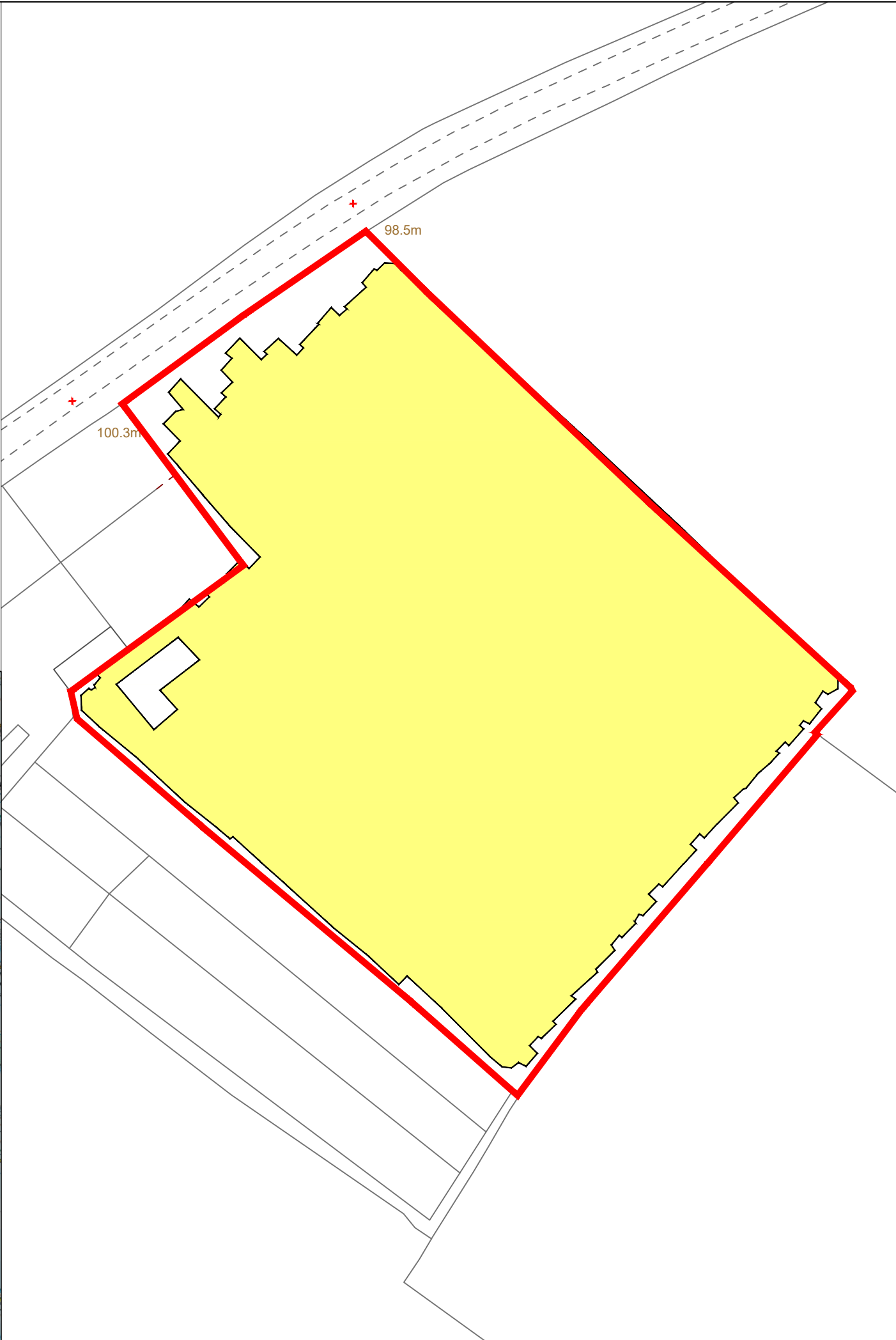
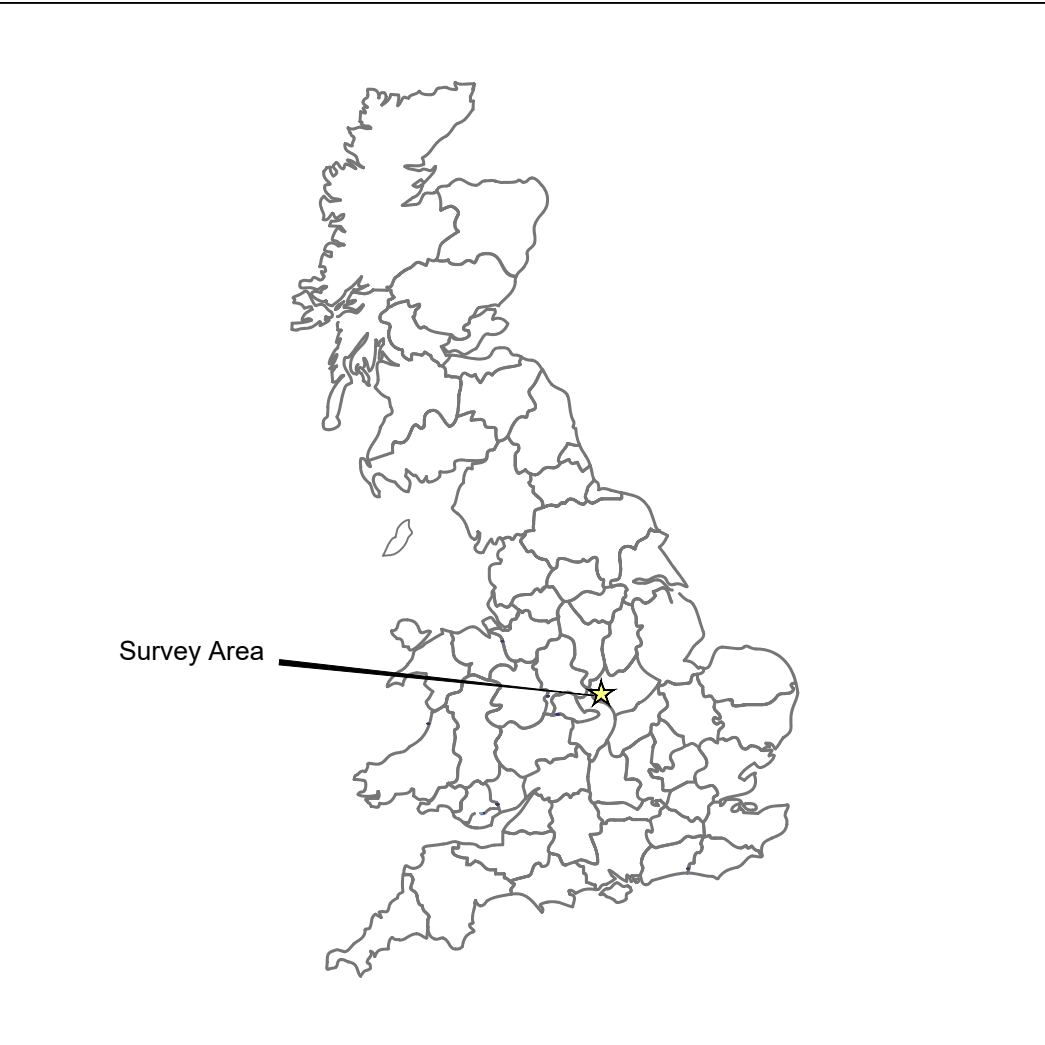
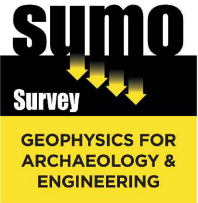
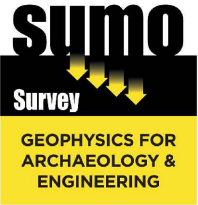
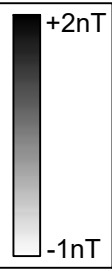


