

GEOPHYSICAL SURVEY REPORT

Kingsland Centre, Houghton Regis, Bedfordshire

Client

Albion Archaeology

Survey Report

05752

OASIS Ref. No.

sumogeop1-503761

Date

12 January 2022



Survey Report 05752: Kingsland Centre, Houghton Regis, Bedfordshire

Survey dates 20 December 2021

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Report Date 12 January 2022

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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.

Bartington Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m

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 of some 3.5 hectares of land has not identified any responses of definite archaeological interest though ridge and furrow ploughing is visible across the survey area. Other magnetic anomalies are the result of a possible former boundary, a service or drain, sports field paraphernalia and other modern features.

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 **Albion Archaeology**.

5.2 Site Details

NGR / Postcode	TL 029 251 / LU5 5PX
Location	The survey area lies on the north-eastern outskirts of Houghton Regis, at the junction of Sundon Road and Parkside Drive. The majority of the development site is occupied by Houghton Regis Academy buildings and play areas; the survey covers part of the school's playing fields.
HER	Central Bedfordshire and Luton
OASIS Ref. No.	sumogeop1-503761
District	Central Bedfordshire
Parish	Houghton Regis
Topography	Generally level c.127m aOD
Current Land Use	School playing fields
Geology (BGS 2022)	Bedrock: Zig Zag Chalk Formation and Tottrnohoe Stone Superficial: None recorded
Soils (CU 2022)	5 Freely draining lime-rich loamy soils
Archaeology (AA 2021)	Based on archaeological background information from the surrounding study area the probability for archaeological heritage assets on the survey area has been assessed as: <i>low</i> to <i>moderate</i> for the prehistoric period; <i>moderate</i> for the Roman period; <i>low</i> for the Anglo-Saxon to medieval and post-medieval periods; and <i>negligible</i> for the modern period. Historic maps show the survey area was under a mixture of open-field cultivation and pasture until enclosure in the late 18th century. It remained agricultural land until the surrounding area was developed for housing and the present school was built on the site during the second half of the 20th century.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	3.5 ha

5.3 ***Aims and Objectives***

- 5.3.1 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 Earlier magnetic survey on land to the east of the site identified responses which clearly had archaeological origins (SUMO 2020); no such responses have been recorded in the current survey. Therefore, it is deemed to be a reasonable assumption that no definite archaeological features are present in the data.

6.3 ***Uncertain***

6.3.1 A weak linear response / trend [1] is visible in the south of the survey area aligned approximately east-west. The results correspond with a linear feature visible on a variety of aerial images during the past 80 years (for example, see Figure 05). The responses could indicate a former boundary, a buried service or drain, hence the uncertain interpretation category.

6.4 ***Former Field Boundary – Corroborated***

6.4.1 A linear response [2] corresponds to the recorded location of a former field boundary that is visible on historic mapping (see Figure 05).

6.5 ***Agricultural – Ridge and Furrow***

6.5.1 Broadly spaced parallel responses, which are slightly curved and follow a north-south line, are indicative of former ridge and furrow ploughing across most of the site.

6.6 ***Ferrous / Magnetic Disturbance***

6.6.1 Pairs of strong dipole anomalies are visible in the data and these are clearly associated with goal posts for hockey, football and rugby pitches (see Figure 05). Other sports paraphernalia, such as running tracks and jumping pits, may also be causing anomalous readings.

6.6.2 Ferrous responses close to boundaries are due to adjacent fences, gates or adjacent buildings. 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 ridge and furrow ploughing; as a consequence, there is no *a priori* reason why archaeological features would not have been detected. There are no responses in the data similar to the results from earlier nearby magnetometer survey.

8 CONCLUSION

8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Ridge and furrow cultivation is clearly recorded in the data; other linear responses indicate a former field boundary and a buried service or drain. Numerous ferrous responses are the result of goal posts on the sports field.

