

GEOPHYSICAL SURVEY REPORT

Land south of Hambridge Way, Pirton, Hertfordshire

Client

Cotswold Archaeology

For

Blakeney Estates Ltd

Survey Report

20027

OASIS Ref. No.

Sumogeop1-529144

Date

09 December 2024



Survey Report 20027: Land south of Hambridge Way, Pirton, Hertfordshire

Survey dates	29 November 2024
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Field Team	Stephen Weston BA
Report Date	09 December 2024
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3 SURVEY TECHNIQUE

- 3.1 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. All survey techniques followed the guidance set out by ClfA (2020) and the European Archaeology Council (EAC) (2016).

Bartington Cart System Traverse Interval 1.0m Sample Interval 0.125m

The only processes performed on data are the following unless specifically stated otherwise:

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes instrument striping effects and edge discontinuities over the whole of the data set.
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4 EXECUTIVE SUMMARY OF RESULTS

- 4.1 A magnetometer survey of 2.5 hectares of land south of Hambridge Way, Pirton has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest, except for ridge and furrow cultivation that is visible in both survey areas. A number of uncertain responses have been detected in the data. They have probably been caused by past land uses or underlying natural variations; however, archaeological origins cannot be entirely discounted for the anomalies.

5 INTRODUCTION

- 5.1 **SUMO GeoSurveys** was commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **Cotswold Archaeology** on behalf of **Blakeney Estates Ltd.**

5.2 Site Details

NGR / Postcode	TL 15111 31610 / SG5 3QS
Location	The site is located 12km north-east of Luton and 4km north-west of Hitchin. The survey area is bounded to the north by Hambridge Way and to the south by Pirton Recreation Ground.
HER	Hertfordshire HER
OASIS Ref. No.	Sumogeop1-529144
District	North Hertfordshire District
Parish	Pirton Civil Parish
Topography	Flat
Land Use	Pasture
Geology	Bedrock: West Melbury Marly Chalk Formation - Chalk
(BGS 2024)	Superficial: Lowestoft Formation - Diamicton
Soils (CU 2024)	Soilscape 3: Shallow lime-rich soils over chalk or limestone
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	2.5 ha

5.3 *Archaeological Background*

- 5.3.1 Cotswold Archaeology (2024) undertook an Historic Environment Desk-Based Assessment which identified a potential for archaeological remains of late prehistoric, Roman, Saxon, medieval and post-medieval date, with evidence of these periods being recorded in the study area.
- 5.3.2 Remains from the Saxon period have been recovered within the village and also within the Site, during several stages of a test pitting programme, and Pirton was well established by the medieval period, as recorded in the Domesday Survey. During this period the major settlement was located around the Motte and Bailey Castle at Toot Hill, with the scheduled earthworks of the associated shrunken village to the south-east and the Grade I Listed Church of St Mary to the north. Further moated settlements were located around Rectory Farm and, possibly, around Wrights Farm, both to the north-west of the Site
- 5.3.3 Taken as a whole, the evidence suggests there is a moderate to high potential for the presence of buried archaeological remains of late Saxon and medieval origin within the area of the proposed development. Such remains may comprise evidence of former agricultural activity, such as furrows and field systems, and older field boundaries, perhaps associated with activities contemporary with the shrunken village to the west.

- 5.3.4 The flourishing of Pirton suffered a significant contraction, probably during the Black Death of 1348, when the settlement was dramatically reduced, possibly limited to the area surrounding of Toot Hill. A recovery is perceivable during the post-medieval period, when many of the designated historic building of the village were established. During this and the following modern period the Site was likely part of the agricultural hinterland surrounding the historic core of the town. As such, it is suggested that there is moderate potential for the presence within the proposed development area of remains dating to these periods, comprising evidence of ploughing and infilled field boundaries but considered to be of negligible significance.

5.4 ***Aims and Objectives***

- 5.4.1 To locate and characterise any anomalies of possible archaeological interest within the study area.

6 **RESULTS**

- 6.1 *The survey has been divided into two survey areas (Areas 1 & 2).*

6.2 ***Probable / Possible Archaeology***

- 6.2.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest, except for ridge and furrow cultivation (see 6.3).

6.3 ***Ridge and Furrow***

- 6.3.1 Broad and parallel linear anomalies have been detected in both survey area which have been caused by historic ridge and furrow cultivation aligned on and east/west axis.

6.4 ***Uncertain***

- 6.4.1 A number of discrete anomalies, trends and zones of increased response have been detected in the survey which have been assigned to the category of *Uncertain*. It is unclear what has caused these anomalies: consequently, archaeological origins cannot be entirely discounted. Area 2 was once part of an allotment garden (see Figure 05) and some of the uncertain responses may have been caused by buried ferrous debris / ground disturbance associated with their removal. Alternatively, they may be due to underlying natural variations.

6.5 ***Ferrous / Magnetic Disturbance***

- 6.5.1 Ferrous responses close to boundaries are due to adjacent buildings, roads, fences, gates and survey pipes that are located of the periphery of the site. 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.

7 **DATA APPRAISAL & CONFIDENCE ASSESSMENT**

- 7.1 Historic England Table 4 (EH 2008) states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of ridge and furrow cultivation; consequently, there is no *a priori* reason why archaeological features would not have been detected.