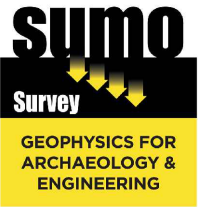
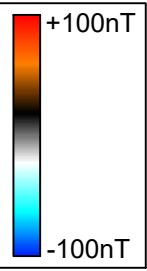
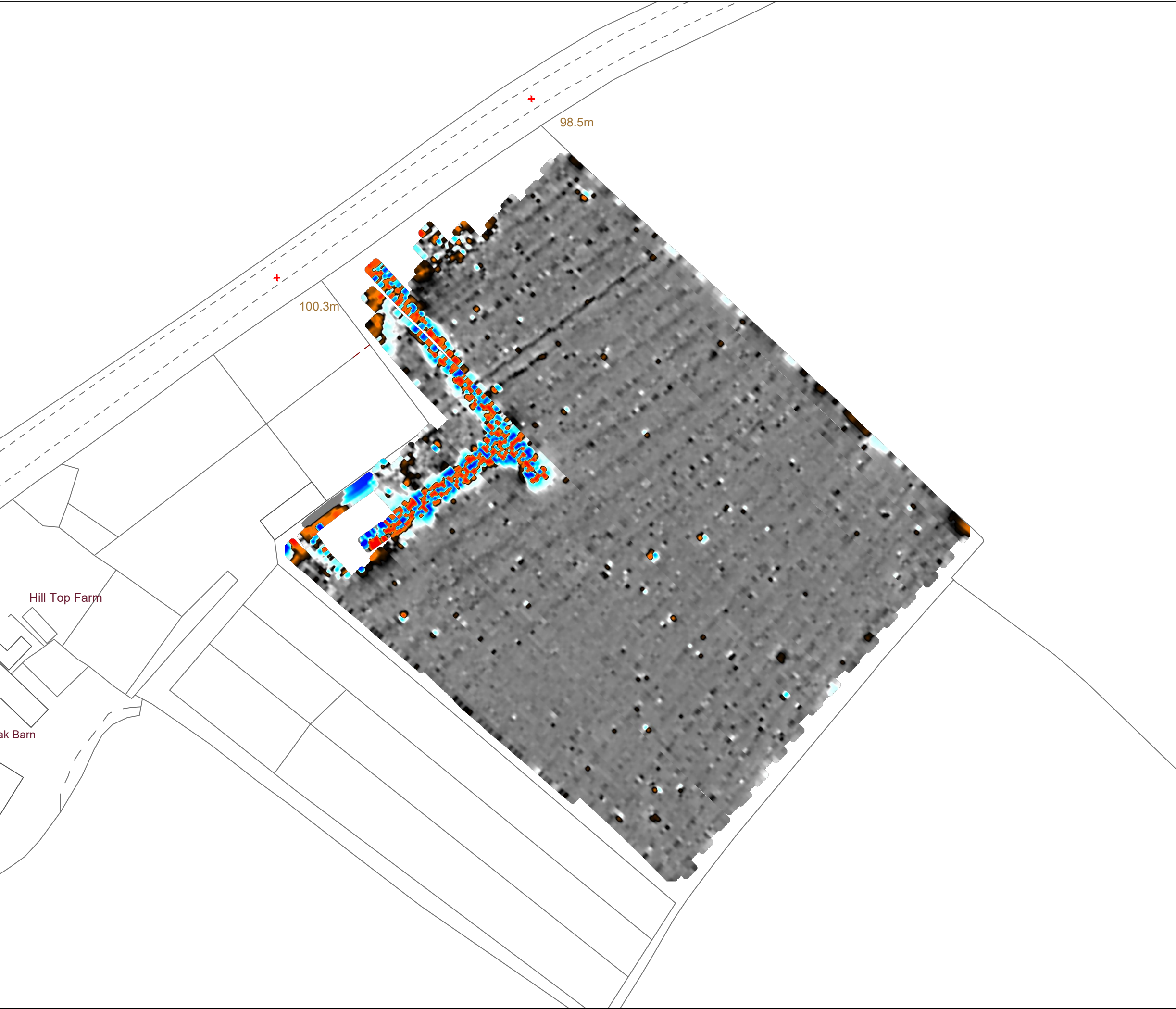


