

GEOPHYSICAL SURVEY REPORT

Land North of Redlands Farm, Swindon

Client

Orion Heritage Ltd

On Behalf of

BSL Strategic Ltd

OASIS Ref.

sumogeop1-503163

Survey Report

SUMO-04725

Date

December 2021



Survey Report 04725: Land North of Redlands Farm, Swindon

Survey dates	15-17 November 2021
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2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2

Traverse Interval 1.0m

Sample Interval 0.25m

3 SUMMARY OF RESULTS

3.1 The magnetic survey of fields north of Redlands Farm covered an area of approximately 18ha extending across four parcels of land and identified a number of responses clearly indicative of archaeological remains. These comprise a small settlement site with possible ring ditches, buildings, yards, paddocks, fields and tentative workshops for small-scale local industrial activities spread across some 3ha. Further archaeological features are visible in the data and include square features, linear and curvilinear responses, tentative rings and pits. Past ridge and furrow cultivation patterns are also visible in the data.

4 INTRODUCTION

- 4.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for residential development. This survey forms part of an archaeological investigation being undertaken by **Orion Heritage Ltd** on behalf of **BSL Strategic Ltd**.
- 4.2 Site details

NGR / Postcode	SU 2062 8521 / SN4 0AA (Redland Farm)
Location	The site lies on the eastern outskirts of Swindon, 1.2km east of where the A419 crosses over the Wanborough Road. Occupying several fields and surrounded by agricultural land on all sides, the southern limit of the site is 300m north of Redlands Farm buildings.
HER	Wiltshire HER
HER / OASIS Ref.	sumogeop1-503163
District	Swindon
Parish	Wanborough
Topography	Undulating
Current Land Use	Pasture
Geology (BGS 2021)	Solid: Ampthill and Kimmeridge clay plus Gaunt mudstone Superficial: None recorded except for alluvial deposits along Liden stream which bisects the site
Soils (CU 2021)	Soilscape 18: slowly permeable loamy and clayey soils
Archaeology (OH 2021)	The study site lies c.600m east of the scheduled remains of the Roman town <i>Durocornovium</i> , west of Wanborough House (NHLE 1004684). The study site lies adjacent to an area which has been subject toarchaeological evaluation including geophysics and trenching but this work identified limited evidence for any archaeological remains (<i>Land at Redlands Airfield Wanborough Swindon Archaeological Evaluation</i> Cotswold Archaeology Project: 5500, CA Report: 15665). A DBA prepared by Orion Heritage in 2020 for the neighbouring site identified two references to heritage assets within the current site (See Figure 06): MWI20033 Romano-British pottery from Liden Steam and MWI20061 Romano-British enclosures
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	<i>c.</i> 18 ha

4.3 Aims and Objectives

To locate and characterise any anomalies of possible archaeological interest within the study area; to further characterise the enclosures referred to in the HER (MWI20061).

5 RESULTS

The survey has been divided into four survey areas (Areas 1-4) and specific anomalies have been given numerical labels [1] [2] which appear in the text below, as well as on the Interpretation Figure(s).

5.1 Probable / Possible Archaeology

- 5.1.1 An area of magnetic responses [1] has been identified in the western central part of the site, mainly lying to the south of Liden Stream in Areas 2 and 4, with additional features extending into Area 1 north of the stream. The anomalies comprise a series of enclosures, paddocks or small fields, generally aligned SSW to NNE, which cover an area of approximately 3 to 3.5ha in size. The strongest responses follow the eastern boundary of Area 3 where there is a complex of smaller features, probably associated with settlement activity; there are numerous pit-like responses and tentative indications of ring ditches. A modern boundary runs through the centre of the complex; to the west of this and extending up to the stream the ditched features are larger, more like fields. It is possible that the boundary follows the line of an original road / track [2] through the settlement. The results as a whole indicate either a cluster of small farmsteads or a larger farm and as such clearly equates to the previously identified enclosures in the HER (MWI20061). Magnetic disturbance (see 5.5.2) immediately north of these responses are thought to be modern, but it is conceivable they could be associated with workshops, small kilns or furnaces which formed part of the farm complex.
- 5.1.2 Approximately 75m to the north of the above complex is a small (15m x 15m) square-shaped response [3] which could represent a ditched feature. It appears to be associated with an oval-shaped trend and a small area of slightly increased magnetic responses [4]. Immediately southwest is a ring [5] with a diameter of 7 m. Along the northern edge of the survey are further responses [6] indicating another partial square feature and a ditch length. Some 50m to the Given the wider context the responses are considered to be indicative of possible archaeological features.

5.2 Uncertain

5.2.1 There are two poorly defined ring responses [7] and an isolated pit-like anomaly [8]; if it were not for the other recorded features (5.1), it is doubtful that an archaeological interpretation would be considered. The magnetic results could simply be agricultural or pedological in origin, perhaps a deeply buried ferrous object in the case of [8]. As such in this instance an uncertain cause is appropriate, and this also applies to other linear and curvilinear trends in the data [9] and [10].

5.3 Former Field Boundary (conjectural)

5.3.1 Narrow linear responses in Area 1 coincide with features visible on Google imagery and LiDAR imagery (see Figure 05) but not on historic mapping. They follow the alignments of existing field boundaries and as such could be unmapped former divisions or simply mark paths or tracks.