8 **CONCLUSION**

- 8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest except for ridge and furrow cultivation that is visible in both survey areas. A number of uncertain responses have been detected in Area 1. They

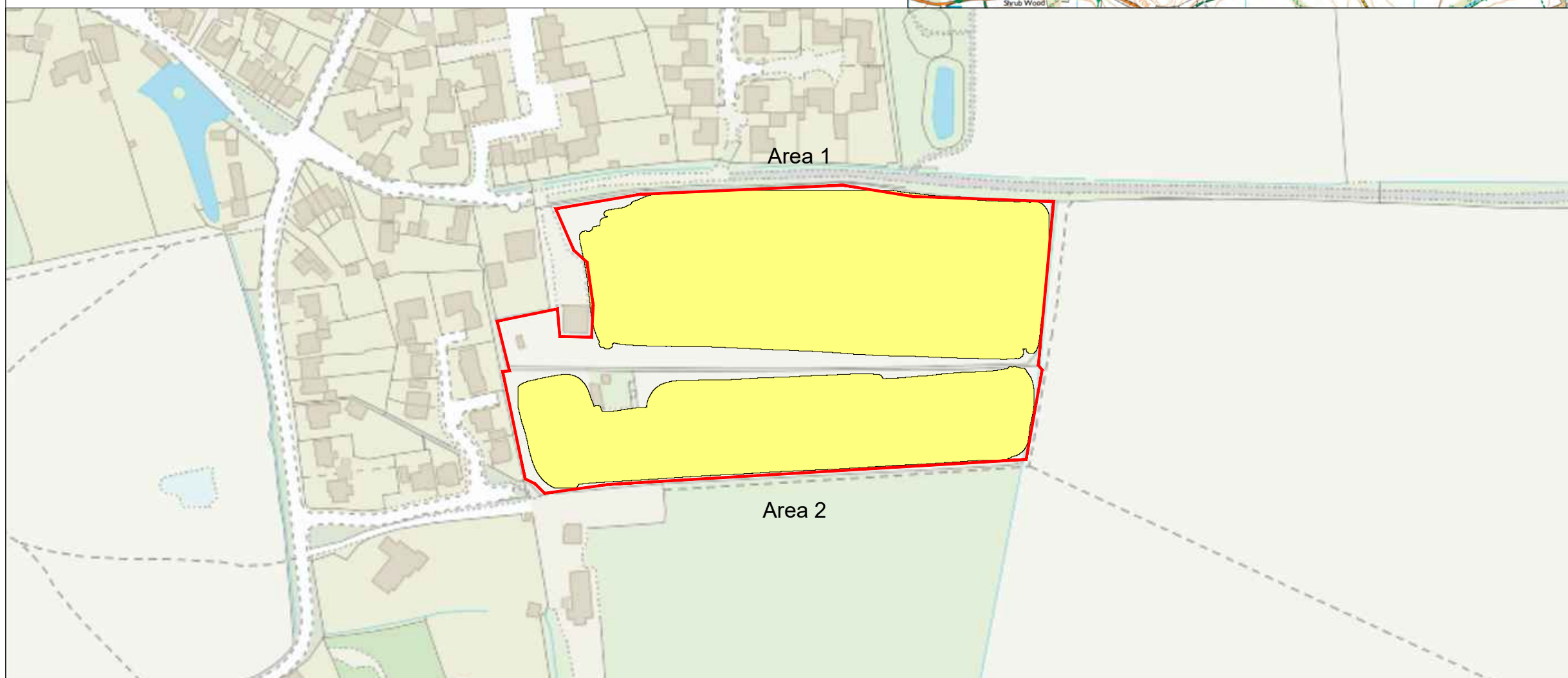
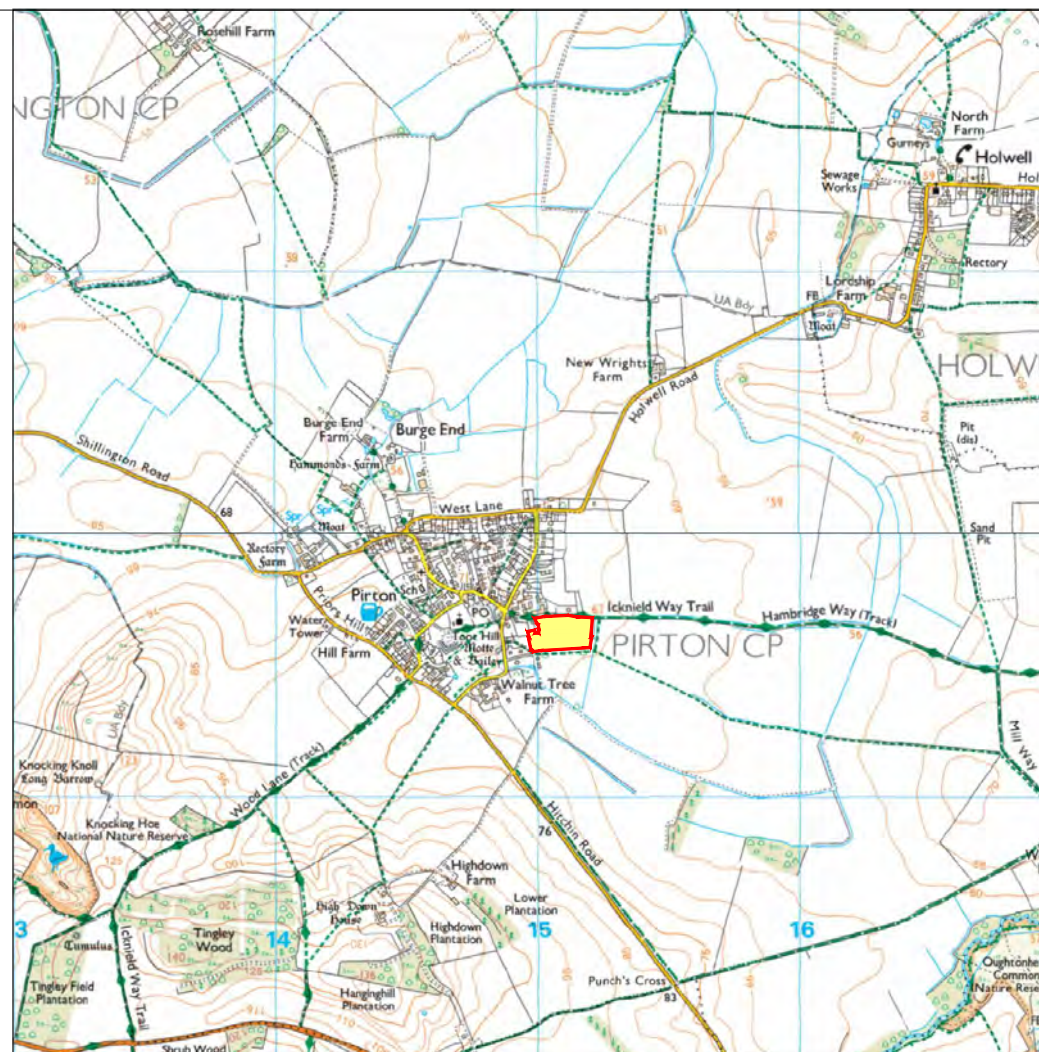
have probably been caused by past land uses or underlying natural variations. However, archaeological origins cannot be entirely discounted for the anomalies.