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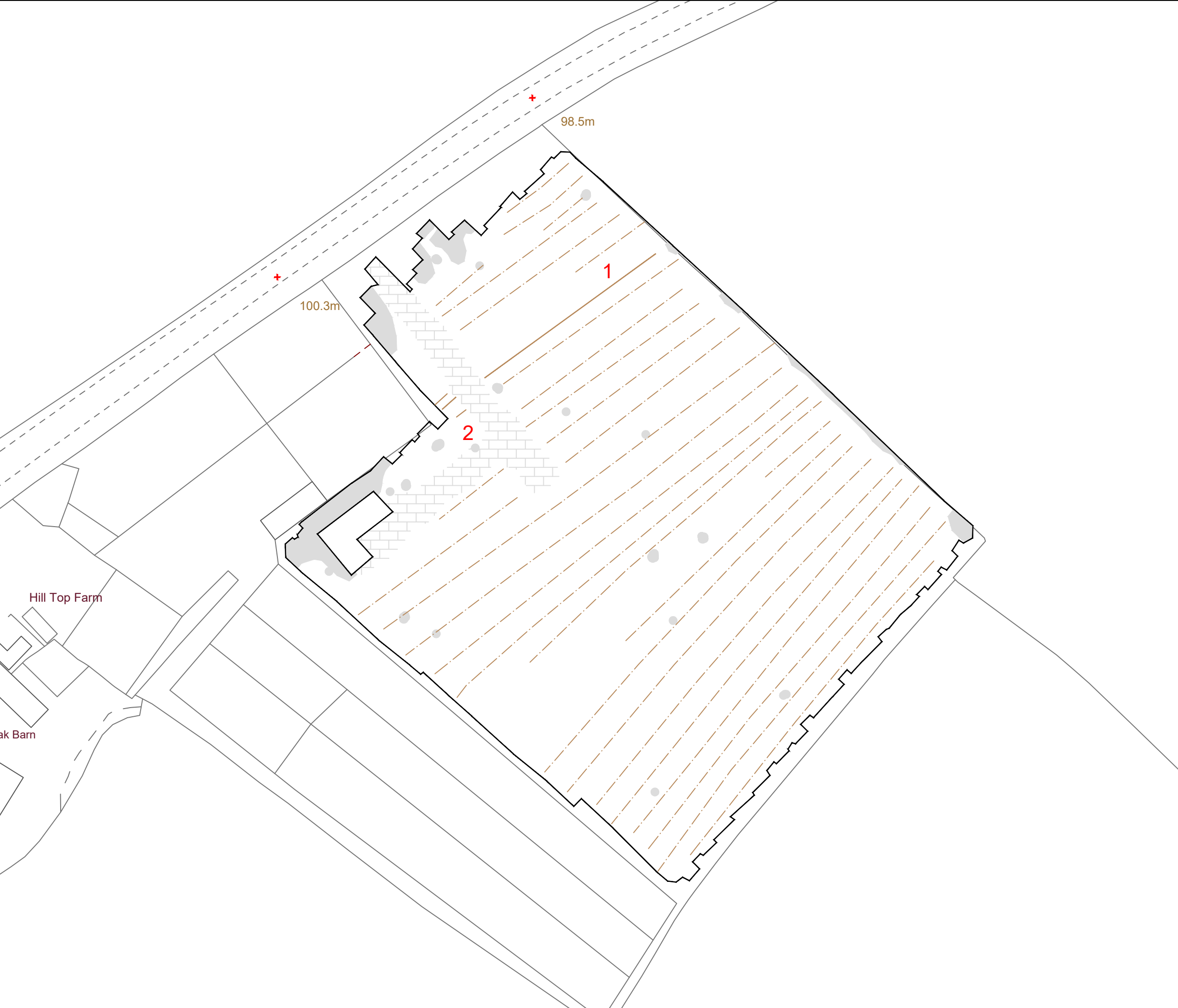
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Title: Site Location		
Client: University of Leicester Archaeological Services		
Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire		
Scale: NOT TO SCALE		Fig No: 01