5.4 Agricultural – Ridge and Furrow / Land Drains

5.4.1 Parallel linear responses in Area 4 aligned approximately N-S indicate an area of ridge and furrow ploughing; this is a continuation of ploughing features marked in the HER and on Plan 1 above.

5.5 Service / Magnetic Disturbance / Ferrous

- 5.5.1 A line of dipolar anomalies extends across Area 3 following an W-E alignment; the anomalies mark the line of a ferrous waterpipe which connects to a drinking trough at the eastern field boundary.
- 5.5.2 Two small areas of magnetic disturbance at the north of Area 3 coincide with patches of ground which it is believed have either be scrubbed out or consolidated; these are visible on Google imagery (see Figure 05) but see 5.1.1 (above).
- 5.5.3 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

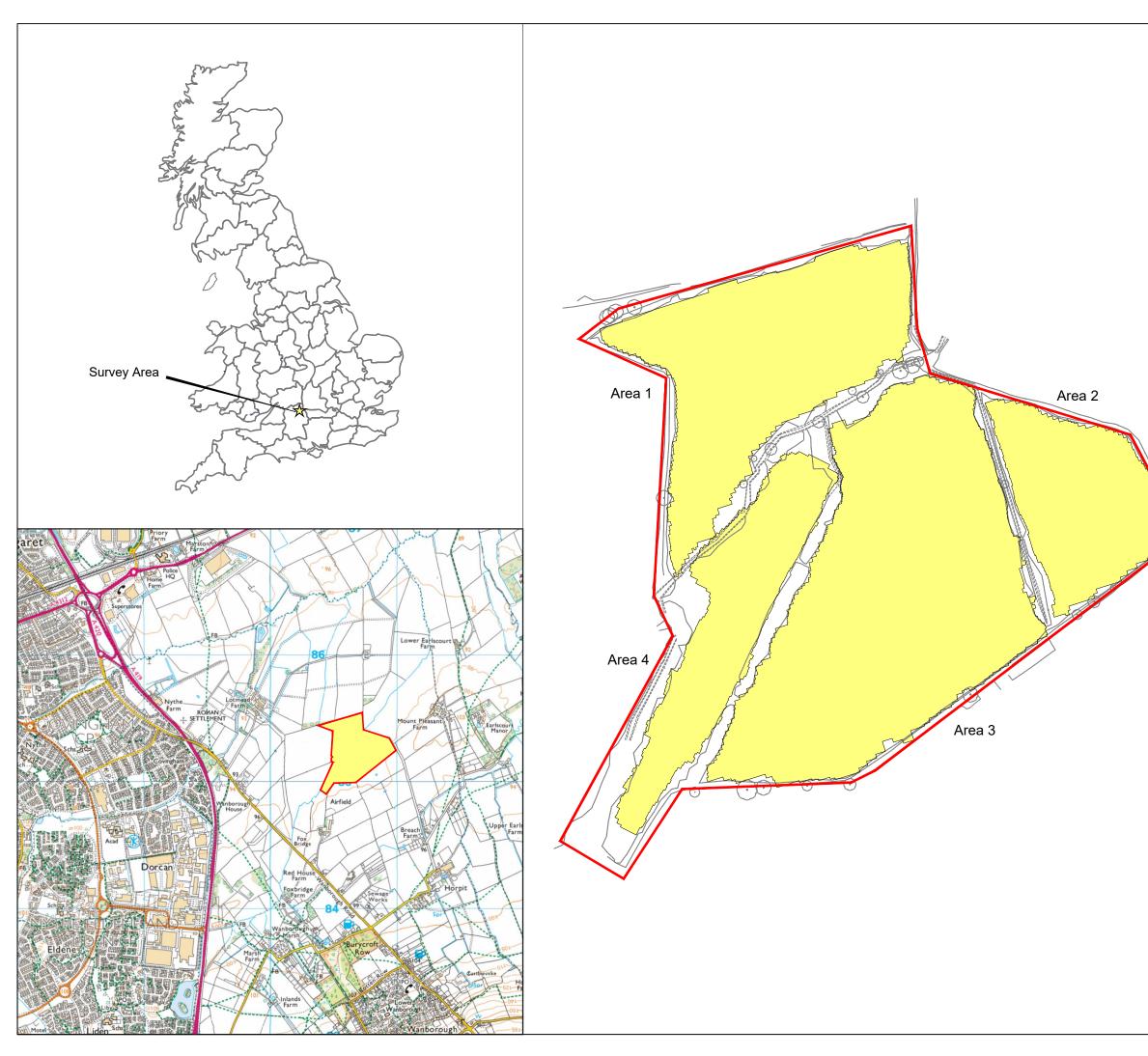
6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of a complex of archaeological features; as such the technique is deemed to have worked well.