9 REFERENCES

- BGS 2024 *Geology of Britain Viewer*, British Geological Survey, website:
(<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
- CA 2024 *Land south of Hambridge Way, Pirton, Hertfordshire Historic Environment Desk-Based Assessment (DRAFT)*. Cotswold Archaeology, Cirencester
- ClfA 2020 *Standard and Guidance for Archaeological Geophysical Survey*. 2014 amended 2020. ClfA Guidance note. Chartered Institute for Archaeologists, Reading
https://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_3.pdf
- CU 2024 *The Soils Guide*. www.landis.org.uk. Cranfield University, UK. website:
<http://mapapps2.bgs.ac.uk/ukso/home.html>
- 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
(now withdrawn, but used for evaluating suitability of soil types)

10 ARCHIVE

- 10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO GeoSurveys'** digital archive, on an internal RAID configured NAS drive in the Midlands Office. These data are also backed up to the Cloud for off-site storage.
- 10.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months.



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Survey Areas



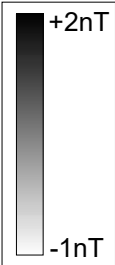
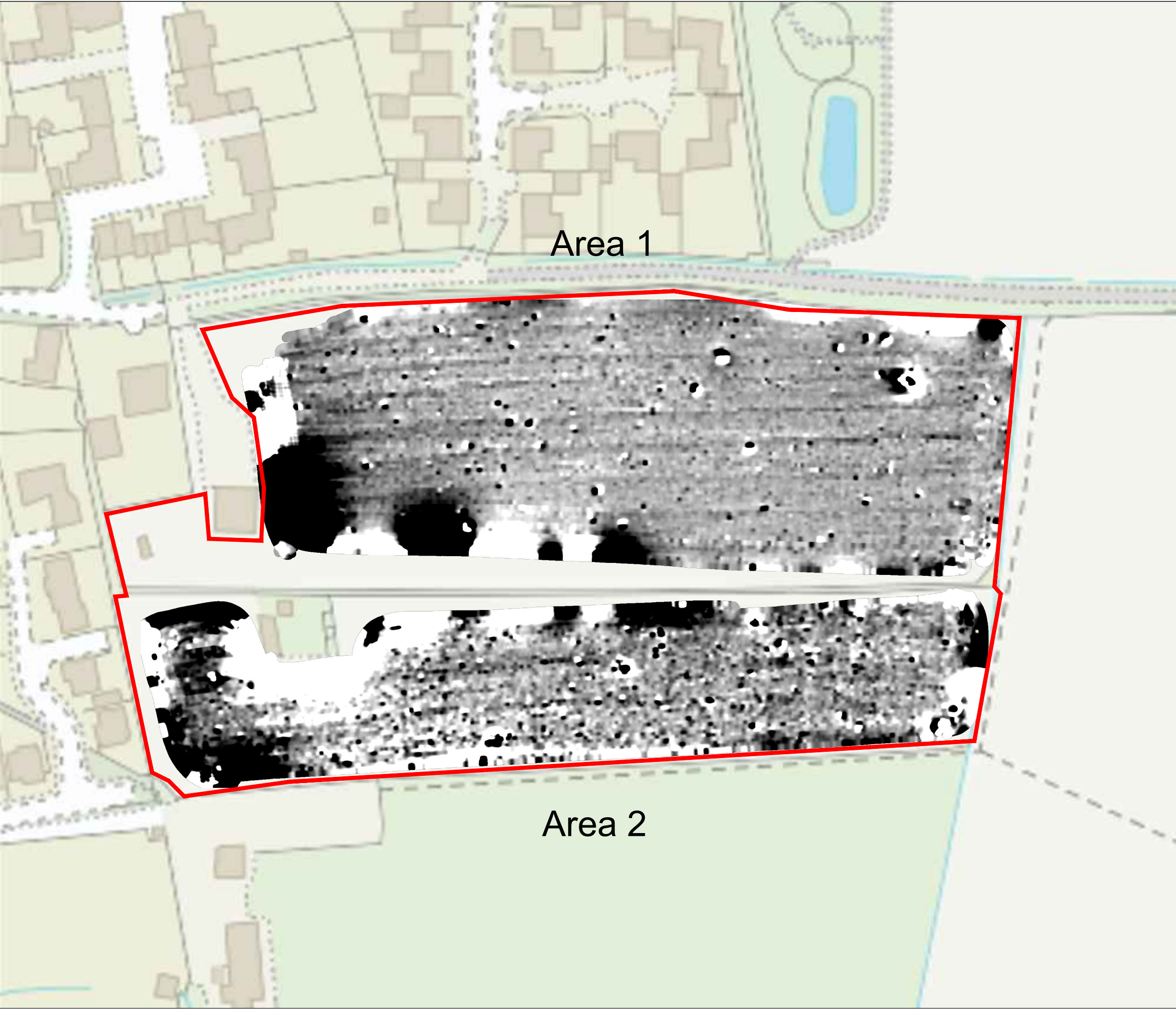
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Client: Cotswold Archaeology