Title: Magnetometer Survey - Greyscale Plot	
Client: University of Leicester Archaeological Services	
Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire	
Scale: 0 50 metres 1:1000 @ A3	Fig No: 02

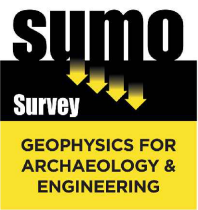


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Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire	
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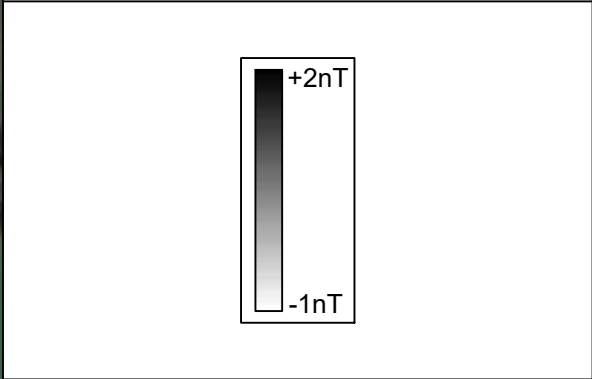
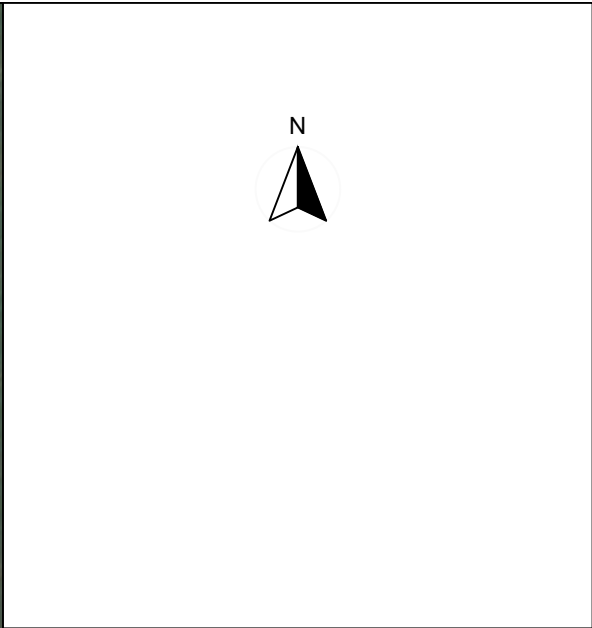


KEY

	Old Field Boundary (corroborated)
	Agriculture (ridge and furrow)
	Made ground
	Ferrous

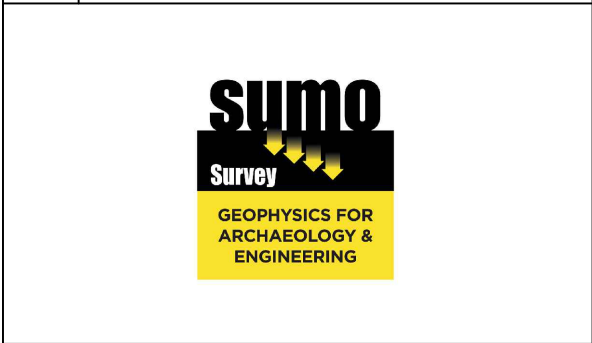


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Client: University of Leicester Archaeological Services	
Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire	
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KEY

	Old Field Boundary (corroborated)
	Agriculture (ridge and furrow)
	Made ground
	Ferrous