7 CONCLUSION

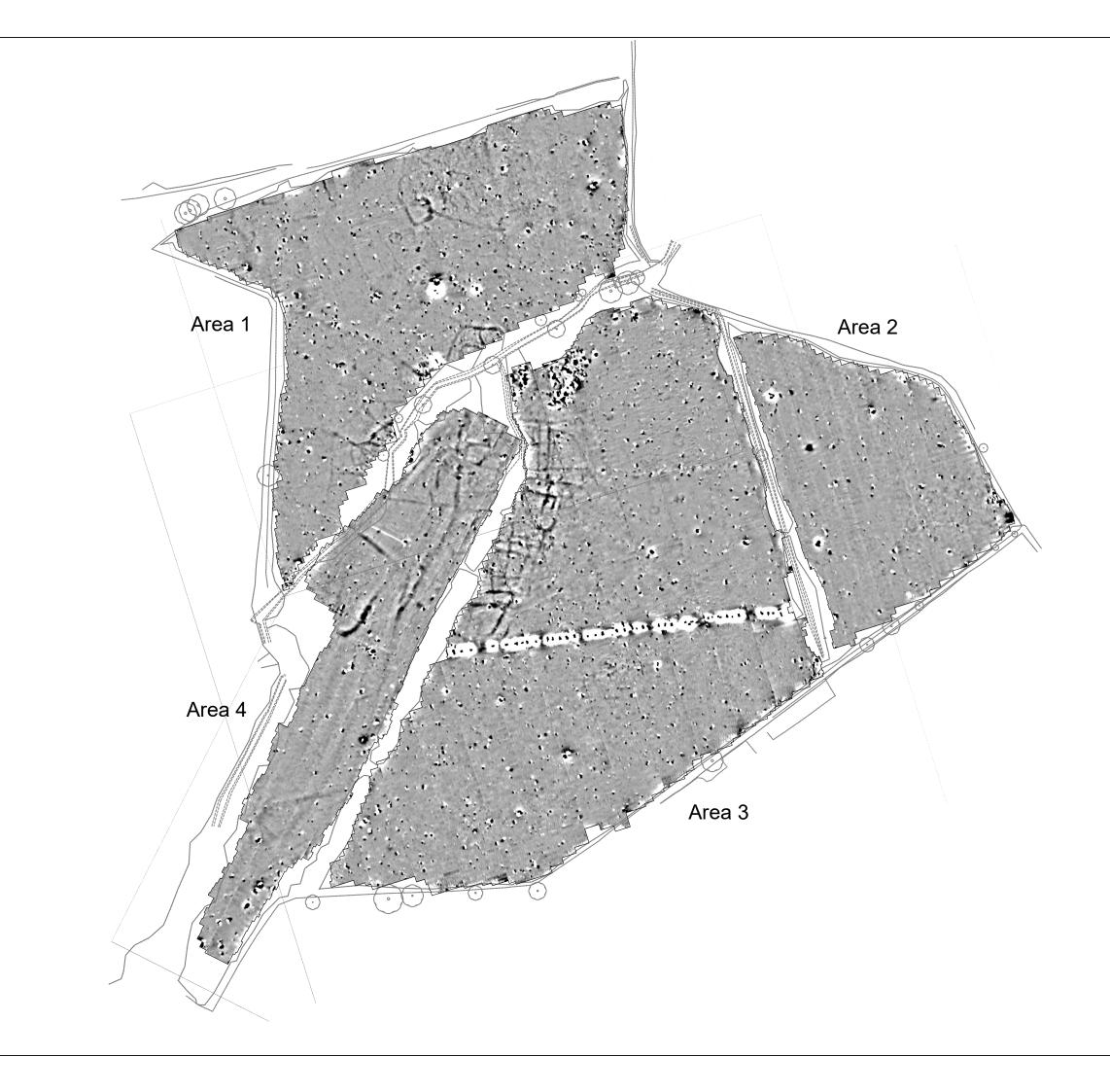
7.1 The magnetic survey of fields north of Redlands Farm has confirmed the existence of archaeological remains associated with previously identified enclosures recorded in the local HER (MWI20061). In addition to enclosures are possible ring ditches, buildings, yards, and paddocks plus tentative small-scale local industrial features. Other archaeological features are visible in the data and include square ditches, linear and curvilinear ditches, tentative rings and pits. Past ridge and furrow cultivation patterns are visible in the data and a small water pipe has also been identified.

