Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton,
Somerset BS39 5XP United Kingdom

[redacted]
www.integrale.uk.com

Proposed Development
Snow Capel
Matson
Gloucester
Gloucestershire
GL4 6EQ

GEOTECHNICAL AND PHASE II CONTAMINATION REPORT

REPORT NO. 1826, August 2017

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

Intégrale is a trading name of Integrale Limited
Registered Office: The Granary, Chewton Fields, Ston Easton,
Somerset, BA3 4BX, United Kingdom
Company Registration No. 2855366 England VAT Reg. No. 609 7402 37

Proposed Development
Geotechnical and Phase II Contamination Report
Snow Capel
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Client: Edward Ware Homes Limited

Intégrale Report No. 1826, August 2017

		Signature/Date
Project Co-ordinator & Report Preparation:	[redacted]	
Report Approved by:	[redacted]	
Final Check by:	[redacted]	

CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

Edward Ware Homes Limited
45 Oakfield Road
Clifton
Bristol
BS8 2AX

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Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

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LIST OF CONTENTS

- EXECUTIVE SUMMARY –

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EXECUTIVE SUMMARY
Geotechnical and Phase II Contamination Report
1826 – Snow Capel, Matson

Edward Ware Homes Limited propose to develop this site with housing. The site contains a scheduled ancient monument, centred around an existing moat, which is excluded from the development area. The site lies adjacent to the M5 motorway. Anecdotally, excavated material from the motorway cutting was deposited across the site.

The geology map reports Lower Lias Clay of Jurassic age. Old maps show open farm land since the 1880s until present date. By the late 1960s/early 1970s, the motorway was constructed adjacent, and it is presumed that the placement of the excavated material must have occurred around these dates. Nearby borehole records available on the BGS website indicate Made Ground comprising firm sandy gravelly Clay from ground level to 0.4/2.5m depth, overlying stiff grey CLAY to 4.2/10.3m depth.

Windowless sampling boreholes and continuous dynamic penetration tests proved a veneer of Topsoil, a variable thickness mantle (1-3.5m) of existing very soft or loosely compact gravelly clay Made Ground, localised soft clayey Alluvium, and a continuous stratum of variably weathered soft through to stiff to very stiff Lower Lias clay. Groundwater stands at 1.5-2.5m depth locally where old drainage ditches or the Moat occur.

The variably weathered Lower Lias Clay is capable of supporting reinforced spread foundations, with design bearing pressures of 100-75kN/m^2 for 1-2m wide foundations at 3-4m depth. Flexible foundation rafts, with continuity of reinforcement and poured monolithically, can even out variations in formation compressibility. A piled foundation is another option. Ground floor slabs should be designed as suspended. Design CBR values of at least 1% onto the clayey Made Ground are feasible. An effective angle of friction (Ø') of 25° is appropriate for the clayey Made Ground and variably weathered Lower Lias Clay. Design Sulphate Class of DS-1 and ACEC Class of AC-1 is recommended for buried concrete, however may require upgrading.

Monitoring to date has encountered significantly raised methane and carbon dioxide within one of the standpipe installations. At these levels (up to approximately 60% and 35% respectively), further borehole installations and monitoring should be completed to provide a robust gas regime classification and/or delineate problem areas.

No specific remedial measures are considered necessary to protect human health or environmental receptors, however, it is anticipated that special gas precautions will be required, pending completion of the recommended supplementary monitoring. Check tests on existing topsoil should be completed to confirm suitability for reuse.

No Radon protection measures are required, however new water supply pipes will require protection.

1.0 INTRODUCTION

Edward Ware Homes Limited *(the client)* are proposing to develop this site with housing.

The site contains a scheduled ancient monument *(SAM)*, which includes a moat. This area is excluded from the development area. The client has commissioned The Environmental Dimension Partnership Limited as project archaeologists.

The site lies adjacent to the M5 motorway. Anecdotally, excavated material from the motorway cutting was deposited across the site. It is not known if the original topsoil was buried, or stripped first.

Integrale Limited *(Intégrale)* are commissioned to undertake a ground investigation and complete a Geotechnical and Phase II Contamination Report. The investigation scope was determined by the client in liaison with Intégrale and the archaeologist.

This interpretative report summarises desk studies, describes the scope of fieldworks, laboratory investigations and monitoring, discusses the ground and groundwater conditions encountered, and gives advice on foundations and other geotechnical aspects. The investigation will also be used to allow the design team to ascertain the need for any archaeological investigation.

The results of contamination analyses and generic quantitative risk assessment are reported and used to establish a conceptual model of pollutant linkages. Potential implications for the development are discussed and recommendations for further investigation and design measures given.

2.0 THE SITE

2.1 Location and Description

As shown in Appendix A, the site is located in agricultural land at Snow Capel, Matson, Gloucester. It has a central Ordnance Survey Grid Reference of SO 851 141 and postcode GL4 6EQ.

Notes describing the site were prepared during the site visit and are included as Appendix B, together with typical photographs. The main features and pertinent aspects on the site and immediately adjacent land are summarised below, and annotated on Figure 1:

Current Use	Open field.
Site Area & Plan Shape	Approximately 7.8 Hectares; Site roughly triangular in shape.
Maximum Dimensions	350m (NW-SE) x 295m (NE-SW).
Ground Slopes & Topography	Site slopes gently from SE (c.61.5mAOD) to NW (50mAOD). The scheduled monument slopes steeply down to form the Moat.
Buildings & Condition	None.
Surfacings & Condition	100% grass/vegetation.
Vegetation & Trees	Site covered in grass and wild flowers. Small copse of trees by Moat.
Water Courses	Small drainage ditch running N-S adjacent to W site boundary. Water level 54.85m AOD Feb 2017. Moat in centre of site.
Site Boundary Features	All four boundaries fence with hedge beyond. Some breaks in hedge on E boundary, framed by fences onto M5 motorway.
Contamination Issues	Thick Made Ground associated with M5 construction anticipated. Potential for anomalous gases and range of contaminants.
Geotechnical Issues	Thick Made Ground may require special foundations.
Other Features	SAM in centre of site, centered around existing Moat.

2.2 Published Geology and Mining

2.2.1 British Geological Survey Mapping

BGS geological maps indicate the following strata beneath and adjacent to the site:

Map / Scale	Sheet 234 (Gloucester) at 1:50,000 scale.
BGS On-Line Viewer	Accessed May 2017.
Artificial Ground	None mapped.
Superficial Deposits	None mapped.
Solid Geology	Lower Lias clay of Jurassic age (known as Charmouth Mudstone Formation).

2.2.2 BGS Previous Investigation Records

Previous investigation records available on the BGS website under the Open Government Licence include boreholes sunk 5m to the east (ref: SO81SE20) and 100m to the south west (ref: SO81SW55). These indicate Made Ground comprising firm sandy gravelly Clay from ground level to 0.4/2.5m depth, overlying stiff grey CLAY to 4.2/10.3m depth. Groundwater details were not given.

2.2.3 Past Coal Mining

The Groundsure Report indicates that the site and surrounding 1000m radius area is not affected by active or historic coal mining.

2.2.4 Other Mining

The Groundsure Report indicates that there are no areas of non-coal mining within a 1000m radius of the site.

2.3 Outline History

Historical maps obtained from a Groundsure Report are included in Appendix C. These indicate the following pertinent information:

Map Date	Site Features / Land Use	Adjacent Features (distance from site)
1883	Site composed of 3 fields. Moat in centre. Footpath running SW to NE.	Site set in agricultural land. Snow Caple farm adjacent to SW.
1884-1901	Footpath running parallel to N boundary.	-
1903-1923	As previous.	Track/road runs N-S adjacent to W boundary.
1924 - 1955	As previous.	Rifle Range 200m S.
1966-1971	As previous.	Motorway constructed adjacent to E boundary in cutting.
1974-1975	Footpath running SW to NE no longer marked.	-
1994-2014	Field boundaries removed	-

2.4 Hydrogeology, Hydrology & Groundwater Vulnerability

Based on the published geological strata, topographic maps showing surface water courses and the Groundwater Vulnerability maps, the following can be anticipated at this site:

Soils Permeability	Low permeability.
Anticipated Groundwater Table Depth	Deep (5-10m+ below ground level). The true groundwater table may well be very deep (10m + BEGL), however, shallow perched water may be encountered within Made Ground.
Anticipated Groundwater Flow Direction	From SE to NW (based on topography).
Surface Water Courses and Flow Direction	Unnamed drain/tertiary river forms W boundary flowing N.
Aquifer Type	Secondary (undifferentiated) aquifer on site.
Environment Agency Soils Classification	Low leaching potential, 133m SE. No information provided for on-site.
Hydraulic Continuity of Groundwater and Water Courses	Unlikely given clayey nature of Lower Lias clay.

2.5 Environmental Information

The following pertinent information on activities within 250m of the site has been extracted from the Groundsure report included in Appendix C.

2.5.1 Pollution Information and Licencing

	Number	Distance from Site
Surface Water Abstractions	0	-
Groundwater Abstractions	1	On site in S apex, for general farming and domestic use, (licence: 18/54/20/0193) issued 1966, referenced as Land at Upton St. Leonards – Well.
Contaminated Land Register Entry/ Enforcement / Prohibition	0	-
Known Pollution to Controlled Waters	0	-
Integrated Pollution Control	0	-
Fuel Station Entry	0	-
Registered Radioactive Substances	0	-
Discharge Consent	1	32m S. Sewage discharges, final/treated effluent.
Known Landfills / Waste Management / Transfer Sites within 250m	0	-
Source Protection Zones	0	-

2.5.2 Geological Information

	Hazard Rating.
Natural and Mining Cavities	Low.
Potential for Shrink/Swell Clays	Low.
Potential for Ground Dissolution	Negligible.
Potential for Landslide Ground Stability Hazard	Very Low (Low 43m SE).
Potential for Compressible Deposits	Negligible.
Potential for Collapsible Deposits	Very Low.
Potential for Running Sands	Negligible.

2.5.3 Background Soils Chemistry

The Groundsure report includes BGS estimated background soil chemistry for 5 metals within shallow soils. This indicates that naturally occurring arsenic and chromium are slightly raised in this area. Interpretation suggests that at these levels, such metals would be unlikely to exceed generic assessment criteria for residential use.

2.5.4 Contemporary Trade Directories

Potentially Contaminative Activities on Site	Historic and current agricultural use.
Potentially Contaminative Business Activities within 250-300m of Site	Livestock farming, 88m NW. Waste pump, 171m W. Electricity substation, 211m N.

2.5.5 Groundsure Radon Risk Information

The Groundsure report indicates that the specific site does not lie within a Radon Affected Area, as less than 1% of the properties are above the action level. No radon protective measures are necessary.

Where Groundsure conclude that no radon gas protection methods are needed, the local authority may have more conservative requirements, based on the indicative maps, and this aspect should be confirmed with their Building Control department.

2.6 Conceptual Exposure Model

This section draws together desk study information, outlines an initial conceptual exposure model, and provides a qualitative assessment of potential contamination via a source-pathway-receptor framework for the proposed redevelopment.

2.6.1 Proposed Redevelopment

The proposed redevelopment will be the subject of an outline planning application. Full details of the proposed redevelopment are not available at the time of writing; however it is understood that the redevelopment may consist of circa 75-85 residential dwellings with conventional gardens. The central area around the scheduled monument will be soft landscaping providing a 25m buffer from the buildings. There will be a public open space/noise bund along the southeastern boundary with the motorway. Access will be provided off Winnycroft Lane along the western boundary, via a loop road around the central public open space. Two soft landscaping 'corridors' are shown on the preliminary drawings in Appendix H; these extend from the loop road to the northern and southeastern boundaries.

Preliminary discussions between the design team indicates that an attenuation pond will be required in the northwestern corner, with storm water drainage being directed to this area, allowing flow at green field levels into the adjacent ditch along the western boundary.

2.6.2 Potential Sources of Contamination

The desk study has been used to identify the likely remnant contaminant sources and distribution. The potential current and historical on- and off-site sources and the contaminants associated with these, derived using CLR8 Potential Contaminants for the Assessment of Land, and through experience of industrial land use, are detailed below.

Potential Contaminants Associated with On-Site Sources			
Description	Metals, semi-metals, non-metals, inorganic chemicals and others	Organic chemicals	Ground Gases & Vapours
Agricultural use	Remnant metals possible, although likely low level. Range of other chemicals locally possible due to long history of farming usage, but unlikely.	Hydrocarbons, PAH's and organic compounds possible locally due to long history of farming usage, but overall unlikely.	Methane, carbon dioxide, hydrogen sulphide possible if buried slurry, animal wastes etc. present locally, but no evidence of this,
Motorway spoil – anecdotally natural soil excavation material from adjacent cutting	Range of potential contaminants could be expected (albeit considered low potential from natural spoil).		Unlikely unless degradable materials (e.g buried topsoil) present.

Potential Relevant Contaminants Associated with Off-Site Sources			
Description	Metals, semi-metals, non-metals, inorganic chemicals and others	Organic chemicals	Ground Gases & Vapours
Agricultural use adjacent to N, W & S	Remnant metals possible, although likely low level. Range of other chemicals locally possible due to long history of farming usage, but unlikely.	Hydrocarbons, PAH's and organic compounds possible locally due to long history of farming usage, but overall unlikely.	Methane, carbon dioxide, hydrogen sulphide possible if buried slurry, animal wastes etc. present locally, but no evidence of this.

2.6.3 Potential Pathways

To understand the potential risks posed by the contaminants to human receptors, the possible contaminant pathways need identified. The CLEA model (DEFRA & EA 2002) indicates potential exposure routes for assessing risks to human health for a residential setting (with home-grown produce uptake) as follows:

- Dermal exposure;
- Inhalation of particulates;
- Inhalation of soil vapour (indoor and outdoor);
- Inhalation of groundwater vapour (indoor and outdoor);
- Direct ingestion of soil;
- Ingestion of home-grown produce and soil attached to vegetables.

The potential pathways with respect to Controlled Waters will include:

- Downward migration through Made Ground and to underlying Secondary (undifferentiated) Aquifer;
- Lateral migration through Made Ground to surface water;
- Lateral migration through groundwater to surface water;
- Lateral migration via man-made pathways (e.g. services) to surface water.

2.6.4 Potential Receptors

For a residential end use and the known neighbouring land uses, the potential receptors to contamination (if present on site) are:

- Immediately adjacent residents – critical receptor female child;
- Construction workers – critical receptor female adult;
- Future site users – critical receptor female child.

The likely sensitive Controlled Waters receptors are considered to be:

- Secondary (undifferentiated) Aquifer in Lower Lias clay on-site;
- Unnamed tertiary river/ditch, along the western boundary;
- Moat, on-site.

Due to the topography of the site, and the underlying thick clay soils, the tertiary river is considered the most likely receptor. The Moat (although a receptor) is isolated and considered less sensitive. Although a groundwater abstraction point is referenced in the southern apex of the site; it is unlikely that this will be used as part of the redevelopment, and the abstraction point would be removed.

3.0 GROUND INVESTIGATION

In view of the anticipated ground conditions, current site layout and proposed redevelopment, the following scope of investigation was completed.

3.1 Lined Sampling Boreholes

8 No. Small diameter boreholes were drilled with a tracked, open-drive percussive lined sampler rig on 24th and 25th May 2017. These borehole locations, chosen by the consulting engineer are shown on Figure 1 and were referenced as WS1-8. Boreholes were sunk to between 2.8 and 4m depth. The general procedures adopted during windowless sampling, together with the detailed borehole records are included in Appendix D.

3.2 Groundwater and Soils Gas Standpipe Installations and Monitoring

Standpipes were installed Boreholes WS1, 3, 5 and 8 to 3m depth, and details are given on the borehole records. Monitoring has been undertaken on two occasions and the results are included in Appendix E, together with the general procedures adopted for installing standpipes.

3.3 Preliminary Geotechnical Laboratory Testing

A schedule of complementary soils testing was prepared by Intégrale and the tests were completed in accordance with BS 1377 (1990) by Geotechnical Engineering Limited. The results are provided in Appendix F and the following shows the testing strategy:

Location	Depth (m)	Stratum	Testing	Criteria for test selection
WS1	2.5	Made Ground	Natural Moisture Content	Soil classification.
WS2	1.5	"	"	"
WS3	2.5	"	Natural Moisture Content, Atterberg Limits	"
WS4	3.5	Weathered Lower Lias	"	"
WS5	2.25	Highly Weathered Lower Lias	BRE (reduced) suite	Concrete classification.
WS7	1.25	Made Ground	Natural Moisture Content, Atterberg Limits	Soil classification.
WS8	2.5	Alluvium	Natural Moisture Content	"

3.4 Contamination Analyses

In view of the desk study and fieldwork findings, a schedule of soils and water analyses was prepared in line with CLR 8. The analyses were completed by Chemtest Limited and the results are provided in Appendix G. The following shows the testing strategy:

Location	Depth (m)	Stratum	Testing	Criteria for Test Selection
WS1	0.5	Made Ground	Generic Suite, Total TPH, Asbestos Screen.	Potential preliminary off site waste classification.
WS5	1.8	"	"	"
WS6	1.4	"	Generic Suite, Total TPH	Check contamination testing
WS8	0.6	"	"	"

3.5 Referencing

Locations of the exploratory positions were set out using taped offsets from existing features, and ground level estimated from spot heights on the topographic survey.

4.0 GROUND & GROUNDWATER CONDITIONS

4.1 Summary of Strata Encountered

The strata encountered across the site are broadly similar, they can be summarised as follows:

Depth (m)	Description
GL to 0.15/0.25	Grass over TOPSOIL.
0.15/0.25 to 1.5/3.5	MADE GROUND: (comprising very loosely and loosely compact grey-brown, brown and dark grey-green, locally black and orange-brown slightly gravelly silty Clay. Rare pockets of buried topsoil).
1.5/3.5 to 2.5/3.9	Soft to firm locally soft brown and grey-brown slightly silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
2.5/3.9 proven to 4.0	Firm becoming firm to stiff and stiff grey-brown and dark grey slightly silty CLAY with occasional lithorelicts. (WEATHERED LOWER LIAS)

Alluvium was encountered in WS1 and WS8 overlying the variably weathered Lower Lias soils. This comprised very soft or soft clay with pieces of wood and organic material.

A buried topsoil pocket was encountered at 1.45-1.55m within WS2, but it is not clear whether this is a wider horizon on layer.

4.2 Strata Properties

4.2.1 Made Ground / Topsoil

Made Ground was proven in all of the exploratory positions and can be categorised as:

Made Ground Type/Location	Reworked Clay Site wide.
Min/Max. thickness (m)	1.25/3.15
Main Constituents	Silt, mudstone gravel, **Clay**, pockets of buried topsoil.
Properties	Cohesive Very loosely and loosely compact, N100 = 0-1 typically.
Moisture Content / Atterberg Limits	MC = 42.3-42.9 (and 29.9%) LL = 62-76% PL = 28-40% PI = 34-36% Organic Clay of High to Very High Plasticity *(note: although the atterberg plot line given in Appendix F indicates that the sample at 2.5m is below the A-Line, the lab note independently that this is caused by organic material, and the sample should be treated as Clay).* Medium Volume Change Potential.
Visual Contamination / Odours	None.

Topsoil, typically 150-250mm thick, was proven in all of the exploratory positions.

The Made Ground is thickest at WS2 & 3 in the southern area, followed by WS1 & 4 centrally. The thinner Made Ground to only 1.5m depth occurs in WS7 & 8 on the north eastern boundary.

4.2.2 Alluvium

For the purposes of this report Alluvium has locally been defined where the natural ground is very soft and compressible, with pieces of rotten wood, and organic material. The properties can be summarised as:

Stratum	Alluvium
Min/Max. thickness (m)	0.1/1.2
Soil Strength / Properties	Very soft or soft: N100 = typically 0-1.
Occurrence	WS1 and WS8 only.
Moisture Content	MC = 28.2%
Visual Contamination / Odours	None.

WS1 is anomalous and appears to show Made Ground of excavated Lias clay to 2.3/2.7m overlying a drainage ditch or potentially the Medieval Moat. This may extend to 4m depth before consistently firm Lias Clay is inferred in the CDPT hole. There may have been a system of drainage ditches to maintain water levels in the Moat which are now backfilled at WS1 & WS8.

4.2.3 Variably Weathered Lower Lias Clay

For the purposes of this report, the typical uppermost horizon of natural ground has been defined as Highly Weathered where soft or soft to firm clays with little or no extraneous material were observed. The deeper soils have been defined as Weathered where becoming firm, firm to stiff and locally stiff. The CDPTs identified very stiff soils at depth. The properties can be summarised as:

Stratum	Highly Weathered Lower Lias	Weathered Lower Lias
Min/Max. thickness (m)	0.3/1.8	0.1/1.5
Soil Strength/ Properties	Soft: N100 = 1-2 Soft to firm: N100 = 2-3	Firm: N100 = 2-4 Firm to stiff: N100 = 4-5 Stiff: N100 = 5-10 Very stiff: N100 = 10-19
Occurrence	WSs 2, 3 & 5-8.	Site wide.
Moisture Content / Atterberg Limits	-	MC = 29.1% LL = 66% PL = 27% PI = 39% Clay of High Plasticity Medium Volume Change Potential.
Sulphate /pH	pH = 7.9 Water sol. Sulphate = 0.066g/l Total Sulphur = 0.035% Acid Sol. Sulphate = 0.035%	-

Visual Contamination/ Odours	None.	None.

4.3 Groundwater

Groundwater was only encountered during drilling in WS1 at 2.6m depth. The following groundwater levels were encountered during the subsequent monitoring visits on 7th and 13th July 2017:

	07/07/2017	13/07/2017
	Depth below existing ground level (m)	Depth below existing ground level (m)
WS1	1.55	1.58
WS3	1.34	1.29
WS5	Dry	Dry
WS8	2.64	2.57

Groundwater appears to stand near the base of the Made Ground (presumably perched on the underlying insitu impermeable Lower Lias clay). In WS8, the standing water level appears to be near the base of the localised Alluvium deposits, again overlying the Lias.

It is noted that the reduced elevation of the standing water in WS1 & WS8 at 55-56m AOD, is similar to that recorded in the western drainage ditch at 54.9m AOD (February 2017).

4.4 Ground Gas

The preliminary monitoring indicates (locally) very high levels of carbon dioxide (35.2-35.7%) and methane (61.1-61.6%) within WS1. WS3 encountered lower, but still significant raised levels of the both gases (7.1-8.5% and 2.8-2.9% respectively). WS's 5 and 8 recorded only trace levels of methane (0.1-0.3% volume) and slightly elevated carbon dioxide (3.5-4.2%).

Typically, no gas flow was encountered, except within WS1 and WS8, where a maximum of 0.1l/hr was recorded. No VOCs were present in the standpipes.

WS1 proved organic Alluvium at the base of the borehole, and is considered the likely source of such high methane and carbon dioxide. No obvious source (except for Made Ground) was noted in WS3. At WS8 Alluvium was also proven, but the gas regime appears only slightly abnormal.

Summary results are detailed below with full information provided in Appendix E.

Exploratory Location	WS1	WS3	WS5	WS8
Response Zone (m) / Strata	0.7-2.7m (Made Ground & Alluvium)	1-2m (Made Ground)	1-3m (Made Ground & Lias)	1-3m Made Ground, Alluvium & Lias)
Evidence of Contamination	None	None	None	None
Monitoring Visits (No.)	2	2	2	2
Methane (%)	61.1-61.6%	2.8-2.9%	0.2-0.3%	0.0-0.1%
Carbon Dioxide (%)	35.2-35.7%	7.1-8.5%	3.8-4%	3.5-4.2%
Oxygen (%)	3.8-5%	16.4-17%	18.3-18.6%	18.9-20%
Gas Flow (litres/hr)	0.0-0.1%	0.0	0.0	0.0-0.1
Water levels (m)	1.55-1.58	1.29-1.34	Dry	2.57-2.64
Atmospheric Pressure Range (mb)	1010-1014	1010-1014	1010-1014	1010-1014

5.0 GEOTECHNICAL CONSIDERATIONS

5.1 Scheme Details & Structural Loadings

The proposed development will be constructed at existing grade. According to the recent architects layout the development is to comprise approximately 90 residential properties, assumed to be of either timber framed or load bearing masonry construction.

Foundation line loads could be between 75-200kN/m run. Combined 'dead' and 'live' loading on the ground floor slabs should be less than 10kN/m^2.

The development will also include access and estate roads, car parking, conventional gardens, and managed communal soft landscaping, as shown on preliminary sketch in Appendix H.

5.2 Site Preparation and Earthworks

Topsoil, typically 120-250mm thick, and any localised areas of particularly poor quality Made Ground, should be removed from beneath proposed building and hardstanding areas. Excavations to at least 3.5m depth are should generally be feasible with conventional soils excavating machinery. Pneumatic tools may be required locally to break out existing foundations, or similar buried masonry obstructions.

Much of the spoil resulting from excavations in the existing Made Ground may well be unsuitable for reuse as structural fill.

Whilst some excavations to 2.5m depth may remain dry, other shallow excavations could encounter slight or moderate infiltration and perched groundwater seepages. Such excavations can be kept dry by intermittent pumping from a convenient sump.

Temporary excavations in the existing Made Ground and variably weathered Lower Lias clay will probably stand unsupported in the short term at gradients of about 1 on 2.5. Excavations below approximately 1m depth will require sheeting and shoring, particularly if personnel are to enter.

Formations in the clayey Made Ground and natural ground will be very susceptible to deterioration due to site traffic and weather and should be protected immediately on exposure with 200mm of granular material, or 100mm of lean mix concrete.

All desiccated and root invaded clayey soils should be excavated and made good with well compacted granular material.

Attention is drawn to the old field boundary lines shown on historical maps and up until the 1990's. Anomalous ground conditions and/or gas regime could be present along these lines.

5.3 Foundations and Ground Floor Slabs

5.3.1 Typical Ground Conditions

The investigation has proven a veneer of Topsoil, a variable thickness mantle (1-3.5m) of existing very soft or loosely compact gravelly clay Made Ground, localised soft clayey Alluvium, and a continuous stratum of variably weathered soft to firm becoming firm to stiff then stiff to very stiff Lower Lias clay.

A localised perched groundwater table appears to be at typically 1.5-2.5m depth. Consequently the variably weathered Lower Lias clay can provide an adequate bearing stratum for mesh reinforced strip footings.

5.3.2 Design Bearing Pressures for Strip and Pad Footings

The following design bearing pressures are given for guidance:

Depth (m) BEGL	Stratum (SPT 'N')	Design Bearing Pressure kN/m²)	
		1m*	2m*
3-4m	Firm WLL (N = 10-12)	100	75
4.5-5.5	Firm to stiff WLL (N = 15-20)	175	150

Notes: * Indicates width of foundation
(WLL = Weathered Lower Lias clay)

At the intensities of loading given above, total settlements should not exceed 25mm, with angular rotation along a typical 10m long mesh reinforced strip footing of not worse than 1 in 500. There will be variations in formation compressibility and consequently mesh reinforcement should be included in all footings to even out those variations in formation performance.

In view of the poor quality soft compressible and variable thickness of shallow to moderate depth of clayey Made Ground soils at this site, the requirement for 'deep' trench fill or strip footings, may prove to be economically unattractive.

Indeed, deep strip footings may result in large quantities of excavation spoil and unless this surplus material can be relocated safely on-site, consideration may need to be given to an alternative foundation solution such as short piles.

5.3.3 Other Shallow Reinforced Spread Foundations

In view of the above, consideration may need to be given to the adoption of a 'flexible' foundation raft. The term flexible raft can apply to a substructure, where there is continuity of reinforcement, poured monolithically, but where the intensity of loading on the underside varies. This type of raft is relatively inexpensive.

5.3.4 Ground Improvement

Consideration could be given to ground improvement of the clayey Made Ground and uppermost weathered Lower Lias clay by the application of vibro replacement (stone columns) of these relatively cohesive and poor quality shallow depth soils to reduce the anticipated settlement beneath flexible foundation rafts, as recommended by NHBC. Further advice should be sought from special vibro contractors.

5.3.5 Piles

In view of the above, consideration could be given to the adoption of piled foundations and a wide range of both driven and bored piles could be suitable in the ground conditions proven at this site.

Experienced piling contractors should be provided with a copy of this report and asked to demonstrate the suitability of their preferred pile type in the ground conditions proven. Intégrale would welcome the opportunity of reviewing those proposals and commenting on the specialist contractors preferred pile types.

5.3.6 Ground Floor Slabs

Ground floor slabs should be designed as suspended. In line with NHBC guidelines, suspended ground floor slabs (e.g. 'beam and block' type or similar) should be adopted where the slab will be underlain by 600mm or more of 'non-engineered' Made Ground.

Ground bearing floor slabs may be adopted following satisfactory ground improvement by vibro-replacement.

5.3.7 Inspections

All foundation, ground slab and other substructure foundations should be checked and approved by a suitably qualified and experience engineer or geotechnical specialist.

5.4 Pavement Design

The equivalent CBR strength of anticipated pavement formations has been judged on the basis of past experience in similar materials. The following tentative design values are given for guidance:

Stratum	Design CBR	Typical Depth (m) BEGL
Clayey Made Ground	1-2%	0.5-1.5m
Firm WLL	2%	Below 2m

It would be prudent to allow a contingency for treating 'soft-spots' equivalent to 25% of the proposed hardstanding area to a depth of typically 500mm. All soft spots should be excavated and replaced with suitable well compacted granular material.

Where there could be rapid variations in formation strength, consideration should be given to a sandwiched geogrid construction which will help even out those variations to within acceptable limits. Intégrale can give further guidance on request.

5.5 Earth Pressures and Retaining Walls

Foundations for retaining walls can be based on the allowable design bearing pressures given in section 5.3.2. Earth pressures may be calculated assuming the following effective shear strength parameters:

Stratum	Effective Cohesion C' (kN/m^2)	Effective Angle of Friction $Ø'$ (degrees)	Bulk Density (Mg/m^3)
Clayey Made Ground	Zero	25°	1.85
Firm WLL	Zero	25°	1.85

5.6 Protection of Buried Concrete

In line with BRE Special Digest 1:2005 'Concrete in Aggressive Ground', a single sample of variably weathered Lower Lias clay was tested for water soluble sulphate, total acid soluble sulphate, total sulphur and pH. The results are reported in Appendix F.

The desk study and ground investigation indicate the site can be categorised as being:

- Natural ground likely to contain pyrites;
- Mobile groundwater conditions, as water will flow into excavations or is percolating slowly through the ground.

Strictly in accordance with the guidance, the number of tests completed is insufficient to fully categorise this type of site and the design team should consider whether further analysis should be completed.

The result for water soluble sulphate was 0.066g/l, and pH was 7.9. The results for total acid soluble sulphate (0.035%) and total sulphur (0.035%) indicate pyrite is not present in the tested samples. It is therefore recommended that a Design Sulphate Class of DS-1 and an ACEC Class of AC-1 be adopted for budgeting purposes.

However, based on past experience within similar ground conditions, higher soluble sulphate values / total potential sulphate values could be anticipated. Sugary gypsum crystals are noted on some of the soil descriptions. Unless a greater number of tests are completed, it may therefore be prudent to upgrade the concrete protection. Intégrale can give further advice if required.

6.0 GENERIC QUANTITATIVE CONTAMINATION ASSESSMENT

6.1 Summary of Soils Results with Respect to Human Health

The conceptual model based on the source-pathway-receptor linkages is summarised as:

SOURCE		PATHWAY		RECEPTOR
Contaminated soils	→	Dermal exposure	→	On-site female child
Contaminated soils	→	Inhalation of soil dust	→	On-site female child
Contaminated soils	→	Indoor inhalation of soil vapour	→	On-site female child
Contaminated soils	→	Outdoor inhalation of soil vapour	→	On-site female child
Contaminated soils	→	Direct ingestion of soil	→	On-site female child
Contaminated soils	→	Ingestion of home-grown produce and soil attached to vegetables	→	On-site female child

A generic risk assessment has been undertaken by comparing proven concentrations of contaminants against generic assessment (or screening) criteria (AC).

The AC adopted are the published LQM/CIEH Suitable For Use Levels (S4UL's), for a generic *residential with plant uptake* end-use, adopted under licence no. 3580. These provide a precautionary approach, based on the principle of minimal or tolerable risk, but relying on conservative values for soil type (sandy loam) and organic matter contents of 1, 2.5 or 6% as appropriate. Where no S4UL is published, e.g. lead, the alternative AC is the most recently published industry standard value.

If the proven contaminant concentration is less than the respective AC, it is considered there is no significant risk to human health from these substances.

6.1.1 Generic Human Health Assessment

No contaminants were present in the analysed samples in excess of the relevant assessment criteria.

6.2 Summary of Soils Results with Respect to Phytotoxicity

No substances were present in the analysed samples in excess of the phytotoxic criteria.

6.3 Summary of Soils Results with Respect to WRAS

The soil samples which exceeded the Water Regulations Advisory Scheme (WRAS) guidance on water supply pipes are:

Standard	Substance	Stratum	Depth BEGL	Area / Zone
WRAS	Arsenic, chromium	Made Ground	0.5-1.8	WSs 1, 5, 6 & 8

This suggests that new water pipes laid through the Made Ground will need to be protective against chemical attack. Requirements should be confirmed with the water supply company.

6.4 Controlled Waters

6.4.1 Conceptual Model

The assessment of risks to controlled waters follows guidance provided by the Environment Agency, including their Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (2006). The conceptual site model has been developed based on the source-pathway-receptor linkages

identified during the desk study and fieldworks. Possible sources, pathways and receptors have been assessed, which identifies the potential pollutant linkages as:

Source Pathway Receptor Linkages for Controlled Waters Risk Assessment

SOURCE		PATHWAY		RECEPTOR
Contaminated soils	→	Leaching from soils or migration of liquid contaminants through the unsaturated zone.	→	Perched water
Contaminated soils	→	Leaching from soils or migration of liquid contaminants through the unsaturated zone.	→	Groundwater
Contaminated soils	→	Leaching from soils or migration of liquid contaminants through service runs	→	Adjacent tertiary river along western boundary
Perched water contamination	→	Transport in groundwater	→	Adjacent tertiary river along western boundary
Groundwater contamination	→	Transport in groundwater	→	Adjacent tertiary river along W boundary
Groundwater contamination	→	Transport in groundwater	→	Abstraction point in S apex of site

The conceptual site model indicates that the tertiary river along the western boundary is the most sensitive controlled waters receptor.

The soils analyses have identified no elevated substances which would pose a risk to human health receptors, as summarised above; it is tentatively inferred that groundwater or leachate testing is unlikely to be necessary based on these results. No obvious impact to groundwater has been identified.

6.5 Gas Mitigation

Based on the maximum gas flow and methane/carbon dioxide results, a gas screening value would identify a Gas Regime as Characteristic Situation 1. For low-rise residential buildings this suggests a Green protection level is required in line with the NHBC Traffic Light system. However, typical gas concentrations for these classifications would be up to 1% methane and 5% carbon dioxide. For the purposes of this report it is tentatively assumed the redevelopment will consist solely of traditional low rise housing.

The monitoring has recorded significantly elevated methane and carbon dioxide (up to 61% and 38% respectively) at one location. These concentrations would typically be encountered within a Red protection level for low rise housing. These high elevations were only encountered within WS1; the remaining locations recorded methane and carbon dioxide up to about 3% and 9% respectively. These concentrations would place the gas regime as Amber 1.

Clearly, the gas regime across the site varies dramatically depending on the underlying ground conditions. It should be noted that the monitoring has been completed in relatively intermediate to high atmospheric pressures (1010-1014mb), thus less favourable gas flow and volumes could be anticipated during lower pressures i.e. 995-1000mb. In addition, the worst case readings were taken from one location, which could be a localised 'hotspot' in comparison with the larger site.

In line with CIRIA C665, standard residential housing would not normally be acceptable without a further gas risk assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

Given the size of the site, the relatively large spacing between investigation locations, and monitoring to date, consideration should be given to installing a system of additional borehole standpipes on a closer spacing beneath the areas for proposed housing. This should allow a robust gas assessment to be completed for the site; it may be possible to define the Red protection area, thus requiring a lesser protection level on other parts of the site.

These standpipes should be monitored on a monthly basis over a 3-6 month period to fully assess the site, ensuring that monitoring is completed within a period of low atmospheric pressure. Intégrale can provide further assistance on request.

Based on these results, it is assumed that both active and passive gas protection measures could be required locally. Where a more normal regime is confirmed, a lesser degree of protection seems likely.

6.6 Conceptual Exposure Model & Risk Assessment

The potential hazards and risks from soils, water and gas contamination have been developed as a Conceptual Exposure Model, based on desk studies, proven ground conditions, analytical and monitoring results and the proposed redevelopment. Substances actually proven, or strongly suspected present, have been assessed against potential exposure pathways and available receptors.

The following hazard-pathway-receptor linkages are therefore established for this site:

- Methane and carbon dioxide are present which will potentially pose a risk to future occupiers of the buildings.
- Sulphates and acids present could potentially pose a risk to building materials.
- WRAS contaminant threshold concentrations are exceeded in the Made Ground.