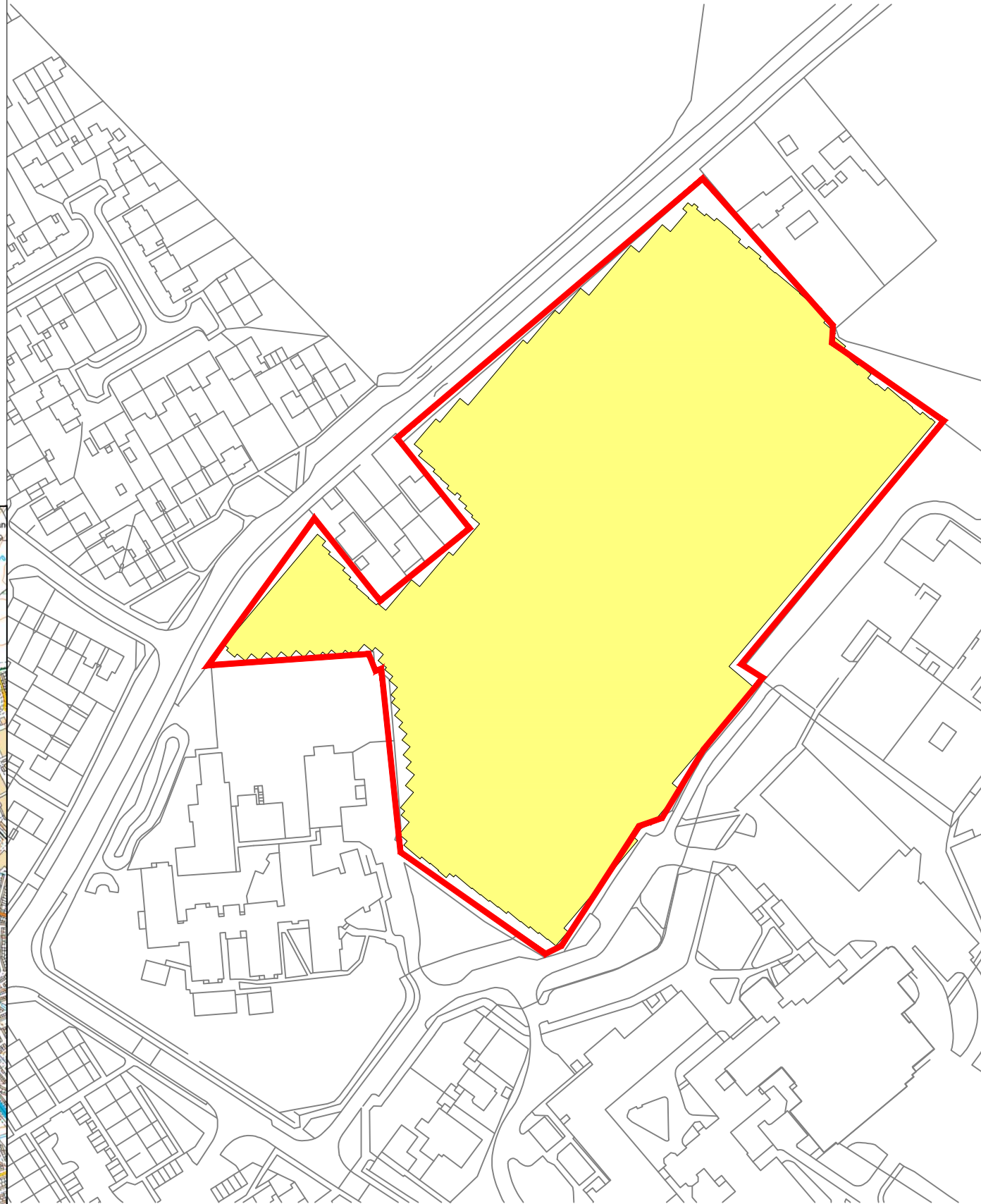