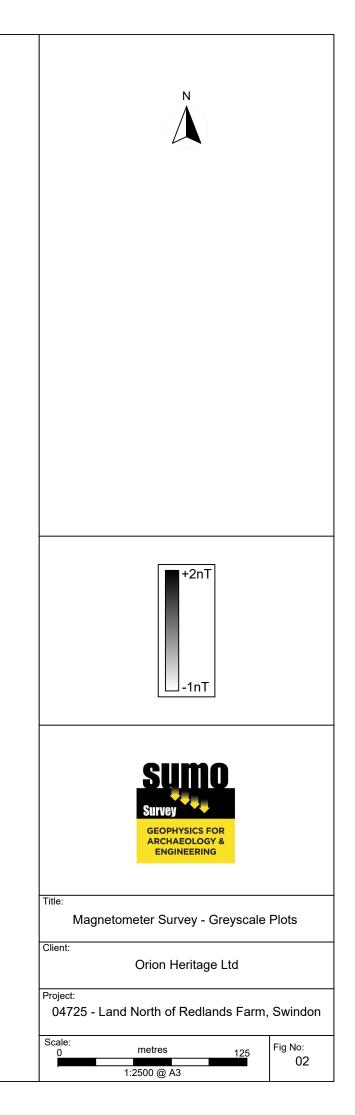
8 REFERENCES

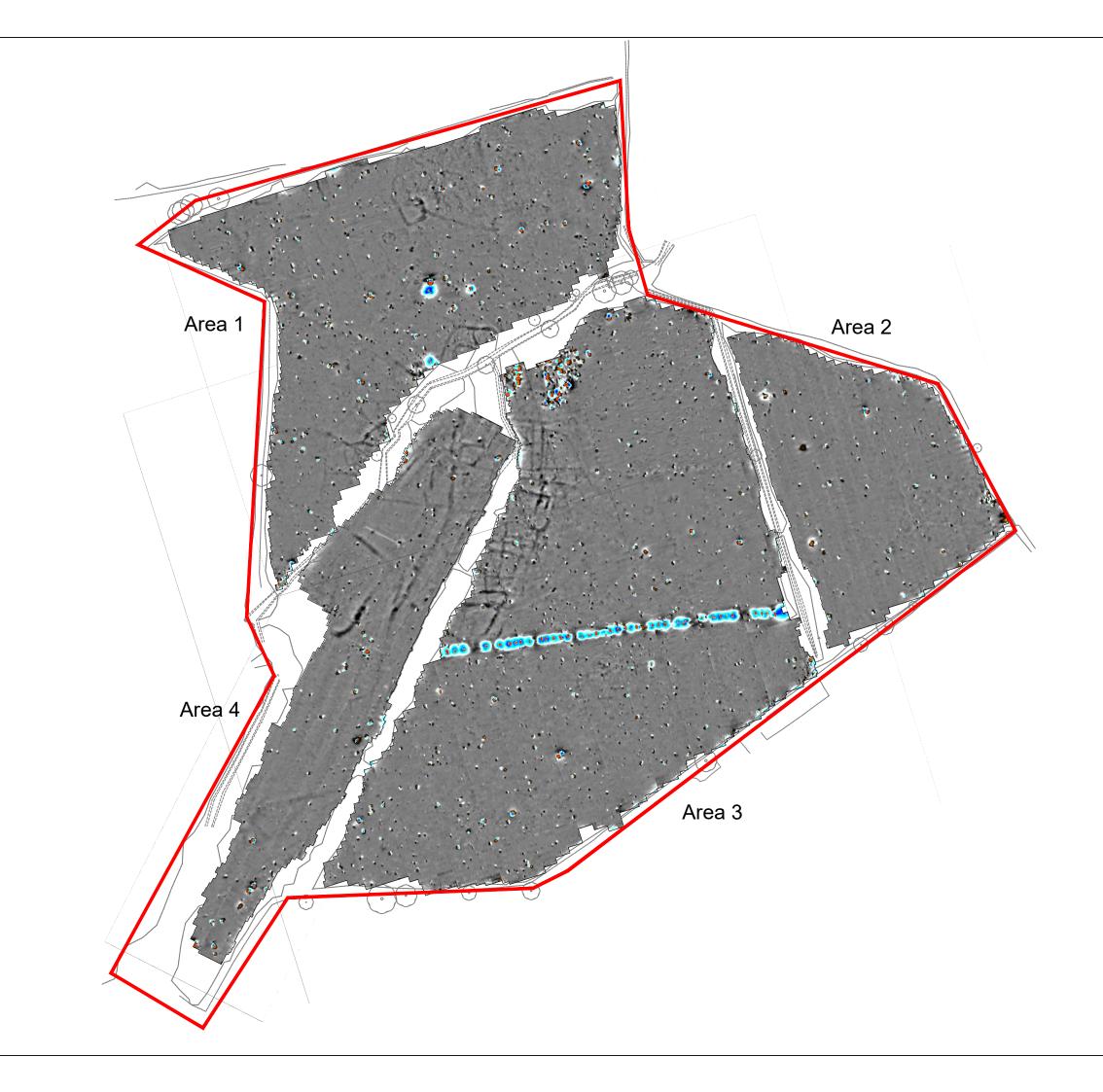
BGS 2020	British Geological Survey, Geology of Britain viewer [accessed 1/12/2021] <i>website</i> : (<u>http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps</u>)
ClfA 2014	Standard and Guidance for Archaeological Geophysical Survey. Amended 2016. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics 2.pdf
CU 2020	The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 1/12/2021] website: <u>http://mapapps2.bgs.ac.uk/ukso/home.html</u>
EAC 2016	EAC Guidelines for the Use of Geophysics in Archaeology, European Archaeological Council, Guidelines 2.
EH 2008	Geophysical Survey in Archaeological Field Evaluation. English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical- survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/
OH 2020	<i>Green Land, Swindon Historic Environment Desk Based Assessment</i> Orion Heritage Ltd, February 2020, unpublished report.