6.7 Recommendations

6.7.1 For Protection of Human Health

Based on the generic screening assessment undertaken to date, the following remedial works and measures will be necessary to protect the health of groundworkers, neighbours, future occupiers and visitors:

a) Install additional borehole standpipes and complete further monitoring to confirm the range of soil gas regimes, allow design and installation of anti-gas measures for houses and garages.
b) Advice and protection to groundworkers during excavations. Based on the monitoring, groundworkers may require suitable respiratory protective equipment (RPE) if entering excavations, depending on the results of further monitoring.

No soil contamination has been identified to date that would pose a risk to human health. Therefore new garden cover systems should not be required, and a minimum of 150mm certified topsoil would only be needed. Validation criteria for any imported topsoil should be agreed with the regulator. It would be prudent to complete further testing of existing topsoil during the installation of additional borehole standpipes to confirm whether the on-site material is suitable for reuse.

6.7.2 For Protection of Groundwater / Surface Water

Controlled Water receptors do not appear to be at risk, as no impact to soils has been identified during the current investigation. Therefore it seems that no further remedial works or measures would be required. During the construction phase, the workers should have adequate precautions in place for minimising chemical spills/leaks.

6.7.3 For Protection of Building Materials & Services

To protect new building materials the following precautions will be necessary:

a) Specification of appropriate concrete protection for the sulphate/pH environment, as detailed in Section 5.
b) Use of protective pipework for all water supplies.

6.7.4 For Protection of New Vegetation

Based on the analyses to date, no remedial measures are required for new planting.

6.7.5 Reuse and Disposal of Surplus Spoil

Surplus spoil from excavations must be categorised and stockpiled as either suitable for reuse, contaminated for selective reuse and/ or treatment, or contaminated for disposal off-site and/ or treatment.

Should soils need removal to a suitably licensed tip, waste characterisation and classification in accordance with the Environment Agency's Technical Guidance will need to be undertaken to comply with the Duty of Care. Consideration should be given to whether it will be a requirement to prepare a Materials Management Plan for all soils excavation, reuse or disposal.

6.7.6 Recommended Further Investigation and Assessment

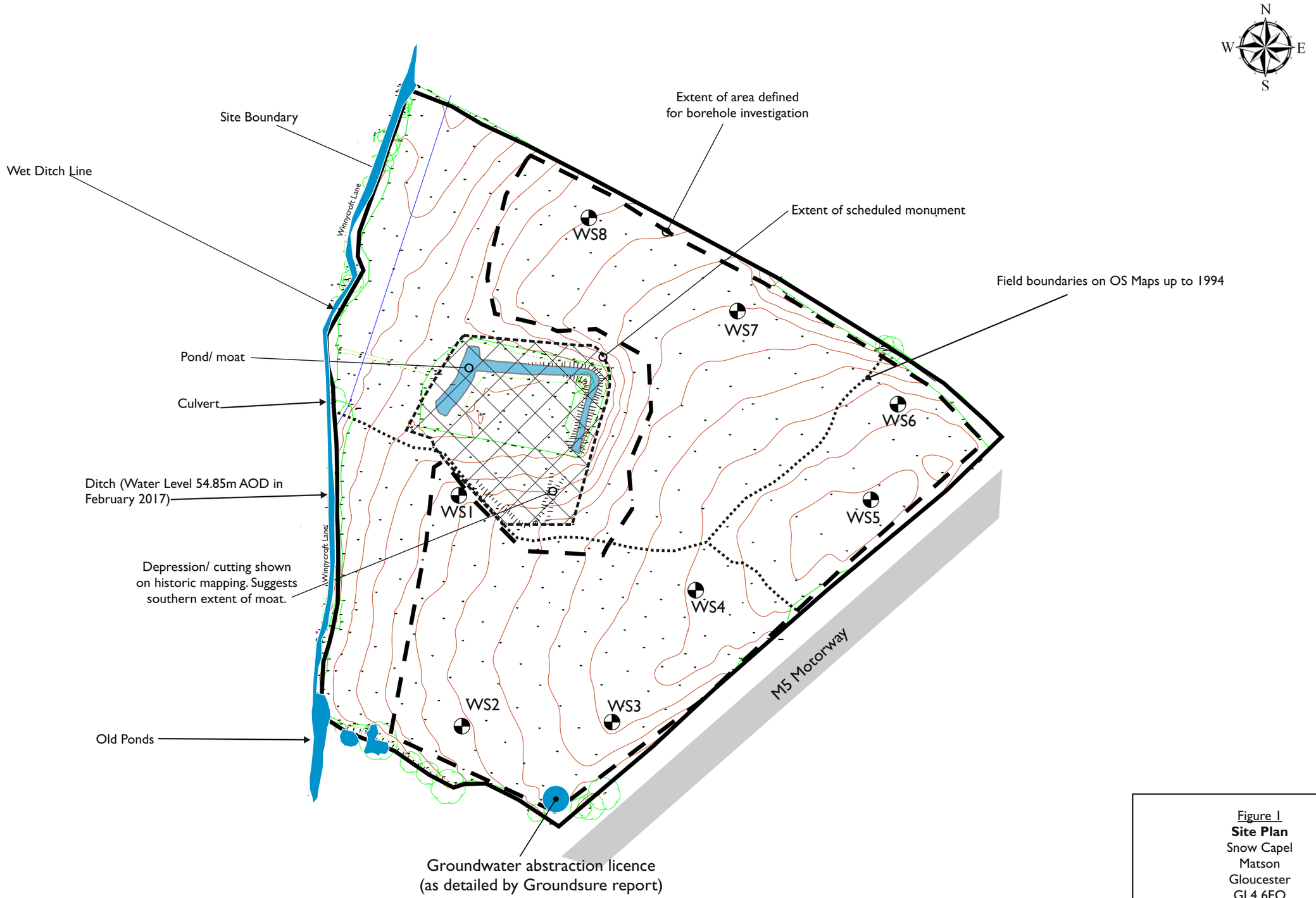
Based on the investigation findings to date, it will be necessary to:

- Complete supplementary investigation and standpipe installations on a relatively close spacing beneath areas of proposed housing, followed by
- Further monitoring of the standpipes over a 3-6 month period to allow the gas regime to be finalised.

Depending on the results of further monitoring, a separate gas risk assessment may be required to clarify the appropriate scope of remedial measures and gas protection design.

Once completed, a watching brief should be kept at all times while groundworks are occurring. Should any signs of unforeseen contamination be found during groundworks, Intégrale should be contacted immediately to determine the best course of action.

Copies of this report should be provided to the local authority and Environment Agency to confirm their agreement with the findings and recommendations.



Scale = 1:2000 (approx.) @ A3

Figure 1
Site Plan
Snow Capel
Matson
Gloucester
GL4 6EQ

Job No: 1826
August 2017

Intégrale

Appendix A

Site Location

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

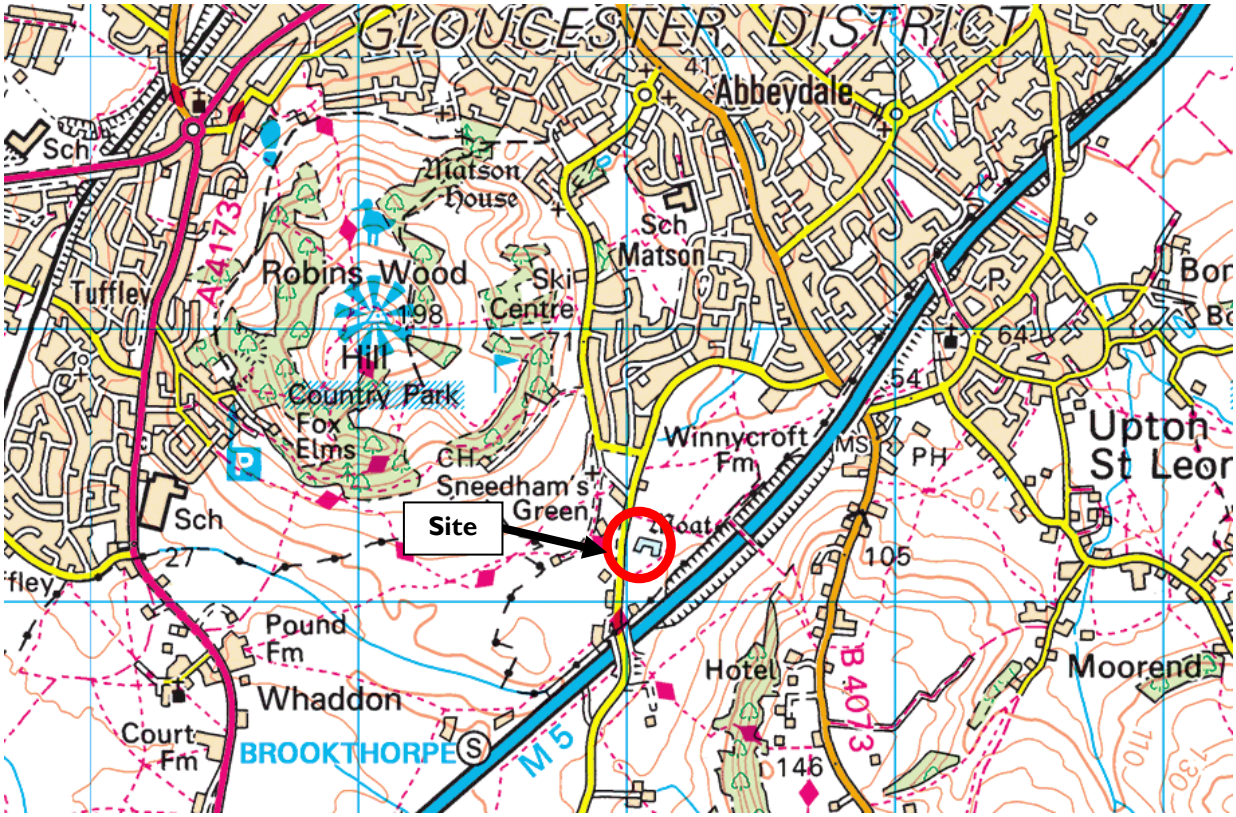
Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

Project: **Snow Capel, Matson, Gloucester, GL4 6EQ**

Job No: 1826

Site Location Plan



Appendix B

Site Description/Photographs

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

REFERENCES	
Project No.	1826
Site Address	Snow Capel, Matson, Gloucester, Gloucestershire, GL4 6EQ.
Grid Reference	SO851141
Date of Visit	24/05/17
Names of site owners/ developers/ engineers met with on site	-
Prepared by	WS
SITE – GENERAL	
Plan of site	See Figure 1.
Site size (area) : % building, % hardstanding, % soft landscaping, % open space, etc.	-
Current use (occupants and operations)	90% field; 10% fenced off moat.
Site Area	Field.
Maximum Dimensions	7.8 Hectares.
Boundaries – e.g. wooden fence/ retaining wall	352m (NW-SE) x 294m (NE-SW).
Any access limitations for JCBs, drilling rigs etc; minimum distances, steps, steep banks, inaccessible areas, need for breaker for SI. Take dimensions of access	All four boundaries fence with hedge beyond. Some breaks in hedge on E boundary.
Any specific working hours for SI; keys required for access	Gate in NW corner unlocked. No issue for window sampling rig access.
Any specific Health and Safety hazards/ considerations	No.
Water supply on site? Fire hydrant nearby? Power supply on site?	No.

SITE – BUILDINGS	
Age of building(s)	No buildings on site.
Building appearance: no. of storeys, basement, roofing type, chimneys / stacks?, car park, service areas;	N/A.
State of buildings, i.e. cracks; structural distress etc.	N/A.
Tanks: location (internal / external : above or below ground), age / condition, size / capacity, type, bunding (condition), refuelling point, evidence of stains / spills	None noted.
Heating : electric/gas/oil	N/A.
Chemical storage : drums, other chemical stores	None noted.
Gas control measures (e.g. vents, cowls, monitoring / alarms)	N/A.
Other evidence of industrial activity	None noted.
Asbestos / deleterious materials – any asbestos surveys?, removal programmes?	None noted.
Electrical equipment / Transformers – check for PCBs? Backup power supplies (generators)	None noted.

SITE – EXTERNAL	
Hard surfacings : type (asphalt/concrete etc.), staining, weathering, subsidence, repairs. Specific reinstatement required.	No hard surfacing on site.
Landscaped areas/ soft landscaping: vegetation dieback/ growth	No landscaped areas on site.
Invasive species noted (e.g. Japanese Knotweed). Note: absence indicated here by non-specialist does not infer that JKn is not present.	None noted.
Can investigation be in landscaped areas. Specific reinstatement required.	N/A.
Site topography – flat / sloping, Level compared to surroundings & mAOD.	Site slopes gently from 62mAOD in SE to 57mAOD in NW. Small slope down towards moat.
Evidence of filling or raising, earthworks, mounds/ hummocks, soil creep, soil fluction, mass movement, steep/ vertical laces, crater-like holes (in chalk/limestone areas). Sloping ground – any indication of instability (cracks in ground, bulges, leaning trees, walls or poles), rotational slip scars.	Raised bank runs parallel with west boundary. Composed of removed material associated with construction of M5 motorway adjacent to site.
Soil drainage – marshy/ marsh vegetation/ dry/ surfaces cracked/ surface rutting etc.	Site was well draining.
Trees – effects on buildings, condition, species and height; location; maturity; leaning/ upright; rotated trees?	Small cluster of mature trees near moat.
Rock/ soil exposures – height/ extent description etc.	None noted.
Drainage : interceptors, disposal of storm water / waste water, mains water supply.	Small drainage ditch running N to S along E boundary.
Other evidence of Services, e.g. overhead cables, Gas 'yellow headstone'.	Overhead cables in E of site.
Vehicle maintenance : washdown areas, workshops, refuelling points.	None noted.
Waste : skips / compounds, any hazardous waste? Burning grounds or incinerators.	None noted.
Sub-stations : age, condition, transformers, operator, servicing?	None noted.
Ecological features of note – Burrows, bats, nest sites, designated preservation areas.	None noted.
Any seepages on or adjacent to site.	None noted.
Watercourses, water levels, direction and rate of flow.	Small drainage ditch running N to S along E boundary.
Other features of note within site.	Moat in centre of site. Standing water with reeds. Fenced off with small gap for entry in the S. Archaeologically significant so no investigation in the immediate vicinity.

SURROUNDING LAND USES	
General site context – industrial, commercial, urban, agricultural etc.	Agricultural.
Land use – north (give distances)	Agricultural.
Land use – south (give distances)	Property then M5 motorway with agricultural beyond.
Land use – east (give distances)	M5 motorway with agricultural beyond.
Land use – west (give distances)	Agricultural. 200m E Gloucester Golf Club.
Nearby (<500m) sources of pollution – landfills, filling stations, industrial activity.	None noted.
Nearby river / surface water features – culverted, banks, flood plain. If visible, condition of watercourse.	None noted.
Local ground profiles and signs of instability.	None noted.
Evidence of structural distress on nearby buildings.	None noted.
Evidence of mining history (colliery spoil heap, miners cottage).	None noted.
Nearby rock/ soil outcrops.	None noted.
Vegetation – distinctive change in vegetation (e.g. hydrophyllic veg).	None noted.
Adjacent geotechnical features of note – cuttings, quarries, embankments, slopes (particularly if failed), major excavations, deep basements, sources of vibrations (railway or heavy machinery).	None noted.
Other features of note adjacent to site.	None noted.

View from S boundary looking N at western half of site.

View from SE corner looking W along S boundary.

View from SE on raised area looking NE showing slope down to M5 motorway beyond E boundary.

View from S boundary looking E at eastern half of site.

View from SE corner looking NE along E boundary showing raised bank.

View from SW corner of fenced moat looking E showing standing water.

View from NE corner looking NW along N boundary.

View looking NW showing small slope down to moat.

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Appendix C

Desk Study Information

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

CENTREMAPS

Open Space, Upper Interfields,
Worcester, WR14 1UT

Groundsure Reference:	CMAPS-CM-625691-13238-220517EDR
Your Reference:	13238
Report Date	22 May 2017
Report Delivery Method:	Email - pdf

Groundsure Enviro Insight

Address: Snow Capel Matson , GL4 6EQ

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 [redacted] quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc.
Groundsure Enviroinsight

Groundsure Enviro Insight

Address:	**Snow Capel Matson , GL4 6EQ**
Date:	**22 May 2017**
Reference:	**CMAPS-CM-625691-13238-220517EDR**
Client:	**CENTREMAPS**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	10-Jul-2014
Grid Reference:	385157,214176
Site Size:	7.95ha

Report Reference: CMAPS-CM-625691-13238-220517EDR
Client Reference: 13238

Contents Page

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	1	7	9
1.2 Additional Information – Historical Tank Database	0	0	1	0
1.3 Additional Information – Historical Energy Features Database	0	0	2	8
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	2	1	9	5

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	1	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	0
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	0	0	1	0
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	3	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?	No
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)	1	0	0	1	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	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	0	0	1	1	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	3	0	6	5	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 7: Flooding

7.1 Are there any Enviroment 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?	Not Prone
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Not Applicable

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	1	1
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	0	2	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	1	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	1	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	1	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	0	0	0	0	0	1
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?	Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	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?	Negligible
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.

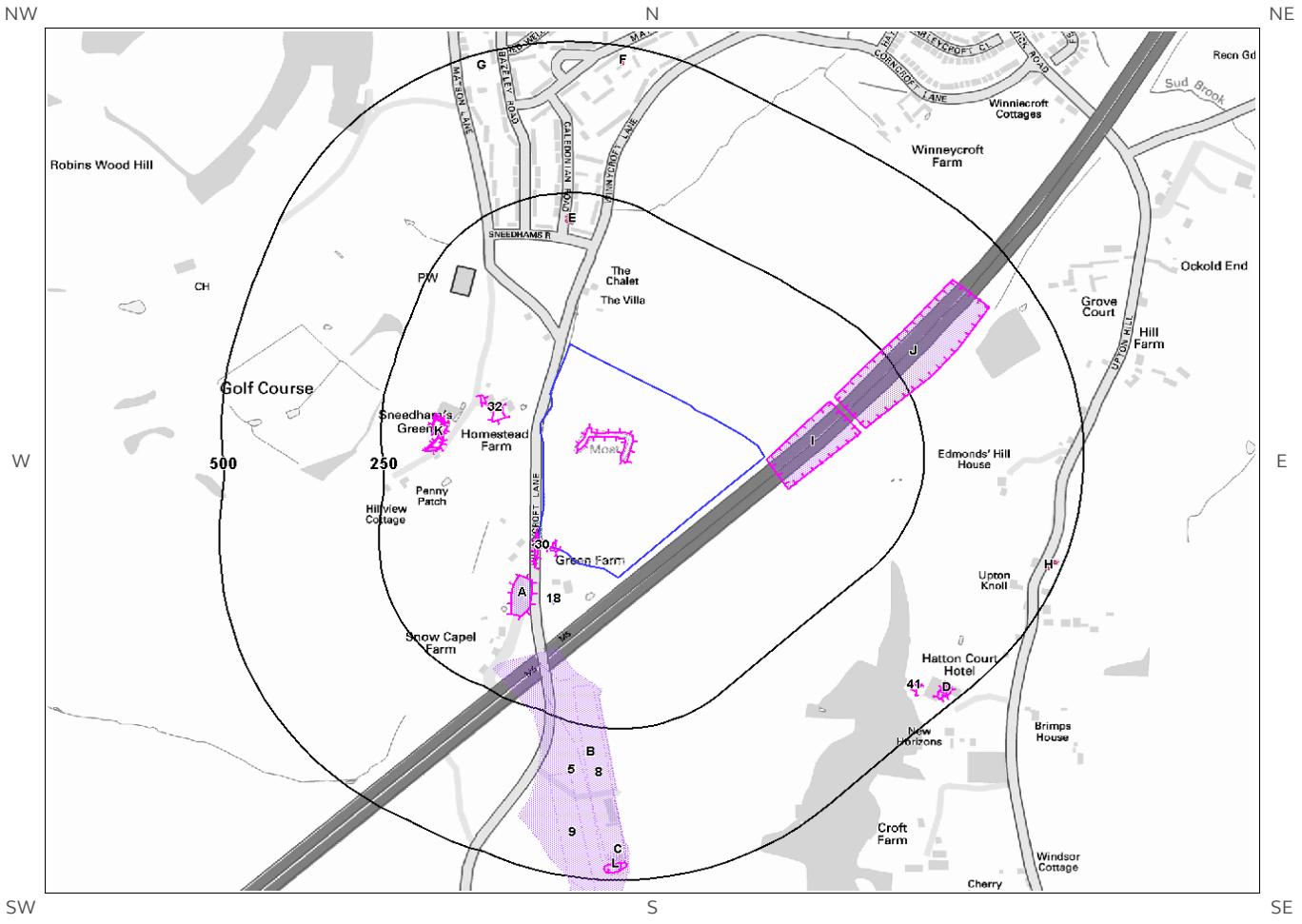
Note: Maps

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



Site Outline

250
500
Search Buffers (m)

Historical 1:10,000 and 1:10,560 scale mapping

Industrial Land Use

Potentially Infilled Land

Historical 1:2,500, 1:1,250 and 1:500 scale mapping

Energy Features

Petrol Stations

Tanks

Garages

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: 17

ID	Distance [m]	Direction	Use	Date
1I	5	SE	Cuttings	1973
2A	59	SW	Unspecified Ground Workings	1973
3A	59	SW	Unspecified Ground Workings	1986
4J	144	NE	Cuttings	1973
5	145	S	Rifle Ranges	1924
6B	172	SW	Rifle Ranges	1938
7B	172	SW	Rifle Ranges	1924
8	183	S	Rifle Ranges	1954
9	331	S	Disused Rifle Ranges	1973
10C	451	S	Fire Station	1924
11C	455	S	Butts	1973
12C	460	S	Fire Station	1924
13C	467	S	Butts	1924
14D	469	SE	Unspecified Pit	1924
15D	469	SE	Unspecified Pit	1938
16L	471	S	Unspecified Heap	1954
17D	471	SE	Unspecified Pit	1954

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: 1

ID	Distance (m)	Direction	Use	Date
18	72	SW	Unspecified Tank	1884

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: 10

ID	Distance (m)	Direction	Use	Date
19E	198	N	Electricity Substation	1978
20E	199	N	Electricity Substation	1994
21F	468	N	Electricity Substation	1978
22F	468	N	Electricity Substation	1994
23G	474	N	Electricity Substation	1986
24G	474	N	Electricity Substation	1994
25H	481	SE	Electricity Substation	1992
26H	483	E	Electricity Substation	1966
27H	484	E	Electricity Substation	1971
28H	487	E	Electricity Substation	1994

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: 17

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

ID	Distance(m)	Direction	Use	Date
29	0	On Site	Pond	1883
30	0	On Site	Ponds	1883

31I	5	SE	Cuttings	1973
32	56	W	Ponds	1883
33A	59	SW	Unspecified Ground Workings	1986
34A	59	SW	Unspecified Ground Workings	1973
35J	144	NE	Cuttings	1973
36K	146	W	Ponds	1883
37K	149	W	Ponds	1924
38K	149	W	Ponds	1938
39K	152	W	Ponds	1973
40K	152	W	Ponds	1986
41	438	SE	Pool	1973
42D	469	SE	Unspecified Pit	1938
43D	469	SE	Unspecified Pit	1924
44L	471	S	Unspecified Heap	1954
45D	471	SE	Unspecified Pit	1954

2. Environmental Permits, Incidents and Registers Map

- Site Outline
- Search Buffers (m) — 250 / 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- 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:

1

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1	32	S	385000 214000	Address: GREEN FARM, SNEEDHAM'S GREEN, NR MATSON, GLOS Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: WQ/72/1085 Permit Version: 1	Receiving Water: UNDERGROUND STRATA Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 23/03/1977 Effective Date: 23-Mar-1977 Revocation Date: -

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:

0

Database searched and no data found.

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

Site Outline

250 / 500 Search Buffers (m)

EA/NRW Active Landfill

EA/NRW Historic Landfill

BGS / DoE Survey Landfill

Historic and Planned Waste Sites

EA/NRW Licensed Waste Site

Local Authority/Historical Mapping Landfill Records

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:

1

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	644	SE	385600 213600	Site Address: On B4073 Road, Upton-St-Leonards, Gloucestershire Waste Licence: - Site Reference: 282 Waste Type: Inert 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.

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4. Current Land Use Map

Site Outline

Search Buffers (m)
250
500

Current Industrial Sites

Petrol & Fuel Sites

Electricity Transmission Cables

Gas Transmission Pipelines

4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 3

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

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	88	NW	C G Herbert	384904 214279	C G Herbert, Homestead Farm, Sneedhams Green, Matson, Gloucester, GL4 6EF	Livestock Farming	Farming
2	171	W	Pump	384814 214260	Pump, GL4	Water Pumping Stations	Industrial Features
3	211	N	Electricity Sub Station	385029 214580	Electricity Sub Station, GL4	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
BLCR-MDST	BLUE LIAS FORMATION AND CHARMOUTH MUDSTONE FORMATION (UNDIFFERENTIATED)	MUDSTONE
CHAM-MDST	CHARMOUTH MUDSTONE FORMATION	MUDSTONE

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

6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology

Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

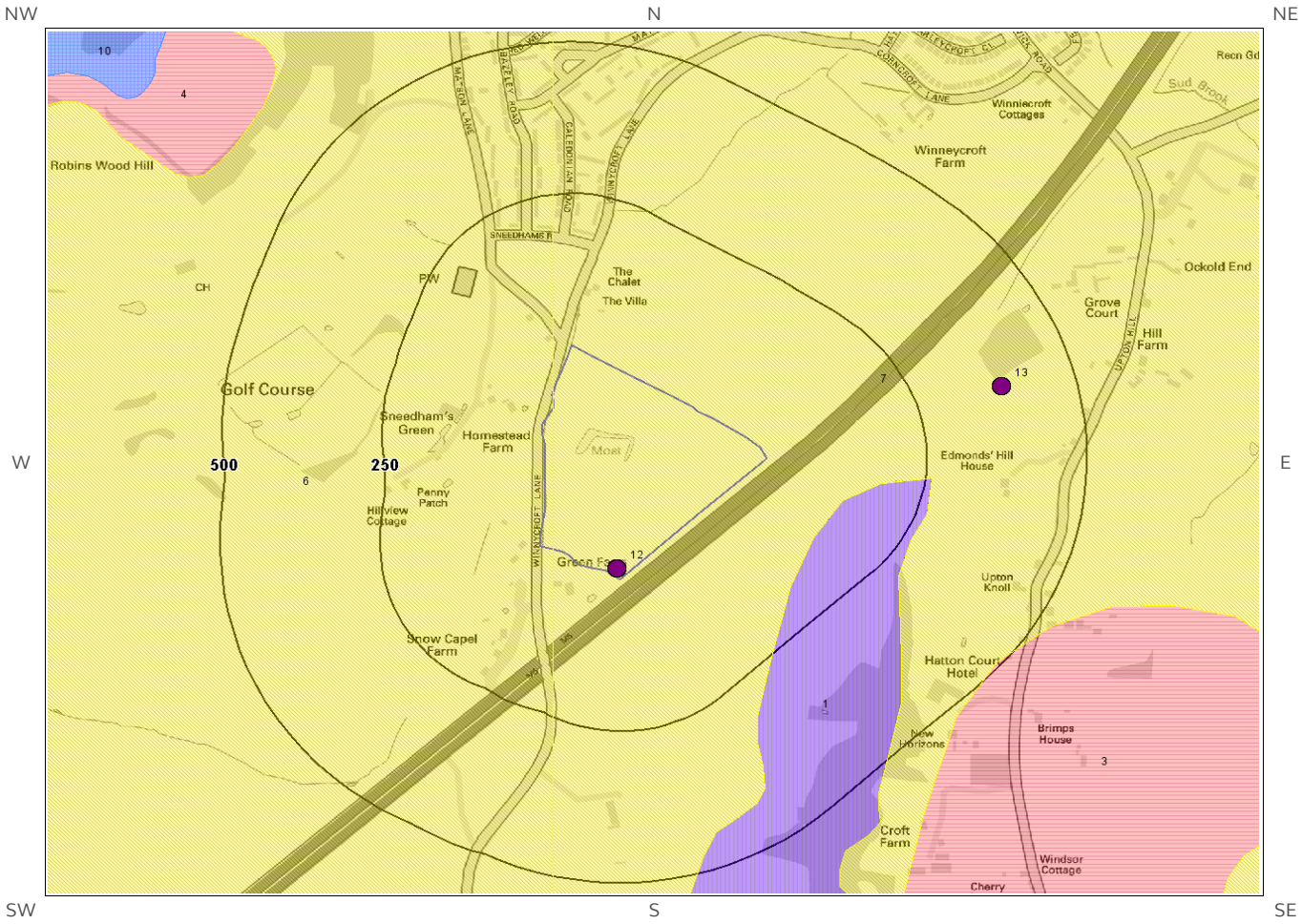
Secondary (B) Aquifer - Lower Permeability Layers

Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

6b. Aquifer Within Bedrock Geology and Abstraction Licenses



Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

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

Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

6d. Hydrogeology – Source Protection Zones within confined aquifer

Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2C - Outer Catchment within Confined Aquifer

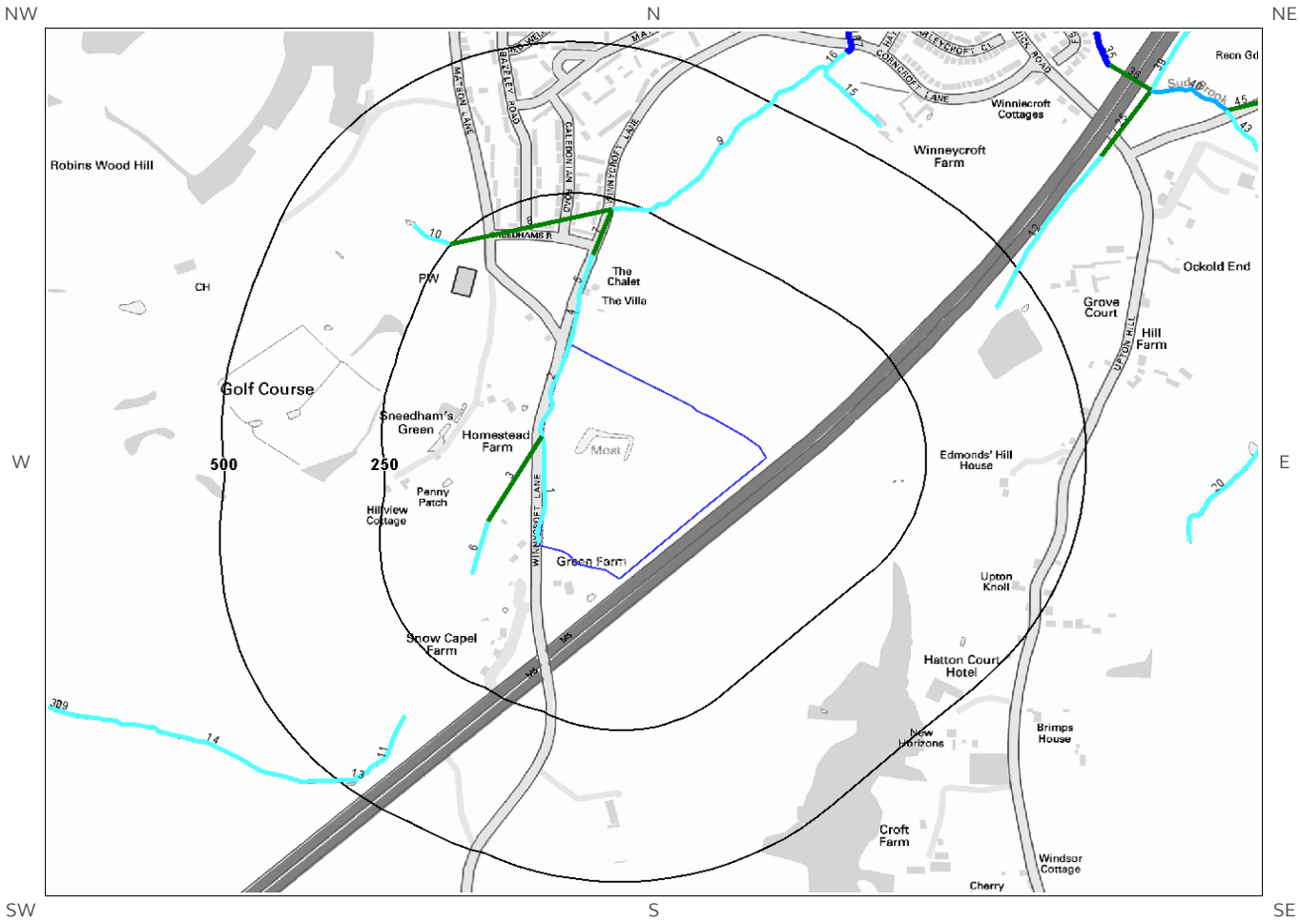
Source Protection Zone 3C - Total Catchment within Confined Aquifer

Potable Water Abstraction Licence

Site Outline

250
500
Search Buffers (m)

6e. Hydrology – Detailed River Network and River Quality



Site Outline

250 / 500 Search Buffers (m)

Primary River
Secondary River
Tertiary River
Lake/Reservoir
Underground River (inferred)
General Quality Assessment: Biology
General Quality Assessment: Chemistry

Canal
Canal Tunnel
Culvert
Multiple Channel Culvert
Underground River (Potential Sewer)
Underground River (local knowledge)

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? No

Database searched and no data found.

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.

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
6	0	On Site	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
7	0	On Site	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
1	137	SE	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers
3	492	SE	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

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
12	0	On Site	385100 214000	Status: Historical Licence No: 18/54/20/0193 Details: General Farming & Domestic Direct Source: Groundwater Midlands Region Point: Land At Upton St Leonards - Well Data Type: Point Name: POLLARD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 18/11/1966 Expiry Date: - Issue No: 100 Version Start Date: 18/11/1966 Version End Date:
13	384	E	385700 214300	Status: Historical Licence No: 18/54/20/0137 Details: General Farming & Domestic Direct Source: Groundwater Midlands Region Point: Land At Upton St Leonards - Catchpits Data Type: Point Name: HATSON ESTATE	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 18/7/1966 Expiry Date: - Issue No: 100 Version Start Date: 18/7/1966 Version End Date:

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? No

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.

Database searched and no data found.

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
133	SE	Minor Aquifer/Low Leaching Potential	L	Soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants.
463	SE	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.

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:

Biological Quality data describes water quality in terms of 83 groups of macroinvertebrates, some of which are pollution sensitive. The results are graded from A ('Very Good') to F ('Bad').