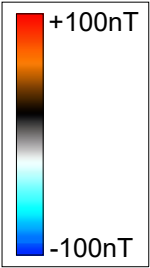
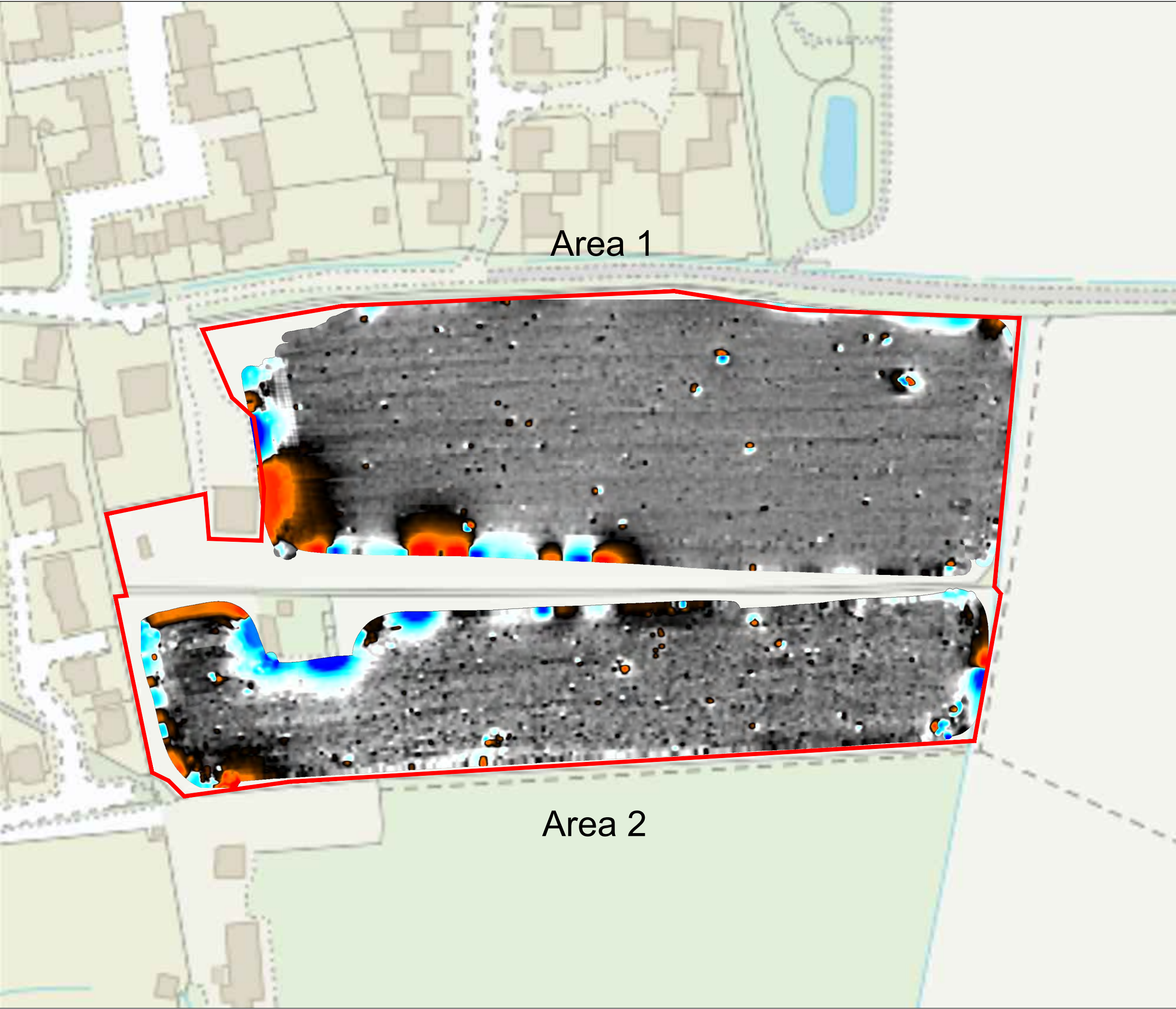
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire