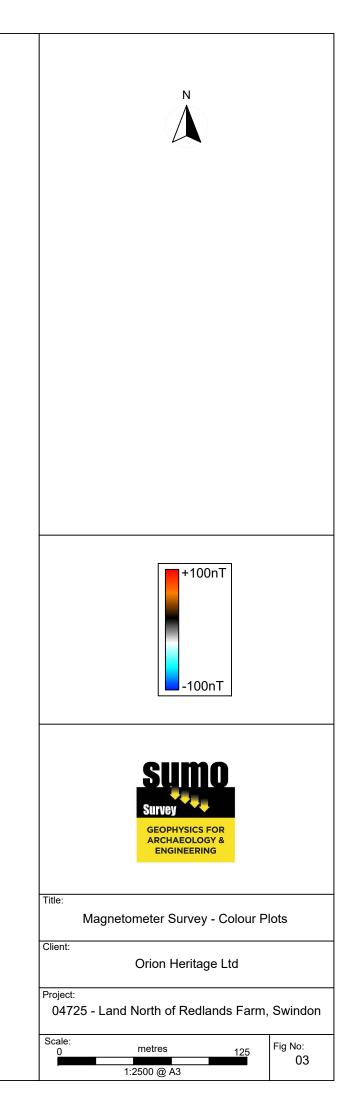


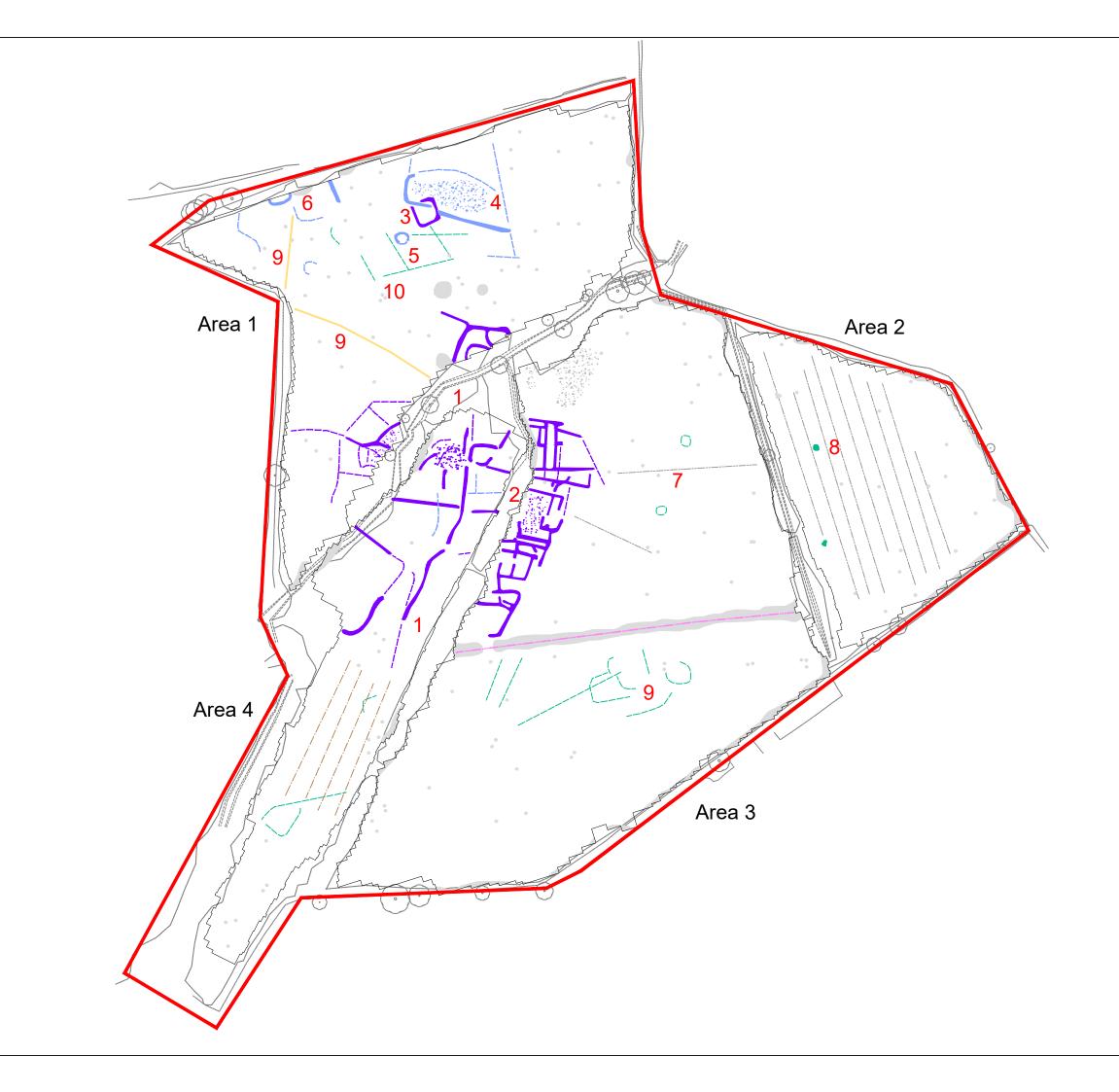