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

ID	Distance (m)	Direction	NGR	River Quality Grade	Biological Quality Grade				
					2005	2006	2007	2008	2009
Not shown	1368	E	386700 214100	River Name: Twyver Reach: A46 Upton St. Leonards To Tredworth End/Start of Stretch: Start of Stretch NGR	D	C	C	C	C

6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). 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):

					Chemical Quality Grade				
ID	Distance (m)	Direction	NGR	River Quality Grade	2005	2006	2007	2008	2009
Not shown	1368	E	386700 214100	River Name: Twyver R Reach: Upton St Leonards To Tredworth End/Start of Stretch: Start of Stretch NGR	C	C	B	B	A

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	0	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
2	0	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
3	0	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
4	52	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
5	54	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	83	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7	153	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
8	204	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
9	233	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
10	252	NW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined

ID	Distance (m)	Direction	Details	
11	351	SW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
12	435	NE	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
13	481	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
14	482	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary 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
0	On Site
0	On Site
2	W
54	N
83	W
88	N
105	N
233	N

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

Site Outline

100
250
Search Buffers (m)

Zone 2 Floodplain

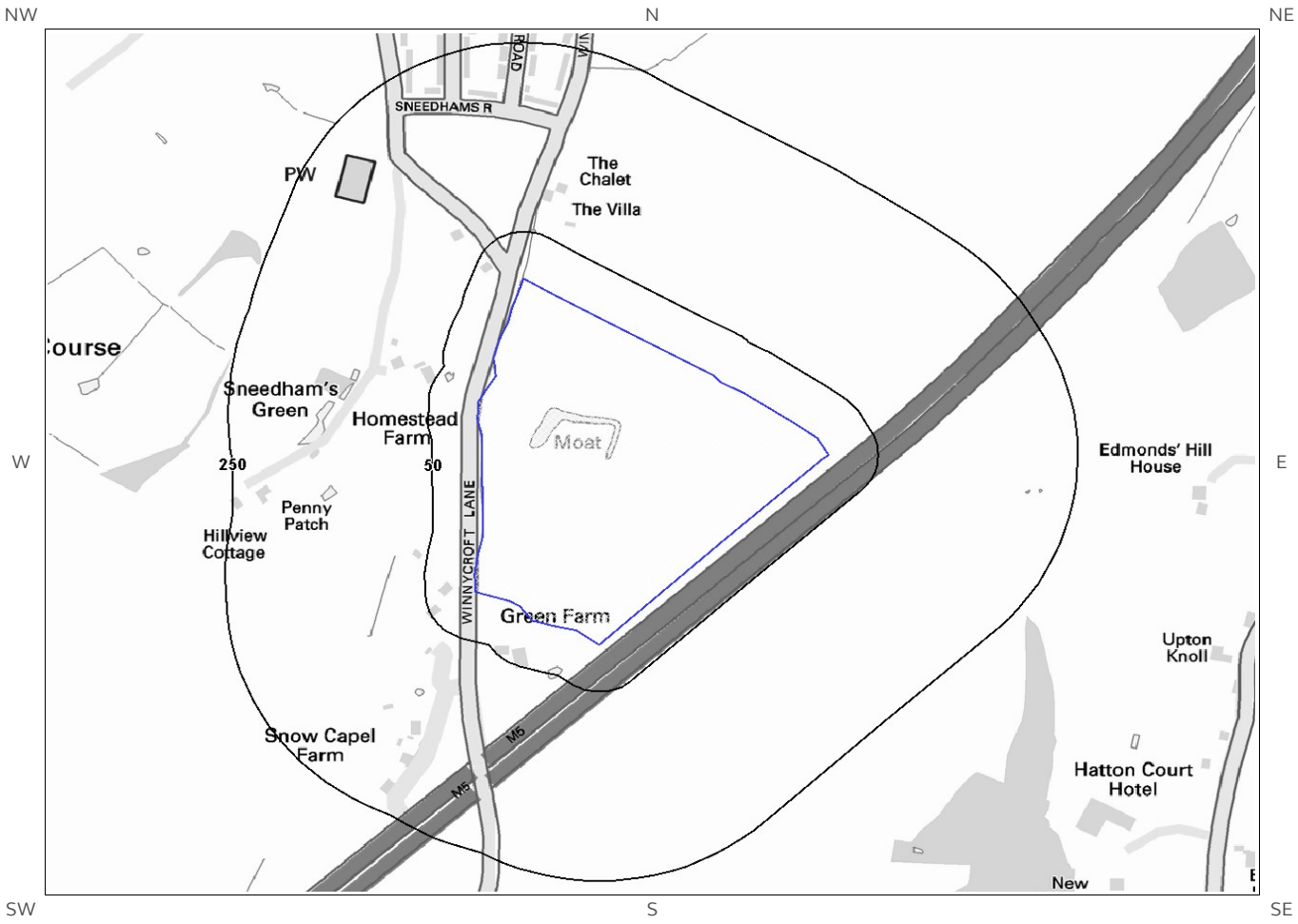
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

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



Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

- Very Low
- Low
- Medium
- High

Report Reference: CMAPS-CM-625691-13238-220517EDR
Client Reference: 13238

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? No

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?

Not Prone

The area is not considered to be prone to groundwater flooding based on rock type.

7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Not Applicable

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

Site Outline

100
250
Search Buffers (m)

AONB
National Park
SSSI
Special Protection Areas
Nitrate Vulnerable Zones

Green Belt
Environmentally Sensitive Areas
Special Areas of Conservation
World Heritage Sites
Nitrate Sensitive Areas

Ancient Woodland
National Nature Reserve
Local Nature Reserves
Ramsar Sites

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:

2

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
1	704	S	Range Farm Fields	Natural England
2	1433	W	Robin's Wood Hill Quarry	Natural England

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:

2

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	732	NW	UNKNOWN	Ancient and Semi-Natural Woodland
8	876	NW	UNKNOWN	Ancient and Semi-Natural Woodland

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

1

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
3	763	W	Robinswood Hill	Natural England

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:

1

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

ID	Distance (m)	Direction	ESA Name	Data Source
6A	56	SE	Cotswold Hills	Natural England

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

1

The following Area of Outstanding Natural Beauty (AONB) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	AONB/NSA Name	Data Source
5A	59	SE	Cotswolds	Natural England

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:

1

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
Not shown	1612	S	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? Low

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

Hazard
Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

What is the maximum Landslide* 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 slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property no significant increase in insurance risk due to natural slope instability problems.

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? Negligible

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

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

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.

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Contact Details

CENTREMAPS
[redacted]
Open Space, Upper Interfields, Malvern, Worcester, WR14 1UT

[redacted]

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Environment Agency

Public Health England

The Coal Authority

OS Data

getmapping®

Report Reference: CMAPS-CM-625691-13238-220517EDR
Client Reference: 13238

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

CENTREMAPS

Open Space, Upper Interfields,
Worcester, WR14 1UT

Report Reference: CMAPS-CM-625691-13238-220517GEO

Your Reference: 13238

Report Date 22 May 2017

Report Delivery Method: Email - pdf

Groundsure Geo Insight

Address: Snow Capel Matson , GL4 6EQ

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 [redacted] quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc.
Groundsure Geo Insight

Groundsure Geo Insight

Address:	**Snow Capel Matson , GL4 6EQ**
Date:	**22 May 2017**
Reference:	**CMAPS-CM-625691-13238-220517GEO**
Client:	**CENTREMAPS**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	10-Jul-2014
Grid Reference:	385157,214176
Site Size:	7.95ha

Contents Page

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 landslip 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 landslip within 500m of the study site boundary?	Yes
	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	3.1Is 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.
	3.2Radon 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	2	1	9	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	0

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	0
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

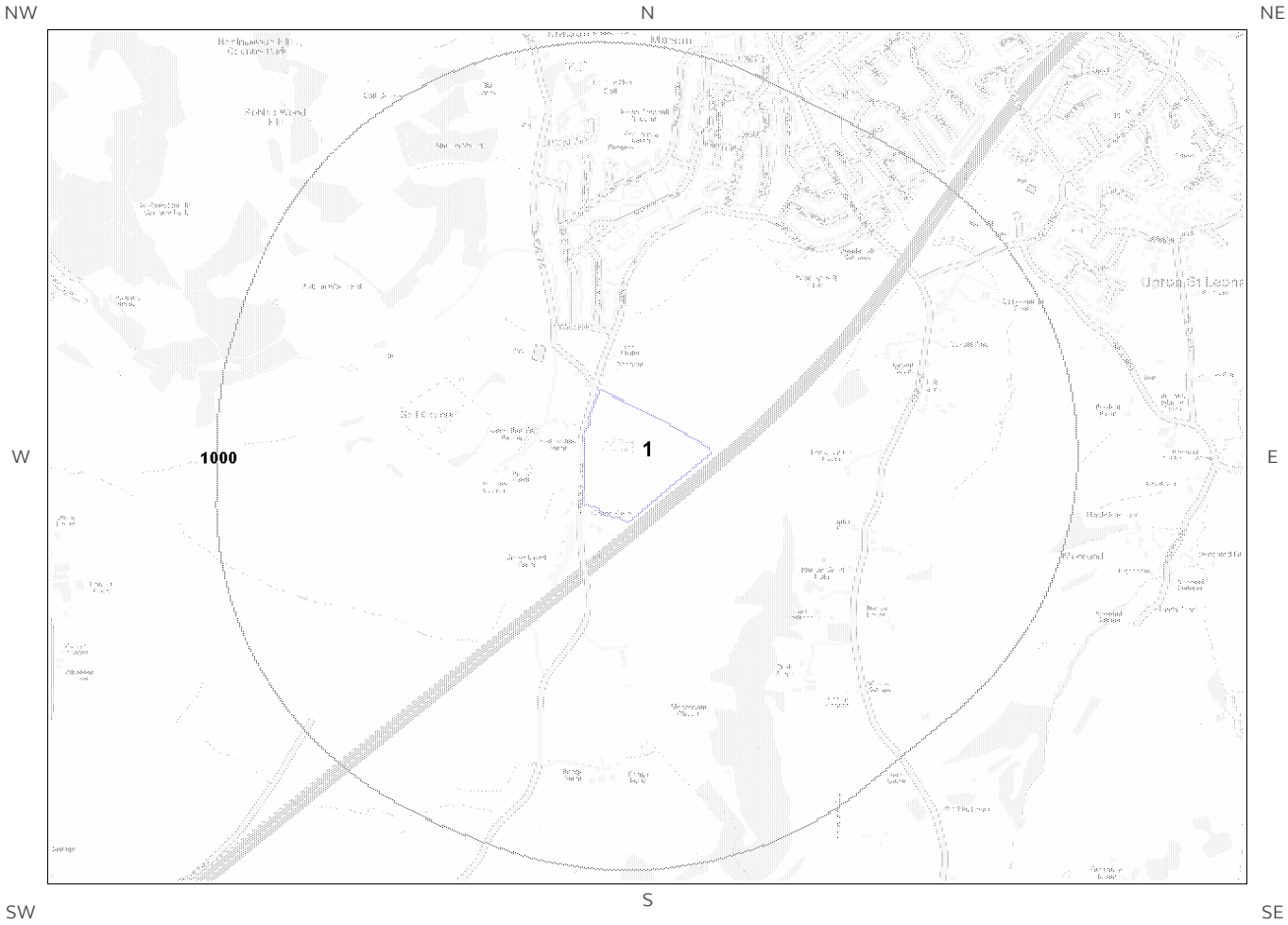
Section 6: Natural Ground Subsidence	On-site
6.1 Shrink-Swell Clay	Low
6.2 Landslides	Low
6.3 Ground Dissolution of Soluble Rocks	Negligible
6.4 Compressible Deposits	Negligible
6.5 Collapsible Deposits	Very Low
6.5 Running Sand	Negligible

Section 7: Borehole Records	On-site	0-50m	51-250
7 BGS Recorded Boreholes	0	1	10

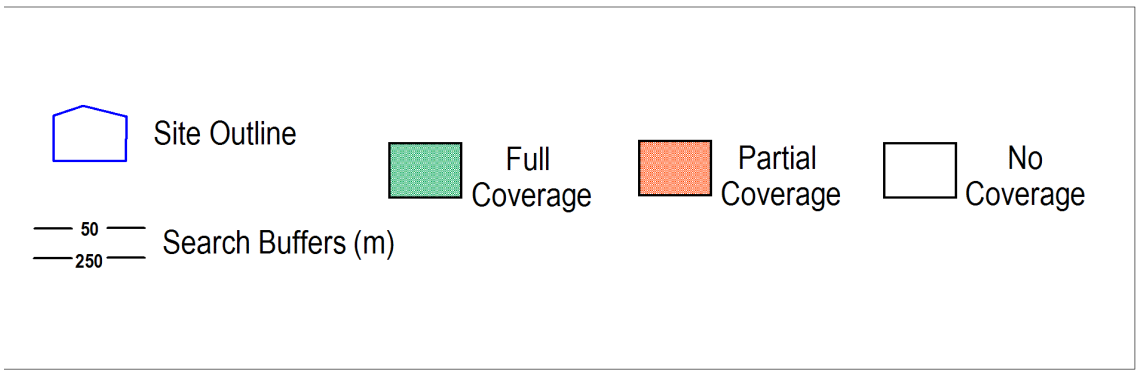
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250
8 Records of Background Soil Chemistry	4	2	0

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



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	No deposits are mapped	No coverage	No coverage	No coverage

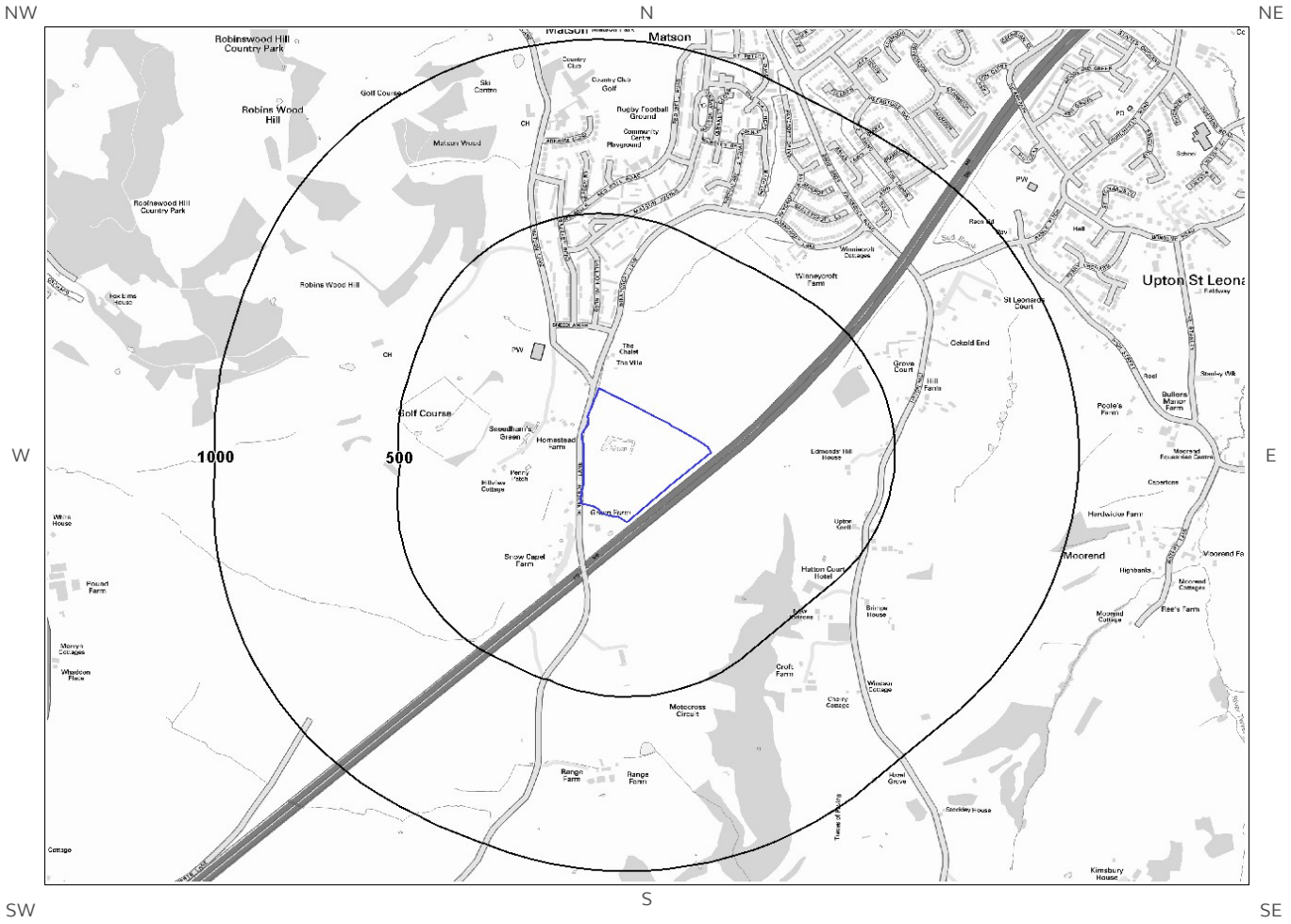
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not 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

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

1. Geology 1:10,000 scale

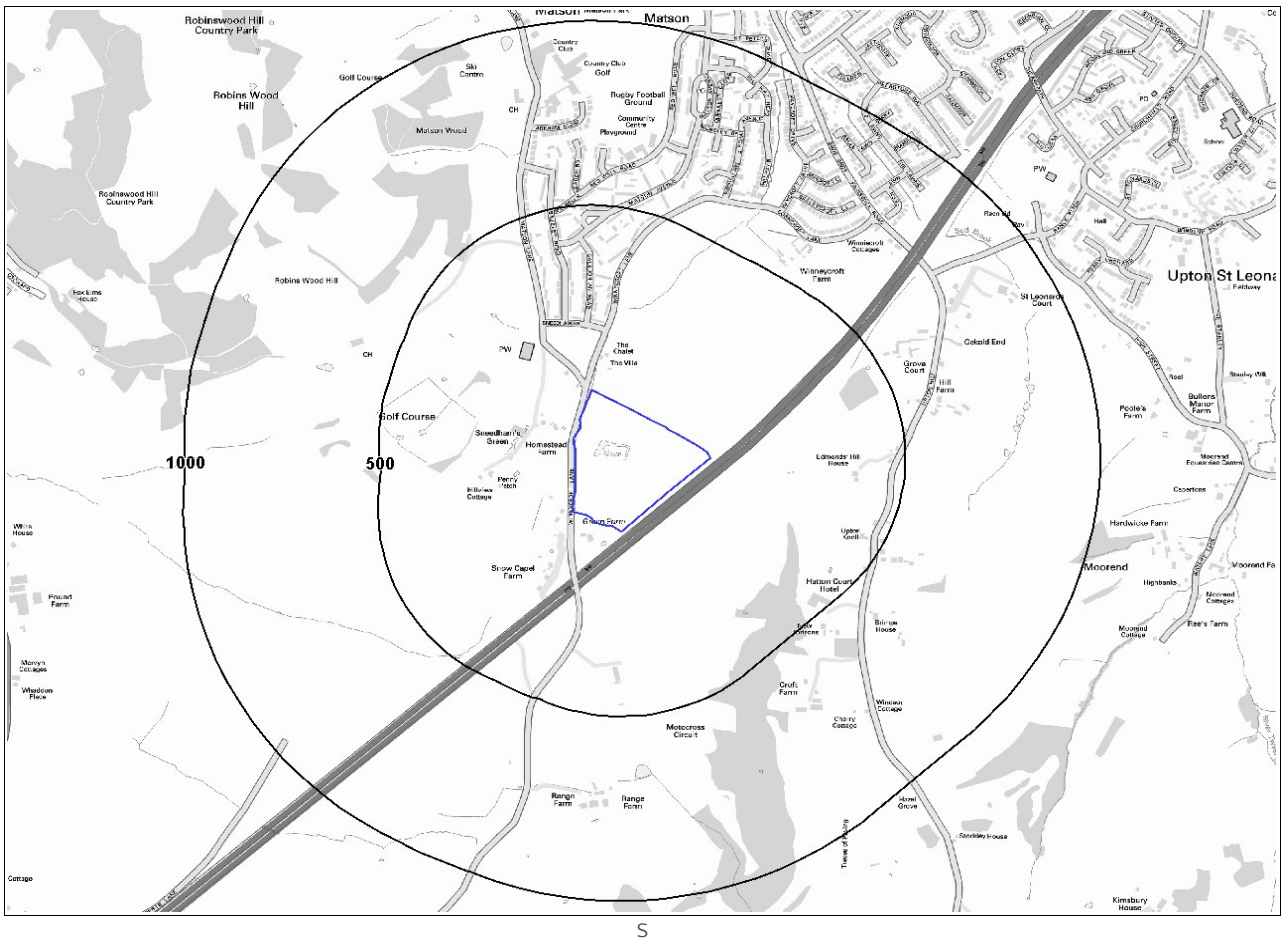
1.1 Artificial Ground

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? No

Database searched and no data found.

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



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

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? No

Database searched and no data found.

1.2.2 Landslip

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

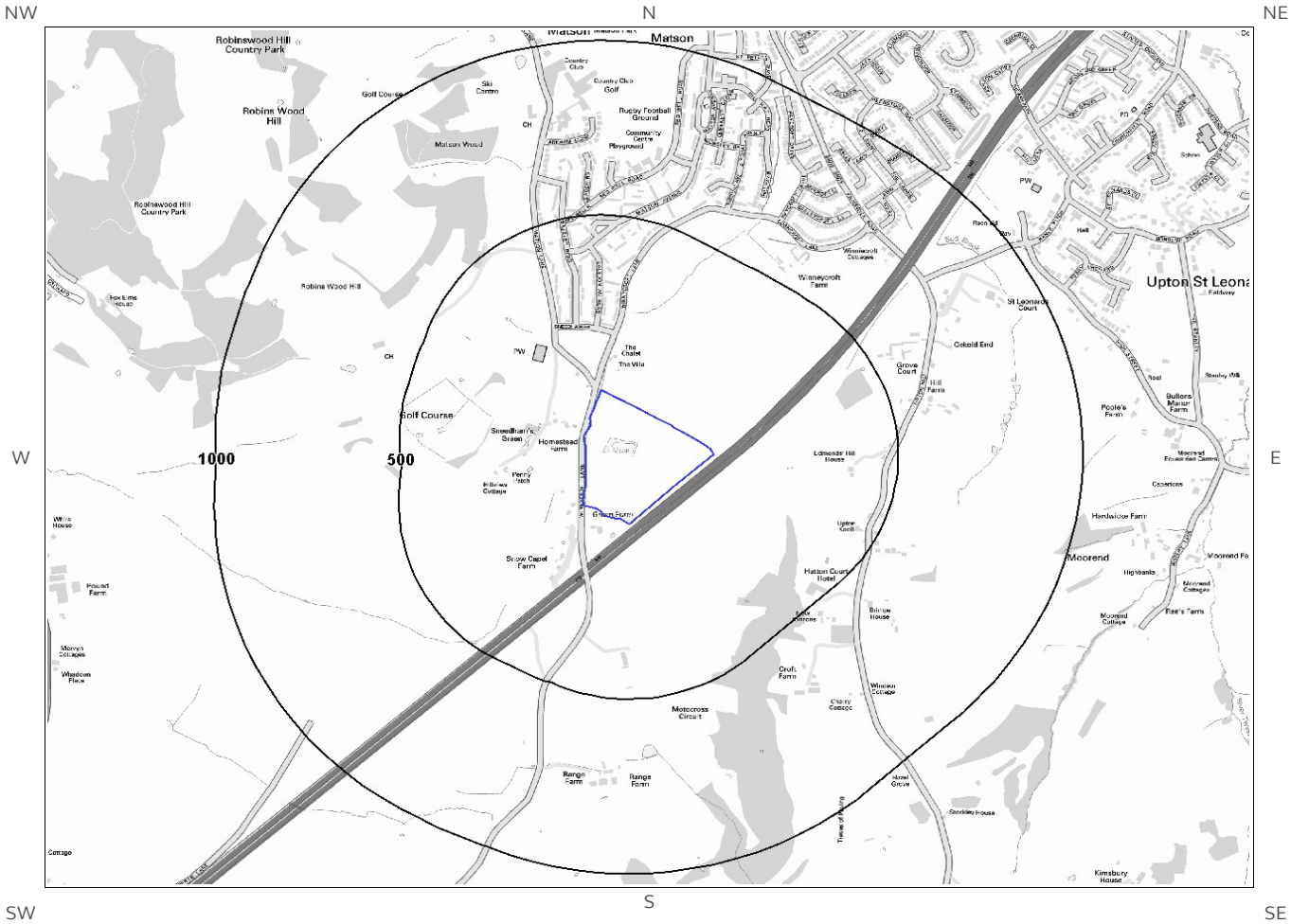
No

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 Map (1:10,000 scale)



Bedrock and Faults Legend

Site Outline

500
1000
Search Buffers (m)

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.

Database searched and no data found at this scale.

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.

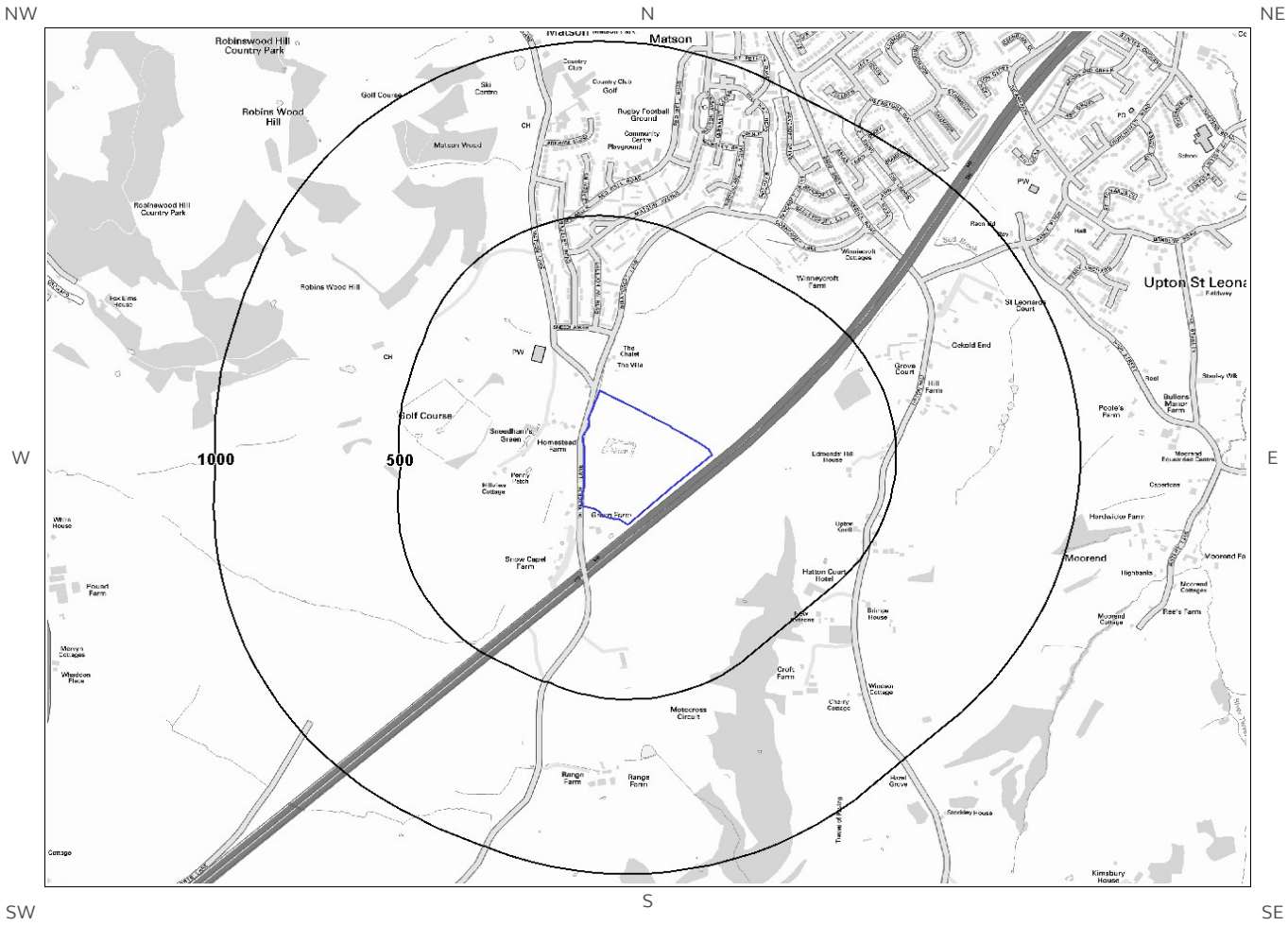
The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

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

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

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: 234

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? No

Database searched and no data found.

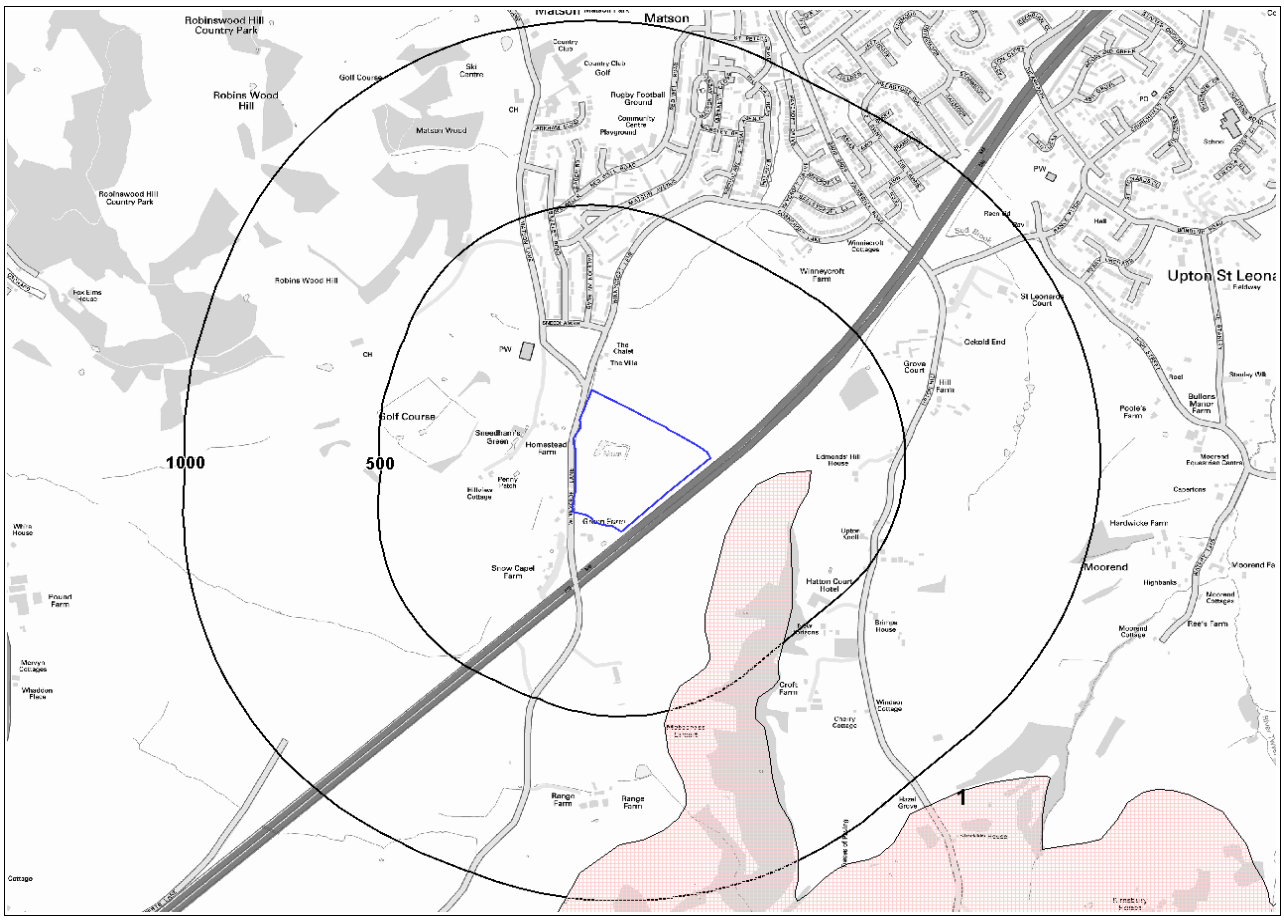
2.1.2 Permeability of Artificial Ground

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)

NW N NE



W E

SW S SE

Ground Workings Legend

Site Outline

500
1000
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? No

Database searched and no data found.

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? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	137.0	SE	SLIP-UKNOWN	LANDSLIDE DEPOSITS	UNKNOWN/UNCLASSIFIED ENTRY

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.

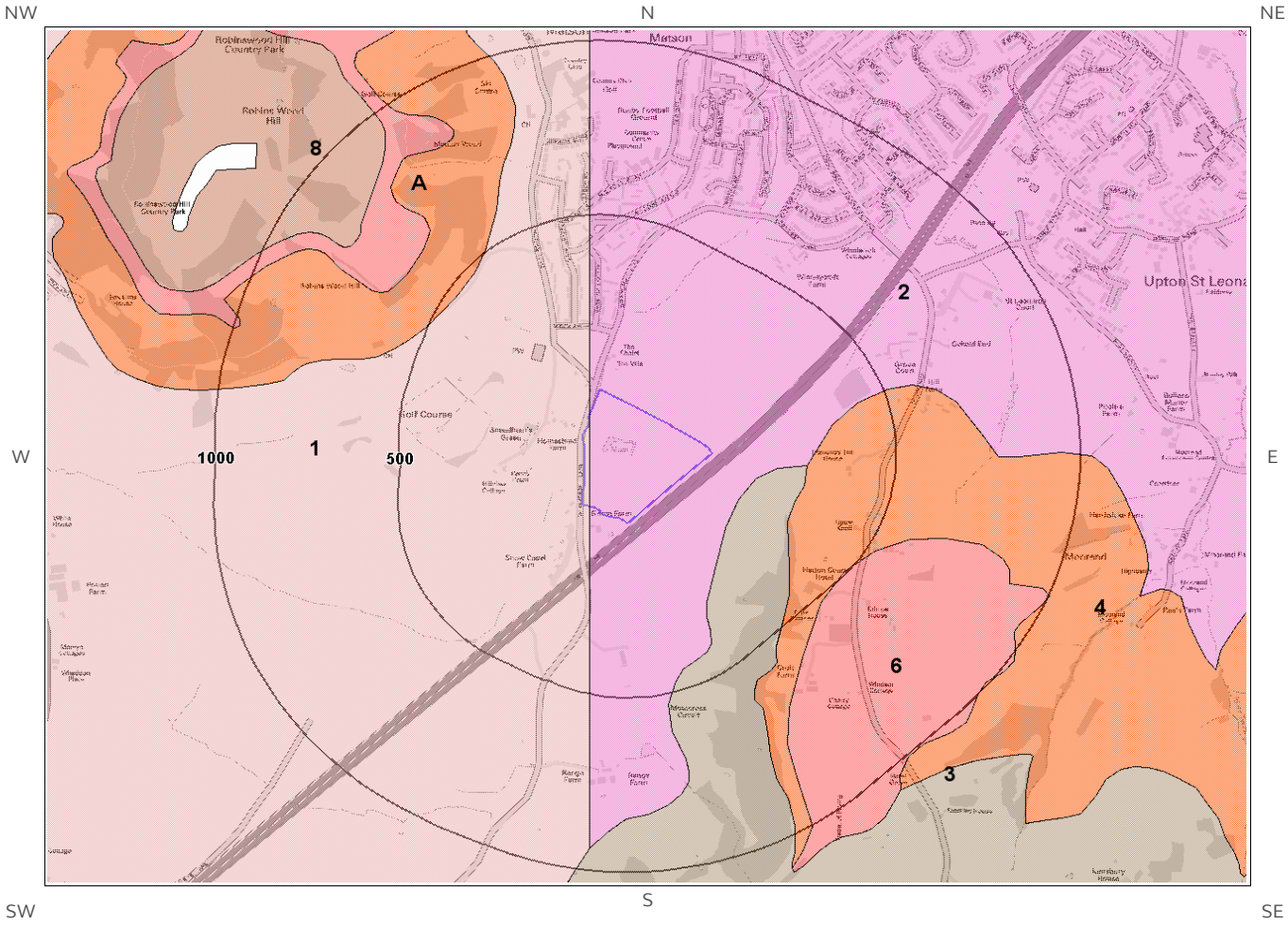
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

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

Site Outline

500
1000
Search Buffers (m)

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: 234

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	BLCR-MDST	BLUE LIAS FORMATION AND CHARMOUTH MUDSTONE FORMATION (UNDIFFERENTIATED) - MUDSTONE	RHAETIAN
2	0.0	On Site	CHAM-MDST	CHARMOUTH MUDSTONE FORMATION - MUDSTONE	SINEMURIAN
3	137.0	SE	LIIO-LMAS	LIAS GROUP AND INFERIOR OOLITE GROUP (UNDIFFERENTIATED) - LIMESTONE, ARGILLACEOUS ROCKS AND SUBORDINATE SANDSTONE, INTERBEDDED	RHAETIAN
4	259.0	E	DYS-SIMD	DYRHAM FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED	PLIENSBACHIAN
5A	472.0	NW	DYS-SIMD	DYRHAM FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED	PLIENSBACHIAN
6	492.0	SE	MRB-FLMST	MARLSTONE ROCK FORMATION - LIMESTONE, FERRUGINOUS	PLIENSBACHIAN

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	Fracture	Low	Low
0.0	On Site	Fracture	Low	Low

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

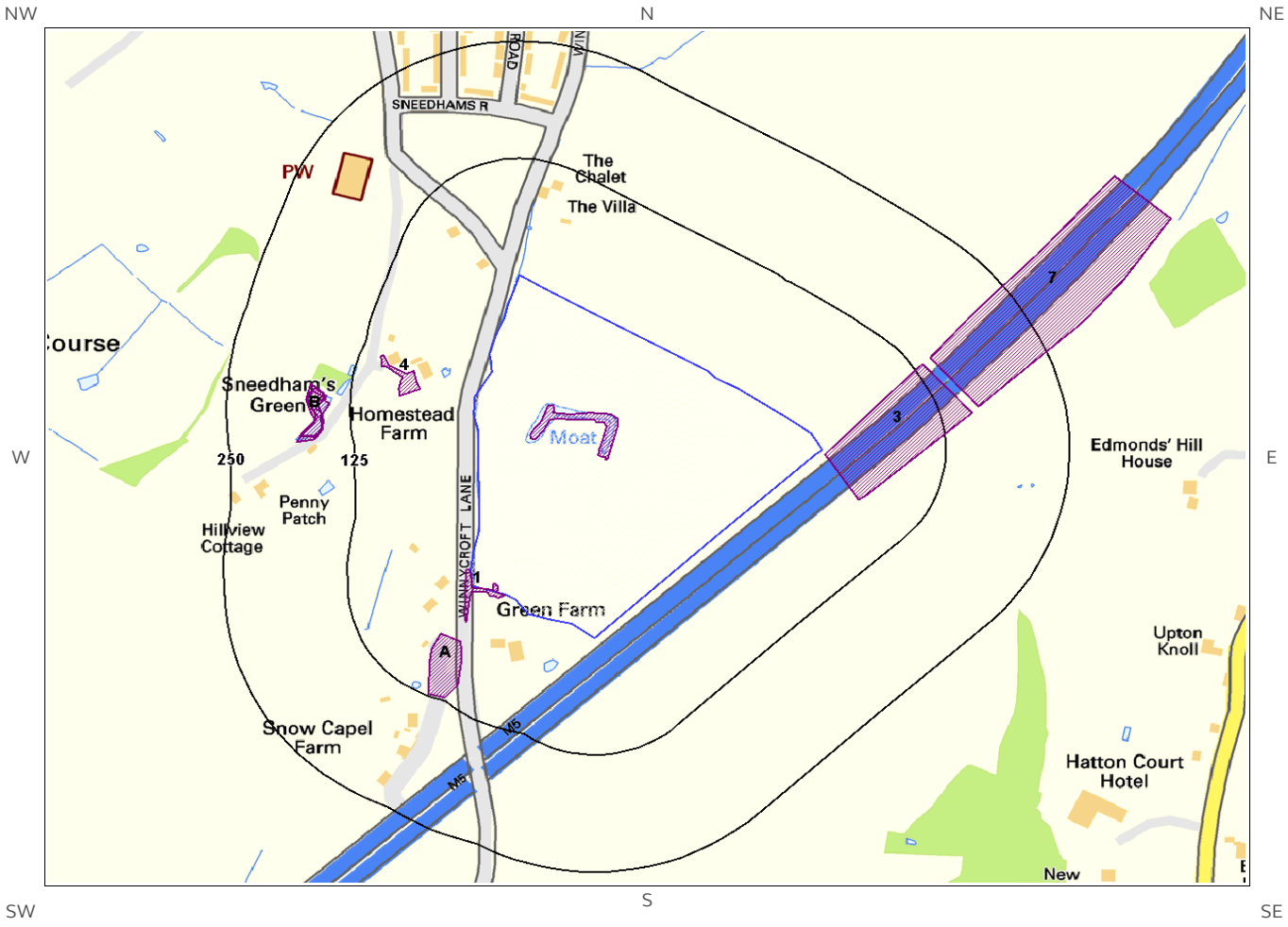
Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

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

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

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? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1	0.0	On Site	384977 214028	Ponds	1883
2	0.0	On Site	385046 214202	Pond	1883
3	5.0	SE	385411 214203	Cuttings	1973
4	56.0	W	384909 214263	Ponds	1883
5A	59.0	SW	384954 213954	Unspecified Ground Workings	1986
6A	59.0	SW	384954 213954	Unspecified Ground Workings	1973
7	144.0	NE	385565 214353	Cuttings	1973
8B	146.0	W	384824 214219	Ponds	1883
9B	149.0	W	384825 214223	Ponds	1924
10B	149.0	W	384825 214223	Ponds	1938
11B	152.0	W	384824 214226	Ponds	1986
12B	152.0	W	384824 214226	Ponds	1973

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? No

Database searched and no data found.