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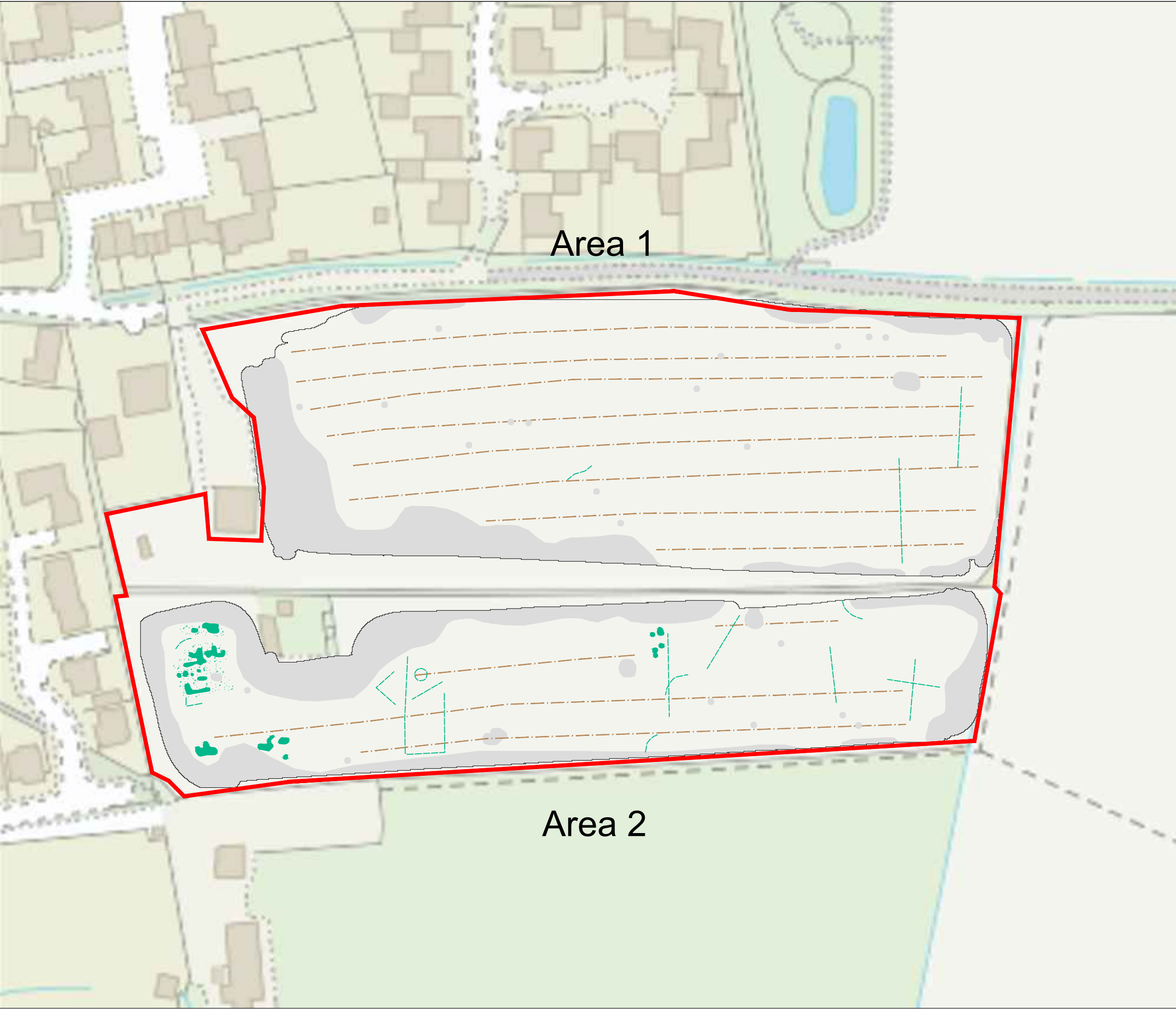
Fig No: 01



Title: Magnetometer Survey - Greyscale Plots	
Client: Cotswold Archaeology	
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire	
Scale: 0 50 metres 1:1000 @ A3	Fig No: 02



Title: Magnetometer Survey - Colour Plots	
Client: Cotswold Archaeology	
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire	
Scale: 0 50 metres 1:1000 @ A3	Fig No: 03



KEY

	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Ferrous



Title:	Magnetometer Survey - Interpretation
Client:	Cotswold Archaeology
Project:	20027 - Land south of Hambridge Way, Pirton, Hertfordshire

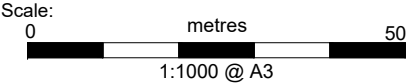
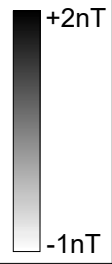


