.000	1.000
Surch.1 - surface	90.31	-2.22	5.32	2.46	1.000	1.000	1.000
Mesh extension	-40.00	-0.83	0.00	2.89	1.000	1.000	1.000

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Mesh extension	-40.00	-2.02	0.00	3.80	1.000	1.000	1.000
Mesh extension	-40.00	-3.20	0.00	4.72	1.000	1.000	1.000
Mesh extension	-36.83	-4.18	0.00	5.49	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 607.37 \text{ kNm/m}$

Overturning moment $M_{ovr} = 386.84 \text{ kNm/m}$

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 242.71 \text{ kN/m}$

Active horizontal force $H_{act} = 231.06 \text{ kN/m}$

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 89.55 kPa

Bearing capacity of foundation soil

Forces acting at the centre of the footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	-117.48	207.34	86.66	0.00	117.28
2	-86.90	157.27	95.35	0.00	92.24

Bearing capacity of foundation soil check

Eccentricity verification

Max. eccentricity of normal force $e = 0.0 \text{ mm}$

Maximum allowable eccentricity $e_{alw} = 660.0 \text{ mm}$

Eccentricity of the normal force is SATISFACTORY

Footing bottom bearing capacity verification

Max. stress at footing bottom $\sigma = 117.28 \text{ kPa}$

Bearing capacity of foundation soil $R_d = 250.00 \text{ kPa}$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Gabion analysis

Input data

Project

Task : Dunsbury Hill Gsbion Wall
Descript. : Preliminary Assessment
Author : Dr David Fall
Date : 21/05/2017

Settings

United Kingdom - EN 1997

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Verification methodology : according to EN 1997
Design approach : 1 - reduction of actions and soil parameters

Partial factors on actions (A)					
Permanent design situation					
		Combination 1		Combination 2	
		Unfavourable	Favourable	Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]	1.30 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]		1.00 [-]	

Partial factors for soil parameters (M)					
Permanent design situation					
		Combination 1		Combination 2	
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]	
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]	
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]	
Partial factor on Poisson's ratio :	$\gamma_v =$	1.00 [-]		1.00 [-]	

Partial factors for variable actions			
Permanent design situation			
Factor for combination value :	$\psi_0 =$	0.70 [-]	
Factor for frequent value :	$\psi_1 =$	0.50 [-]	
Factor for quasi-permanent value :	$\psi_2 =$	0.30 [-]	

Material of blocks - filling

No.	Name	γ [kN/m ³]	ϕ [°]	c [kPa]
1	Class 6G Fill	16.00	35.00	0.00

Material of blocks - mesh

No.	Name	Strength overh. R_t [kN/m]	Spacing of vert. meshes v [m]	Bear.cap. of front joint R_s [kN/m]
1	Class 6G Fill	40.00	1.00	40.00

Geometry of structure

No.	Width b [m]	Height h [m]	Offset a [m]	Material
5	1.20	1.00	0.20	Class 6G Fill
4	1.40	1.00	0.20	Class 6G Fill
3	1.60	1.20	0.20	Class 6G Fill
2	1.80	1.20	0.20	Class 6G Fill
1	2.00	1.20	-	Class 6G Fill

No.	Mesh extension	Length l [m]	Bear.cap. R_t [kN/m ²]	Material
5	NO	-	-	Class 6G Fill
4	YES	5.00	40.00	Class 6G Fill
3	YES	4.00	40.00	Class 6G Fill
2	YES	3.00	40.00	Class 6G Fill
1	YES	2.00	40.00	Class 6G Fill

No.	Mesh extension	Coefficient C [-]	Anchor. length l_k [m]	Bearing capacity T_p [kN/m ²]	Material
5	NO	-	-	-	Class 6G Fill
4	YES	0.80	-	-	Class 6G Fill
3	YES	0.80	-	-	Class 6G Fill
2	YES	0.80	-	-	Class 6G Fill
1	YES	0.80	-	-	Class 6G Fill

Gabion slope = 10.00 °
Overall height = 5.38 m
Overall wall volume = 9.08 m³/m

Soil parameters

London Clay Formation / BSM

Unit weight : γ = 21.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 16.00 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 21.00 kN/m³

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	20.00	London Clay Formation / BSM	
2	-	London Clay Formation / BSM	

Terrain profile

Terrain behind the structure is flat.