5 Mining, Extraction & Natural Cavities Map

Mining, Extraction and Natural Cavities Legend

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? No

Database searched and no data found.

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

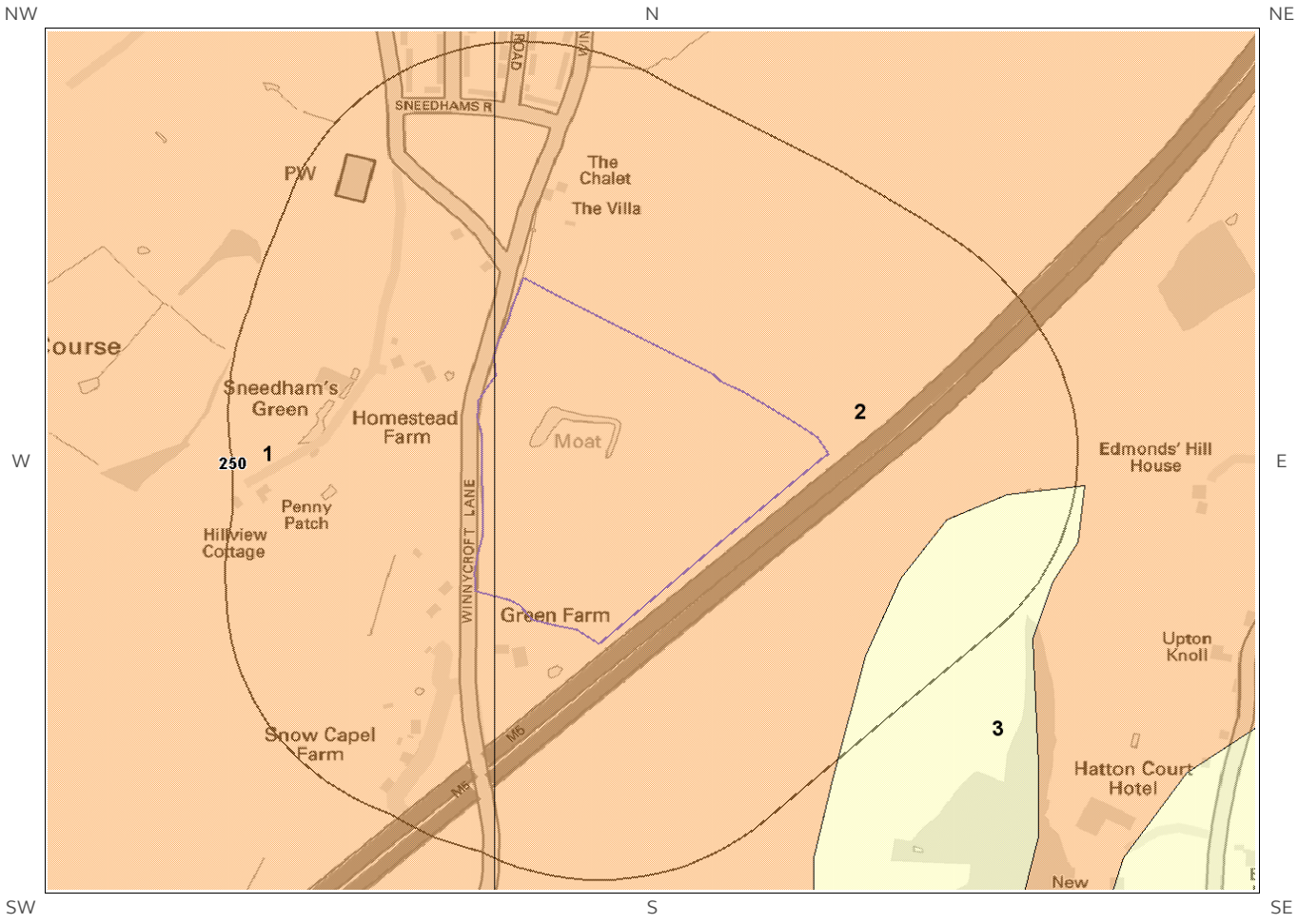
This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

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



Shrink Swell Clay Legend

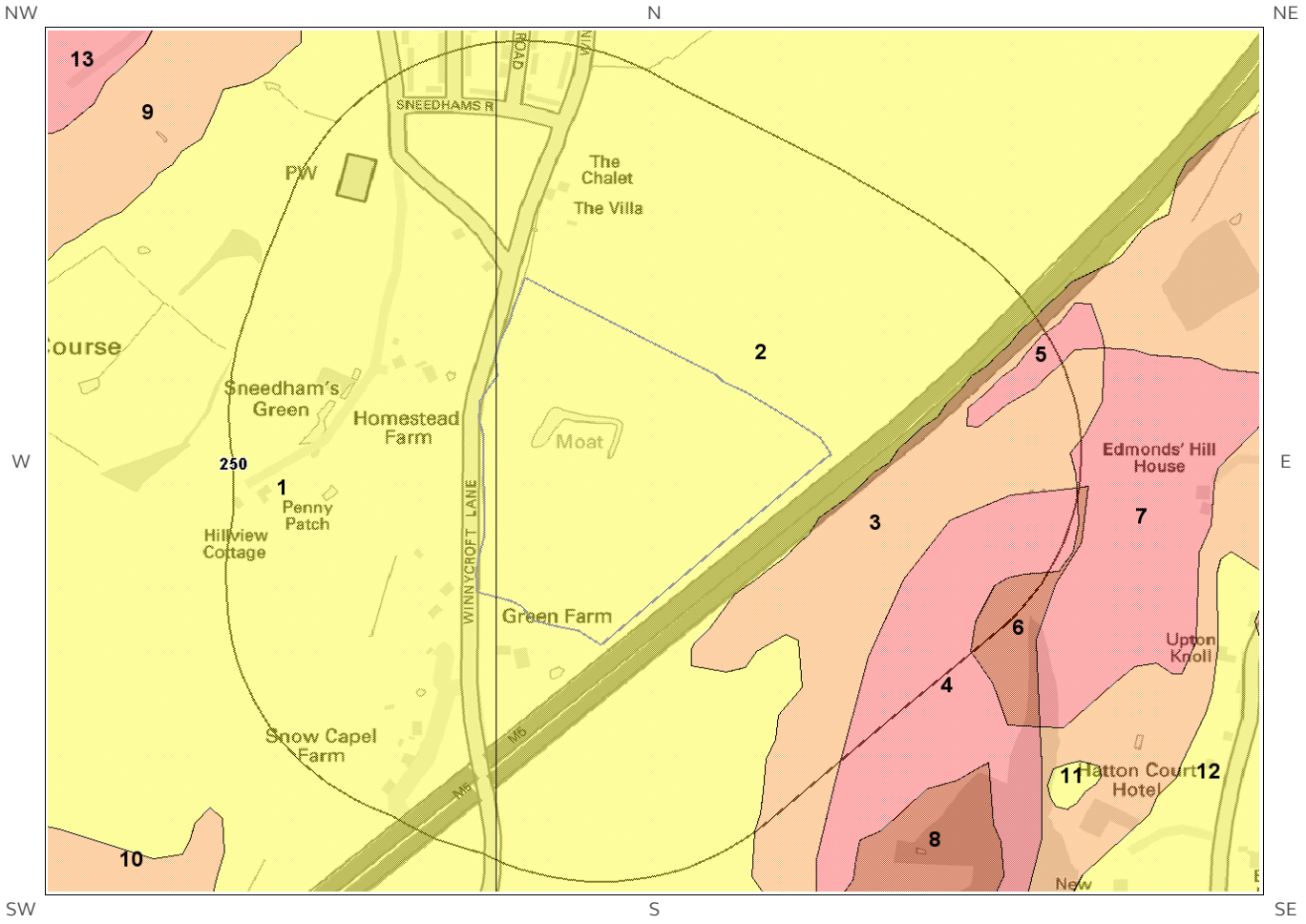
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.2 Landslides Map



Landslides Legend

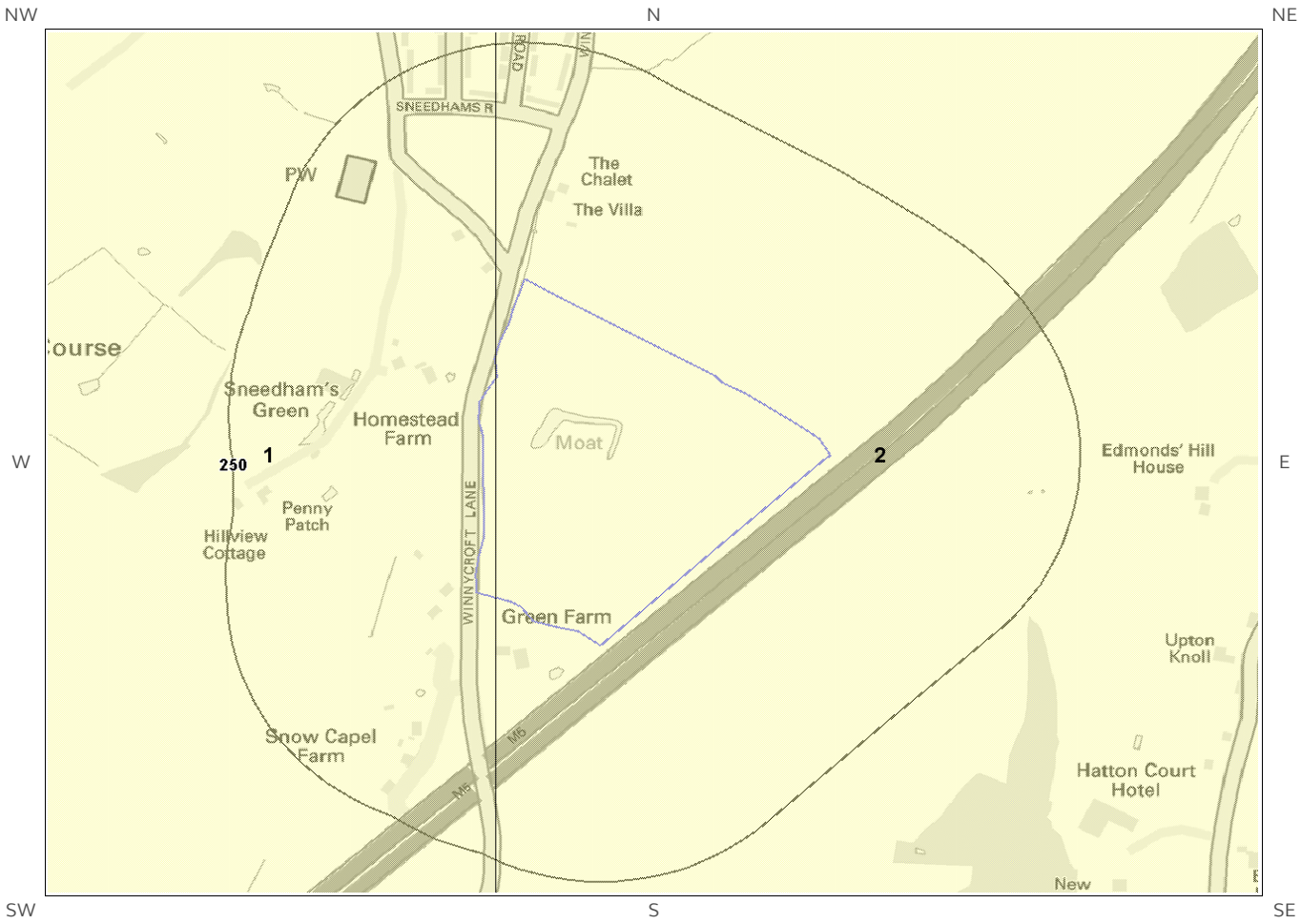
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.3 Ground Dissolution of Soluble Rocks Map



Ground Dissolution Soluble Rocks Legend

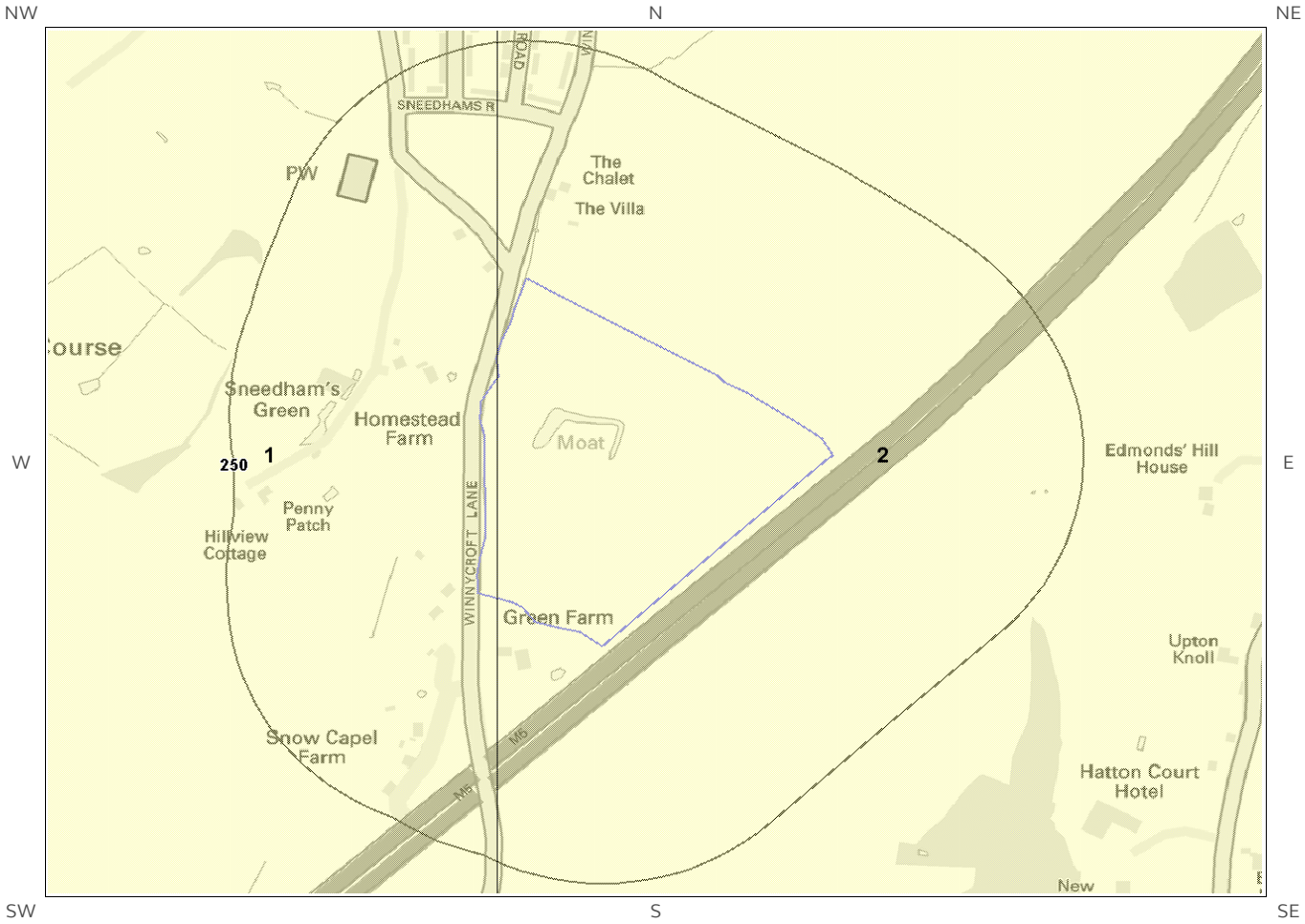
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.4 Compressible Deposits Map



Compressible Deposits Legend

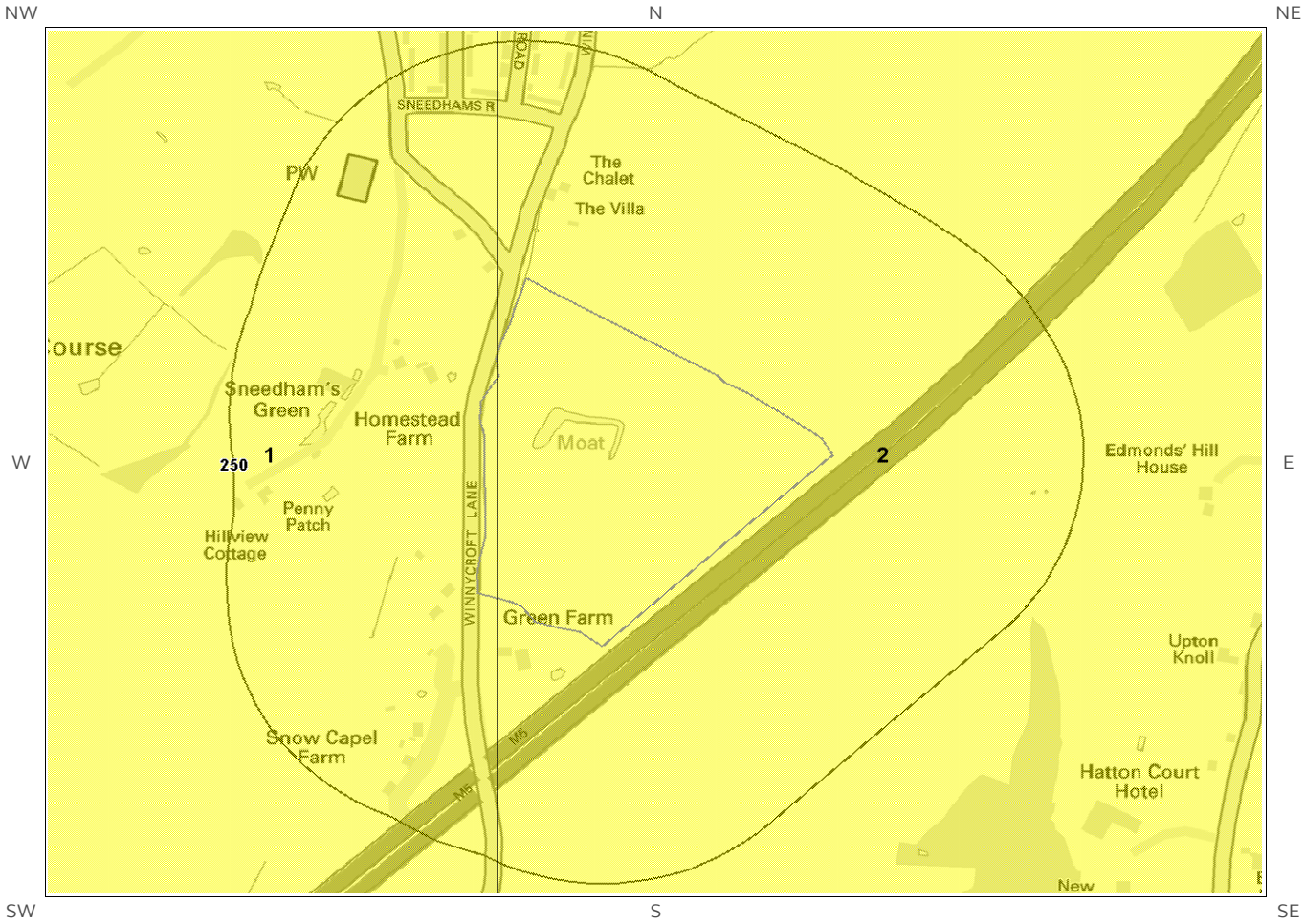
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.5 Collapsible Deposits Map



Collapsible Deposits Legend

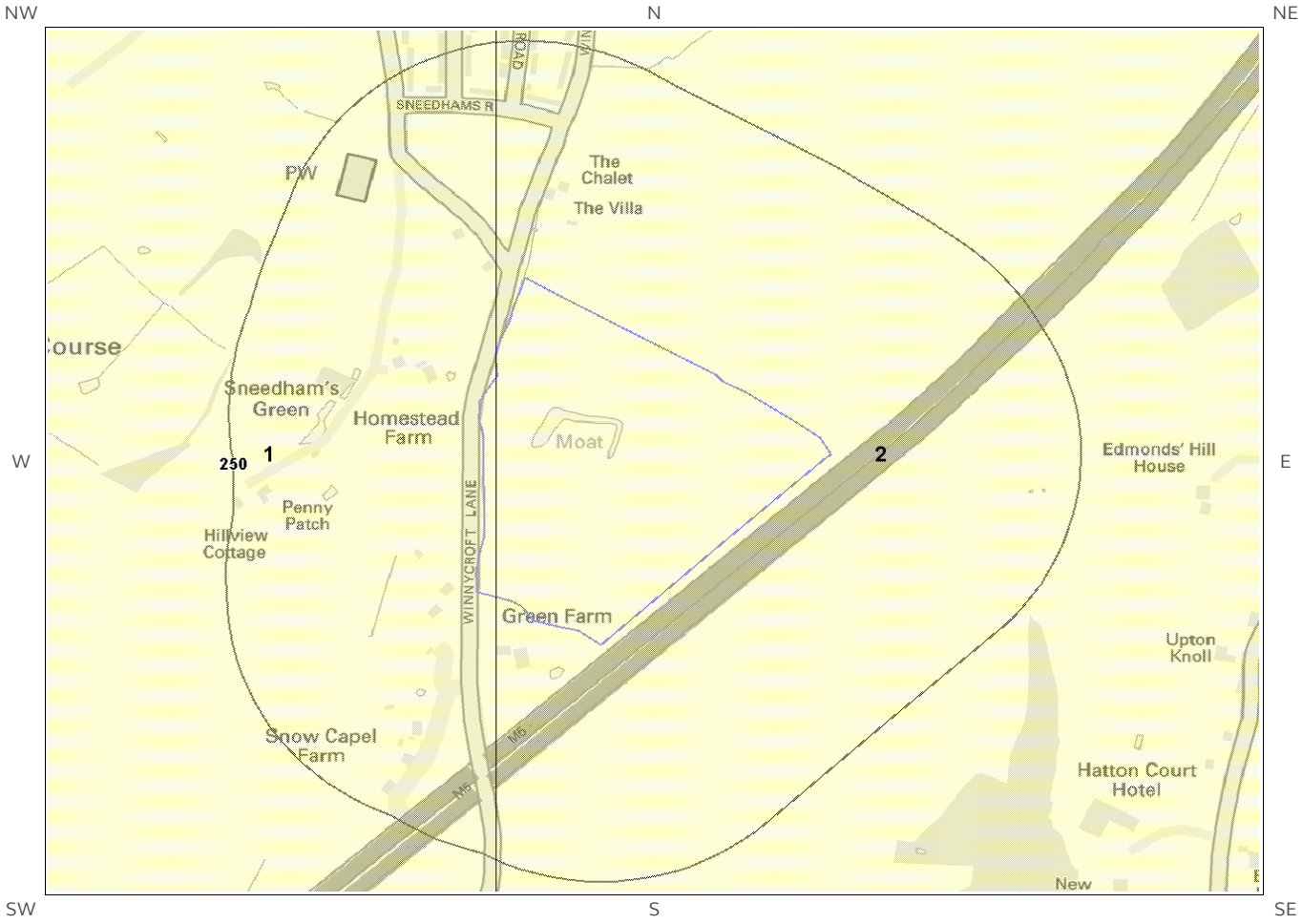
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.6 Running Sand Map



Running Sand Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

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	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
2	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

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

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	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.
3	43.0	SE	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.

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	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.

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.

ID	Distance (m)	Direction	Hazard Rating	Details
2	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.

6.5 Collapsible Deposits

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

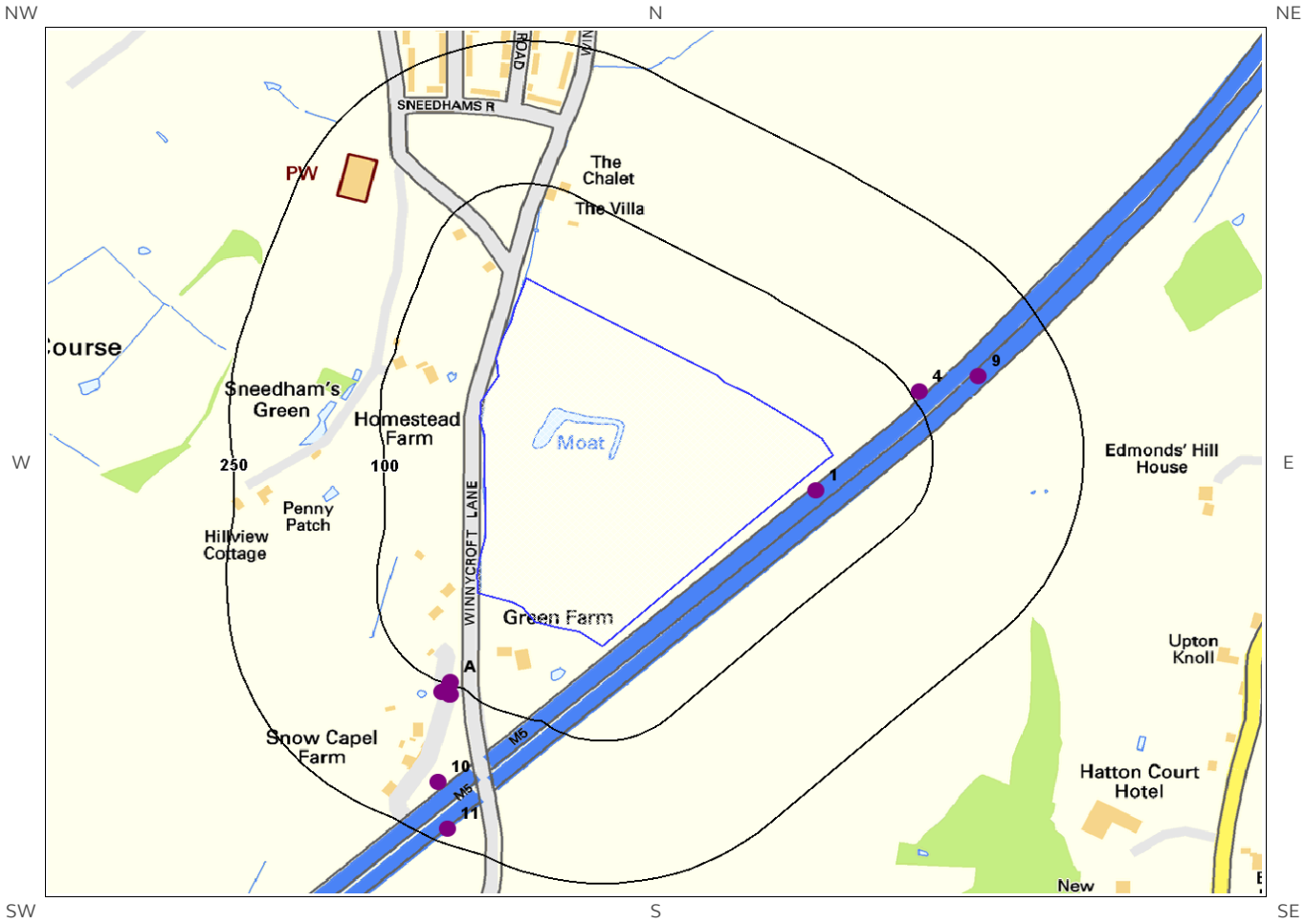
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible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

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	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
2	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

7 Borehole Records Map



Borehole Records Legend

Site Outline

Borehole Locations

125
250
Search Buffers (m)

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: 11

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	18.0	SE	385317 214146	SO81SE20	10.33	AREA 2 M5 MOTORWAY GDIS PHASE 3 11
2A	97.0	S	384953 213945	SO81SW55	4.2	M5 J11-12 & M4 J17-18 WS6
3A	100.0	S	384952 213942	SO81SW54	4.2	M5 J11-12 & M4 J17-18 WS5
4	108.0	NE	385420 214250	SO81SE8	4.87	M5 ROSS SPUR-EASTINGTON 73
5A	110.0	S	384945 213934	SO81SW52	4.2	M5 J11-12 & M4 J17-18 WS3
6A	111.0	S	384944 213934	SO81SW53	4.2	M5 J11-12 & M4 J17-18 WS4
7A	111.0	S	384953 213931	SO81SW51	4.2	M5 J11-12 & M4 J17-18 WS2
8A	111.0	S	384952 213931	SO81SW50	4.2	M5 J11-12 & M4 J17-18 WS1
9	167.0	NE	385479 214266	SO81SE19	10.26	AREA 2 M5 MOTORWAY GDIS PHASE 3 5
10	195.0	SW	384940 213840	SO81SW2	6.4	M5 ROSS SPUR-EASTINGTON 74A
11	236.0	S	384950 213790	SO81SW3	9.14	M5 ROSS SPUR-EASTINGTON 74B

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#1: scans.bgs.ac.uk/sobi_scans/boreholes/19329370
#2A: scans.bgs.ac.uk/sobi_scans/boreholes/18843960
#3A: scans.bgs.ac.uk/sobi_scans/boreholes/18843959
#4: scans.bgs.ac.uk/sobi_scans/boreholes/271391
#5A: scans.bgs.ac.uk/sobi_scans/boreholes/18843957
#6A: scans.bgs.ac.uk/sobi_scans/boreholes/18843958
#7A: scans.bgs.ac.uk/sobi_scans/boreholes/18843956
#8A: scans.bgs.ac.uk/sobi_scans/boreholes/18843955
#9: scans.bgs.ac.uk/sobi_scans/boreholes/19329369
#10: scans.bgs.ac.uk/sobi_scans/boreholes/271396
#11: scans.bgs.ac.uk/sobi_scans/boreholes/271397

8 Estimated Background Soil Chemistry

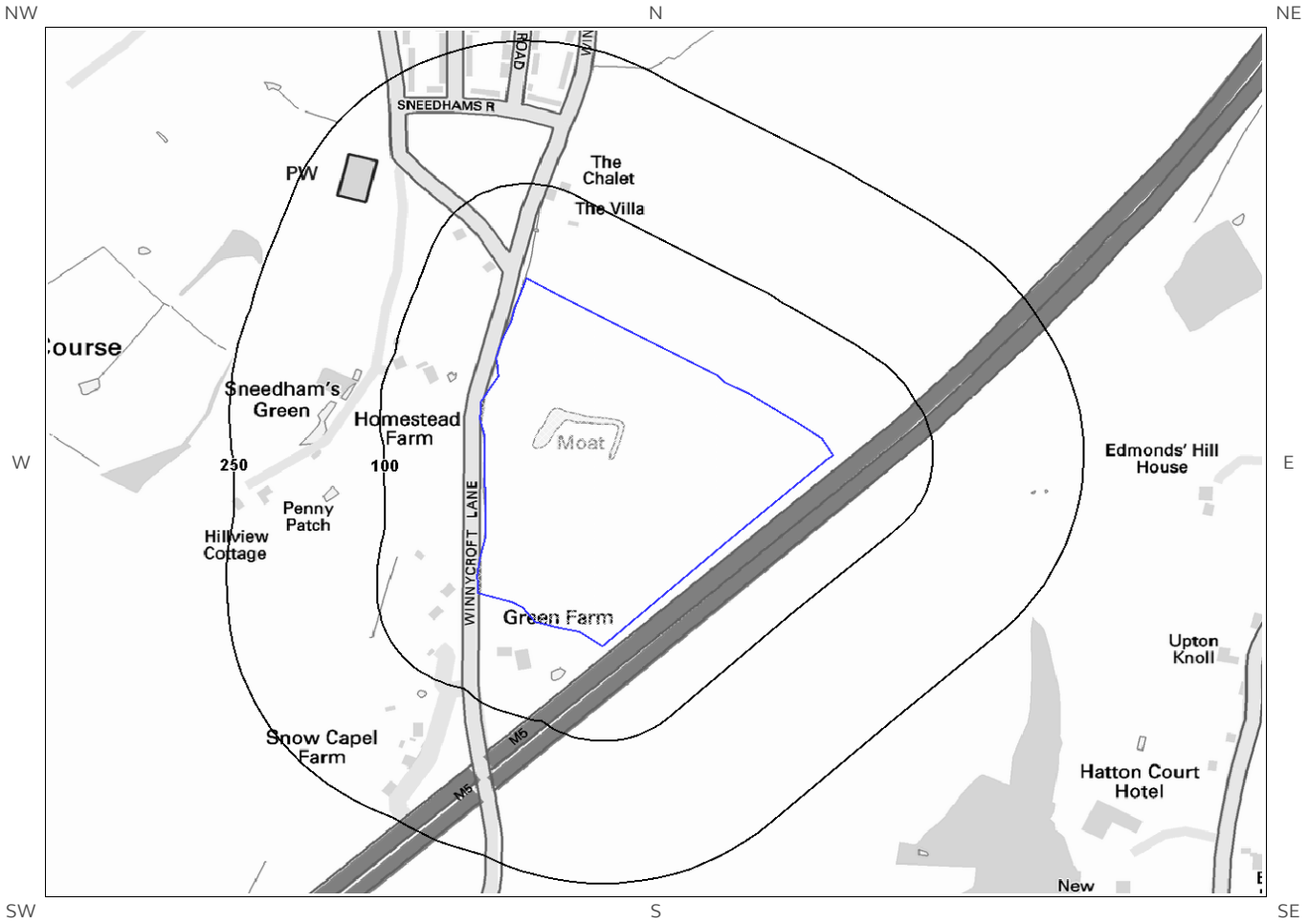
Records of background estimated soil chemistry within 250m of the study site boundary: 6

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 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
32.0	S	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
32.0	S	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 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

- Site Outline
- 250 / 500 — Search Buffers (m)
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- High Speed 2 Revised Proposed Route
- 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.