Fig No: 04







KEY

	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Ferrous

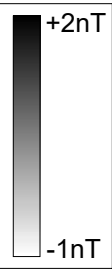
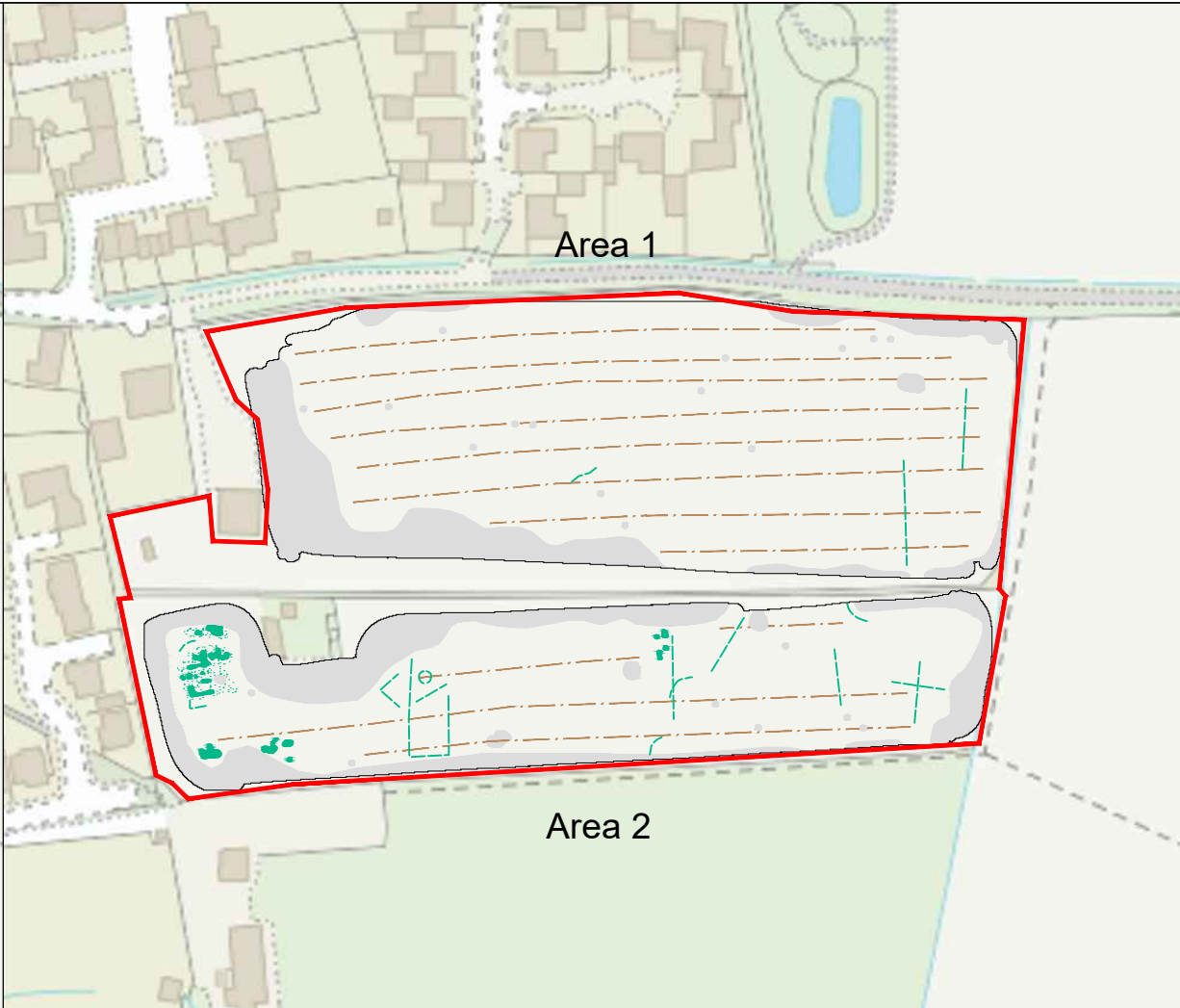
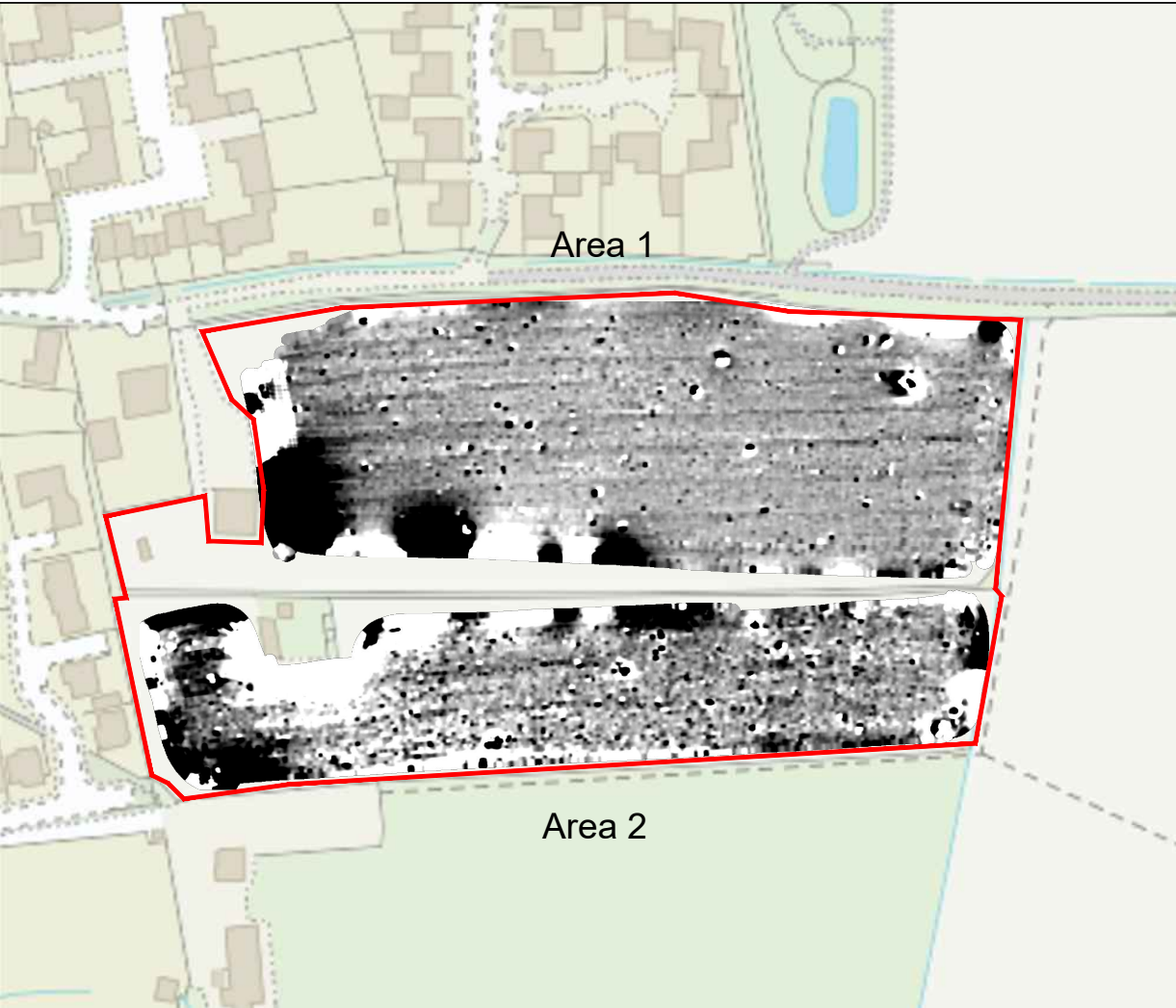