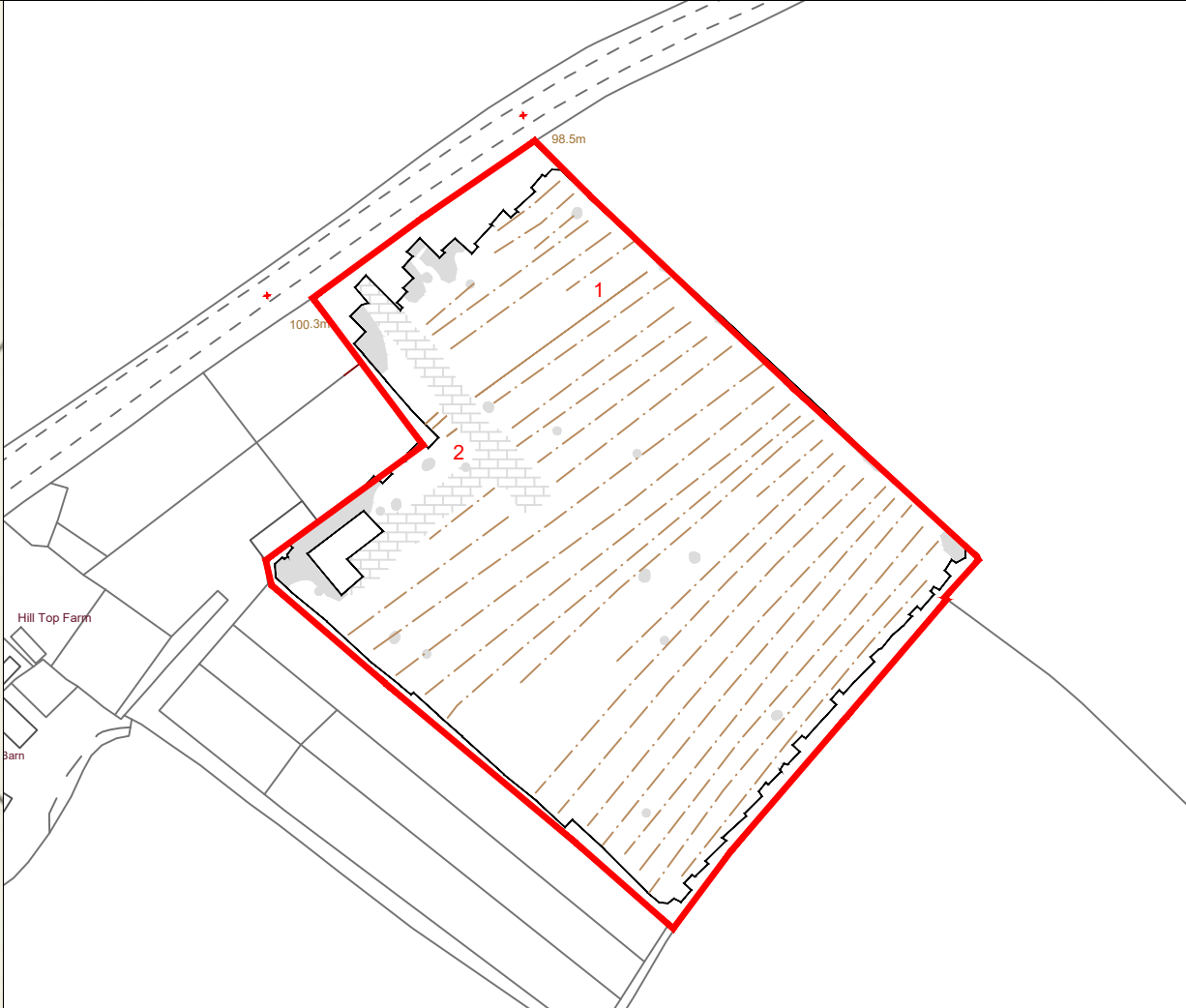
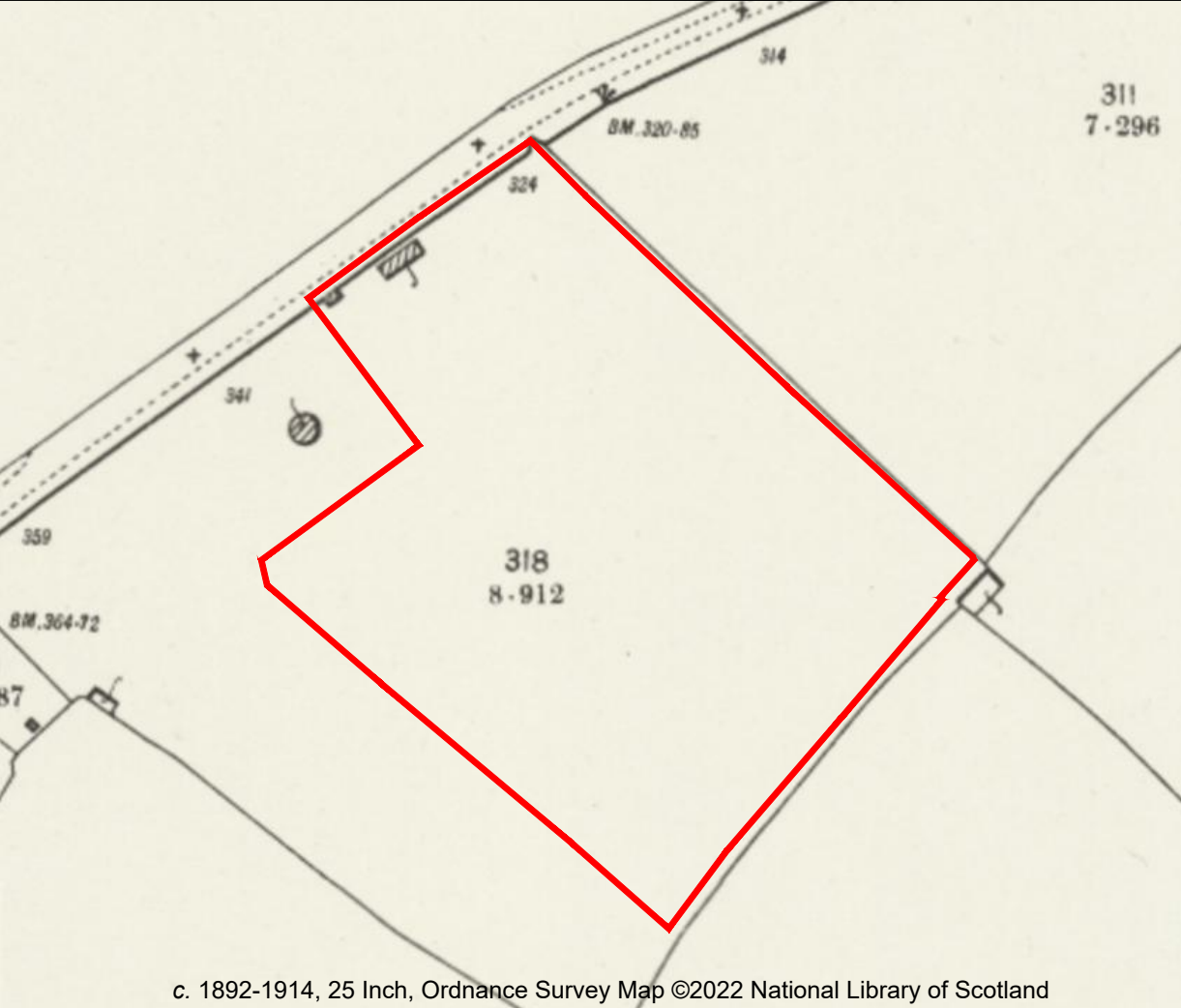