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Contact Details

[redacted]

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Gypsum
SAINT-GOBAIN

The Coal Authority

Public Health England

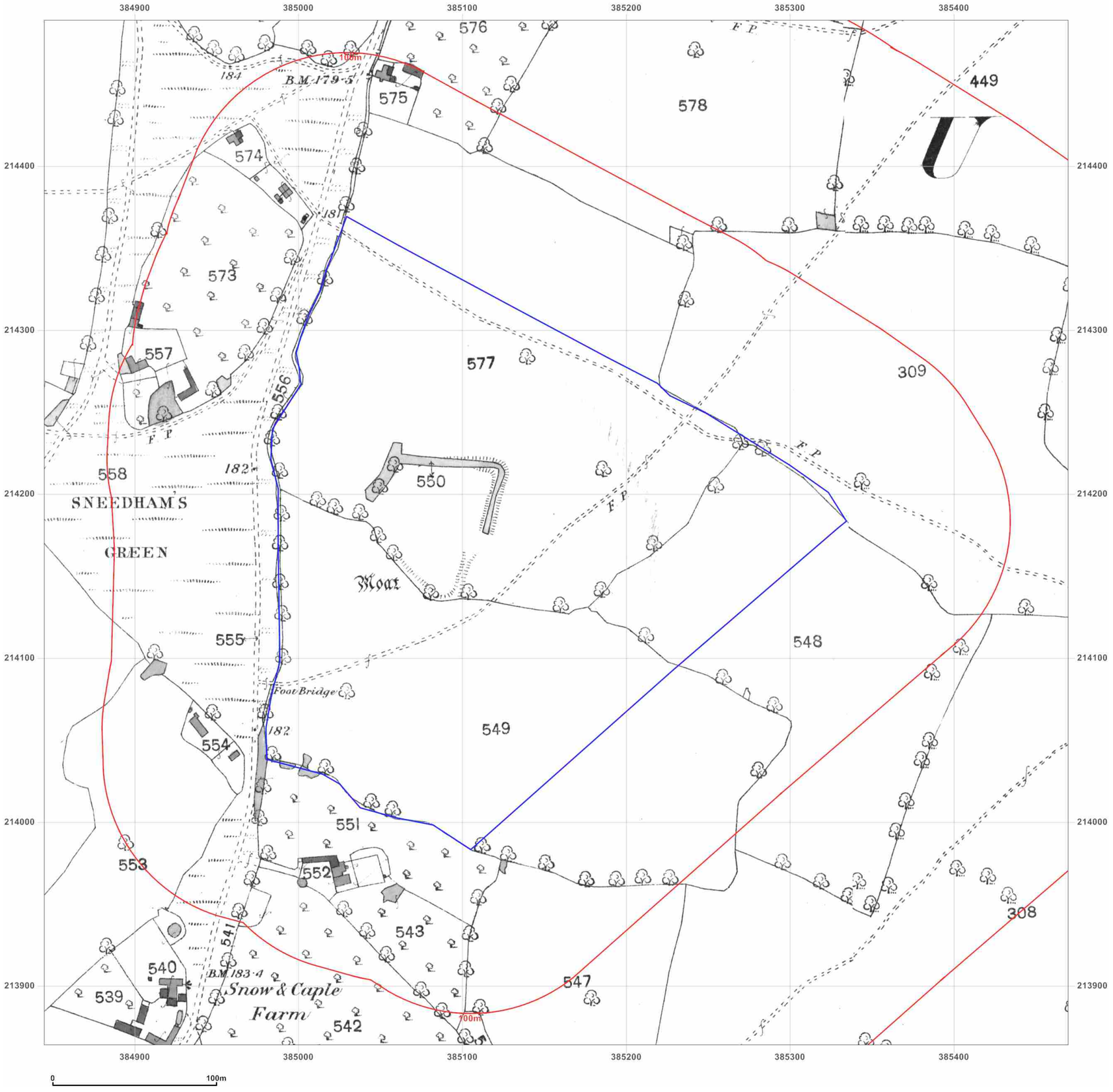
JOHNSON POOLE & BLOOMER
CONSULTANTS

Data

getmapping

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/



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

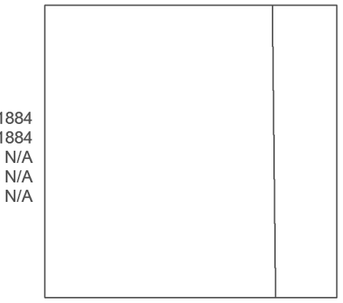
Map date: **1884**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed 1884
Revised 1884
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1884
Revised 1884
Edition N/A
Copyright N/A
Levelled N/A

Groundsure INSIGHTS

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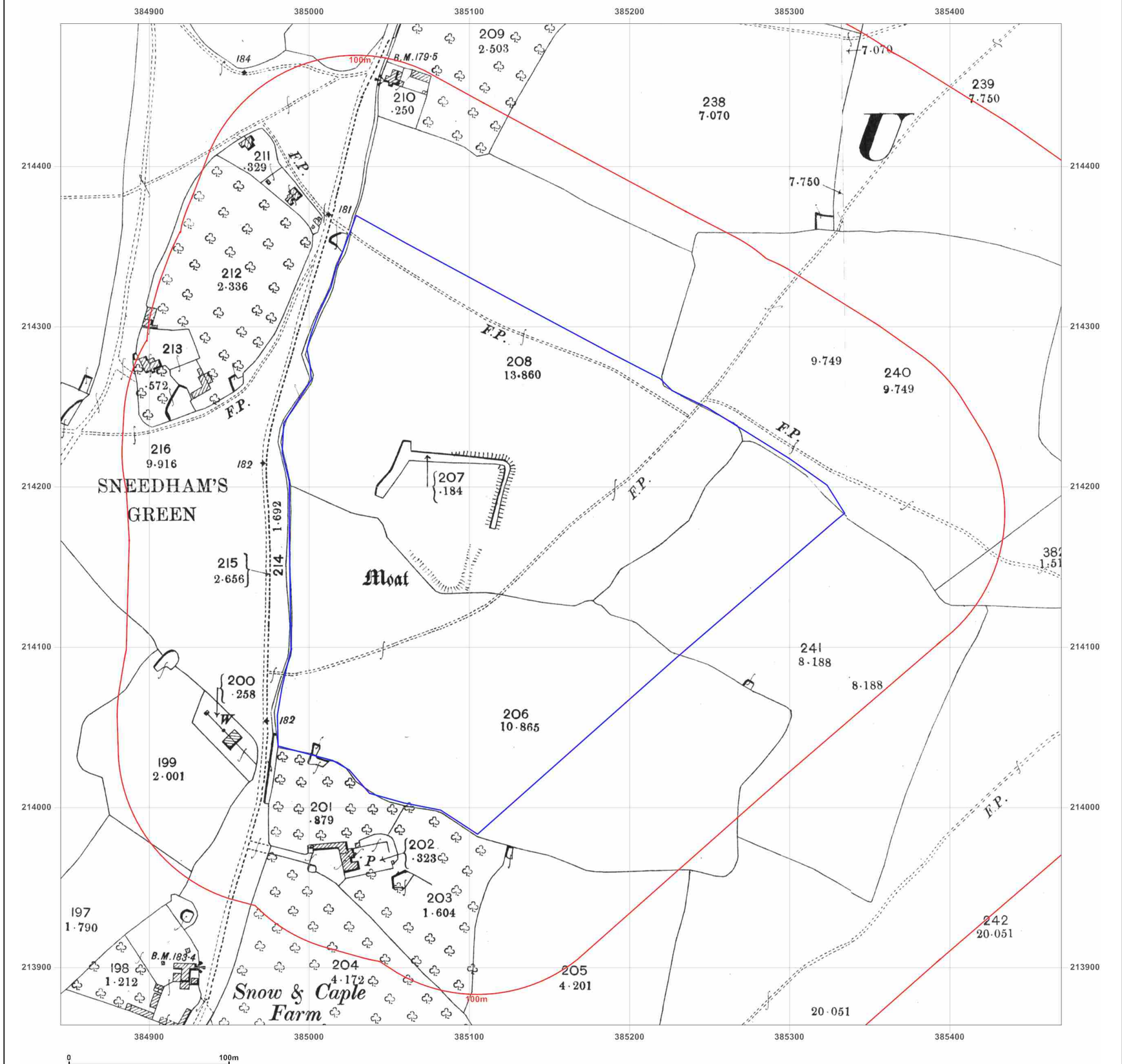
Powered by

Supplied by:
www.centremapslive.com
[redacted]

Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

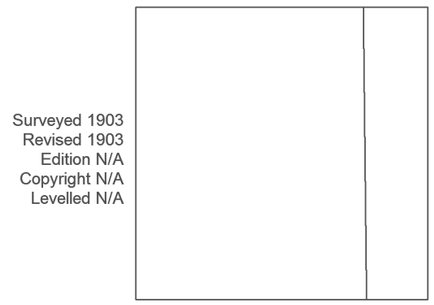
Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series
Map date: **1903**
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S



Groundsure INSIGHTS

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Powered by

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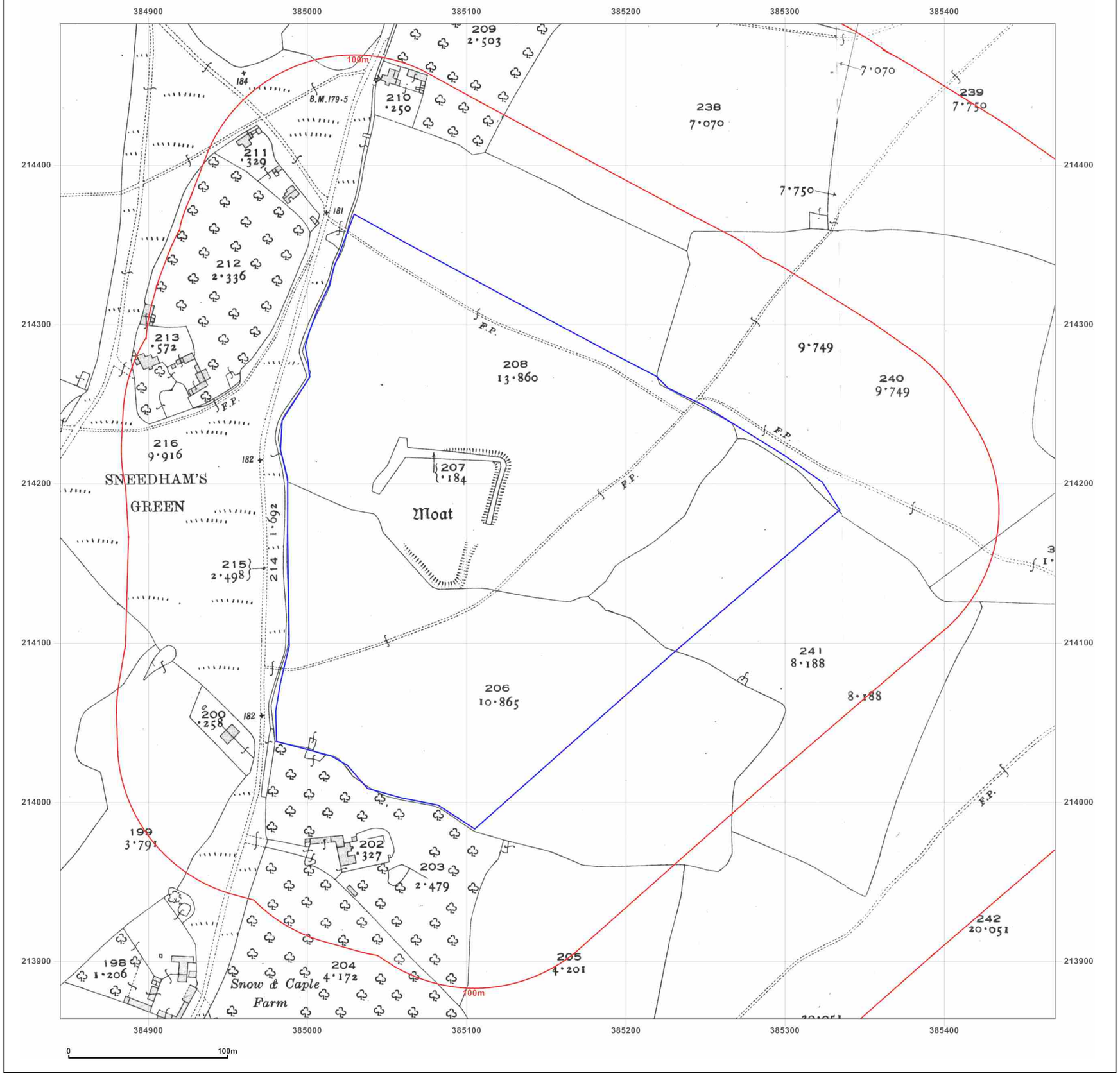
[redacted]

Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series
Map date: **1923**
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1923
Revised 1923
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1923
Revised 1923
Edition N/A
Copyright N/A
Levelled N/A

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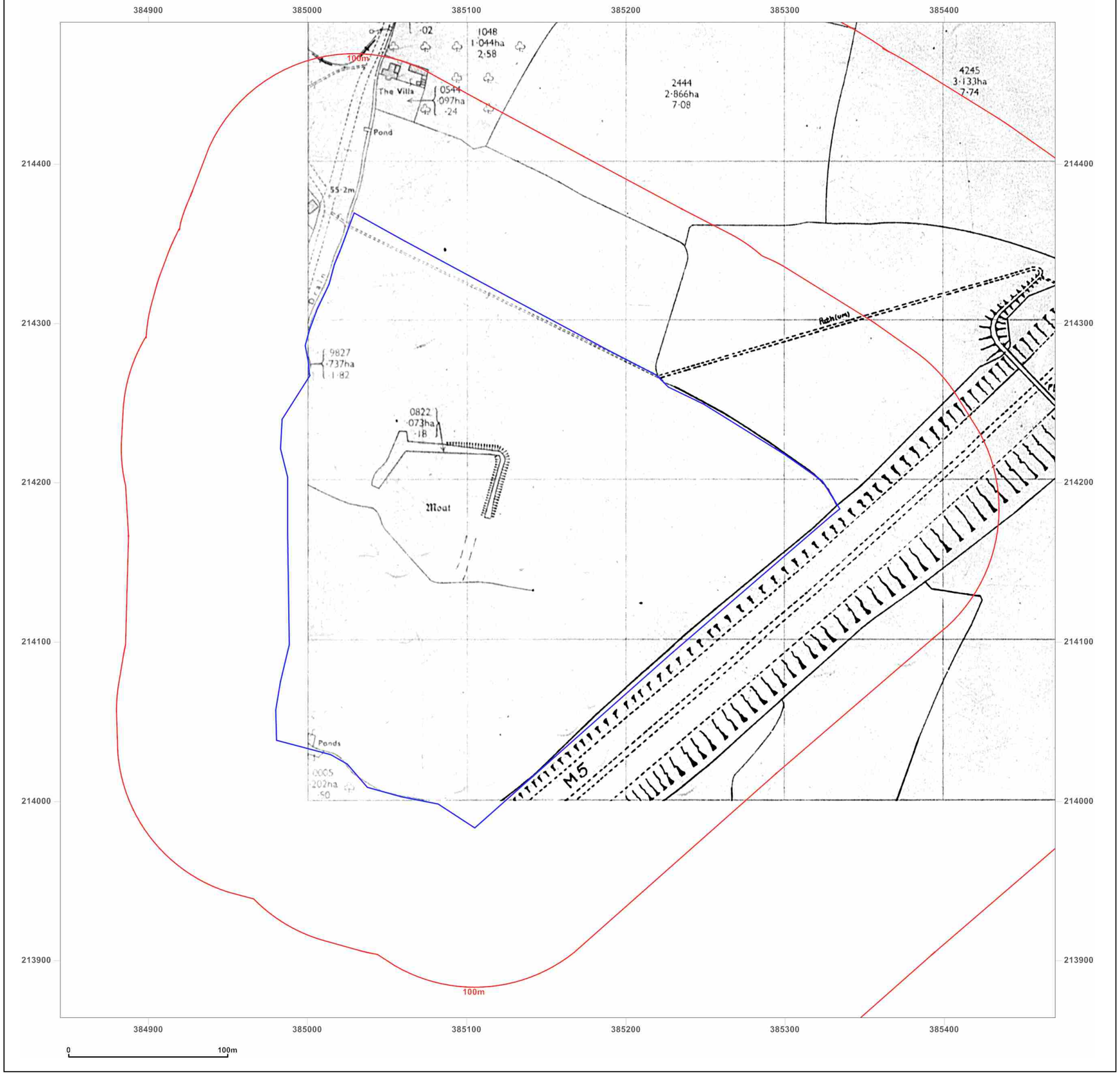
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid

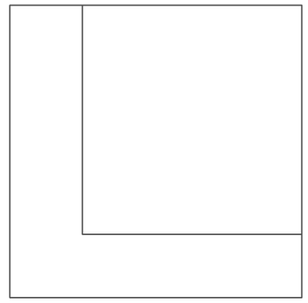
Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

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



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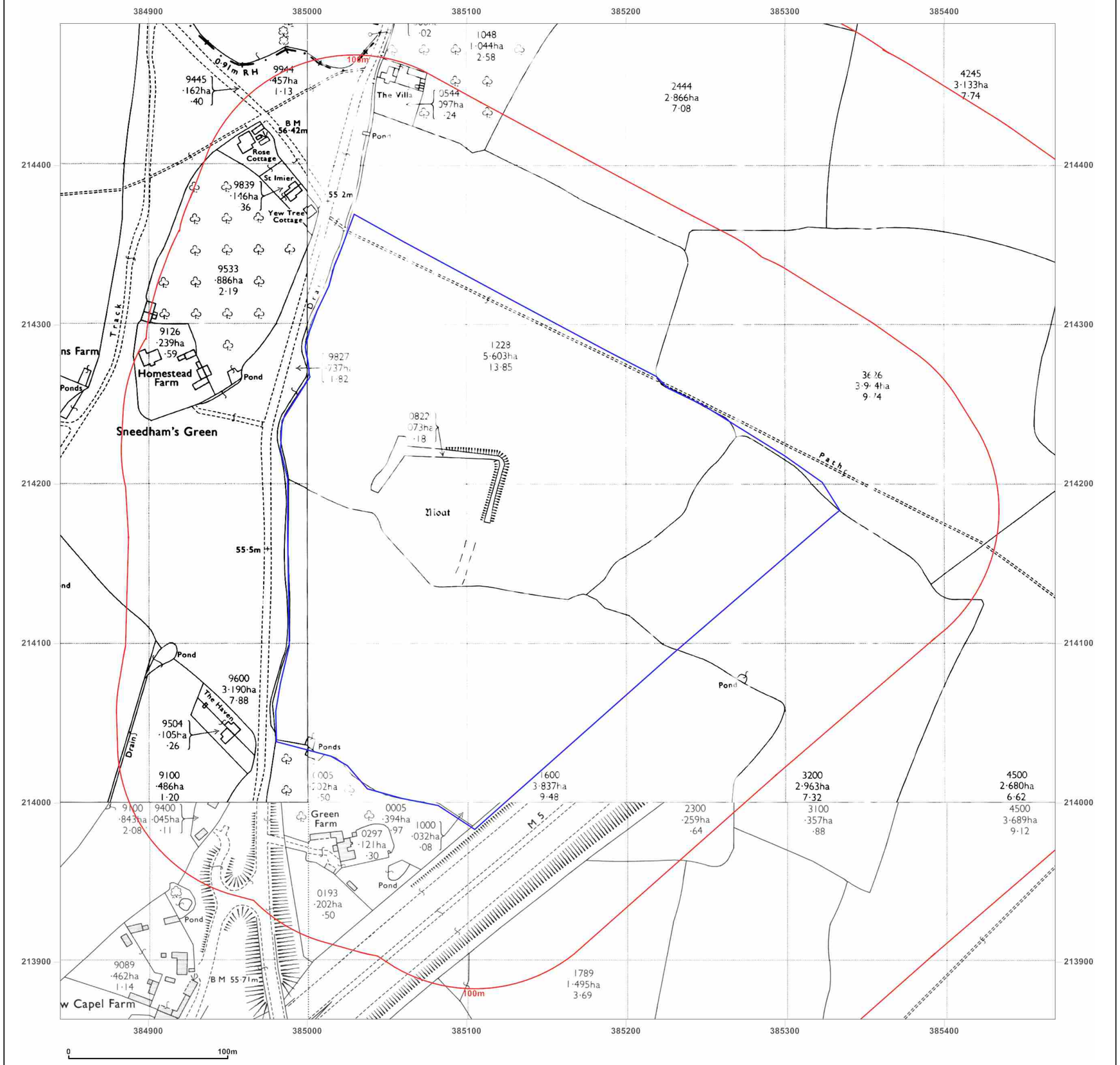
Supplied by:
www.centremapslive.com
[redacted]

Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid

Map date: **1970-1971**

Scale: 1:2,500

Printed at: 1:2,500

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

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

Surveyed 1971
Revised 1971
Edition N/A
Copyright 1972
Levelled 1966

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Production date: 22 May 2017

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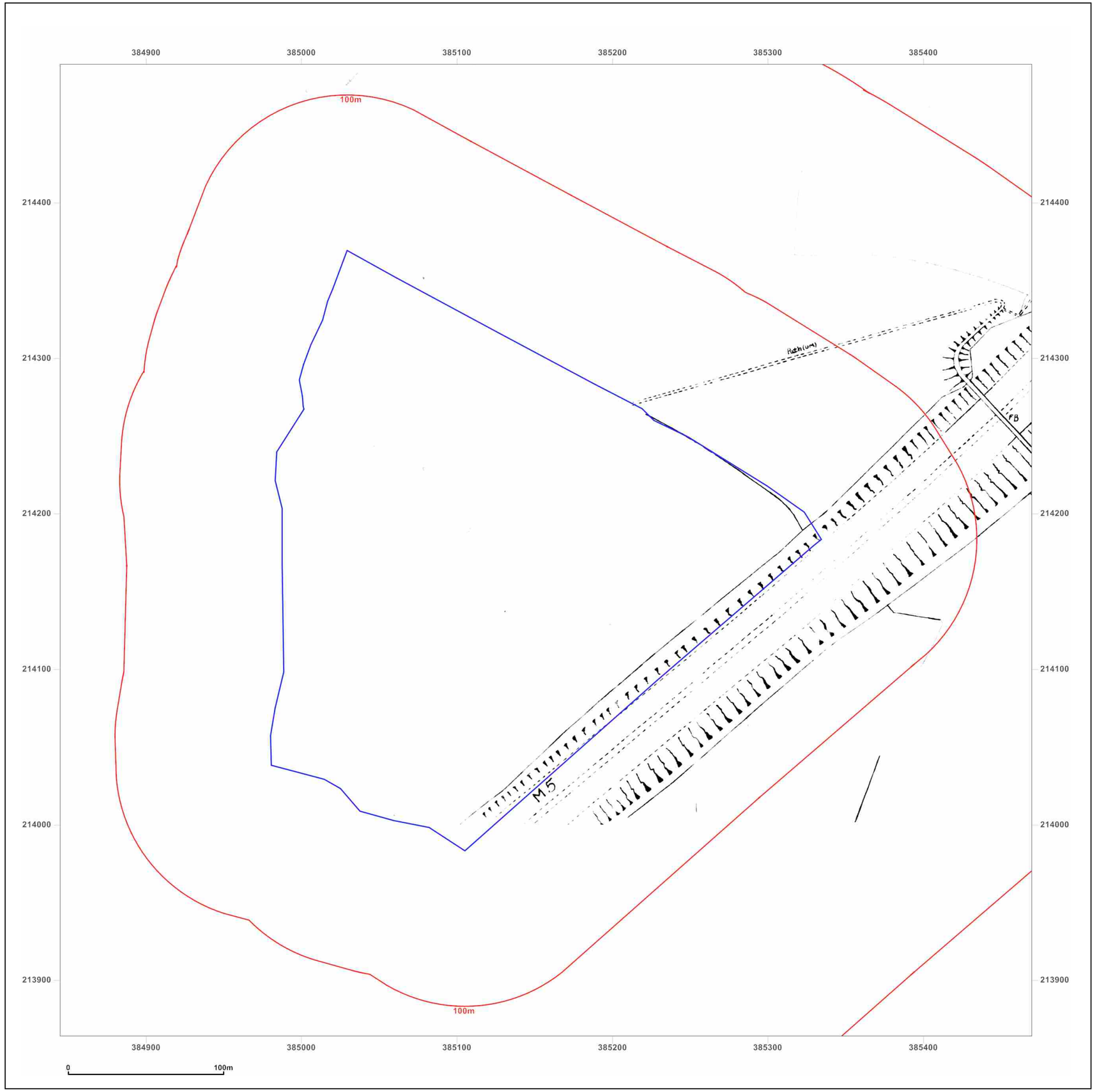

CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid
Map date: **1978**
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

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

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Production date: 22 May 2017

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FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid
Map date: **1994**
Scale: 1:1,250
Printed at: 1:2,000

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed 1994
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

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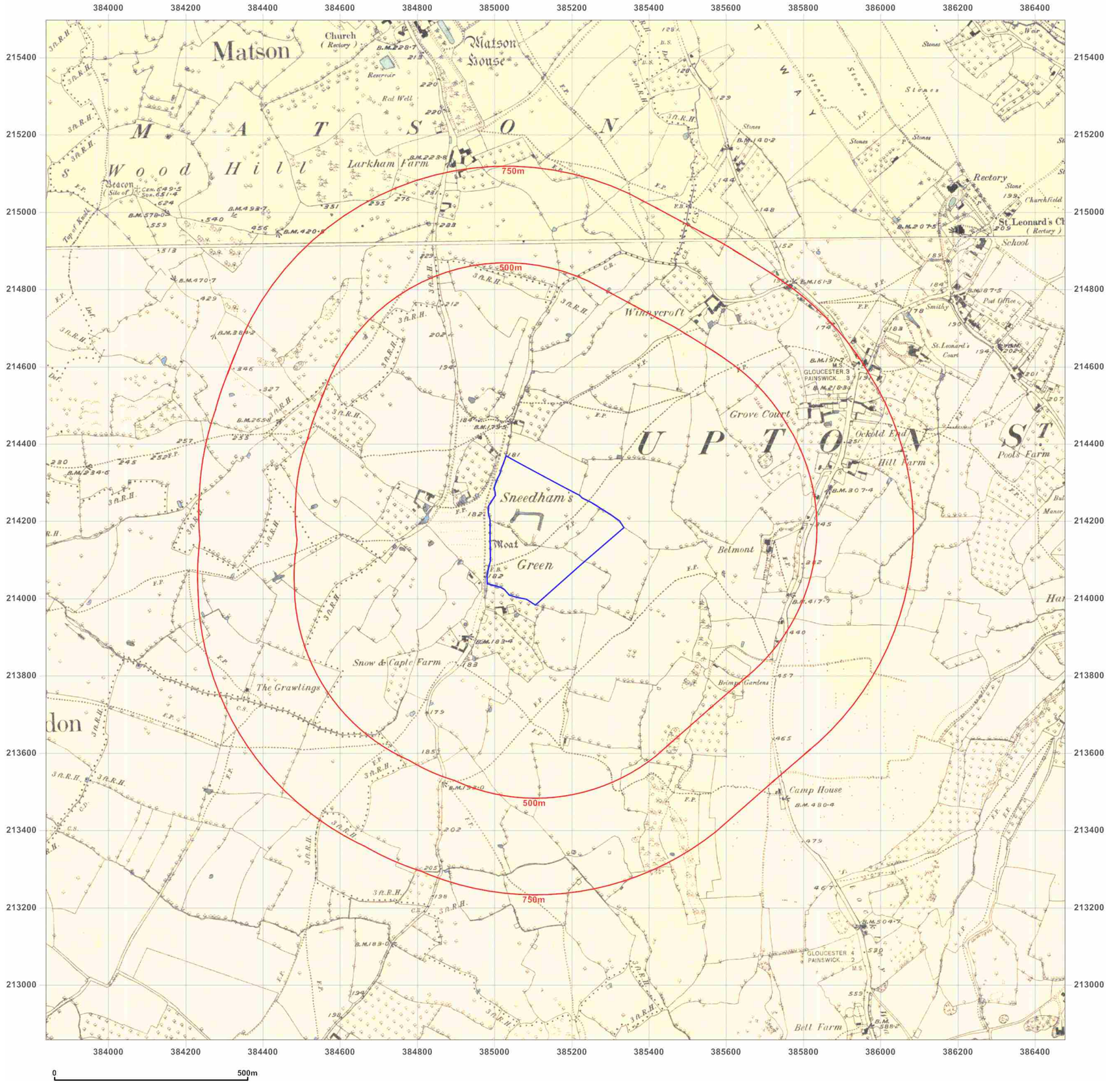
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

Map date: **1883**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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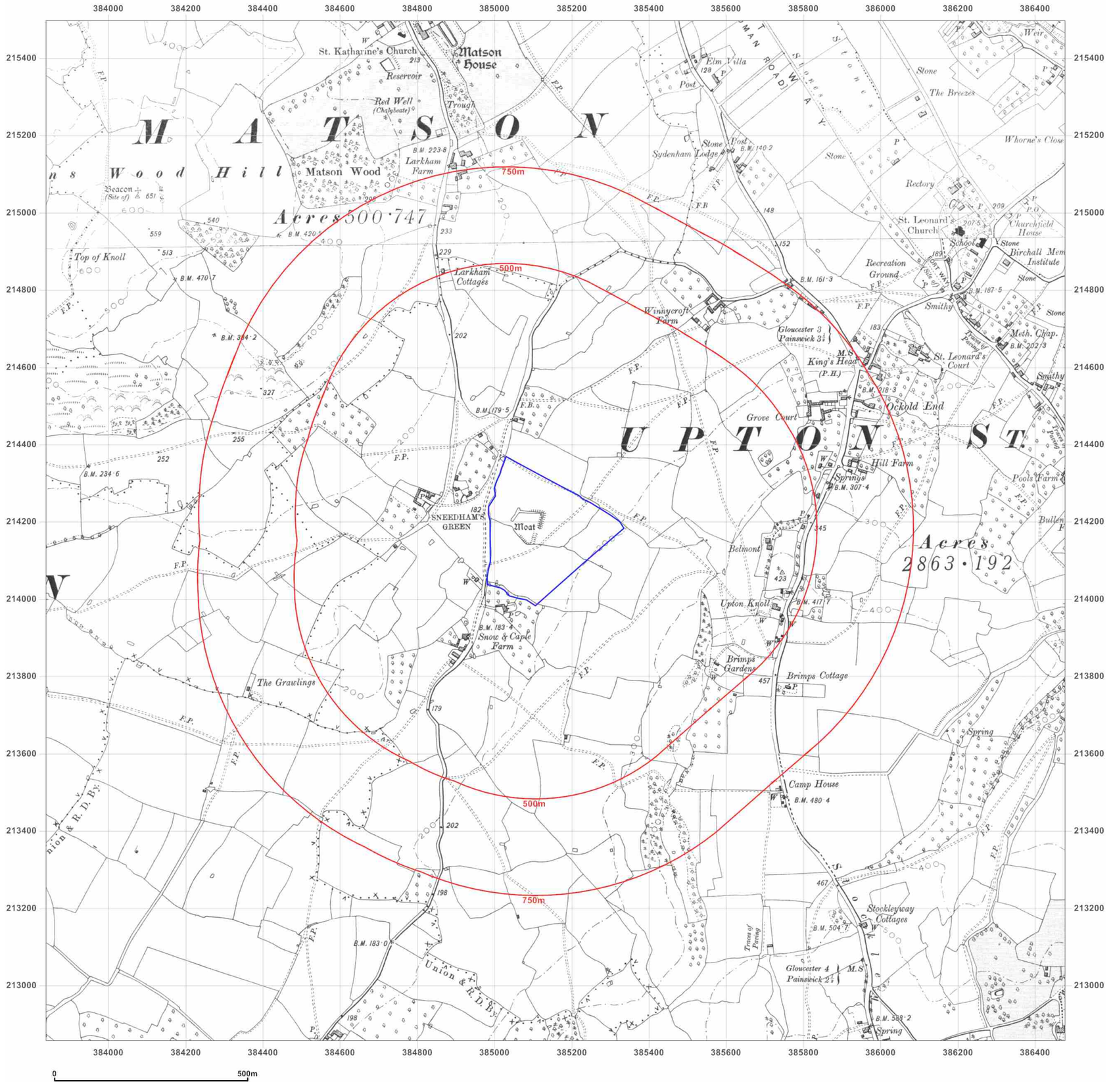
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

Map date: **1901**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1882
Revised 1901
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1882
Revised 1901
Edition N/A
Copyright N/A
Levelled N/A

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Supplied by:
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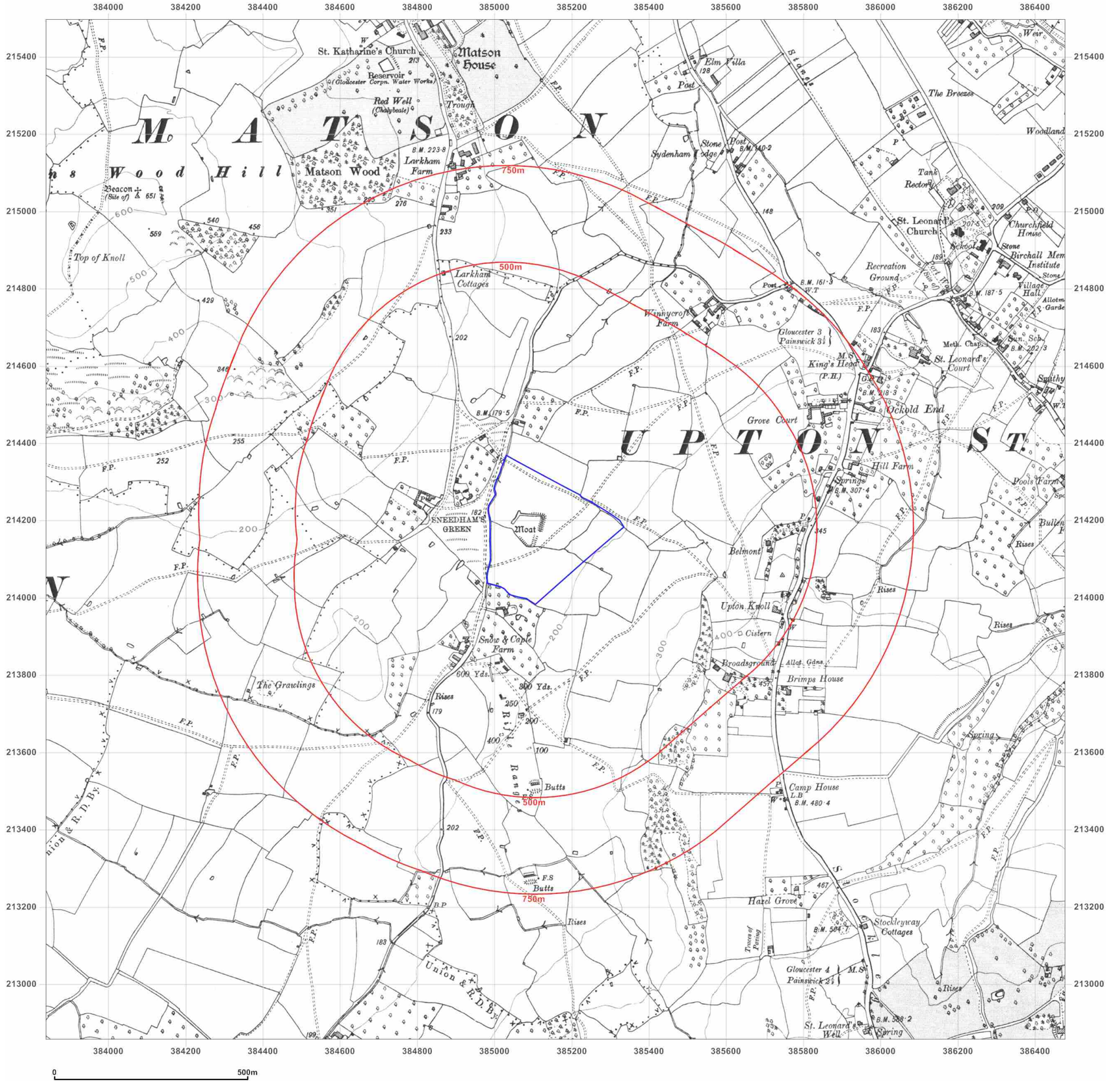
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

Map date: **1924**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1882
Revised 1924
Edition N/A
Copyright N/A
Levelled N/A