Title: Greyscale Plots / Interpretation / 1830-1840 (bottom left) & 1892-1914 (bottom right) Ordnance Survey Mapping

Client: Cotswold Archaeology

Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire

Scale: NOT TO SCALE	Fig No: 05
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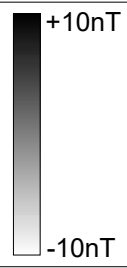
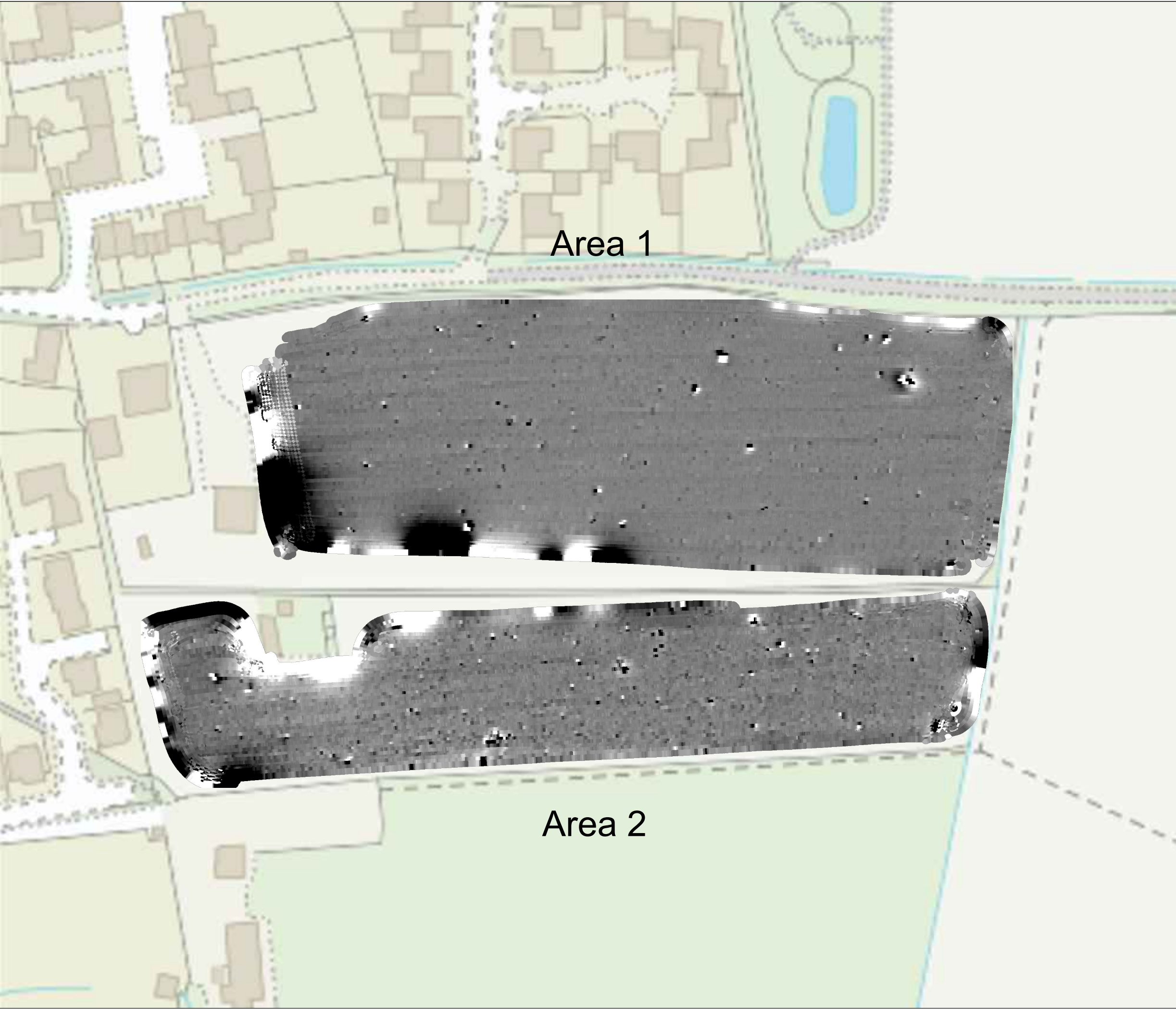


KEY

	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Ferrous



Title: Greyscale Plots / Interpretation / 2016 (bottom left) & 2022 (bottom right) Aerial Imagery	
Client: Cotswold Archaeology	
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire	
Scale: NOT TO SCALE	Fig No: 06



Title: Minimally Processed Data - Greyscale Plots	
Client: Cotswold Archaeology	
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire	
Scale: 0 metres 50 1:1000 @ A3	Fig No: 07



Title: XY Trace Plots (clipped at +/-15nT)	
Client: Cotswold Archaeology	
Project: 20027 - Land south of Hambridge Way, Pirton, Hertfordshire	
Scale: 0 50 metres 1:1000 @ A3	Fig No: 08

Appendix A - Technical Information: Magnetometer Survey Method

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 re-broadcasts 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	1.0m	0.25m
Magnetometer	Bartington Cart System	1.0m	0.125m
Magnetometer	MACS Cart System (Foerster)	1.0m	0.125m

Instrumentation:

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted horizontally, 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.