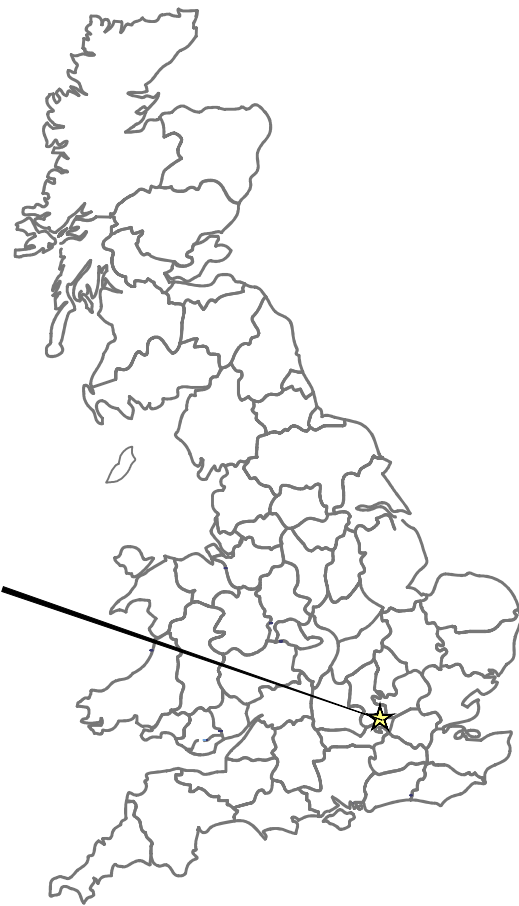
9 REFERENCES