Water influence

GWT behind the structure lies at a depth of 1.00 m
GWT in front of the structure lies at a depth of 6.00 m

Subgrade at the heel is permeable.
Hydraulic gradient = 0.00

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	YES		permanent	50.00				on terrain

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction - combination 1

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.350
Active pressure	93.11	-1.48	9.79	2.29	1.350	1.350	1.350
Water pressure	101.92	-1.16	-17.97	2.23	1.350	1.350	1.350
Surch.1 - surface	77.73	-2.41	8.17	2.46	1.350	1.350	1.350
Mesh extension	-40.00	-0.83	0.00	2.96	1.000	1.000	1.000
Mesh extension	-40.00	-2.02	0.00	3.95	1.000	1.000	1.000
Mesh extension	-40.00	-3.20	0.00	4.94	1.000	1.000	1.000
Mesh extension	-32.24	-4.18	0.00	5.77	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 610.39$ kNm/m

Overturning moment $M_{ovr} = 598.24$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 253.19$ kN/m

Active horizontal force $H_{act} = 337.41$ kN/m

Wall for slip is NOT SATISFACTORY

Overall check - WALL is NOT SATISFACTORY

Maximum stress in footing bottom : 356.00 kPa

Forces acting on construction - combination 2

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.000
Active pressure	117.06	-1.48	6.37	2.29	1.000	1.000	1.000
Water pressure	101.92	-1.16	-17.97	2.23	1.000	1.000	1.000
Surch.1 - surface	97.73	-2.41	5.32	2.46	1.000	1.000	1.000
Mesh extension	-40.00	-0.83	0.00	2.96	1.000	1.000	1.000
Mesh extension	-40.00	-2.02	0.00	3.95	1.000	1.000	1.000

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Mesh extension	-40.00	-3.20	0.00	4.94	1.000	1.000	1.000
Mesh extension	-32.24	-4.18	0.00	5.77	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 594.76$ kNm/m

Overturning moment $M_{ovr} = 526.79$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 227.11$ kN/m

Active horizontal force $H_{act} = 287.77$ kN/m

Wall for slip is NOT SATISFACTORY

Overall check - WALL is NOT SATISFACTORY

Maximum stress in footing bottom : 270.86 kPa

Bearing capacity of foundation soil

Forces acting at the centre of the footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	100.31	230.64	172.67	0.64	356.00
2	130.90	180.56	181.36	0.94	1762.93

Bearing capacity of foundation soil check

Eccentricity verification

Max. eccentricity of normal force $e = 941.3$ mm

Maximum allowable eccentricity $e_{alw} = 660.0$ mm

Eccentricity of the normal force is NOT SATISFACTORY

Footing bottom bearing capacity verification

Max. stress at footing bottom $\sigma = 356.00$ kPa

Bearing capacity of foundation soil $R_d = 250.00$ kPa

Bearing capacity of foundation soil is NOT SATISFACTORY

Overall verification - bearing capacity of found. soil is NOT SATISFACTORY

Dimensioning No. 1

Forces acting on construction - combination 1

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-0.39	19.20	0.68	1.000	1.000	1.350
Active pressure	2.87	-0.12	0.30	1.24	1.350	1.350	1.350
Water pressure	0.00	-0.78	0.00	1.36	1.000	1.000	1.000
Surch.1 - surface	13.88	-0.28	1.46	1.27	1.350	1.350	1.350

Verification of the most stressed construction joint - above the block No. 4

Check for overturning stability

Resisting moment $M_{res} = 16.02 \text{ kNm/m}$

Overturning moment $M_{ovr} = 5.79 \text{ kNm/m}$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 17.63 \text{ kN/m}$

Active horizontal force $H_{act} = 18.52 \text{ kN/m}$

Joint for slip is NOT SATISFACTORY

Forces acting on construction - combination 2

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-0.39	19.20	0.68	1.000	1.000	1.000
Active pressure	3.61	-0.12	0.20	1.24	1.000	1.000	1.000
Water pressure	0.00	-0.78	0.00	1.36	1.000	1.000	1.000
Surch.1 - surface	17.45	-0.28	0.95	1.27	1.000	1.000	1.000

Verification of the most stressed construction joint - above the block No. 4

Check for overturning stability

Resisting moment $M_{res} = 14.46 \text{ kNm/m}$

Overturning moment $M_{ovr} = 5.39 \text{ kNm/m}$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 16.59 \text{ kN/m}$

Active horizontal force $H_{act} = 17.21 \text{ kN/m}$

Joint for slip is NOT SATISFACTORY

Verification of gabion block for maximum stress:

Maximum pressure on the bottom block = 34.19 kPa

Red.Coeff. by offset of top block = 0.71

Average value of pressure on face = 11.26 kPa

Shear force transmitted by friction = 22.26 kN/m

Bearing capacity against transverse pressure:

Joint bear.capacity = 40.00 kN/m

Computed stress-state = 5.55 kN/m

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 40.00 kN/m

Computed stress-state = 5.55 kN/m

Joint between blocks is SATISFACTORY

Gabion analysis

Input data

Project

Task : Dunsbury Hill Gsbion Wall
Descript. : Preliminary Assessment
Author : Dr David Fall
Date : 21/05/2017

Settings

United Kingdom - EN 1997

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Verification methodology : according to EN 1997
Design approach : 1 - reduction of actions and soil parameters

Partial factors on actions (A)					
Permanent design situation					
		Combination 1		Combination 2	
		Unfavourable	Favourable	Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]	1.30 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]		1.00 [-]	

Partial factors for soil parameters (M)				
Permanent design situation				
		Combination 1		Combination 2
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]
Partial factor on Poisson's ratio :	$\gamma_v =$	1.00 [-]		1.00 [-]

Partial factors for variable actions		
Permanent design situation		
Factor for combination value :	$\psi_0 =$	0.70 [-]
Factor for frequent value :	$\psi_1 =$	0.50 [-]
Factor for quasi-permanent value :	$\psi_2 =$	0.30 [-]

Material of blocks - filling

No.	Name	γ [kN/m ³]	ϕ [°]	c [kPa]
1	Class 6G Fill	16.00	35.00	0.00

Material of blocks - mesh

No.	Name	Strength overh. R_t [kN/m]	Spacing of vert. meshes v [m]	Bear.cap. of front joint R_s [kN/m]
1	Class 6G Fill	40.00	1.00	40.00

Geometry of structure

No.	Width b [m]	Height h [m]	Offset a [m]	Material
5	1.20	1.00	0.20	Class 6G Fill
4	1.40	1.00	0.20	Class 6G Fill
3	1.60	1.20	0.20	Class 6G Fill
2	1.80	1.20	0.20	Class 6G Fill
1	2.00	1.20	-	Class 6G Fill

No.	Mesh extension	Length l [m]	Bear.cap. R_t [kN/m ²]	Material
5	NO	-	-	Class 6G Fill
4	YES	5.00	40.00	Class 6G Fill
3	YES	4.00	40.00	Class 6G Fill
2	YES	3.00	40.00	Class 6G Fill
1	YES	2.00	40.00	Class 6G Fill

No.	Mesh extension	Coefficient C [-]	Anchor. length l_k [m]	Bearing capacity T_p [kN/m ²]	Material
5	NO	-	-	-	Class 6G Fill
4	YES	0.80	-	-	Class 6G Fill
3	YES	0.80	-	-	Class 6G Fill
2	YES	0.80	-	-	Class 6G Fill
1	YES	0.80	-	-	Class 6G Fill

Gabion slope = 10.00 °
Overall height = 5.38 m
Overall wall volume = 9.08 m³/m

Soil parameters

Class 6I

Unit weight : γ = 18.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 24.00 °
Soil : cohesionless
Saturated unit weight : γ_{sat} = 21.00 kN/m³

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	20.00	Class 6I	
2	-	Class 6I	

Terrain profile

Terrain behind the structure is flat.

Water influence

GWT behind the structure lies at a depth of 1.00 m
GWT in front of the structure lies at a depth of 6.00 m

Subgrade at the heel is permeable.
Hydraulic gradient = 1.50

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	YES		permanent	50.00				on terrain

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction - combination 1

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.350
Active pressure	52.42	-1.45	13.07	2.29	1.350	1.350	1.350
Water pressure	101.92	-1.16	-17.97	2.23	1.350	1.350	1.350
Surch.1 - surface	45.85	-2.41	11.43	2.46	1.350	1.350	1.350
Mesh extension	-40.00	-0.83	0.00	2.78	1.000	1.000	1.000
Mesh extension	-40.00	-2.02	0.00	3.58	1.000	1.000	1.000
Mesh extension	-40.00	-3.20	0.00	4.39	1.000	1.000	1.000
Mesh extension	-40.00	-4.18	0.00	5.06	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 663.74$ kNm/m

Overturning moment $M_{ovr} = 410.87$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 304.35$ kN/m