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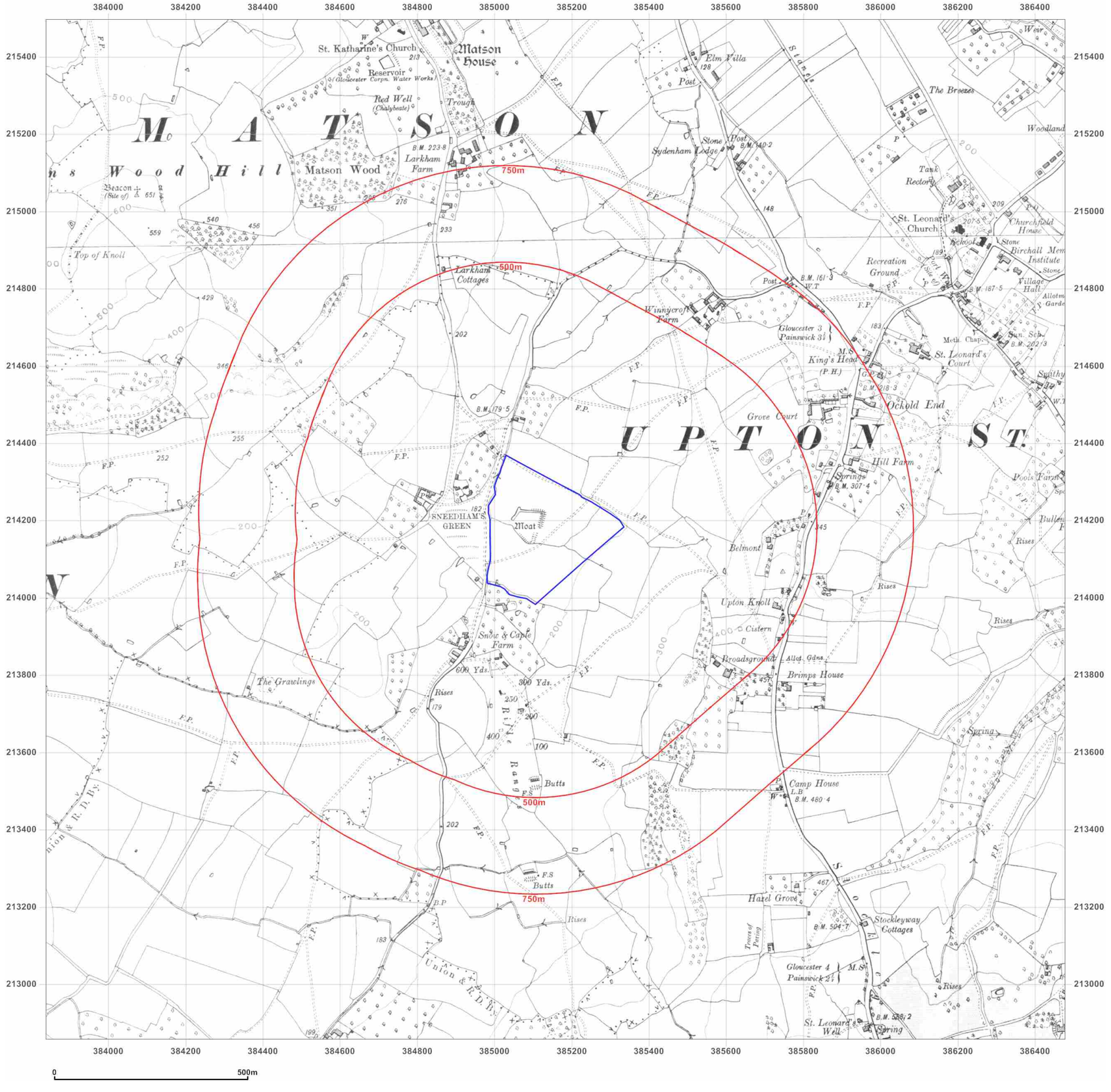
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

Map date: **1924**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1882
Revised 1924
Edition 1924
Copyright N/A
Levelled N/A

Surveyed 1882
Revised 1924
Edition 1924
Copyright N/A
Levelled N/A

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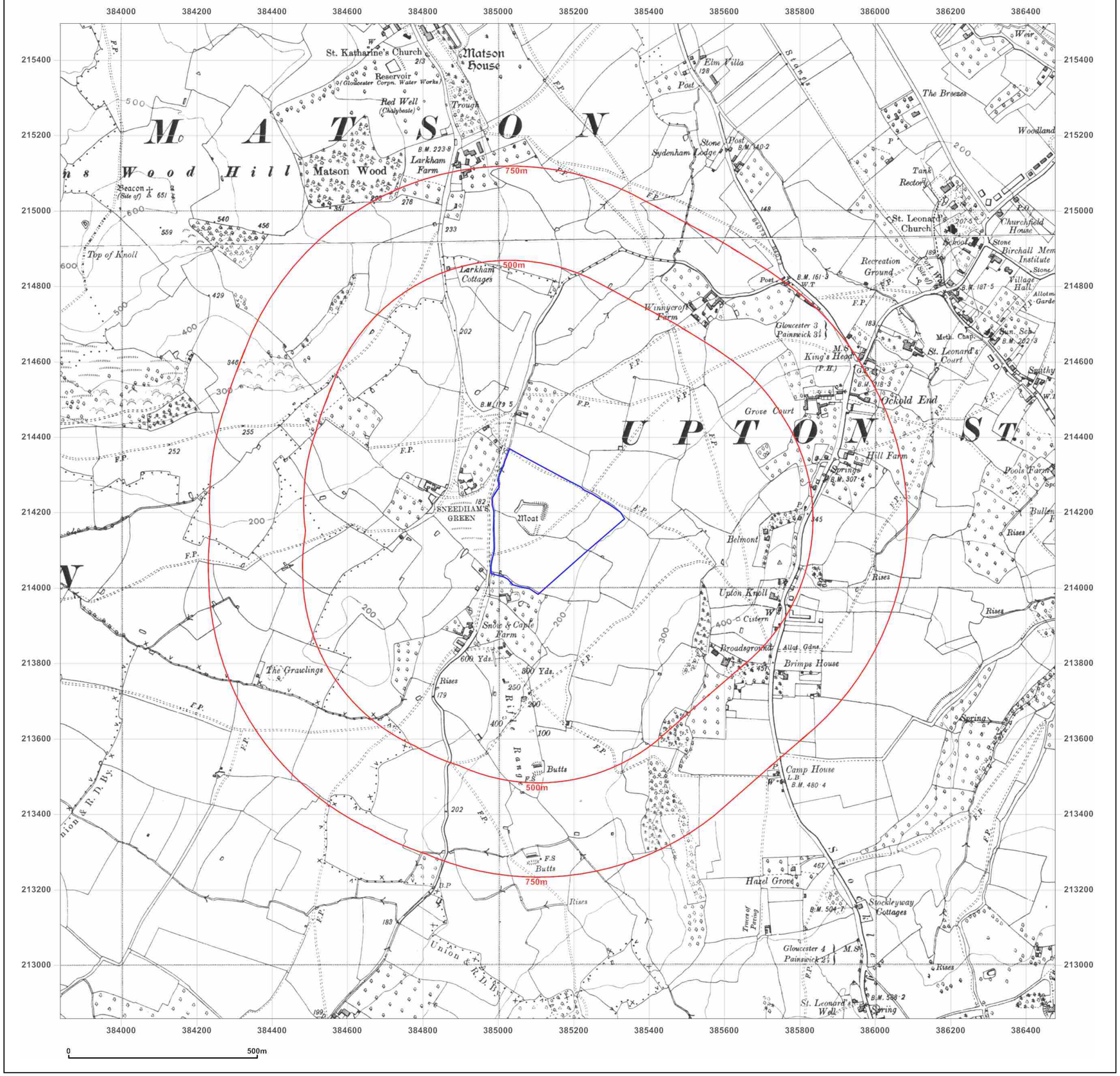
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: County Series

Map date: **1938**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1882
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1882
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

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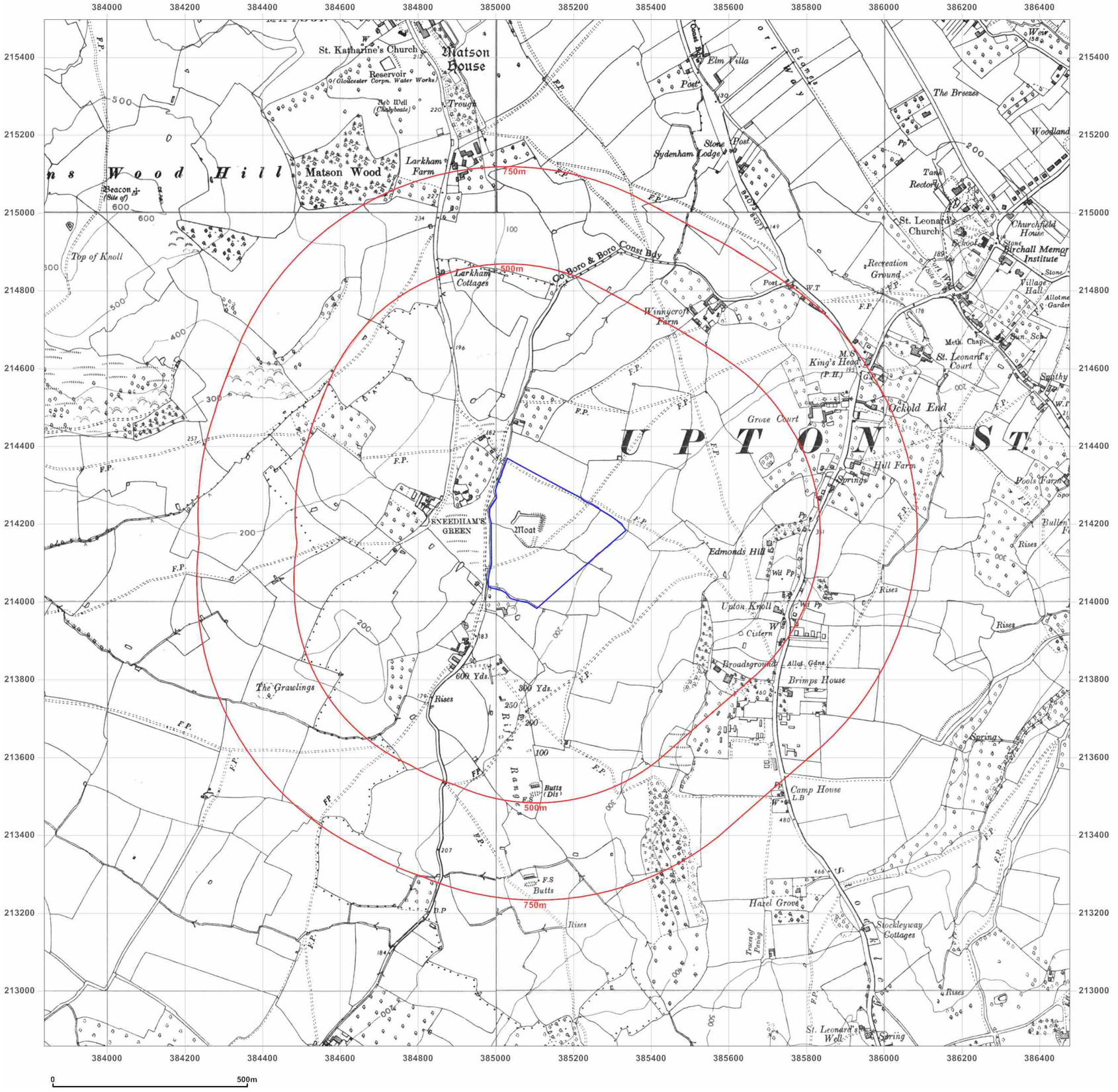
[redacted]

Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: Provisional
Map date: **1954-1955**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1949
Revised 1954
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1954
Edition 1955
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1954
Edition 1954
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1955
Levelled N/A

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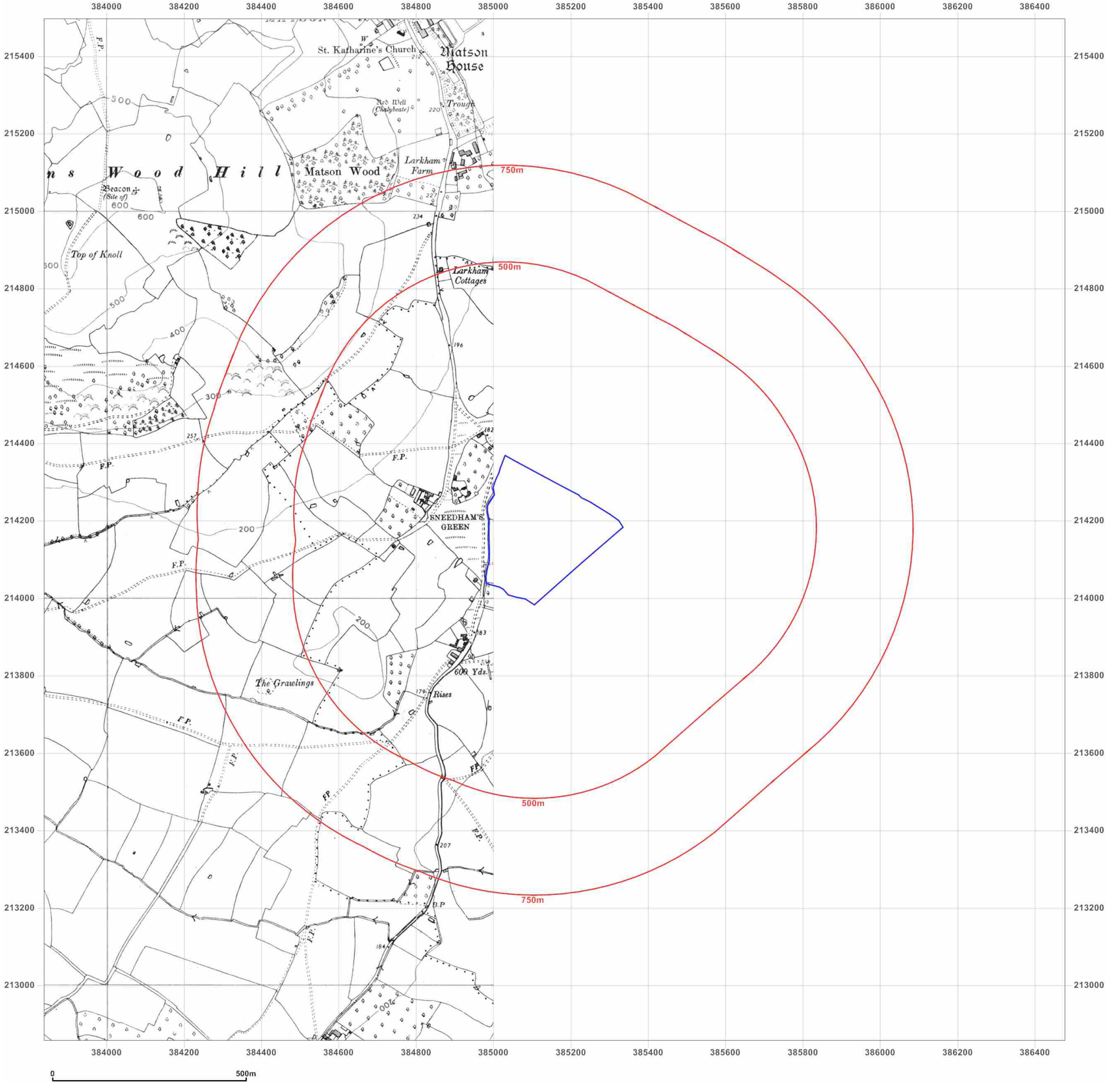
[redacted]

Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: Provisional
Map date: **1960-1961**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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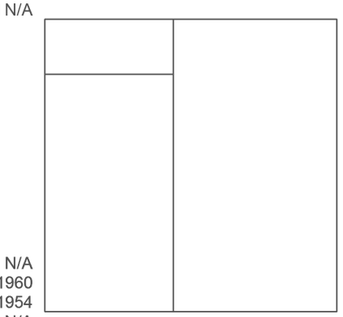
Surveyed 1949
Revised 1960
Edition 1961
Copyright N/A
Levelled N/A



Surveyed N/A
Revised 1960
Edition 1954
Copyright N/A
Levelled N/A

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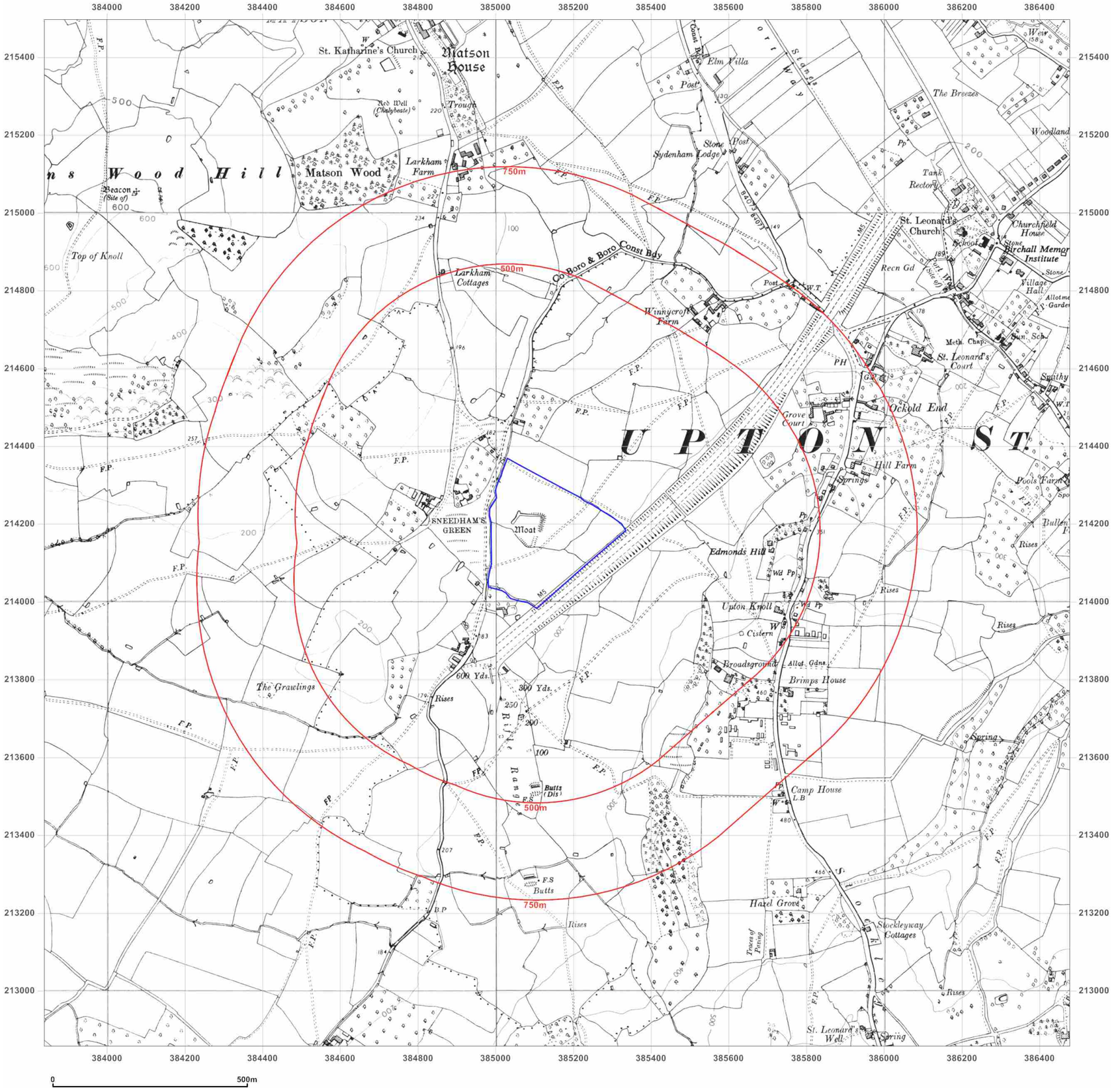
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: Provisional
Map date: **1966-1971**
Scale: 1:10,560
Printed at: 1:10,560

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

Surveyed N/A
Revised 1966
Edition 1955
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1968
Edition 1954
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1971
Edition N/A
Copyright 1955
Levelled N/A

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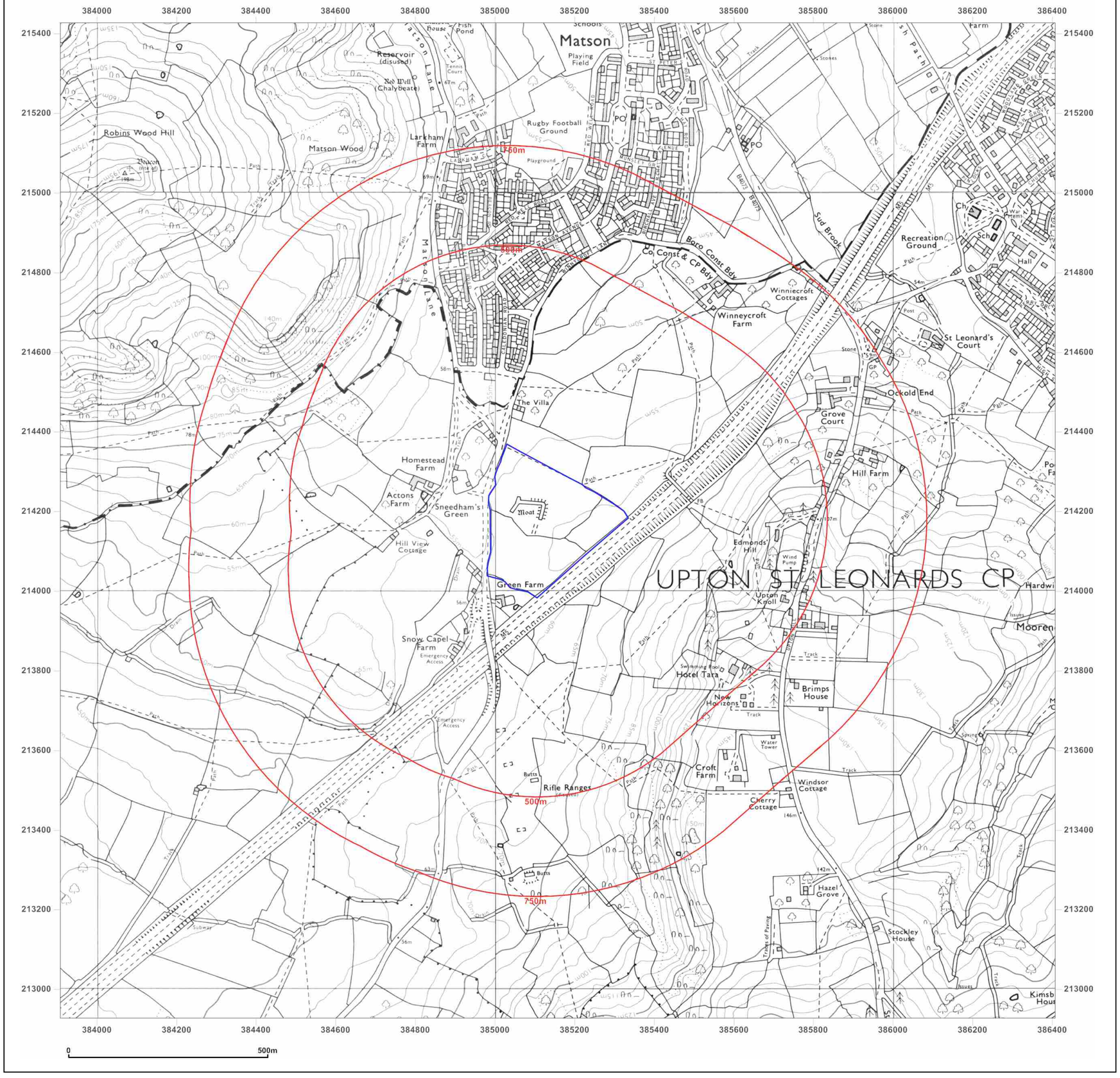
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid

Map date: **1974-1975**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1973
Revised 1975
Edition N/A
Copyright 1975
Levelled 1972

Surveyed 1973
Revised 1975
Edition N/A
Copyright 1975
Levelled 1972

Surveyed 1972
Revised 1974
Edition N/A
Copyright 1974
Levelled 1972

Surveyed 1971
Revised 1973
Edition N/A
Copyright 1975
Levelled 1972

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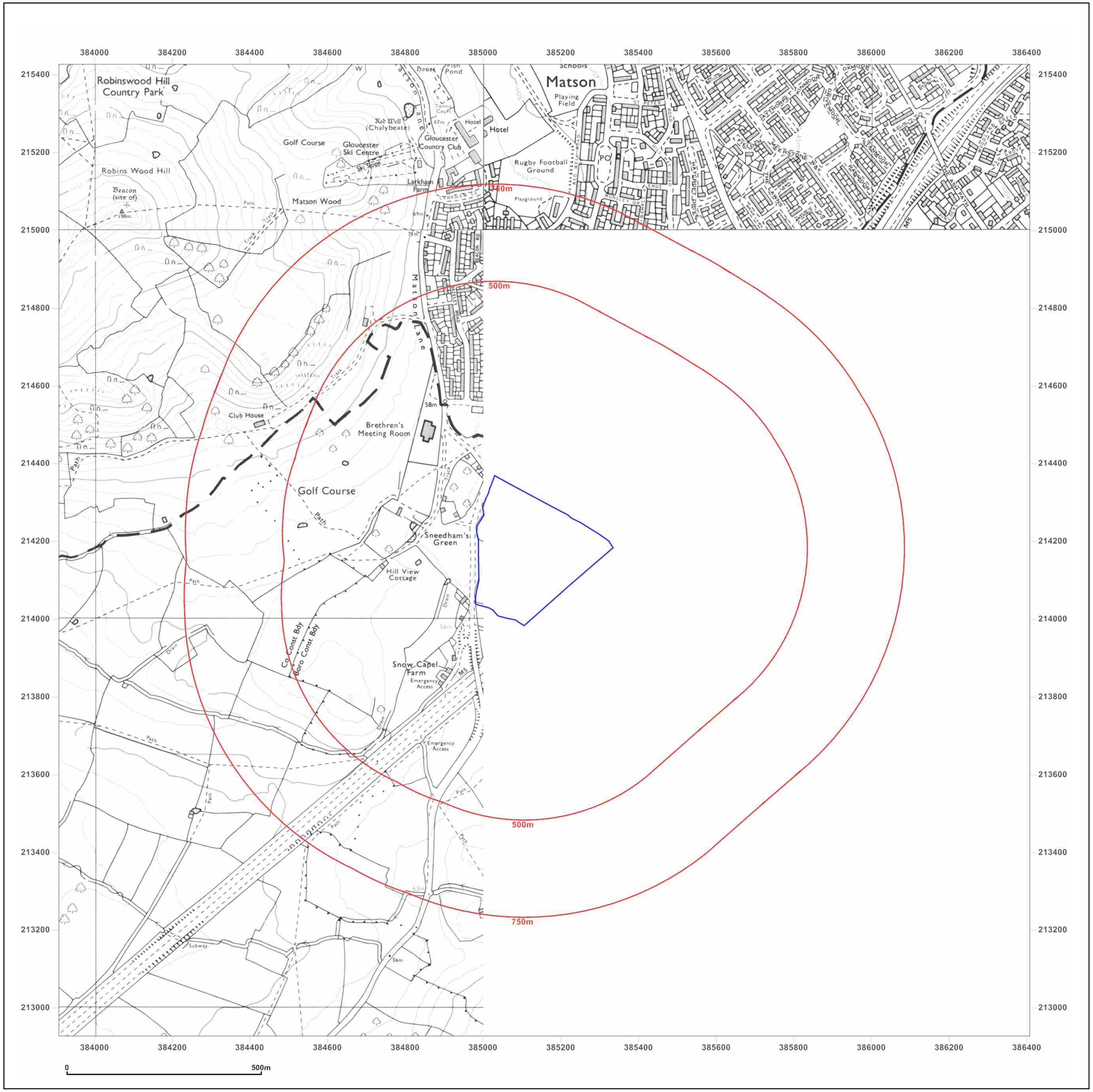
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid
Map date: **1986-1989**
Scale: 1:10,000
Printed at: 1:10,000

N
W E
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Surveyed 1984
Revised 1988
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1987
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1985
Revised 1986
Edition N/A
Copyright N/A
Levelled N/A

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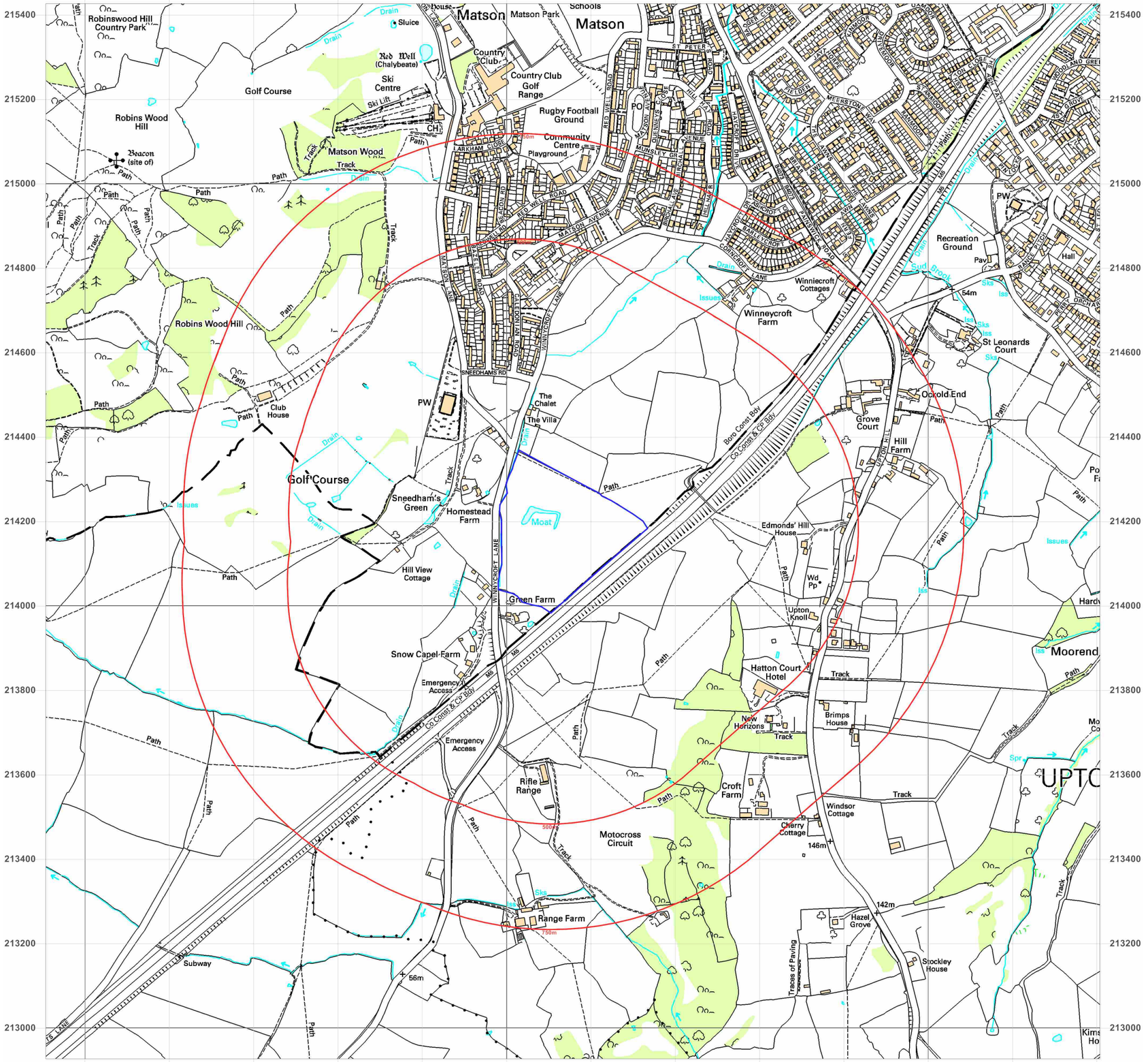
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

N
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2002

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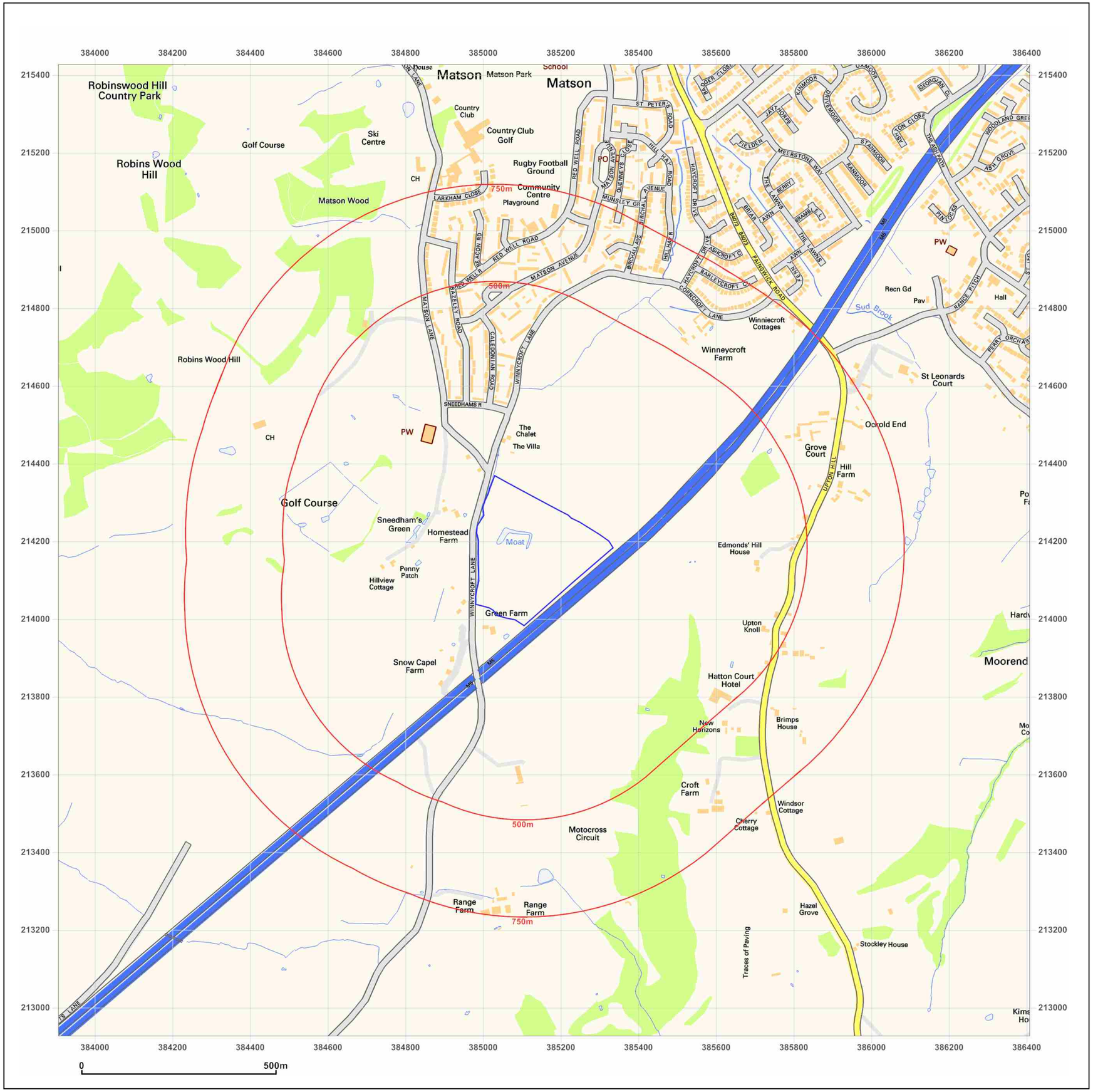
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid
Map date: **2010**
Scale: 1:10,000
Printed at: 1:10,000

N
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2010

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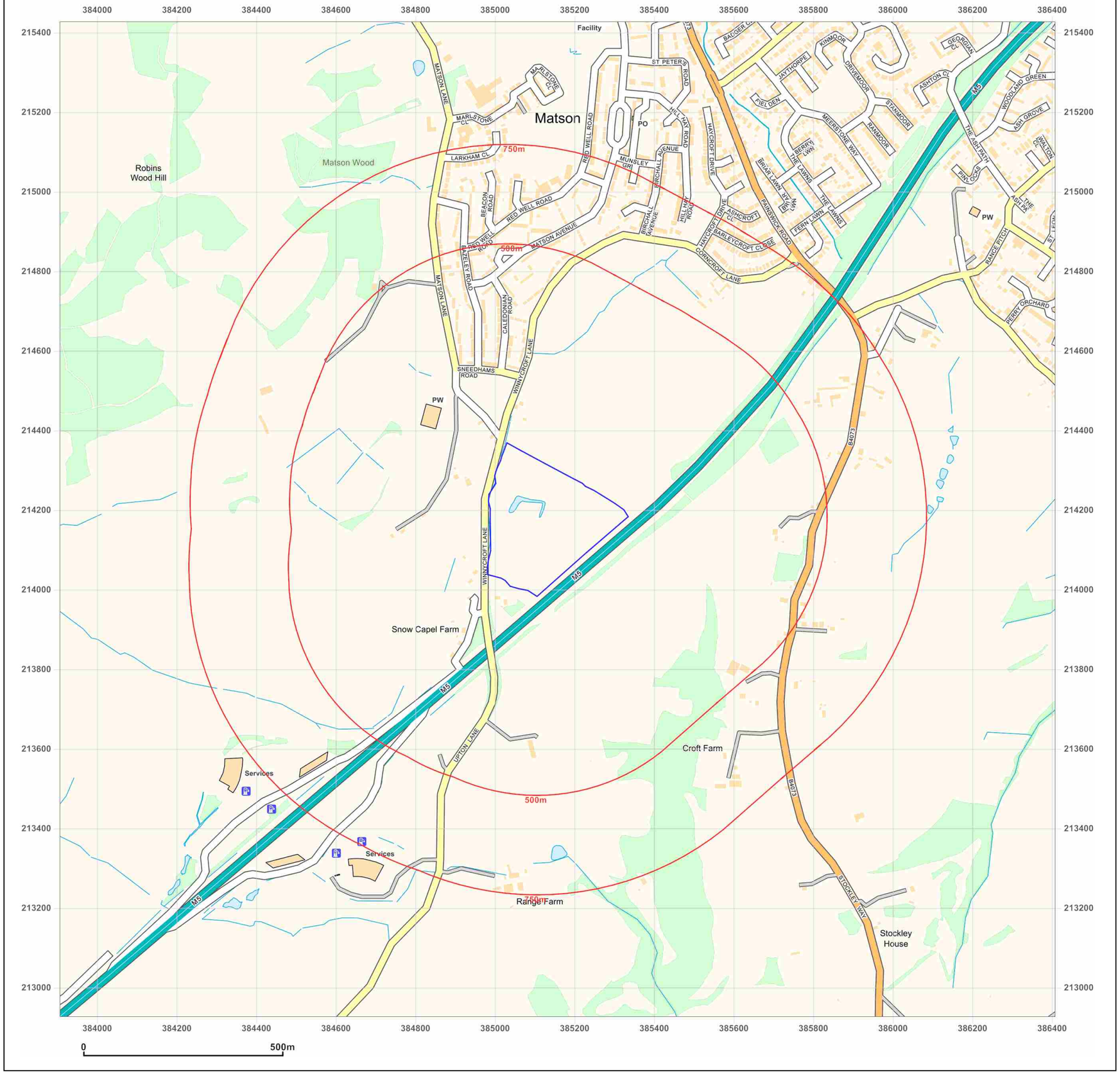
Production date: 22 May 2017

To view map legend click here *Legend*



CENTRE MAPS LIVE.
FOR A BETTER POINT OF VIEW

Site Details:

Snow Capel Matson , GL4 6EQ

Client Ref: 13238
Report Ref: CMAPS-CM-625691-13238-220517HIS
Grid Ref: 385157, 214176

Map Name: National Grid
Map date: **2014**
Scale: 1:10,000
Printed at: 1:10,000

N
W E
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2014

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Production date: 22 May 2017

To view map legend click here *Legend*

Appendix D

Boreholes

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

STANDARD METHODOLOGY FOR WINDOWLESS SAMPLING BOREHOLES & CONTINUOUS DYNAMIC PENETRATION TESTING (CDPT)

Windowless sampling boreholes and heavy or super heavy continuous dynamic penetration tests were sunk using a small tracked drilling and probing rig. The types of drilling are identified on each of the borehole records included as a separate appendix. The locations are given in Figure 1 and selected using information on the proposed redevelopment, existing buried services and structures, ongoing site use, reinstatement requirements and time constraints.