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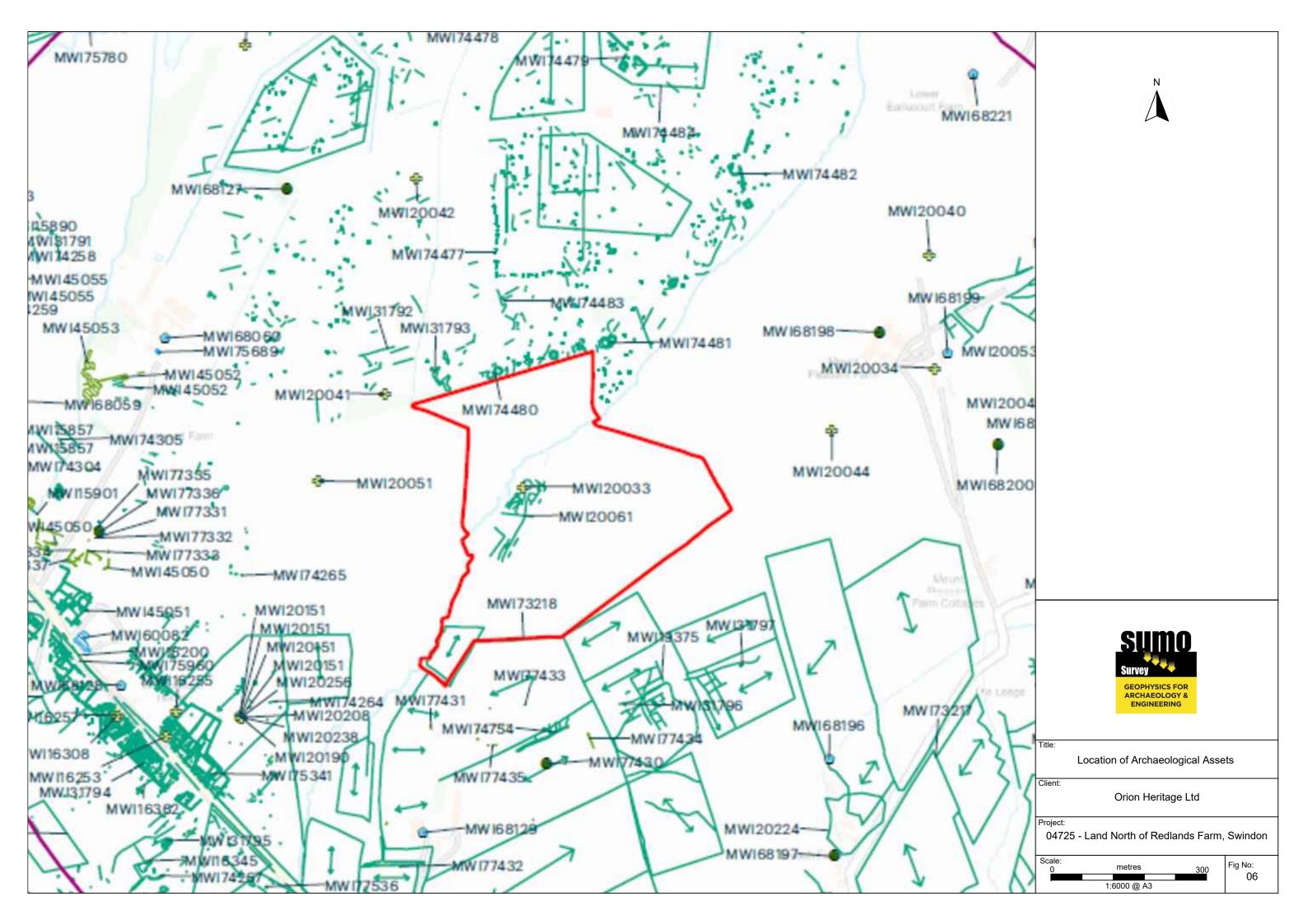