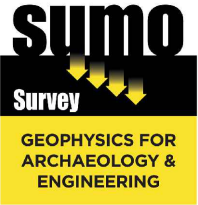
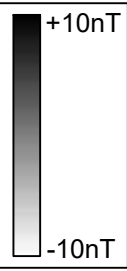
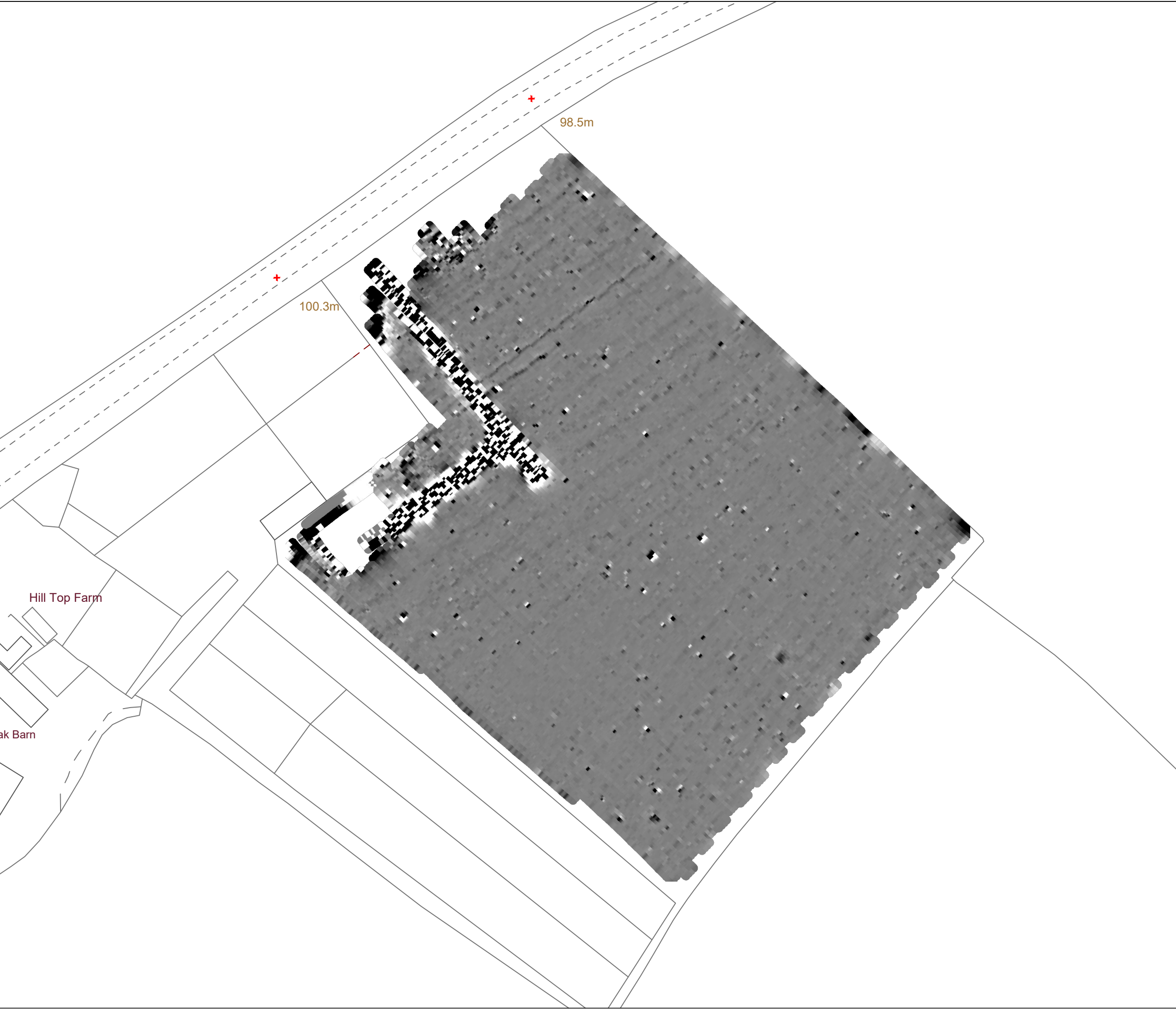
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Greyscale Plots, 2022 Aerial Image, c. 1892-1914
Ordnance Survey Map and Interpretation