- AA 2021 *Kingsland Centre, Houghton Regis, Bedfordshire, Archaeological Heritage Statement*, Albion Archaeology, Project HRN3777, 2021/019, unpublished.
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<https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/>
(now withdrawn)

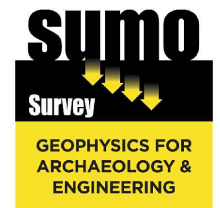
10 ARCHIVE

- 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 Midland's 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

Survey Area



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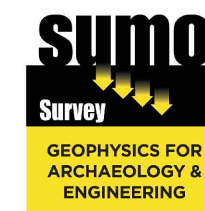
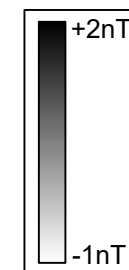


Title: Site Location

Client: Albion Archaeology

Project: 05752 - Kingsland Centre, Houghton Regis, Bedfordshire

Scale: NOT TO SCALE Fig No: 01



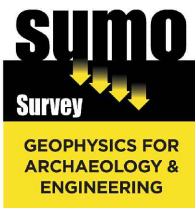
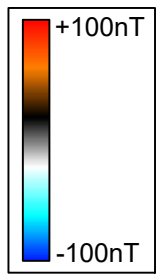
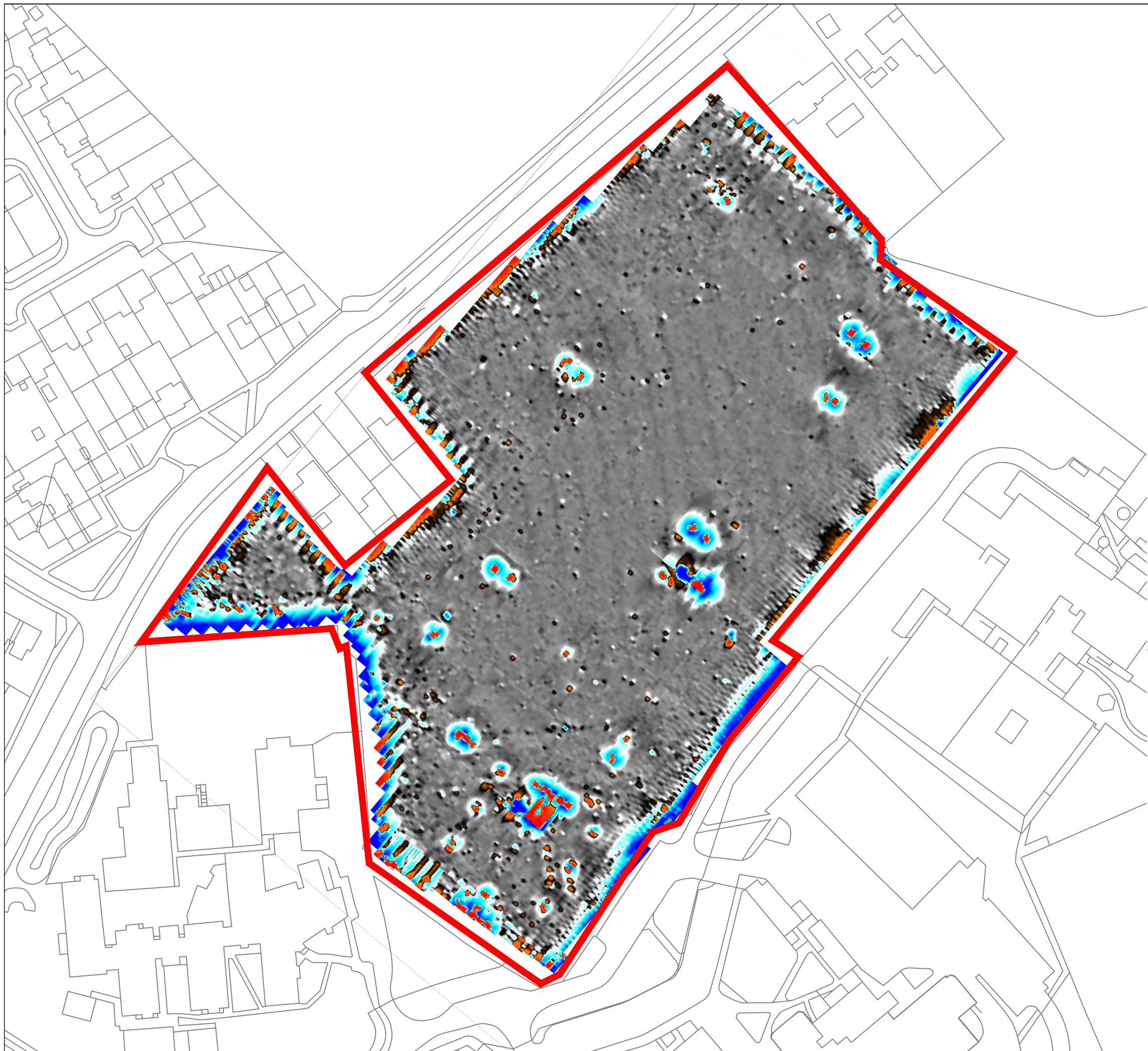
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Magnetometer Survey - Greyscale Plot