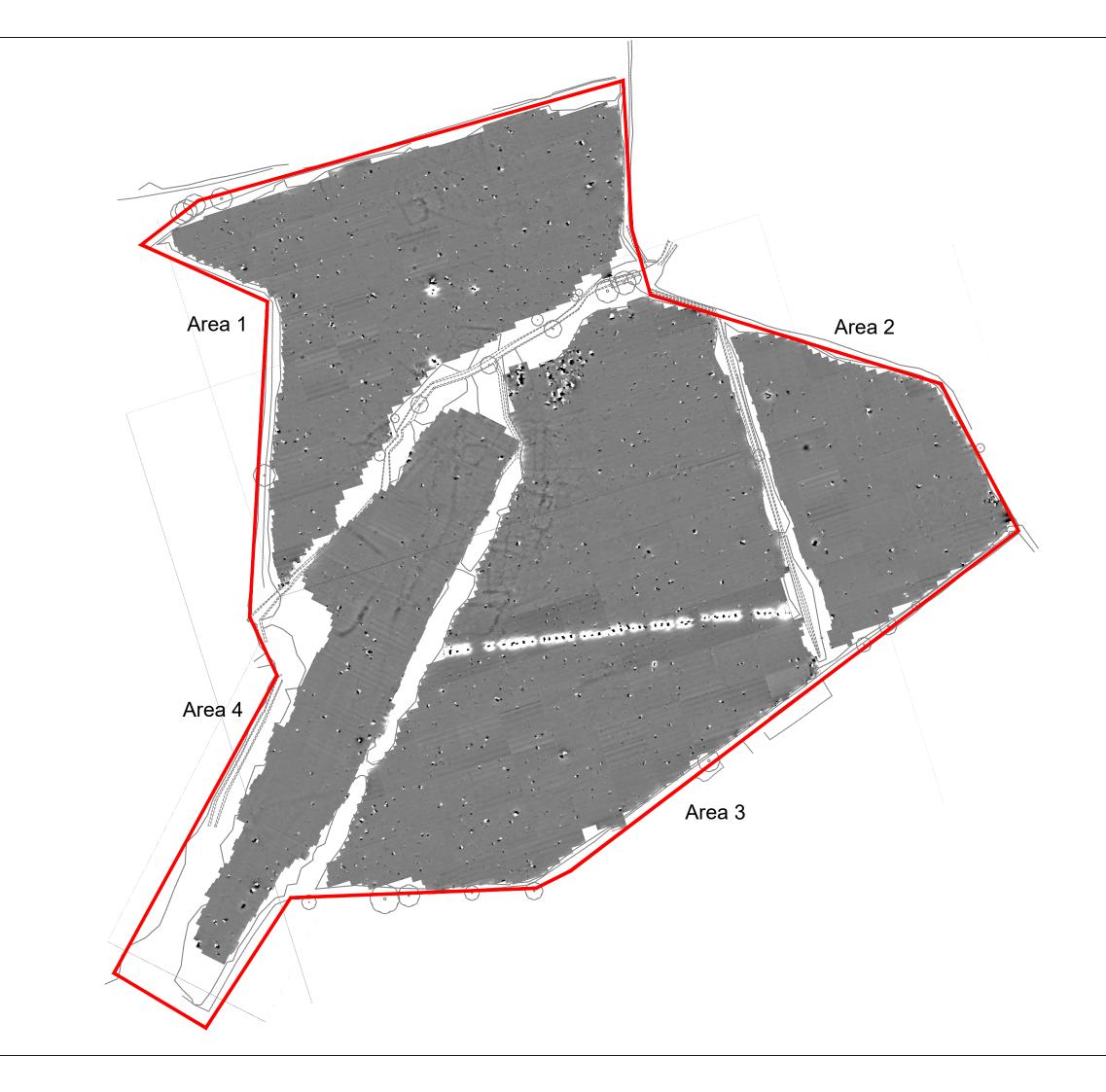


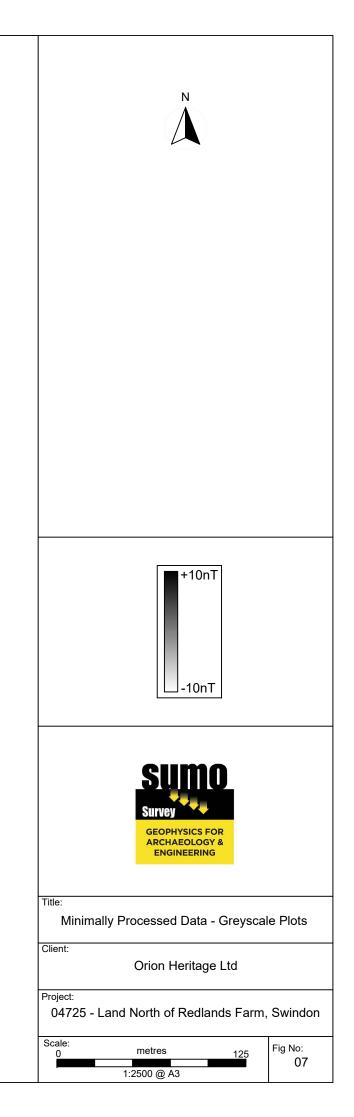


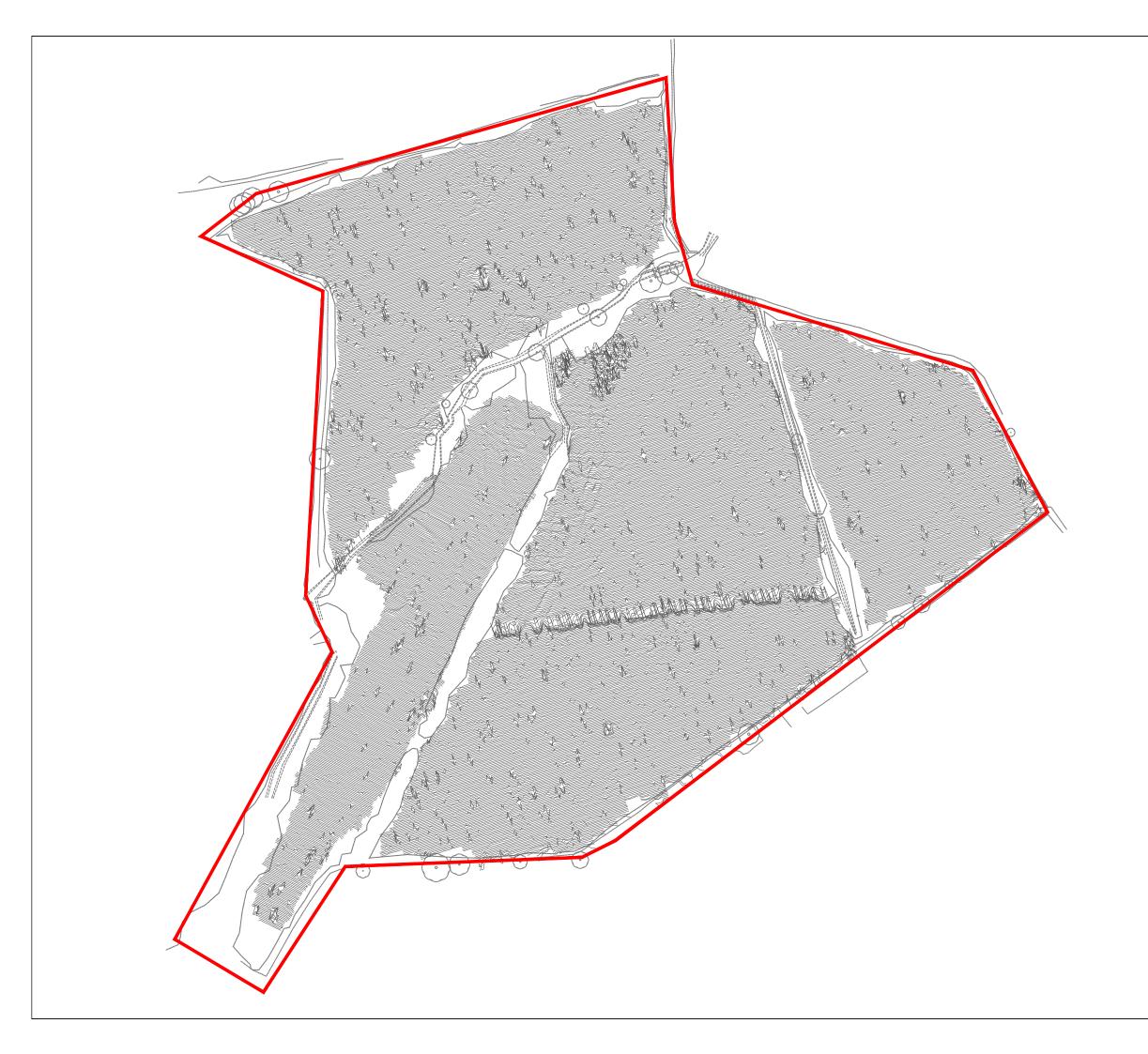
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	Possible archaeology (discrete anon / increased response)	naly / trend
	Uncertain Origin (discrete anomaly /	trend)
	Former field boundary (conjectural)	
	Agriculture (ridge and furrow)	
	Land drain	
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	Service	
	Ferrous	
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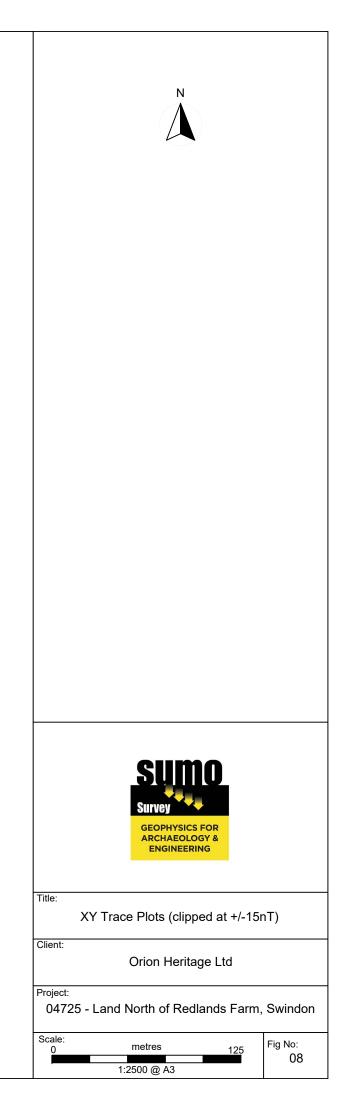












Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station rebroadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington Grad 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing Zero Mean Traverse Step Correction (De-stagger)	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set. When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.
Display Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Presentation of results and interpretation

The presentation of the results includes a 'minimally processed data' and a 'processed data' greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the 'Interpretation' drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of <i>Possible Archaeology / Natural</i> or (in the case of linear responses) <i>Possible Archaeology / Agriculture</i> ; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

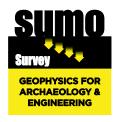
Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.

Summary for sumogeop1-503163

OASIS ID (UID)	sumogeop1-503163
Project Name	Geophysical Survey at Land North of Redlands Farm, Swindon
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	04725
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	15-Nov-2021 - 17-Nov-2021
Location	Land North of Redlands Farm, Swindon
	NGR : SU 20646 85240
	LL : 51.5656616697325, -
	1.70353127257749
	12 Fig : 420646,185240
Administrative Areas	Country : England
	County : Wiltshire
	District : Swindon
	Parish : Wanborough