Bartington Grad 601-2

Hand-Held: Data will be collected using a Bartington Grad 601-2. The instrument consists of two paired sensors 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

Bartington Cart System

Data will be collected using a cart carrying four paired Bartington magnetic sensors. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart.

MACS Cart System (Foerster)

A multi-sensor array cart system (MACS) utilising 4 Foerster 4.032 Ferex CON 650 gradiometers, spaced at 1m intervals, with a control unit and data logger was used for the magnetic survey. Each data point is geographically referenced using an on-board RTK GNSS system. Readings will be taken at 0.125m centres along traverses 1.0m apart.

Data Processing

Zero Mean	This process sets the background mean of each traverse within each grid to zero.
Traverse	The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	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.

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.

<i>Archaeology / Probable Archaeology</i>	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.
<i>Possible Archaeology</i>	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.
<i>Industrial / Burnt-Fired</i>	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.
<i>Former Field Boundary (probable & possible)</i>	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.
<i>Ridge & Furrow</i>	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.
<i>Agriculture (ploughing)</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Land Drain</i>	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.
<i>Natural</i>	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
<i>Magnetic Disturbance</i>	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
<i>Service</i>	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.
<i>Ferrous</i>	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 *Possible Archaeology / Natural* or (in the case of linear responses) *Possible Archaeology / Agriculture*; 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.

Appendix C - OASIS Summary

OASIS ID (UID)	sumogeop1-529144
Project Name	Geophysical Survey at Land south of Hambridge Way, Pirton, Hertfordshire
Sitename	Land south of Hambridge Way, Pirton, Hertfordshire
Sitecode	20027
Project Identifier(s)	20027
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	29-Nov-2024 - 29-Nov-2024
Location	Land south of Hambridge Way, Pirton, Hertfordshire NGR: TL 15095 31617 LL: 51.97111748601198, -0.32593829326034 12 Fig: 515095,231617
Administrative Areas	Country: England County/Local Authority: Hertfordshire Local Authority District: North Hertfordshire Parish: Pirton
Project Methodology	A temporary grid system was established over the site and marked out using canes. The location of the grid was set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co-ordinates. Data was collected using a cart carrying four paired Bartington magnetic sensors. Four 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. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings were taken at 0.125m centres along traverses 1.0m apart. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.
Project Results	The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest except for ridge and furrow cultivation that is visible in both survey areas. A number of uncertain responses have been detected in Area 1. They have probably been caused by past land uses or underlying natural variations. However, archaeological origins cannot be entirely discounted for the anomalies.

Keywords	Ridge And Furrow - MEDIEVAL - FISH Thesaurus of Monument Types
Funder	Private or public corporation Cotswold Archaeology
HER	Hertfordshire HER - unRev - STANDARD
Person Responsible for work	Thomas Cockcroft
HER Identifiers	
Archives	

Report generated on: 09-12-2024:1639

Appendix D – Data Management Plan & Archive Selection Strategy

Data Management Plan

Project ID / OASIS ID

SUMO-20027 / sumogeop1- 529144

Project Name

Land south of Hambridge Way, Pirton, Hertfordshire

Project Description

Detailed magnetic survey over approx. 2.5ha

Client

Cotswold Archaeology

Project Manager

Thomas Cockcroft

Field Leader

Simon Lobel

Date DMP created

29.10.2024

Date DMP last updated

09.12.2024

Version

2

Technique - data

Detailed magnetic survey.

Manual – cart - other

ATV/Cart magnetometers.

Documentation and metadata

All documentation and data produced are stored on SUMO servers in a specific job file.

Data storage, access and back-up

- SUMO Secure server during the project life set up in a RAID configuration (a RAID configuration incorporates a level of data redundancy meaning if a single hard drive in fails data can still be restored).

- Snap shots of the data will be made at several intervals during the day to allow data to be restored for up to 30 days if changed / deleted.
- Once the final report has been completed data will be moved onto NAS drive set up in a RAID configuration.
- All data is backed up to an off-site location (Cloud storage).

Archive Selection Strategy

Digital Data

Selection

It is proposed that only the final version of all born digital documents (reports, images and CAD files) will be selected for inclusion in the Preserved Archive. All raw and processed survey data will be included in the preserved archive. Below is what will constitute the selected archive:

- Raw data in XYZ format .csv and .png plus .pgw world file
- Processed data as .png plus .pgw world file
- Final survey report .pdf
- CAD and Vector graphics (interpretations) in .dwg format

De-selected digital data

The de-selected material will be retained on the SUMO Secure server and Cloud storage.

Documents

Not applicable – no archive

Materials

Not applicable – no archive



- Archaeological Geophysics
- Engineering Geophysics
- Measured Building Services
- Utility and Topographic Services
- Aerial Surveys
- Rail Surveys

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