Client:
Albion Archaeology

Project:
05752 - Kingsland Centre, Houghton Regis,
Bedfordshire

Scale:
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1:1200 @ A3

Fig No:
02



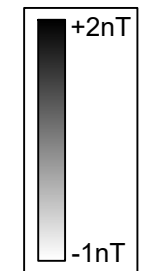
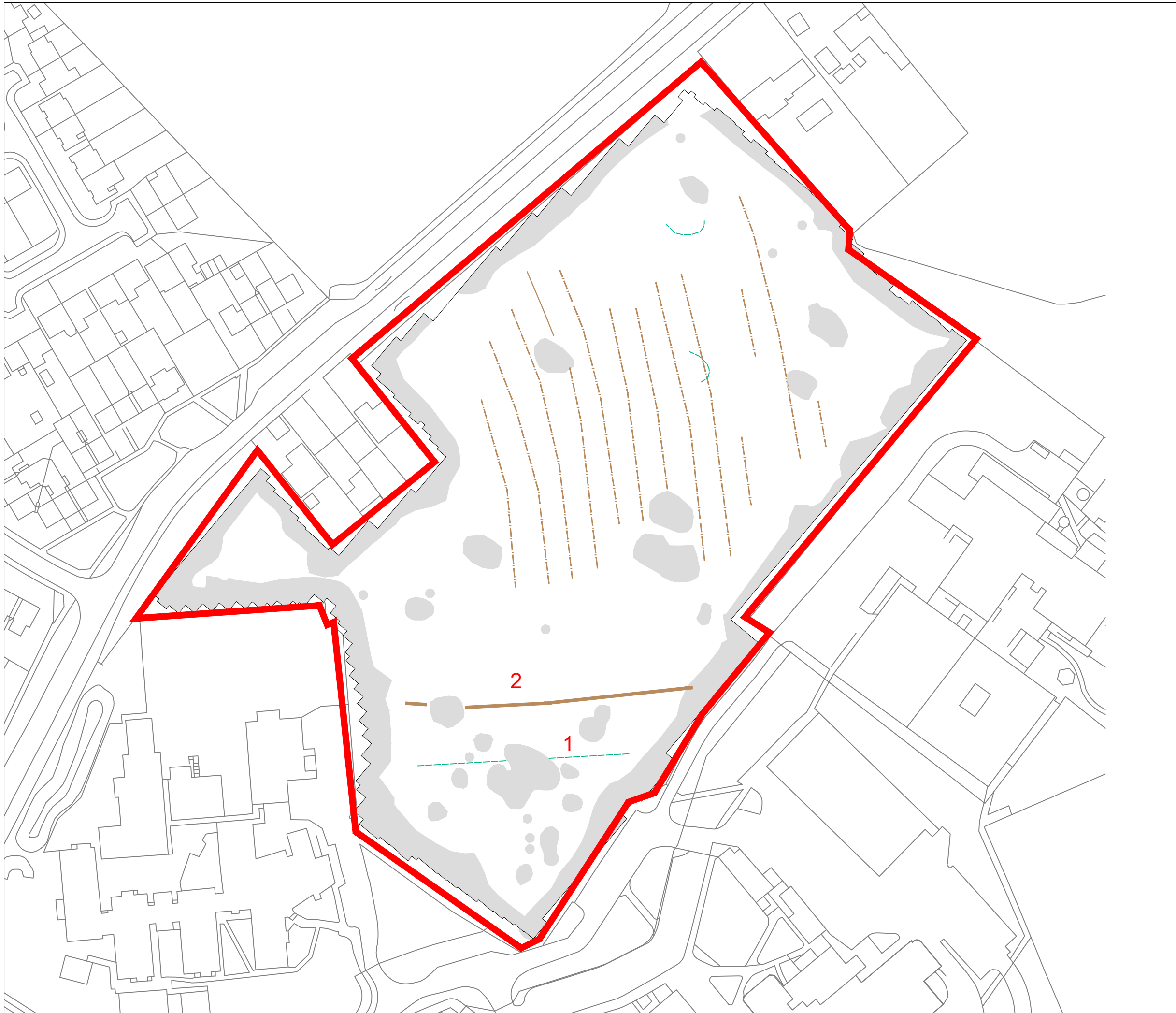
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Magnetometer Survey - Colour Plot