The windowless sampling technique consists of driving a hollow tube sampler with a plastic liner into the ground by repeated blows using the dynamic probing apparatus. This sampler is extracted from the ground by a pneumatically operated jack and the sample extracted from the plastic liner for logging. Deeper sections of the strata are sampled by driving successively smaller diameter samplers into the ground. If the material is suitable, the soil strength is examined using a pocket penetrometer.

Continuous dynamic probing is a simple test consisting of driving a rod, with an oversized cone point, into the ground with a uniform hammer blow. The blow count is recorded for every 100mm penetration (N100). The equipment is a machine driven unit using a 63.5kg hammer dropping through 0.75m onto 32mm diameter rods with a 1500mm^2 cone. The equipment confirms to the DPSH probing apparatus in Clause 3.2 of Part 9 of BS 1377 (199)). The equivalent SPT 'N' value can be estimated by multiplying the blow count by 3-5, dependant on soil characteristics. This method has been used to interpret soil strengths given on the CDPT plots.

Drilling was directed and supervised full-time by an experienced geologist who kept a record of the strata encountered, recorded the groundwater ingress and also recovered representative disturbed samples.

On completion the boreholes were either backfilled with their spoil, and if requested the surface reinstated, or a standpipe installation fitted.

The borehole records have been prepared using Gint software, taking into account both site descriptions and subsequent laboratory testing.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS1
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 57.92	Scale 1:25
Client: Edward Ware Homes		Dates: 24/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.15	57.77		Grass over TOPSOIL: (comprising soft to firm brown slightly sandy Silt, with occasional small rootlets [Ø 2-3mm]).
		0.50	ES					MADE GROUND: (comprising loosely compact grey-brown to grey slightly silty Clay, with extraneous fine angular mudstone/clay gravel and randomly oriented laminations).
		0.75	D					
					1.00	56.92		MADE GROUND: (comprising loosely compact grey-brown to grey-green slightly gravelly silty Clay, with localised horizontal laminations and pockets of sugary gypsum).
		1.50	D					
		1.50	D					
		1.75	D					
					2.30	55.62		MADE GROUND: (comprising loosely compact dark grey-green slightly gravelly Clay. Gravel is fine angular mudstone lithorelicts with localised peat specks).
	▼	2.50	D					
					2.70	55.22		Soft brownish-grey slightly gravelly CLAY with pieces of wood. (ALLUVIUM)
					2.80	55.12		End of borehole at 2.80 m

1
2
3
4
5

Remarks
Recovery: 0-1m (100%); 1-2m (100%); 2-2.8m (70%).
CDPT to 9m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS2
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 58.29	Scale 1:25
Client: Edward Ware Homes		Dates: 24/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	58.09		Grass over TOPSOIL: (comprising soft light slightly sandy Silt, with abundant small brown to white rootlets [Ø 2-3mm]).
		0.40	ES					MADE GROUND: (comprising loosely compact grey-brown to green-brown Clay with rare fine angular mudstone gravel).
		0.50	D					
		0.75	D					
		1.50	D		1.45	56.84		BURIED TOPSOIL.
		1.50	ES		1.55	56.74		MADE GROUND: (comprising loosely compact brown to grey-brown locally grey-green Clay).
		2.50	D					
		3.50	D		3.20	55.09		Soft brown to grey-brown slightly silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
					3.90	54.39		Firm grey-brown slightly silty CLAY. (WEATHERED LOWER LIAS)
					4.00	54.29		End of borehole at 4.00 m

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Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 8.8m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS3
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 60.10	Scale 1:25
Client: Edward Ware Homes		Dates: 24/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.25	59.85		Grass over TOPSOIL: (comprising brown slightly sandy Silt, with occasional small brown rootlets [Ø 2mm]. Gravel is extraneous sandstone and mudstone).
		0.50	ES					MADE GROUND: (comprising loosely compact brown slightly gravelly Clay with occasional roots [Ø 1-3cm]).
		0.75	D					
		1.25	D					
					1.60	58.50		MADE GROUND: (comprising loosely compact, locally very loosely compact grey-green Clay with pockets of brown silt).
		2.50	D					
					2.70	57.40		MADE GROUND: (comprising loosely compact black to grey-brown Clay with occasional sugary gypsum crystals).
		3.25	D					
					3.40	56.70		Soft to firm grey to grey-brown slightly silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
		3.75	D					
					3.80	56.30		Firm grey-brown slightly silty CLAY. (WEATHERED LOWER LIAS)
					4.00	56.10		End of borehole at 4.00 m

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Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 9m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS4
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 60.60	Scale 1:25
Client: Edward Ware Homes		Dates: 24/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.15	60.45		Grass over TOPSOIL: (comprising soft brown slightly sandy Silt, with abundant rootlets [Ø 2-3mm]).
		0.50	ES					MADE GROUND: (comprising loosely compact grey-brown to brown slightly silty Clay, with occasional fine angular extraneous gravel and localised brown to black speckling).
		0.80	D					
		1.25	D					
					1.60	59.00		MADE GROUND: (comprising loosely compact grey to dark grey-brown Clay, with occasional black mottling/speckling).
		1.85	D					
								Below 2.2m, becoming loosely to moderately compact.
		2.40	D					
					2.70	57.90		Firm grey to dark grey locally brown slightly silty CLAY. (WEATHERED LOWER LIAS)
		2.80	D					
		3.50	D					
					3.70	56.90		Firm to stiff rapidly becoming stiff dark grey slightly silty CLAY. (WEATHERED LOWER LIAS)
					4.00	56.60		End of borehole at 4.00 m

Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 7.9m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS5
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 61.60	Scale 1:25
Client: Edward Ware Homes		Dates: 25/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	61.40		Grass over TOPSOIL: (comprising soft brown slightly sandy Silt, with abundant rootlets [Ø 2-3mm]).
		0.60	ES		0.55	61.05		MADE GROUND: (comprising moderately compact orange-brown to grey-brown silty Clay, with orange and black speckles).
		1.00	D					MADE GROUND: (comprising loosely compact, becoming moderately compact brown to grey-brown slightly gravely Clay, with horizons of black mottling and rare rootlet traces [Ø 2-3mm]. Gravel is fine angular mudstone.
		1.25	D					
		1.80	ES					
					2.10	59.50		Soft to firm grey to dark grey slightly silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
		2.50	D		2.50	59.10		Firm grey to dark grey slightly silty CLAY. (WEATHERED LOWER LIAS)
		3.60	D		3.40	58.20		Firm to stiff becoming stiff grey to dark grey slightly silty CLAY, with rare fine angular mudstone gravel. (WEATHERED LOWER LIAS)
					4.00	57.60		End of borehole at 4.00 m

1 2 3 4 5

Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 6.9m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS6
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 60.81	Scale 1:25
Client: Edward Ware Homes		Dates: 25/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES					Grass over TOPSOIL: (comprising soft brown very sandy Silt, with occasional rootlets [Ø 2-3mm]).
					0.25	60.56		MADE GROUND: (comprising loosely compact to grey-brown slightly silty Clay, with occasional black speckles).
		0.70	ES					
		1.10	D		1.10	59.71		MADE GROUND: (comprising loosely compact to dark grey to brown locally gravelly Clay with localised black to brown mottling/speckles).
		1.40	ES					
		1.80	D					
		2.25	D					
					2.50	58.31		Soft to firm locally soft grey to dark grey slightly silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
		3.25	D		3.20	57.61		Firm grey to dark grey slightly silty CLAY with localised fine angular mudstone lithorelicts. (WEATHERED LOWER LIAS)
					3.50	57.31		Firm to stiff dark grey slightly gravelly silty CLAY with localised fine angular lithorelicts. (WEATHERED LOWER LIAS)
		3.85	D					*Between 3.8-4.0m, abundant angular fine mudstone lithorelicts and horizontal laminations.*
					4.00	56.81		End of borehole at 4.00 m

Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 5.8m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS7
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 59.00	Scale 1:25
Client: Edward Ware Homes		Dates: 25/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.15	ES		0.25	58.75		Grass over TOPSOIL: (comprising soft brown slightly sandy Silt, with abundant rootlets [Ø 203mm] and roots [Ø 0.5-1.0cm]).
								MADE GROUND: (comprising loosely compact brown to orange-brown slightly silty gravelly Clay. Gravel is fine to angular mudstone lithorelicts).
		1.25	D		1.50	57.50		Soft grey locally grey-brown silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
		2.00	D					
		2.25	D		2.20	56.80		Soft to firm locally soft grey to grey-brown silty CLAY. (HIGHLY WEATHERED LOWER LIAS)
		2.75	D					
		3.25	D		3.30	55.70		Firm grey-brown silty CLAY. (WEATHERED LOWER LIAS)
		3.75	D		3.80	55.20		Firm to stiff grey to grey-brown CLAY, with occasional fine angular mudstone lithorelicts. (WEATHERED LOWER LIAS)
					4.00	55.00		End of borehole at 4.00 m

1
2
3
4
5

Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 7.5m.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS8
Sheet 1 of 1

Project Name: Snow Capel	Project No. 1826	Co-ords: -	Hole Type WS
Location: Snow Capel, Matson, Gloucester GL4 6EQ		Level: 57.50	Scale 1:25
Client: Edward Ware Homes		Dates: 25/05/2017 -	Logged By S.J.

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25	57.25		Grass over TOPSOIL: (comprising soft brown sandy Silt).
		0.60	ES					MADE GROUND: (comprising loosely compact grey to blue-grey Clay, with wood fragments, abundant roots and rootlets [Ø 2-15mm]).
		0.90	D					
		1.40	D					
					1.60	55.90		Very soft blue-grey to grey CLAY with occasional black organic fragments. (ALLUVIUM)
		2.50	D					
					2.80	54.70		Soft to firm brown slightly gravelly CLAY. (HIGHLY WEATHERED LOWER LIAS)
					3.10	54.40		Firm grey-brown slightly gravelly slightly silty CLAY. (WEATHERED LOWER LIAS)
								Between 3.5-4.0m, mudstone lithorelicts.
					4.00	53.50		End of borehole at 4.00 m

1
2
3
4
5

Remarks
Dry.
Recovery: 0-1m (100%); 1-2m (100%); 2-3m (100%); 3-4 (100%).
CDPT to 5.7m.

Intégrale
Understanding Ground Conditions

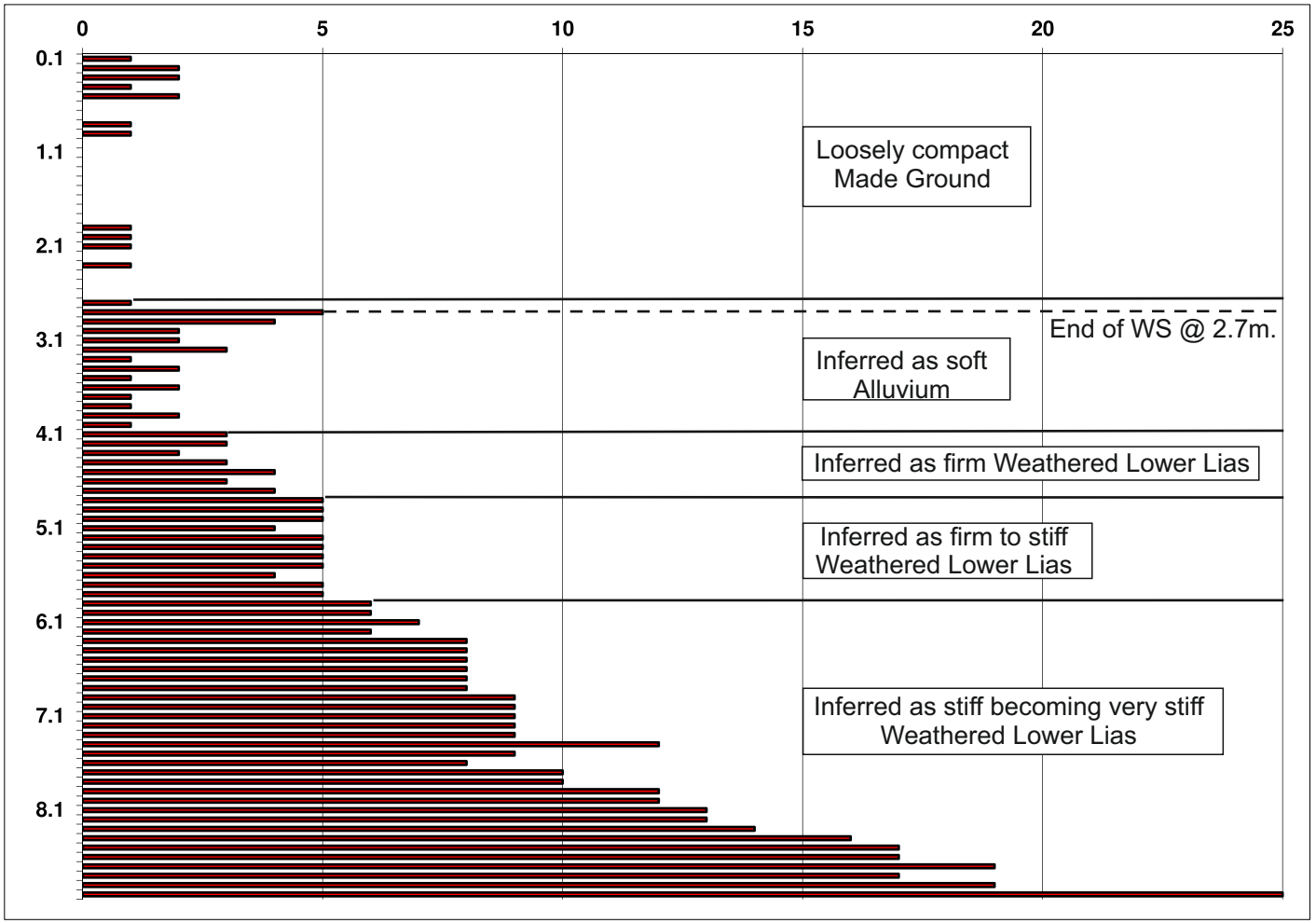
Super Heavy Dynamic Probe Records

Job Ref: 1826

Job Name: Snow Capel, Gloucester

Hole: WS1 **CDPT 1**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	1	2.6	0	5.1	4	7.6	8
0.2	2	2.7	1	5.2	5	7.7	10
0.3	2	2.8	5	5.3	5	7.8	10
0.4	1	2.9	4	5.4	5	7.9	12
0.5	2	3	2	5.5	5	8	12
0.6	0	3.1	2	5.6	4	8.1	13
0.7	0	3.2	3	5.7	5	8.2	13
0.8	1	3.3	1	5.8	5	8.3	14
0.9	1	3.4	2	5.9	6	8.4	16
1	0	3.5	1	6	6	8.5	17
1.1	0	3.6	2	6.1	7	8.6	17
1.2	0	3.7	1	6.2	6	8.7	19
1.3	0	3.8	1	6.3	8	8.8	17
1.4	0	3.9	2	6.4	8	8.9	19
1.5	0	4	1	6.5	8	9	25
1.6	0	4.1	3	6.6	8	9.1	
1.7	0	4.2	3	6.7	8	9.2	
1.8	0	4.3	2	6.8	8	9.3	
1.9	1	4.4	3	6.9	9	9.4	
2	1	4.5	4	7	9	9.5	
2.1	1	4.6	3	7.1	9	9.6	
2.2	0	4.7	4	7.2	9	9.7	
2.3	1	4.8	5	7.3	9	9.8	
2.4	0	4.9	5	7.4	12	9.9	
2.5	0	5	5	7.5	9	10	

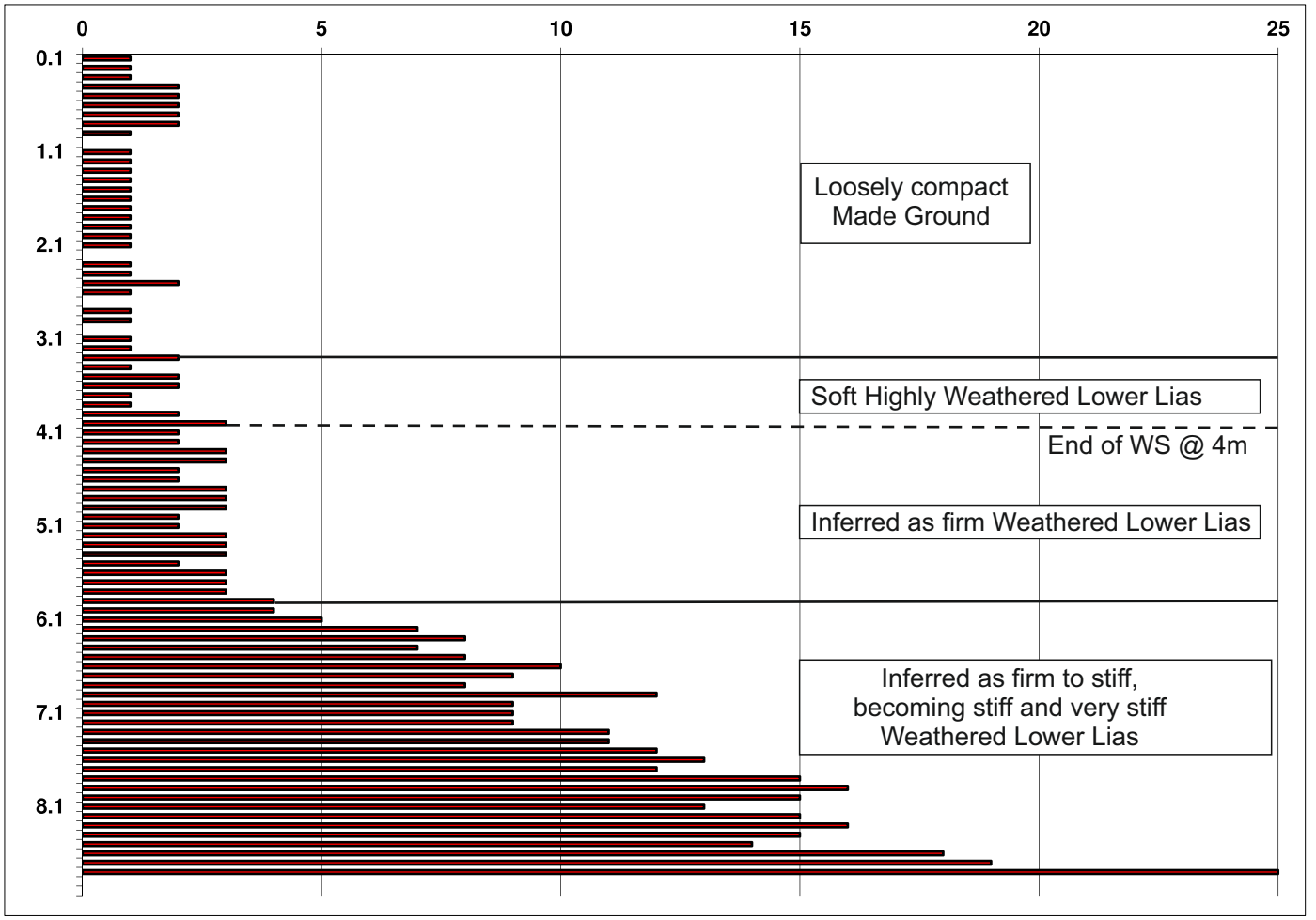


Intégrale
Understanding Ground Conditions

Super Heavy Dynamic Probe Records

Job Ref: 1826
Job Name: Snow Capel, Gloucester
Hole: WS2 **CDPT 2**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	1	2.6	1	5.1	2	7.6	13
0.2	1	2.7	0	5.2	3	7.7	12
0.3	1	2.8	1	5.3	3	7.8	15
0.4	2	2.9	1	5.4	3	7.9	16
0.5	2	3	0	5.5	2	8	15
0.6	2	3.1	1	5.6	3	8.1	13
0.7	2	3.2	1	5.7	3	8.2	15
0.8	2	3.3	2	5.8	3	8.3	16
0.9	1	3.4	1	5.9	4	8.4	15
1	0	3.5	2	6	4	8.5	14
1.1	1	3.6	2	6.1	5	8.6	18
1.2	1	3.7	1	6.2	7	8.7	19
1.3	1	3.8	1	6.3	8	8.8	25
1.4	1	3.9	2	6.4	7	8.9	
1.5	1	4	3	6.5	8	9	
1.6	1	4.1	2	6.6	10	9.1	
1.7	1	4.2	2	6.7	9	9.2	
1.8	1	4.3	3	6.8	8	9.3	
1.9	1	4.4	3	6.9	12	9.4	
2	1	4.5	2	7	9	9.5	
2.1	1	4.6	2	7.1	9	9.6	
2.2	0	4.7	3	7.2	9	9.7	
2.3	1	4.8	3	7.3	11	9.8	
2.4	1	4.9	3	7.4	11	9.9	
2.5	2	5	2	7.5	12	10	

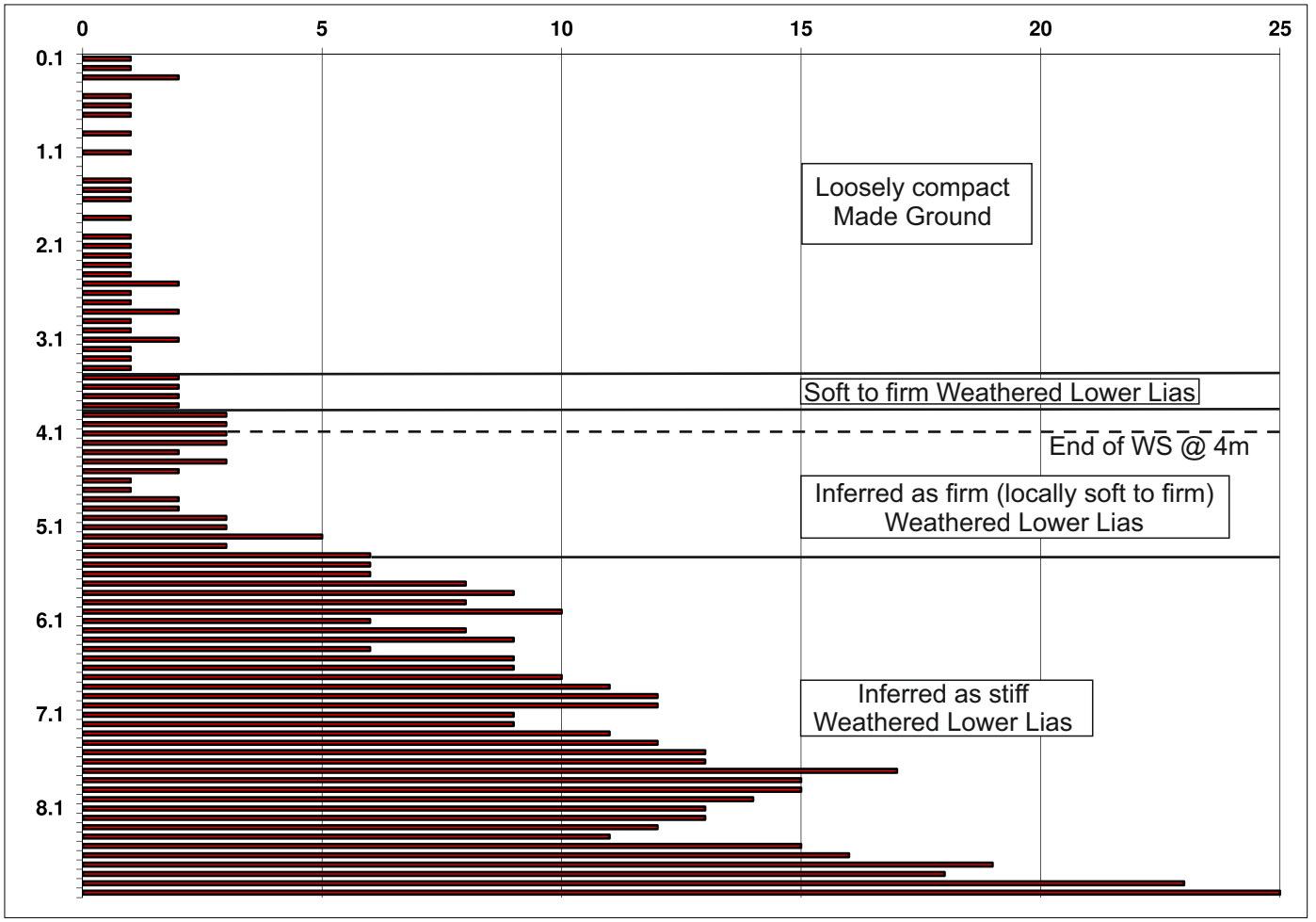


Intégrale
Understanding Ground Conditions

Super Heavy Dynamic Probe Records

Job Ref: 1826
Job Name: Snow Capel, Gloucester
Hole: WS3 **CDPT 3**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	1	2.6	1	5.1	3	7.6	13
0.2	1	2.7	1	5.2	5	7.7	17
0.3	2	2.8	2	5.3	3	7.8	15
0.4	0	2.9	1	5.4	6	7.9	15
0.5	1	3	1	5.5	6	8	14
0.6	1	3.1	2	5.6	6	8.1	13
0.7	1	3.2	1	5.7	8	8.2	13
0.8	0	3.3	1	5.8	9	8.3	12
0.9	1	3.4	1	5.9	8	8.4	11
1	0	3.5	2	6	10	8.5	15
1.1	1	3.6	2	6.1	6	8.6	16
1.2	0	3.7	2	6.2	8	8.7	19
1.3	0	3.8	2	6.3	9	8.8	18
1.4	1	3.9	3	6.4	6	8.9	23
1.5	1	4	3	6.5	9	9	25
1.6	1	4.1	3	6.6	9	9.1	
1.7	0	4.2	3	6.7	10	9.2	
1.8	1	4.3	2	6.8	11	9.3	
1.9	0	4.4	3	6.9	12	9.4	
2	1	4.5	2	7	12	9.5	
2.1	1	4.6	1	7.1	9	9.6	
2.2	1	4.7	1	7.2	9	9.7	
2.3	1	4.8	2	7.3	11	9.8	
2.4	1	4.9	2	7.4	12	9.9	
2.5	2	5	3	7.5	13	10	



Intégrale
Understanding Ground Conditions

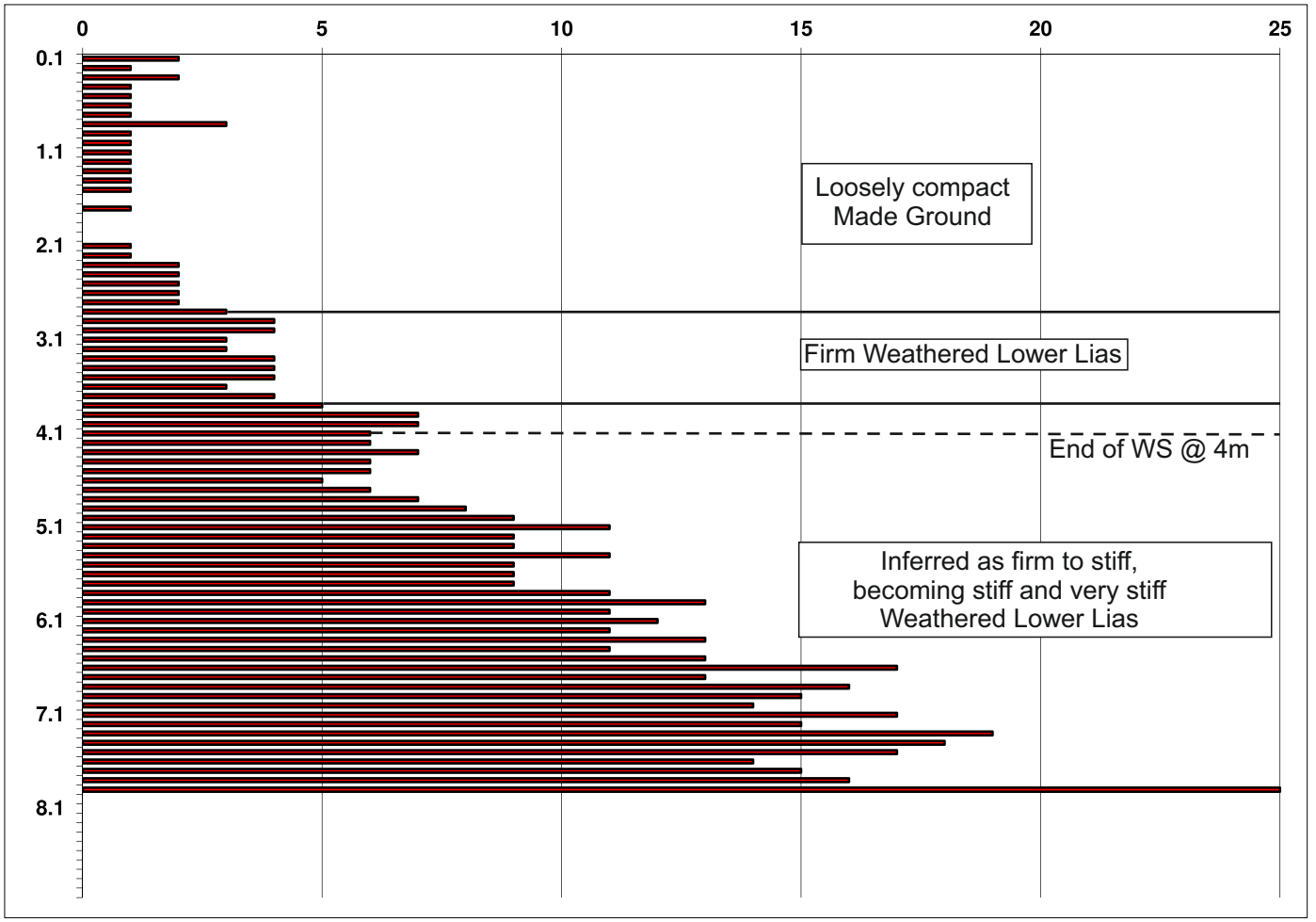
Super Heavy Dynamic Probe Records

Job Ref: 1826

Job Name: Snow Capel, Gloucester

Hole: WS4 **CDPT 4**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	2	2.6	2	5.1	11	7.6	14
0.2	1	2.7	2	5.2	9	7.7	15
0.3	2	2.8	3	5.3	9	7.8	16
0.4	1	2.9	4	5.4	11	7.9	25
0.5	1	3	4	5.5	9	8	
0.6	1	3.1	3	5.6	9	8.1	
0.7	1	3.2	3	5.7	9	8.2	
0.8	3	3.3	4	5.8	11	8.3	
0.9	1	3.4	4	5.9	13	8.4	
1	1	3.5	4	6	11	8.5	
1.1	1	3.6	3	6.1	12	8.6	
1.2	1	3.7	4	6.2	11	8.7	
1.3	1	3.8	5	6.3	13	8.8	
1.4	1	3.9	7	6.4	11	8.9	
1.5	1	4	7	6.5	13	9	
1.6	0	4.1	6	6.6	17	9.1	
1.7	1	4.2	6	6.7	13	9.2	
1.8	0	4.3	7	6.8	16	9.3	
1.9	0	4.4	6	6.9	15	9.4	
2	0	4.5	6	7	14	9.5	
2.1	1	4.6	5	7.1	17	9.6	
2.2	1	4.7	6	7.2	15	9.7	
2.3	2	4.8	7	7.3	19	9.8	
2.4	2	4.9	8	7.4	18	9.9	
2.5	2	5	9	7.5	17	10	



Intégrale
Understanding Ground Conditions

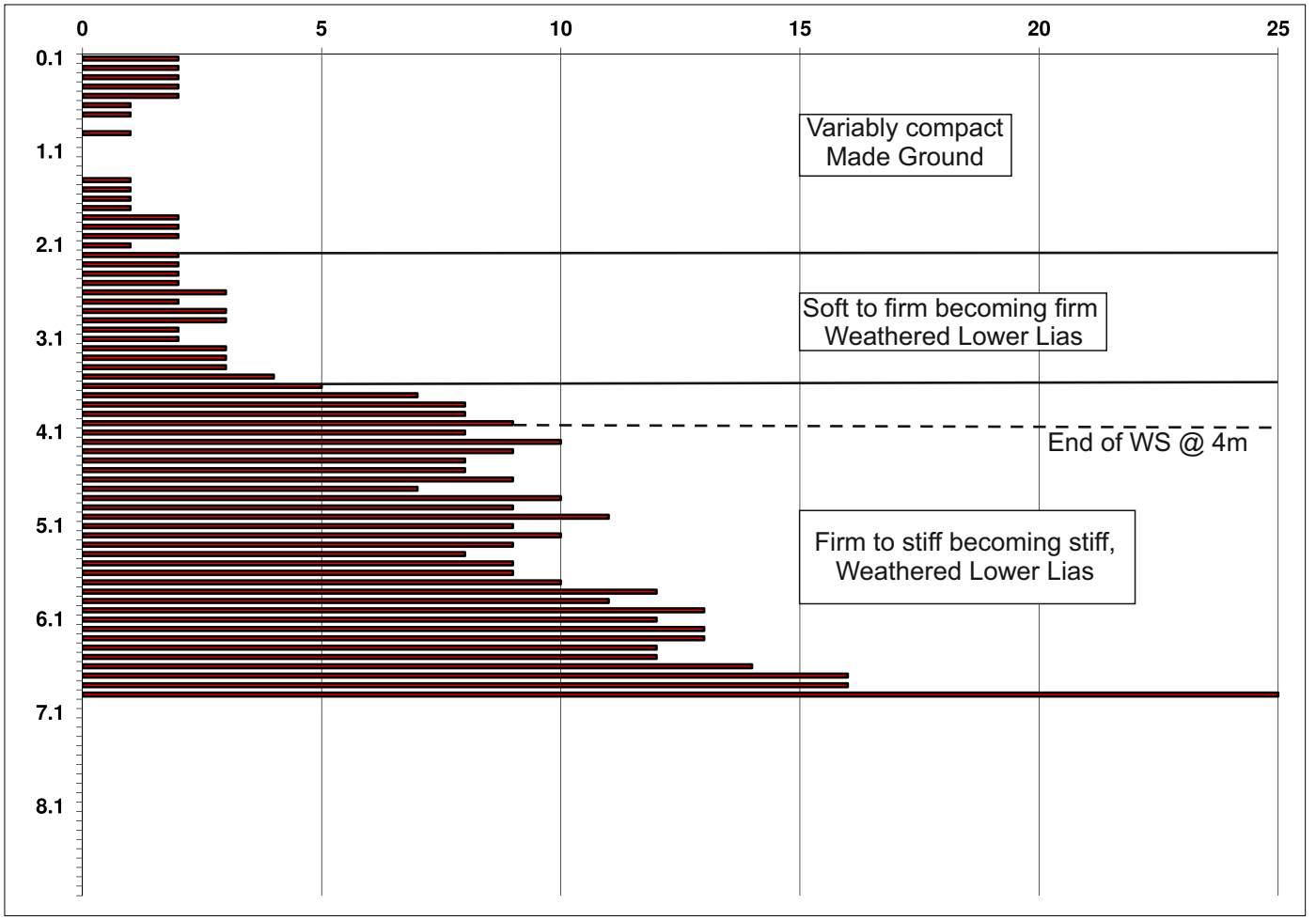
Super Heavy Dynamic Probe Records

Job Ref: 1826

Job Name: Snow Capel, Gloucester

Hole: WS5 **CDPT 5**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	2	2.6	3	5.1	9	7.6	
0.2	2	2.7	2	5.2	10	7.7	
0.3	2	2.8	3	5.3	9	7.8	
0.4	2	2.9	3	5.4	8	7.9	
0.5	2	3	2	5.5	9	8	
0.6	1	3.1	2	5.6	9	8.1	
0.7	1	3.2	3	5.7	10	8.2	
0.8	0	3.3	3	5.8	12	8.3	
0.9	1	3.4	3	5.9	11	8.4	
1	0	3.5	4	6	13	8.5	
1.1	0	3.6	5	6.1	12	8.6	
1.2	0	3.7	7	6.2	13	8.7	
1.3	0	3.8	8	6.3	13	8.8	
1.4	1	3.9	8	6.4	12	8.9	
1.5	1	4	9	6.5	12	9	
1.6	1	4.1	8	6.6	14	9.1	
1.7	1	4.2	10	6.7	16	9.2	
1.8	2	4.3	9	6.8	16	9.3	
1.9	2	4.4	8	6.9	25	9.4	
2	2	4.5	8	7		9.5	
2.1	1	4.6	9	7.1		9.6	
2.2	2	4.7	7	7.2		9.7	
2.3	2	4.8	10	7.3		9.8	
2.4	2	4.9	9	7.4		9.9	
2.5	2	5	11	7.5		10	