Client:
University of Leicester Archaeological Services

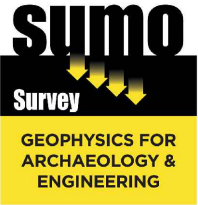
Project:
10364 - Land North East of Hill Top Farm,
Bosworth Road, Wellsborough, Leicestershire

Scale: NOT TO SCALE	Fig No: 05
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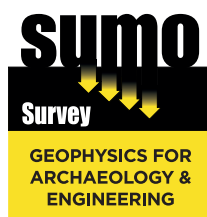




Title: Minimally Processed Data - Greyscale Plot	
Client: University of Leicester Archaeological Services	
Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire	
Scale: 0 metres 50 1:1000 @ A3	Fig No: 06



Title: XY Trace Plot (clipped at +/-15nT)	
Client: University of Leicester Archaeological Services	
Project: 10364 - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire	
Scale: 0 metres 50 1:1000 @ A3	Fig No: 07

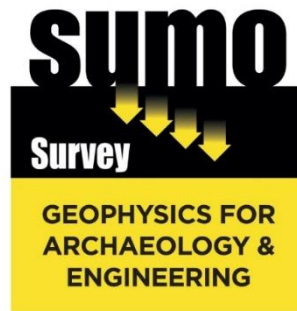


- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL

Summary for sumogeop1-511148

OASIS ID (UID)	sumogeop1-511148
Project Name	Geophysical Survey at Land North East of Hill Top Farm, Bosworth Road, wellsborough, Leicestershire
Sitename	Land North East of Hill Top Farm, Bosworth Road, wellsborough, Leicestershire
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	10364
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	08-Nov-2022 - 08-Nov-2022
Location	Land North East of Hill Top Farm, Bosworth Road, wellsborough, Leicestershire NGR : SK 36959 02759 LL : 52.6213440336672, -1.45549874667827 12 Fig : 436959,302759
Administrative Areas	Country : England County : Leicestershire District : Hinckley and Bosworth Parish : Sheepy
Project Methodology	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 CIFA (2014, updated 2020), Historic England (2008), and the European Archaeology Council (EAC) (2016). Bartington Cart System Traverse Interval 1.0m Sample Interval 0.125m
Project Results	A magnetometer survey conducted at Bosworth Road, Wellsborough has not identified any anomalies of definite archaeological interest. A former field boundary has been mapped, while ridge and furrow is present across the site. An area of made ground associated with a modern road / track has been identified, along with further areas of magnetic disturbance from nearby ferrous objects.
Keywords	
Funder	
HER	Leicestershire HER - unRev - STANDARD
Person Responsible for work	Rebecca, Fradgley
HER Identifiers	
Archives	



GEOPHYSICAL SURVEY REPORT

**Erection of single dwelling, stables and 132 photovoltaic panels
(off-grid hybrid passiv haus) - Land North East of Hill Top Farm,
Bosworth Road, Wellsborough, Leicestershire**