Client:
Albion Archaeology





Project:
05752 - Kingsland Centre, Houghton Regis,
Bedfordshire

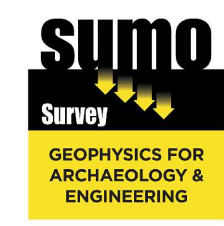
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Fig No:
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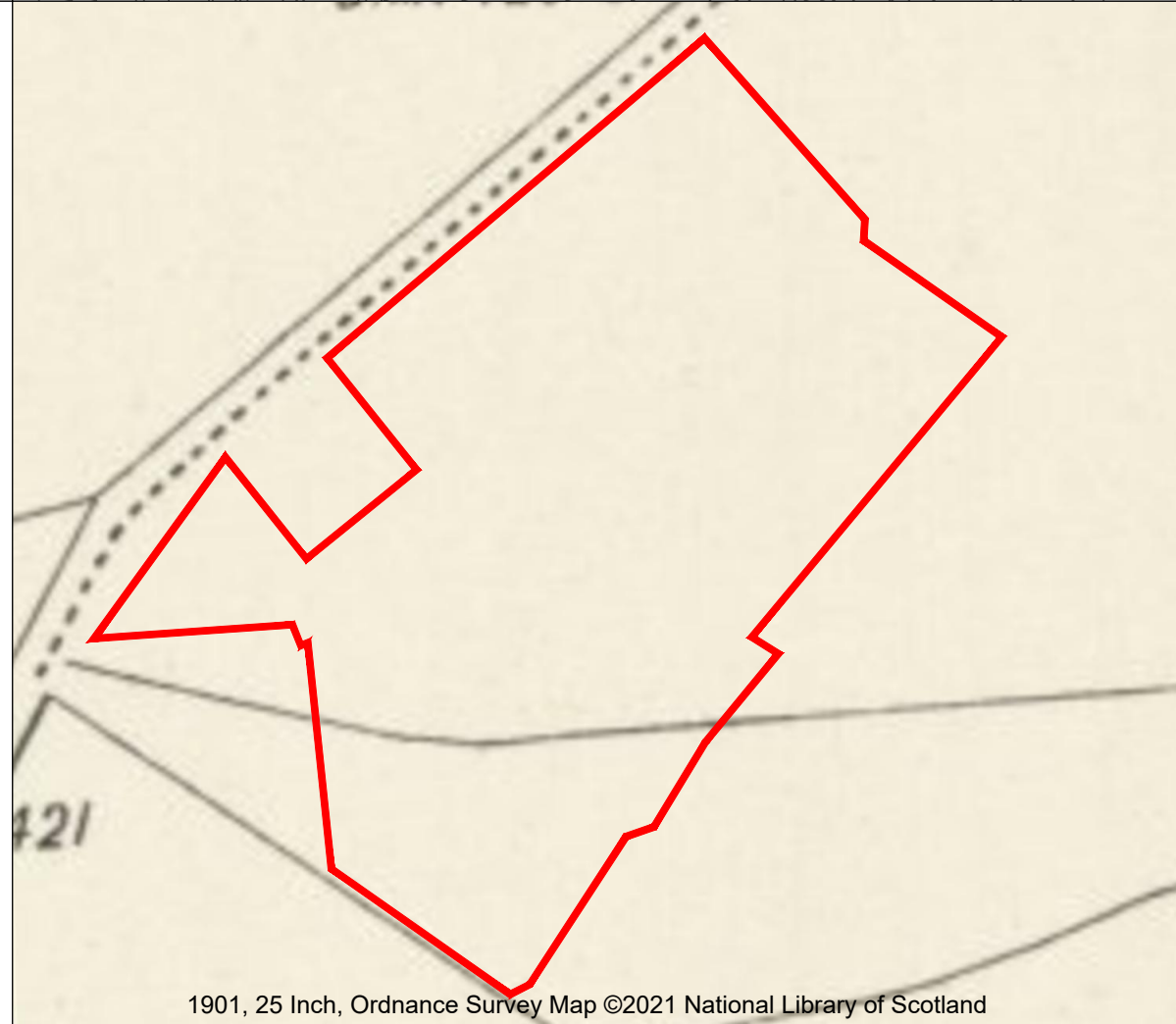