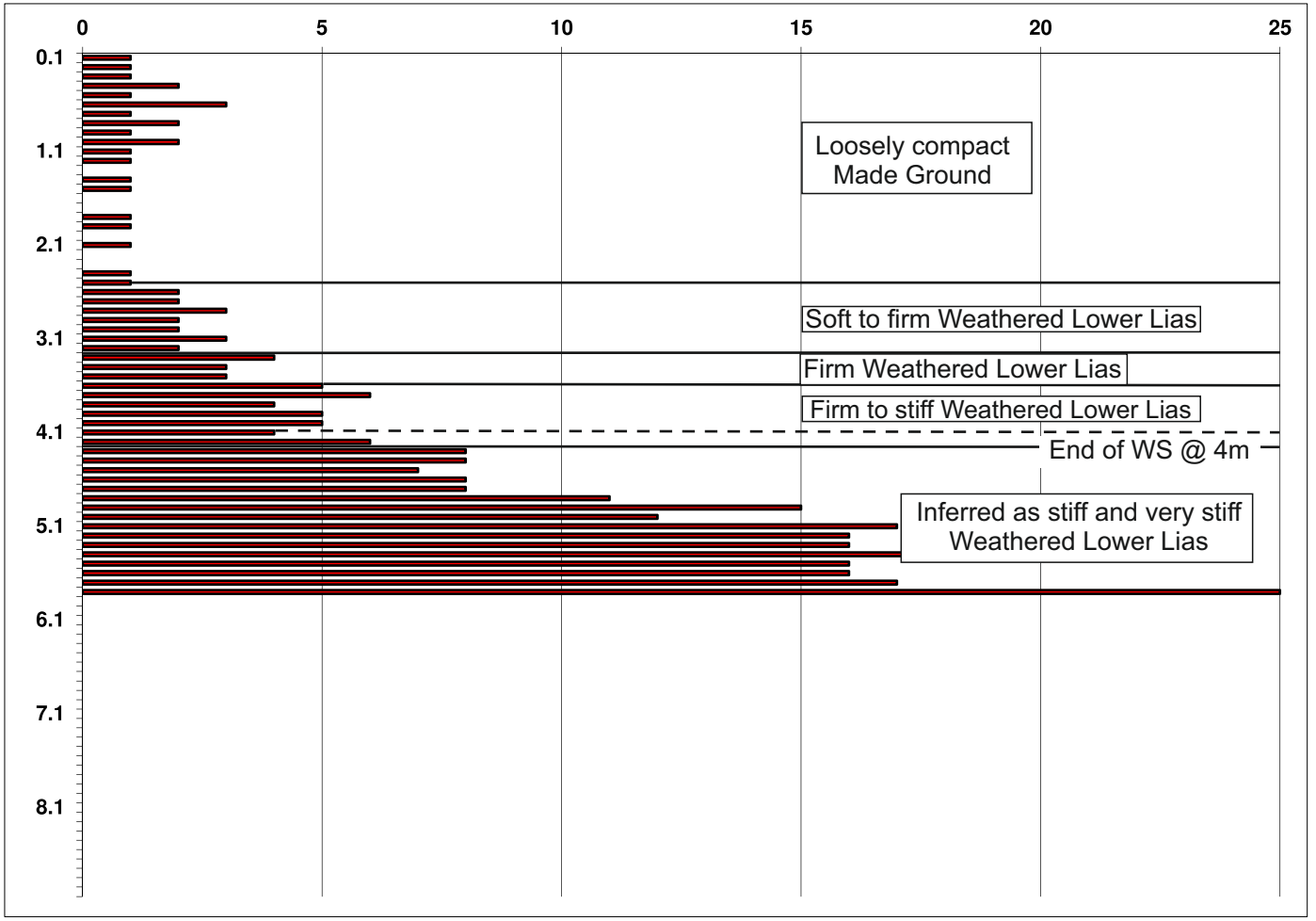
Super Heavy Dynamic Probe Records

Job Ref: 1826

Job Name: Snow Capel, Gloucester

Hole: WS6 **CDPT 6**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	1	2.6	2	5.1	17	7.6	
0.2	1	2.7	2	5.2	16	7.7	
0.3	1	2.8	3	5.3	16	7.8	
0.4	2	2.9	2	5.4	18	7.9	
0.5	1	3	2	5.5	16	8	
0.6	3	3.1	3	5.6	16	8.1	
0.7	1	3.2	2	5.7	17	8.2	
0.8	2	3.3	4	5.8	25	8.3	
0.9	1	3.4	3	5.9		8.4	
1	2	3.5	3	6		8.5	
1.1	1	3.6	5	6.1		8.6	
1.2	1	3.7	6	6.2		8.7	
1.3	0	3.8	4	6.3		8.8	
1.4	1	3.9	5	6.4		8.9	
1.5	1	4	5	6.5		9	
1.6	0	4.1	4	6.6		9.1	
1.7	0	4.2	6	6.7		9.2	
1.8	1	4.3	8	6.8		9.3	
1.9	1	4.4	8	6.9		9.4	
2	0	4.5	7	7		9.5	
2.1	1	4.6	8	7.1		9.6	
2.2	0	4.7	8	7.2		9.7	
2.3	0	4.8	11	7.3		9.8	
2.4	1	4.9	15	7.4		9.9	
2.5	1	5	12	7.5		10	



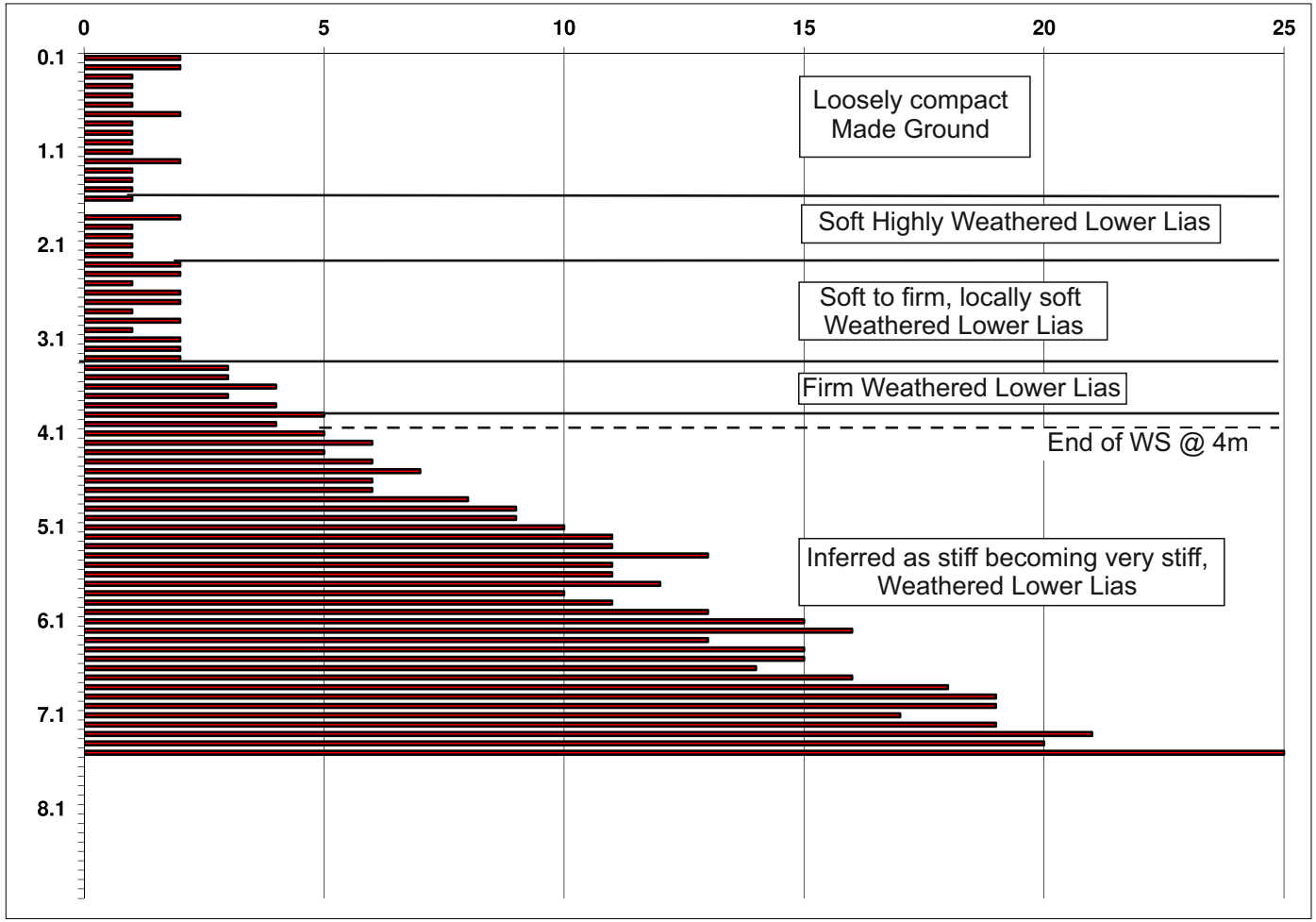
Intégrale
Understanding Ground Conditions

Super Heavy Dynamic Probe Records

Job Ref: 1826
Job Name: Snow Capel, Gloucester

Hole: WS7 **CDPT 7**

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	2	2.6	2	5.1	10	7.6	
0.2	2	2.7	2	5.2	11	7.7	
0.3	1	2.8	1	5.3	11	7.8	
0.4	1	2.9	2	5.4	13	7.9	
0.5	1	3	1	5.5	11	8	
0.6	1	3.1	2	5.6	11	8.1	
0.7	2	3.2	2	5.7	12	8.2	
0.8	1	3.3	2	5.8	10	8.3	
0.9	1	3.4	3	5.9	11	8.4	
1	1	3.5	3	6	13	8.5	
1.1	1	3.6	4	6.1	15	8.6	
1.2	2	3.7	3	6.2	16	8.7	
1.3	1	3.8	4	6.3	13	8.8	
1.4	1	3.9	5	6.4	15	8.9	
1.5	1	4	4	6.5	15	9	
1.6	1	4.1	5	6.6	14	9.1	
1.7	0	4.2	6	6.7	16	9.2	
1.8	2	4.3	5	6.8	18	9.3	
1.9	1	4.4	6	6.9	19	9.4	
2	1	4.5	7	7	19	9.5	
2.1	1	4.6	6	7.1	17	9.6	
2.2	1	4.7	6	7.2	19	9.7	
2.3	2	4.8	8	7.3	21	9.8	
2.4	2	4.9	9	7.4	20	9.9	
2.5	1	5	9	7.5	25	10	



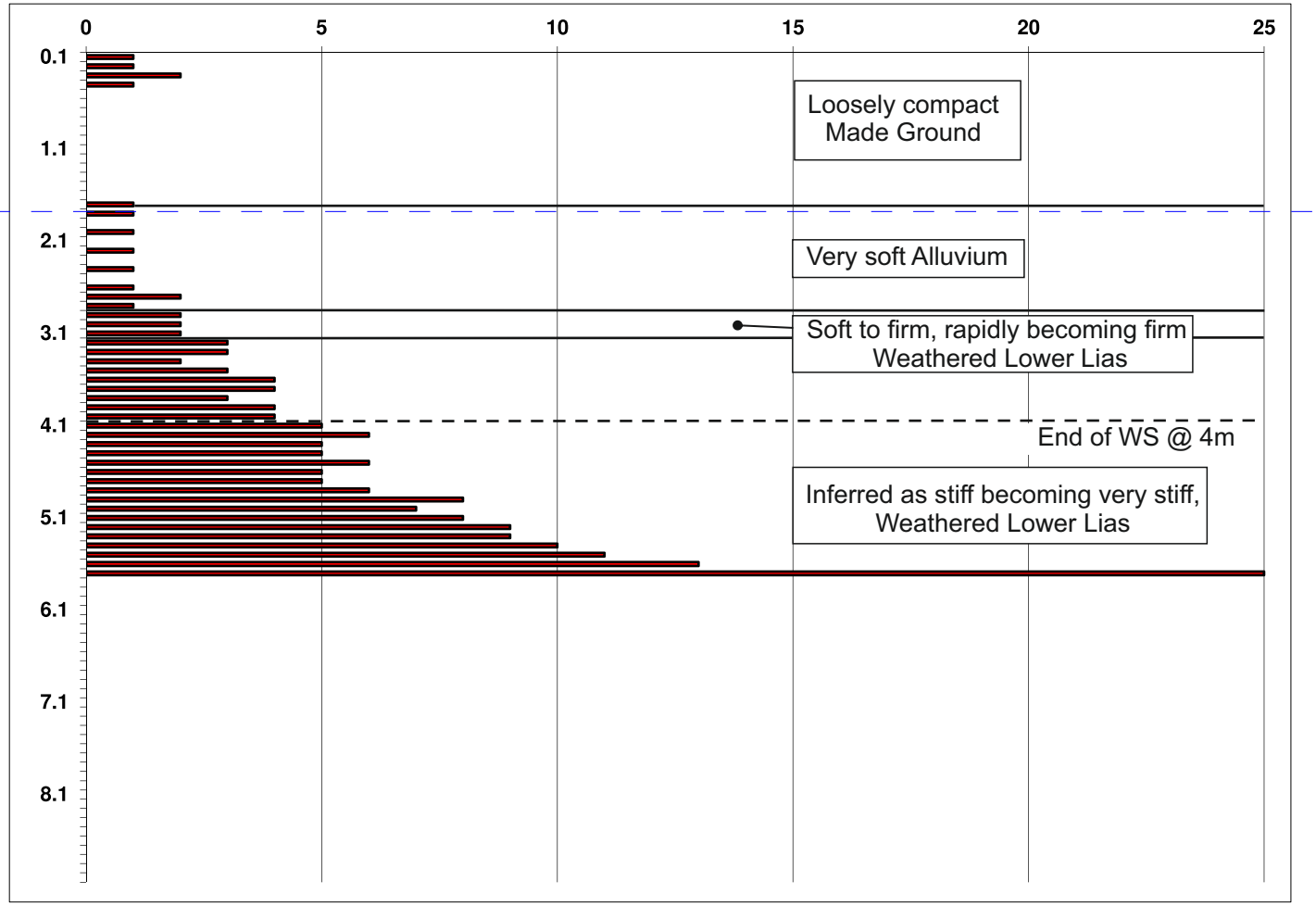
Super Heavy Dynamic Probe Records

Job Ref: 1826

Job Name: Snow Capel, Gloucester

Hole: WS8 **CDPT** 8

Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count	Depth (m)	Blow Count
0.1	1	2.6	1	5.1	8	7.6	
0.2	1	2.7	2	5.2	9	7.7	
0.3	2	2.8	1	5.3	9	7.8	
0.4	1	2.9	2	5.4	10	7.9	
0.5	0	3	2	5.5	11	8	
0.6	0	3.1	2	5.6	13	8.1	
0.7	0	3.2	3	5.7	25	8.2	
0.8	0	3.3	3	5.8		8.3	
0.9	0	3.4	2	5.9		8.4	
1	0	3.5	3	6		8.5	
1.1	0	3.6	4	6.1		8.6	
1.2	0	3.7	4	6.2		8.7	
1.3	0	3.8	3	6.3		8.8	
1.4	0	3.9	4	6.4		8.9	
1.5	0	4	4	6.5		9	
1.6	0	4.1	5	6.6		9.1	
1.7	1	4.2	6	6.7		9.2	
1.8	1	4.3	5	6.8		9.3	
1.9	0	4.4	5	6.9		9.4	
2	1	4.5	6	7		9.5	
2.1	0	4.6	5	7.1		9.6	
2.2	1	4.7	5	7.2		9.7	
2.3	0	4.8	6	7.3		9.8	
2.4	1	4.9	8	7.4		9.9	
2.5	0	5	7	7.5		10	



Appendix E

Gas and Groundwater Monitoring

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

STANDARD METHODOLOGIES FOR STANDPIPE INSTALLATIONS, SAMPLING and MONITORING FOR GAS AND GROUNDWATER

Standpipe Installations in Trial Pits

Simple 30-50mm diameter plastic standpipes are installed in trial pits during backfilling. These consist of slotted pipe throughout the buried length to within 0.5m of the ground surface, with unslotted pipe above. These are capped off with removable stop-ends above ground level. They provide a useful guide to soil gas conditions within the backfilled trial pit, however some soil gas will be lost by dispersal within the loose backfill at the surface of the pit. They are commonly used for monitoring standing groundwater levels which would develop within excavations, however careful consideration has to be given to the possible infiltration of rainfall and throughflow into the sump created by the excavated pit.

Standpipe Installations in Boreholes

Simple standpipes to measure the hydrostatic head of groundwater are formed in boreholes using 50mm diameter pipe. The details of individual installations are provided on borehole records. Typically the lower length is formed in slotted pipe, with the upper 1m unslotted. The annulus between the riser pipe and the borehole wall is filled with clean granular material. Details of any bentonite seals or grouting are given on the borehole records. A removable gas tap is fitted where gas monitoring is required and standpipes typically have a metal access cover concreted in at ground level.

Standpipe piezometers are formed by using a Casagrande type piezometer tip at the base of the pipe, set in a granular response zone of sand or pea gravel. The response zone is isolated from the strata above and below by placing 500mm thick bentonite seals. The remaining annulus above the bentonite seal is filled with a cement bentonite grout or similar.

Groundwater Monitoring & Sampling

Details of return monitoring visits are included in this appendix. Groundwater standing levels are measured by inserting an electrically operated dip meter into the standpipe and recording the level to 2 decimal places, relative to existing ground level. Where groundwater levels are critical to calculation of hydraulic gradients or flow directions, the measurement is taken to 3 decimal places and to a marked point on the standpipe cover. That point is then surveyed and levelled to provide accurate calculations.

Groundwater samples are recovered using either Waterra valves and sample tubing or by manually lifting water from the standpipe using a bailer. For contamination analyses, the boreholes are initially purged by removing up to 3 borehole volumes of water, allowing the rest level to redevelop and taking a sufficient sample into custom containers. If groundwater does not recover sufficiently, the purged water may be used as the sample.

Gas Monitoring

Monitoring is usually completed in standpipes prior to groundwater measurements, using portable instruments. Details are given on the monitoring tables, and typically using a PhoCheck Tiger photoionisation detector to measure volatile organic compounds in ppm and a GA5000 Gas meter to measure oxygen, carbon dioxide and methane, both by % Lower Explosive Limit and % Volume. Atmospheric pressure and temperature are also recorded. Measurements are taken immediately on opening the gas valve and the highest to lowest levels recorded. If levels fluctuate, then this is recorded, with the maximum reading and a more typical or rest level given.

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Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

Results of Gas & Groundwater Monitoring Visit No. 1

Site	Snow Capel, Gloucester
Client	Edward Ware Homes Limited
Date	07/07/17

Job No.	1826
Monitored By	WS

Weather	Sunny
Air Temperature	21°C
Atmospheric Pressure (mbar)	1010
Ground Conditions	Dry

Position ID	Time Elapsed (secs)	Gas Flow (l/hr)	%LEL	Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	VOC (ppm)	Depth to Product (mbgl)	Depth to Water (mbgl)	Product Thickness (mm)	Well Depth (mbgl)
WS1	0	0.0	1232	61.6	35.2	3.8	0.0	-	1.55	-	2.75
	30	0.0									
	60	0.0									
Comments:											
WS3	0	0.0	58	2.9	8.5	16.4	0.0	-	1.34	-	2.17
	30	0.0									
	60	0.0									
Comments:											
WS5	0	0.0	6	0.3	4	18.6	0.0	-	DRY	-	2.92
	30	0.0									
	60	0.0									
Comments:											
WS8	0	0.0	2	0.1	3.5	20	0.0	-	2.64	-	3.02
	30	0.0									
	60	0.0									
Comments:											

Equipment:

Type:	*Serial No:*	*Used:*
GA5000	G501893	✓
Tiger PID Gas Detector	T-108427	✓
Solinst Mini Interface Meter	122 008236-1	
Dip Meter		✓

%LEL = Calculated Lower Explosive Limit
Worst case of six readings reported for each position/time

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Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

Results of Gas & Groundwater Monitoring Visit No. 2

Site	Snow Capel, Gloucester
Client	Edward Ware Homes Limited
Date	13/07/17

Job No.	1826
Monitored By	WS

Weather	Cloudy
Air Temperature	19°C
Atmospheric Pressure (mbar)	1014
Ground Conditions	Dry

Position ID	Time Elapsed (secs)	Gas Flow (l/hr)	%LEL	Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	VOC (ppm)	Depth to Product (mbgl)	Depth to Water (mbgl)	Product Thickness (mm)	Well Depth (mbgl)
WS1	0	0.0	1222	61.1	35.7	5	0.0	-	1.58	-	2.78
	30	0.1									
	60	0.1									
Comments:											
WS3	0	0.0	56	2.8	7.1	17	0.0	-	1.29	-	2.15
	30	0.0									
	60	0.0									
Comments:											
WS5	0	0.0	4	0.2	3.8	18.3	0.0	-	DRY	-	2.83
	30	0.0									
	60	0.0									
Comments:											
WS8	0	0.1	0	0.0	4.2	18.9	0.0	-	2.57	-	3.02
	30	0.1									
	60	0.1									
Comments:											

Equipment:

Type:	*Serial No:*	*Used:*
GA5000	G501893	✓
Tiger PID Gas Detector	T-108427	✓
Solinst Mini Interface Meter	122 008236-1	
Dip Meter		✓

%LEL = Calculated Lower Explosive Limit
Worst case of six readings reported for each position/time

Appendix F

Results of Geotechnical Laboratory Testing

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

STANDARD METHODOLOGY FOR GEOTECHNICAL SAMPLING

Soil samples are recovered from trial pits or borehole samples using a stainless steel trowel and immediately placed into airtight plastic tubs or bags, as appropriate for the testing. If required the soil samples may be wrapped in cling film, particularly in suspected desiccated soils. Samples are labelled with the site name, investigation location and depth and placed into either cool boxes or large bulk bags for transit from site. An analytical schedule is drawn up in line with the actual ground conditions proven, proposed site use and likely design parameters.

Samples are sent to a specialist testing laboratory. Testing is completed in line with BS1377 as far as possible and details of the test method and UKAS accreditation are provided by the laboratory on the results sheets in a separate appendix.

2718

Intégrale Limited
Unit 7
Westway Farm Business Park
Wick Road
Bishop Sutton
BS39 5XP

For the attention of [redacted]

Version No. 1
Page No. 1 of 7
Date of Issue 13/06/2017

TEST REPORT

PROJECT/SITE	Snow Capel, Gloucester	Samples received	30/05/2017
GEL REPORT NUMBER	33145	Schedule received	30/05/2017
Your ref/PO:	1826	Testing commenced	02/06/2017
Test report refers to	Schedule 1	Status	Final

SUMMARY OF RESULTS ATTACHED

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS EN ISO 17892-1: 2014:5. Water Content	6	YES
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits	3	YES
BRE SD1 Reduced Suite: pH, Sulphate - water and acid soluble, sulphur (Subcontracted)	1	YES

Remarks

Approved Signatories: [redacted]

Geotechnical Engineering Ltd
Centurion House
Olympus Park, Quedgeley
Gloucester GL2 4NF

www.geoeng.co.uk

[redacted]

Registered number: 00700739
VAT Number: 682 5857 89

Payments: Geotechnical Engineering Limited
Sort code: 30-15-99 **Bank account**: 00072116

Geotechnical Engineering Limited

LIQUID AND PLASTIC LIMITS

BS.1377 : PART 2 : 1990 : 4 and 5

CLIENT INTEGRALE LIMITED

SITE SNOW CAPEL, GLOUCESTER

borehole /trial pit no.	sample no./type	sample depth (m)	specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
WS1	D	2.50	2.50	42.3	E					Grey slightly sandy CLAY with rare organic material
WS2	D	1.50	1.50	42.9	E					Brown mottled grey slightly sandy CLAY with rare organic material
WS3	D	2.50	2.50	45.7	BXE	5	76	40	36	Greyish brown slightly sandy slightly gravelly CLAY with rare rootlets
WS4	D	3.50	3.50	29.1	BXE	2	66	27	39	Greenish brown mottled grey slightly sandy CLAY with rare organic material
WS7	D	1.25	1.25	29.9	BXE	3	62	28	34	Greenish brown slightly sandy slightly gravelly CLAY
WS8	D	2.50	2.50	28.2	E					Greenish brown slightly sandy CLAY

general remarks

natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)

NP denotes non plastic

# denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892

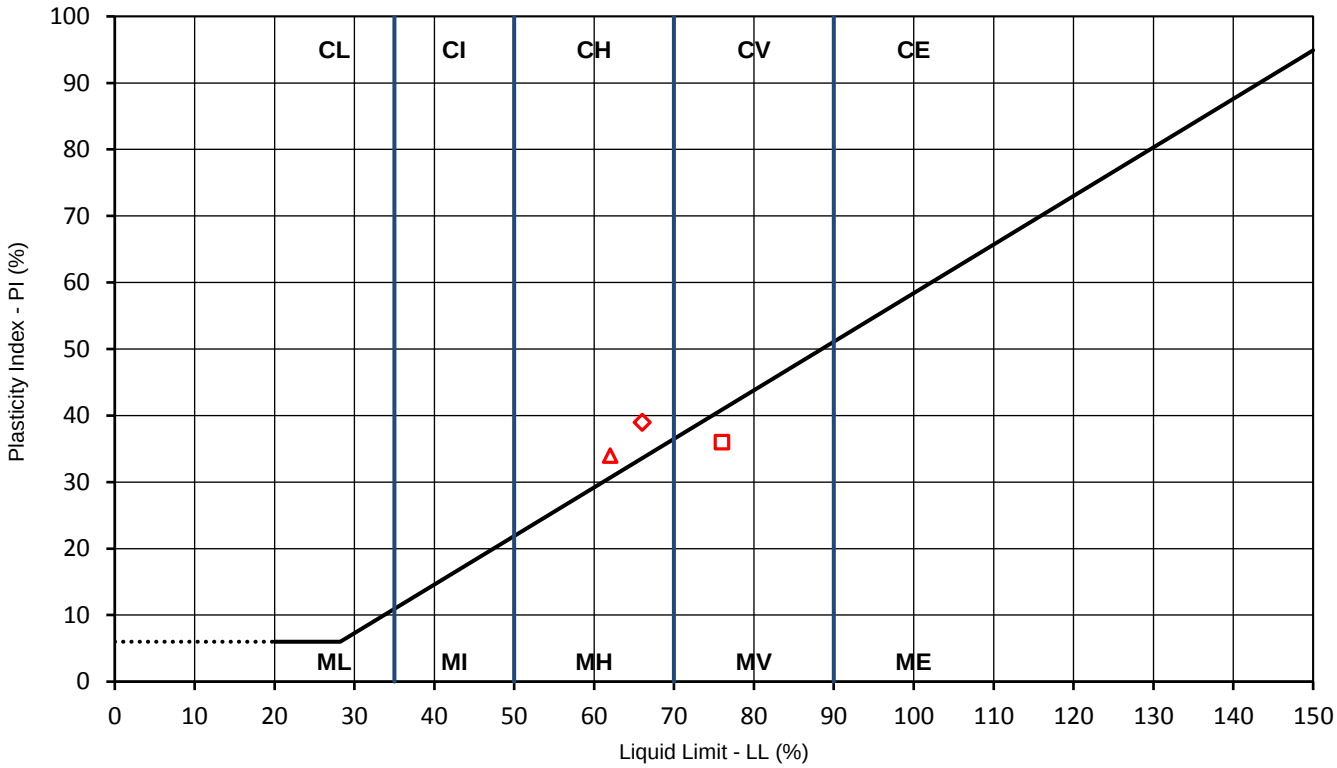
specimen preparation		test method	CONTRACT	CHECKED
A - as received	D - oven dried (60oC)	X - cone penetrometer (test 4.3)		
B - washed on 0.425mm sieve	E - oven dried (105oC)	Y - cone penetrometer (test 4.4)	**33145**	**SR**
C - air dried	F - not known	Z - casagrande apparatus (test 4.5)		

Geotechnical Engineering Limited

ATTERBERG LINE PLOT

CLIENT INTEGRALE LIMITED

SITE SNOW CAPEL, GLOUCESTER



	BH/TP No.	depth (m)	LL	PL	PI	remarks
□	WS3	2.50	76	40	36	
◇	WS4	3.50	66	27	39	
△	WS7	1.25	62	28	34	

CONTRACT	CHECKED
33145	**SR**

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
[redacted]

Final Report

Report No.:	17-13762-1
Initial Date of Issue:	07-Jun-2017
Client	Geotechnical Engineering Ltd
Client Address:	Centurion House Olympus Park Quedgeley Gloucester Gloucestershire GL2 4NF
Contact(s):	Stewart Robinson
Project	33145 Snow Capel, Gloucester

Quotation No.:		**Date Received:**	01-Jun-2017
Order No.:	33145	**Date Instructed:**	01-Jun-2017
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	07-Jun-2017
Date Approved:	07-Jun-2017		

Approved By:

[redacted]

Results - Soil

Project: 33145 Snow Capel, Gloucester

Client: Geotechnical Engineering Ltd			**Chemtest Job No.:**		17-13762
Quotation No.:			**Chemtest Sample ID.:**		461482
Order No.: 33145			Client Sample Ref.:		WS5
			Client Sample ID.:		D
			Sample Type:		SOIL
			Top Depth (m):		2.25
			Date Sampled:		31-May-2017
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	18
pH	U	2010		N/A	7.9
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.066
Total Sulphur	U	2175	%	0.010	0.035
Sulphate (Acid Soluble)	U	2430	%	0.010	0.035

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Intégrale

Appendix G

Results of Contamination Analyses

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

[redacted]
www.integrale.uk.com

STANDARD METHODOLOGY FOR CONTAMINATION SAMPLING & SCHEDULING

Soil samples for contamination analyses are recovered from trial pits or borehole samples using a stainless steel trowel and immediately placed into airtight amber glass jars, vials, or plastic tubs, as appropriate for the testing. These samples are labelled with the site name, investigation location and depth and placed into cool boxes for transit from site. Groundwater samples recovered during subsequent monitoring visits are similarly treated.

An analytical schedule is drawn up in line with the desk study findings, guidance given in CLR 8 and any relevant industry information, the actual ground conditions proven and proposed site use.

Samples are sent via overnight courier to the specialist testing laboratory. Testing is scheduled for MCERTS accredited analyses as far as possible and details of the test method are provided by the laboratory on the results sheets in a separate appendix. A standard turnaround of 10 working days is adopted unless otherwise agreed with the client at the time of instruction.

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
[redacted]

Final Report

Report No.:	17-13349-1
Initial Date of Issue:	05-Jun-2017
Client	Integrale Limited
Client Address:	Fieldworks Office Unit 7 Westway Farm Business P Wick Road Bishops Sutton BS39 5XP
Contact(s):	Sean Jefferson
Project	1826 Snow Capel, Gloucester

Quotation No.:		**Date Received:**	30-May-2017
Order No.:		**Date Instructed:**	30-May-2017
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	05-Jun-2017
Date Approved:	05-Jun-2017		

[redacted]

Results - Soil

Project: 1826 Snow Capel, Gloucester

Client: Integrale Limited			Chemtest Job No.:		17-13349	17-13349	17-13349	17-13349
Quotation No.:			Chemtest Sample ID.:		459417	459418	459419	459420
Order No.:			Client Sample Ref.:		WS1	WS5	WS6	WS8
			Client Sample ID.:		INT 1826	INT 1826	INT 1826	INT 1826
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	1.80	1.40	0.60
			Date Sampled:		25-May-2017	25-May-2017	25-May-2017	25-May-2017
			Asbestos Lab:		COVENTRY	COVENTRY		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-		
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected		
Moisture	N	2030	%	0.020	14	20	16	16
pH	U	2010		N/A	8.0	7.3	7.4	8.0
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	1.0	1.1	< 0.40	0.80
Sulphur (Elemental)	U	2180	mg/kg	1.0	< 1.0	63	23	5.3
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50	7.0	11	7.7	6.8
Sulphate (Total)	U	2430	%	0.010	1.3	0.72	0.075	0.28
Arsenic	U	2450	mg/kg	1.0	8.1	14	6.7	14
Barium	U	2450	mg/kg	10	87	73	36	49
Beryllium	U	2450	mg/kg	1.0	< 1.0	1.0	< 1.0	< 1.0
Cadmium	U	2450	mg/kg	0.10	0.19	< 0.10	< 0.10	< 0.10
Chromium	U	2450	mg/kg	1.0	29	44	50	47
Copper	U	2450	mg/kg	0.50	17	21	24	27
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	33	36	50	50
Lead	U	2450	mg/kg	0.50	19	29	23	25
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0	27	52	54	48
Zinc	U	2450	mg/kg	0.50	82	100	93	98
Chromium (Trivalent)	N	2490	mg/kg	5.0	29	44	50	47
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	1.0	2.2	0.71	1.4
Total TPH >C6-C40	U	2670	mg/kg	10	< 10	< 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	0.14	< 0.10	< 0.10	0.13
Acenaphthylene	U	2700	mg/kg	0.10	0.11	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	0.17	0.22	< 0.10	0.13
Fluorene	U	2700	mg/kg	0.10	< 0.10	0.13	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	0.41	0.60	< 0.10	0.13
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	0.33	0.42	0.16	0.15
Pyrene	U	2700	mg/kg	0.10	0.38	0.45	0.16	0.12
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.13	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	0.22	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

WRAS = Exceeds WRAS thresholds

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 1826 Snow Capel, Gloucester

Client: Integrale Limited			**Chemtest Job No.:**		17-13349	17-13349	17-13349	17-13349
Quotation No.:			**Chemtest Sample ID.:**		459417	459418	459419	459420
Order No.:			Client Sample Ref.:		WS1	WS5	WS6	WS8
			Client Sample ID.:		INT 1826	INT 1826	INT 1826	INT 1826
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	1.80	1.40	0.60
			Date Sampled:		25-May-2017	25-May-2017	25-May-2017	25-May-2017
			Asbestos Lab:		COVENTRY	COVENTRY		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30

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The right chemistry to deliver results

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Appendix H

Proposed Redevelopment

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom
[redacted] www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

GCN DISPERSAL.

MAINTAIN FOOTPATH

FOOTPATH LINKS ACROSS BARWOOD SCHEME.

POTENTIAL CONNECTION TO BARWOOD P.O.S.

GCN DISPERSAL

SM DESIGNATION.

25m BUFFER

50m BUFFER.

← DIVERTED PROW

GCN DISPERSAL.

OPTION FOR LOOP ROAD? OTHERWISE, LOOP INTERNALLY.

35m BUFFER

A.O.N.B.

POTENTIAL NOISE BUND + FENCE (3m + 2m).