Active horizontal force $H_{act} = 239.39$ kN/m

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 124.38 kPa

Forces acting on construction - combination 2

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-2.29	145.28	1.59	1.000	1.000	1.000
Active pressure	71.32	-1.45	12.72	2.29	1.000	1.000	1.000
Water pressure	101.92	-1.16	-17.97	2.23	1.000	1.000	1.000
Surch.1 - surface	62.38	-2.41	11.12	2.46	1.000	1.000	1.000
Mesh extension	-40.00	-0.83	0.00	2.78	1.000	1.000	1.000
Mesh extension	-40.00	-2.02	0.00	3.58	1.000	1.000	1.000

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Mesh extension	-40.00	-3.20	0.00	4.39	1.000	1.000	1.000
Mesh extension	-40.00	-4.18	0.00	5.06	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 655.96$ kNm/m

Overturning moment $M_{ovr} = 371.56$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 270.30$ kN/m

Active horizontal force $H_{act} = 205.80$ kN/m

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 94.89 kPa

Bearing capacity of foundation soil

Forces acting at the centre of the footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	-131.70	220.97	70.21	0.00	124.38
2	-101.11	170.90	78.90	0.00	99.34

Bearing capacity of foundation soil check

Eccentricity verification

Max. eccentricity of normal force $e = 0.0$ mm

Maximum allowable eccentricity $e_{alw} = 660.0$ mm

Eccentricity of the normal force is SATISFACTORY

Footing bottom bearing capacity verification

Max. stress at footing bottom $\sigma = 124.38$ kPa

Bearing capacity of foundation soil $R_d = 250.00$ kPa

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Forces acting on construction - combination 1

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.81	106.88	1.36	1.000	1.000	1.350
Active pressure	35.49	-1.06	8.85	2.02	1.350	1.350	1.350
Water pressure	55.55	-0.80	-9.79	1.97	1.350	1.350	1.350
Surch.1 - surface	36.02	-1.85	8.98	2.15	1.350	1.350	1.350
Mesh extension	-40.00	-0.87	0.00	2.58	1.000	1.000	1.000
Mesh extension	-40.00	-2.05	0.00	3.39	1.000	1.000	1.000

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Mesh extension	-40.00	-3.04	0.00	4.06	1.000	1.000	1.000

Verification of the most stressed construction joint - above the block No. 1

Check for overturning stability

Resisting moment $M_{res} = 407.73 \text{ kNm/m}$

Overturning moment $M_{ovr} = 200.94 \text{ kNm/m}$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 222.04 \text{ kN/m}$

Active horizontal force $H_{act} = 148.48 \text{ kN/m}$

Joint for slip is SATISFACTORY

Forces acting on construction - combination 2

Name	F _{hor} [kN/m]	App.Pt. z [m]	F _{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.81	106.88	1.36	1.000	1.000	1.000
Active pressure	48.29	-1.06	8.61	2.02	1.000	1.000	1.000
Water pressure	55.55	-0.80	-9.79	1.97	1.000	1.000	1.000
Surch.1 - surface	49.02	-1.85	8.74	2.15	1.000	1.000	1.000
Mesh extension	-40.00	-0.87	0.00	2.58	1.000	1.000	1.000
Mesh extension	-40.00	-2.05	0.00	3.39	1.000	1.000	1.000
Mesh extension	-40.00	-3.04	0.00	4.06	1.000	1.000	1.000

Verification of the most stressed construction joint - above the block No. 1

Check for overturning stability

Resisting moment $M_{res} = 400.47 \text{ kNm/m}$

Overturning moment $M_{ovr} = 186.53 \text{ kNm/m}$

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 217.50 \text{ kN/m}$

Active horizontal force $H_{act} = 130.66 \text{ kN/m}$

Joint for slip is SATISFACTORY

Verification of gabion block for maximum stress:

Maximum pressure on the bottom block = 101.42 kPa

Red.Coeff. by offset of top block = 0.76

Average value of pressure on face = 30.25 kPa

Shear force transmitted by friction = 127.83 kN/m

Bearing capacity against transverse pressure:

Joint bear.capacity = 40.00 kN/m

Computed stress-state = 16.25 kN/m

Transverse pressure check is SATISFACTORY

Joint btw. blocks check:

Mesh material bear.capacity = 40.00 kN/m

Computed stress-state = 16.25 kN/m

Joint between blocks is SATISFACTORY