Client

University of Leicester Archaeological Services

For

Mr & Mrs Cordy

Survey Report

10364

OASIS Ref. No.

sumogeop1-511148

Date

22 November 2022



Survey Report 10364: Erection of single dwelling, stables and 132 photovoltaic panels (off-grid hybrid passiv haus) - Land North East of Hill Top Farm, Bosworth Road, Wellsborough, Leicestershire

Survey dates	8 November 2022
Field co-ordinator	Darcy Hooper MSc
Field Team	Liam Brice-Bateman BA
Report Date	22 November 2022
CAD Illustrations	Rebecca Fradgley BSc (Hons)
Report Author	Rebecca Fradgley BSc (Hons)
Project Manager	Simon Haddrell BEng AMBCS PCIfA
Report approved	Dr John Gater BSc DSc(Hon) MCIfA FSA

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Appendix A	Technical Information: Magnetometer Survey Methods, Processing and Presentation
Appendix B	Technical Information: Magnetic Theory
Appendix C	OASIS Data Collection Sheet

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 CIFA (2014, updated 2020), Historic England (2008), 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.
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.

4 SUMMARY OF RESULTS

- 4.1 A magnetometer survey conducted at Bosworth Road, Wellsborough has not identified any anomalies of definite archaeological interest. A former field boundary has been mapped, while ridge and furrow is present across the site. An area of made ground associated with a modern road / track has been identified, along with further areas of magnetic disturbance from nearby ferrous objects.

5 INTRODUCTION

- 5.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **University of Leicester Archaeological Services** on behalf of **Mr & Mrs Cordy**.

5.2 Site Details

NGR / Postcode	SK 362 025 / CV13 6PA
Location	The site is located east of the village of Wellsborough, which lies approximately 3km west of Market Bosworth, Leicestershire. Bosworth Road forms the northern boundary of the site, with agricultural fields to the west, south and east.
HER	Leicestershire
OASIS Ref. No.	sumogeop1-511148
District	Hinckley and Bosworth
Parish	Sheepy
Topography	Sloping down slightly from west to east.
Land Use	Pasture
Geology	Bedrock: Gunthorpe Member – mudstone.
(BGS 2022)	Superficial: Bosworth Clay Member – clay and silt.
Soils (CU 2022)	Soilscape 18: slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	c. 2.2 ha

5.3 *Archaeological Background*

- 5.3.1 Leicestershire Historic Environment Record (LHER 2022) does not identify any designated or non-designated heritage assets within the boundary of the site. Immediately northwest of the area lies the site of a 19th century brickyard (MLE22393), while further to the west lies the extent of the shrunken medieval / post-medieval village of Wellsborough (MLE3178), where fieldwalking recovered large quantities of medieval pottery. Earthworks of an enclosure, house platforms and linear features (MLE3177) are noted to the west of the survey area on aerial photographs and likely relate to the previous extent of the medieval village.

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 *Specific anomalies have been given numerical labels [1] [2] which appear in the text below, as well as on the Interpretation Figure(s).*

6.2 **Probable / Possible Archaeology**

6.2.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest.

6.3 **Former Field Boundary – Corroborated**

6.3.1 A linear anomaly [1] running northeast-southwest in the north of the site can be corroborated with a former field boundary that is visible on aerial imagery dating from 1999 to 2011.

6.4 **Agricultural – Ridge and Furrow**

6.4.1 Widely spaced, slightly curved, parallel linear anomalies have been detected in the data and are mapped across the site. These are indicative of former ridge and furrow cultivation.

6.5 **Ferrous / Magnetic Disturbance / Made Ground**

6.5.1 A partial rectilinear area of strong magnetic disturbance [2] is visible in the northwest of the survey area and corresponds with an area of hardstanding or road surface that is visible on aerial imagery (see Fig. 05).

6.5.2 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.

7 DATA APPRAISAL & CONFIDENCE ASSESSMENT

7.1 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 former field boundary and evidence for ridge and furrow; as a consequence, 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. A former field boundary and evidence of ridge and furrow cultivation indicate that the site has a largely agricultural past. The remaining responses include an area of made ground that is associated with a road / trackway visible on aerial imagery of the site, along with ferrous disturbance at field edges from nearby fences.

9 REFERENCES

- BGS 2022 British Geological Survey, Geology of Britain viewer [accessed 21/11/2022] *website:* (<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
- ClfA 2014 *Standard and Guidance for Archaeological Geophysical Survey*. Amended 2020. ClfA Guidance note. Chartered Institute for Archaeologists, Reading
Amended 2020 https://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_3.pdf
- CU 2022 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 21/11/2022] *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)
- LHER 2022 Leicestershire Historic Environment Record [accessed 21/11/2022] *website:* www.heritagegateway.org.uk

10 ARCHIVE

- 10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO Geophysics Ltd.'s** 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.

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 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	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	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.
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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.

<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.
<i>Uncertain Origin</i>	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.

Appendix C - OASIS Summary Sheet