Project Methodology	A temporary grid system will be established over the site and marked out using canes. The location of the grid will be set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co- ordinates. Hand Held: Data will be collected using a Bartington Grad 601- 2. The instrument consists of two paired sensors (see below) and readings are logged at 0.25m centres along traverses 1.0m apart across 30m grids. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution as per Historic England guidelines. Two sensors mounted 1m horizontally apart and very accurately aligned to nullify the effects of the earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.

Project Results	The magnetic survey of fields north of Redlands Farm has confirmed the existence of archaeological remains associated with previously identified enclosures recorded in the local HER (MWI20061). In addition to enclosures are possible ring ditches, buildings, yards, and paddocks plus tentative small-scale local industrial features. Other archaeological features are visible in the data and include square ditches, linear and curvilinear ditches, tentative rings and pits. Past ridge and furrow cultivation patterns are visible in the data and a small water pipe has also been identified.
Keywords	Oval Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Pit - UNCERTAIN - FISH Thesaurus of Monument Types Ridge And Furrow - POST MEDIEVAL - FISH Thesaurus of Monument Types Drain - 20TH CENTURY - FISH Thesaurus of Monument Types Ring Ditch - UNCERTAIN - FISH Thesaurus of Monument Types Field Boundary - UNCERTAIN - FISH Thesaurus of Monument Types Square Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Water Pipe - 20TH CENTURY - FISH Thesaurus of Monument Types
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- Laser Scanning
- Archaeological
 Geophysical
 Measured Building
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 - TopographicUtility Mapping

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