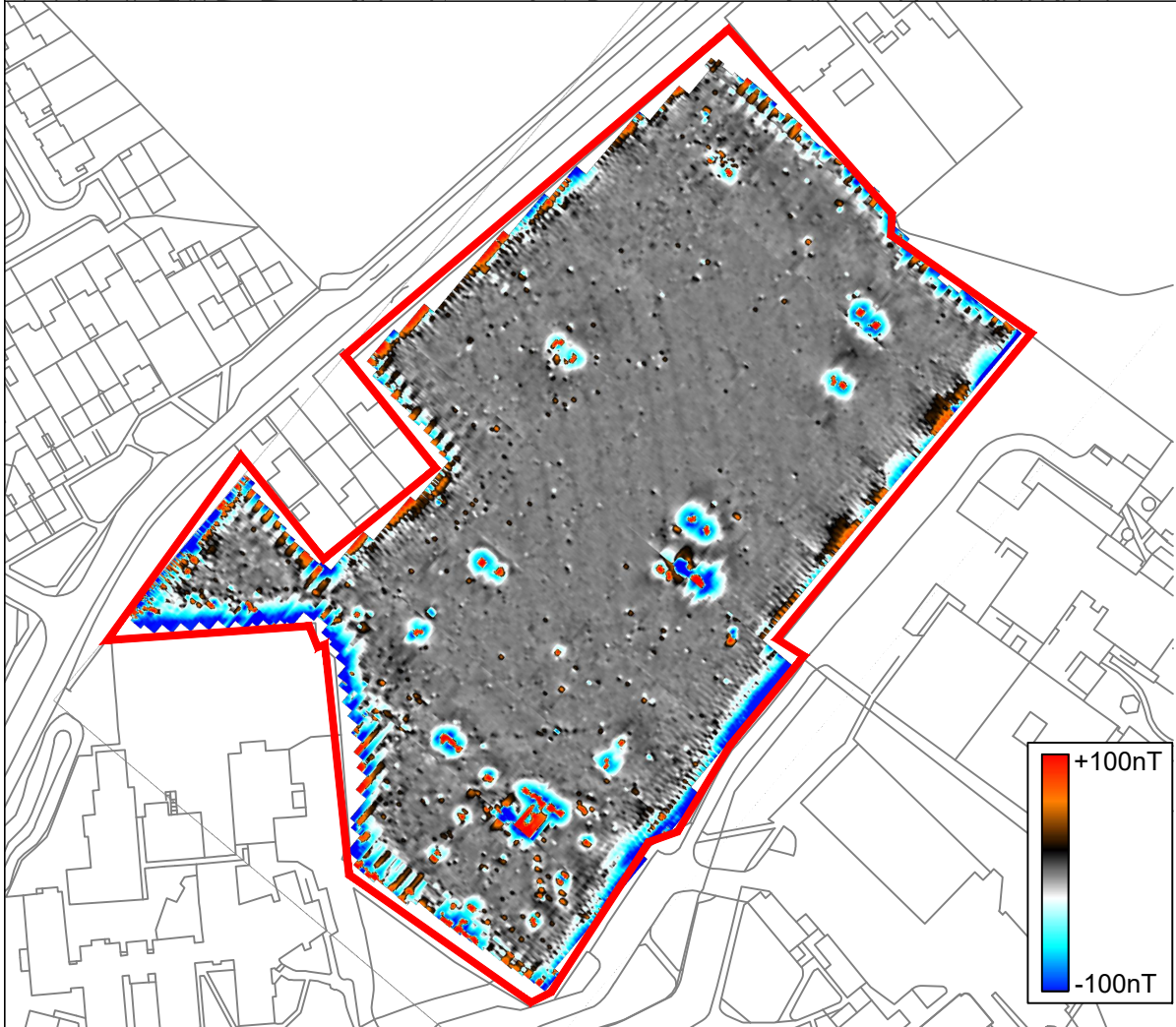
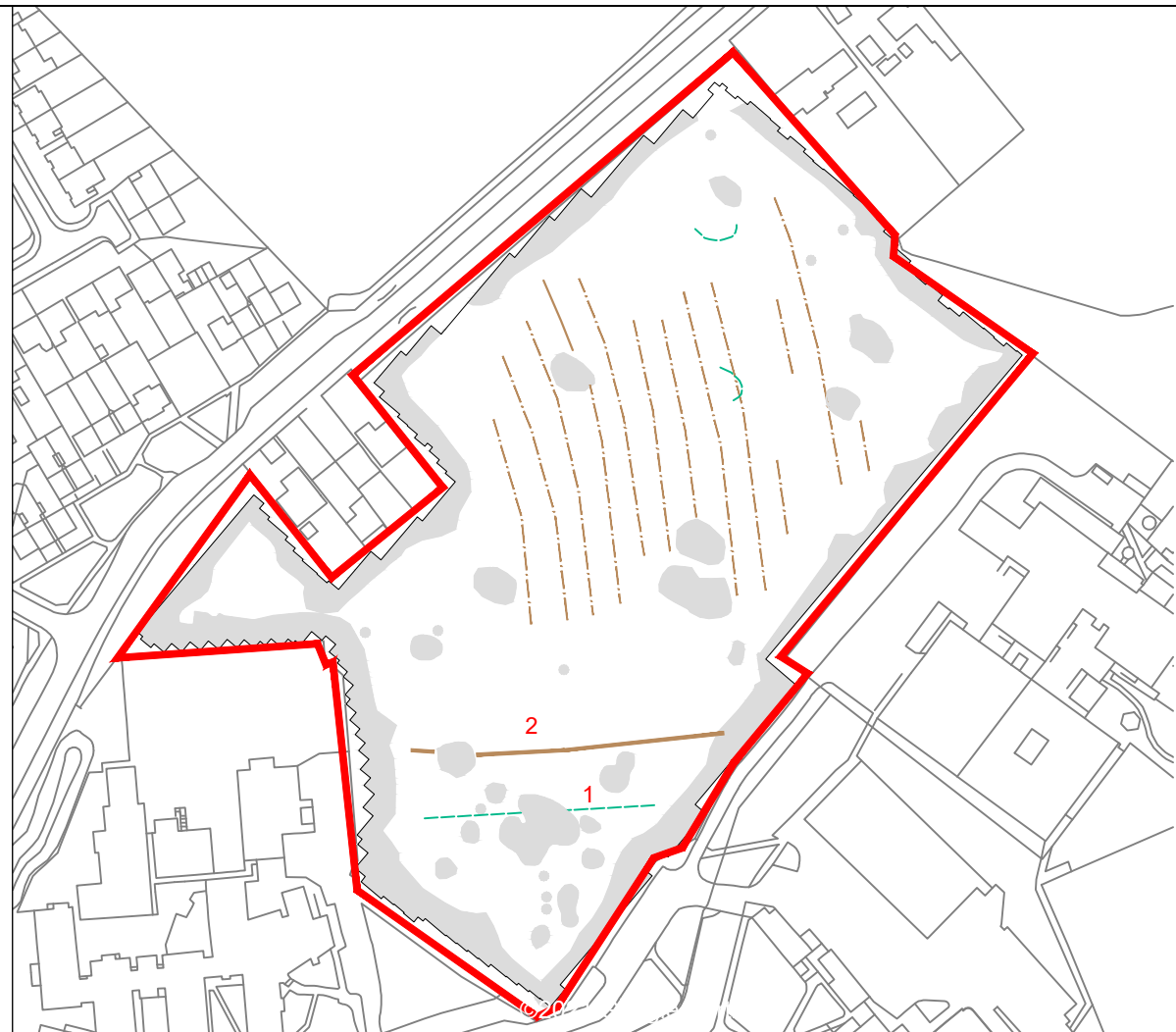


KEY





	Uncertain Origin (trend)
	Former field boundary (corroborated)
	Agriculture (ridge and furrow)
	Ferrous

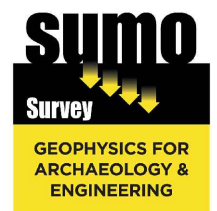


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Client: Albion Archaeology	
Project: 05752 - Kingsland Centre, Houghton Regis, Bedfordshire	
Scale: 0 metres xx 1: @ A3	Fig No: 04



KEY

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	Former field boundary (corroborated)
	Agriculture (ridge and furrow)
	Ferrous

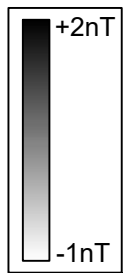
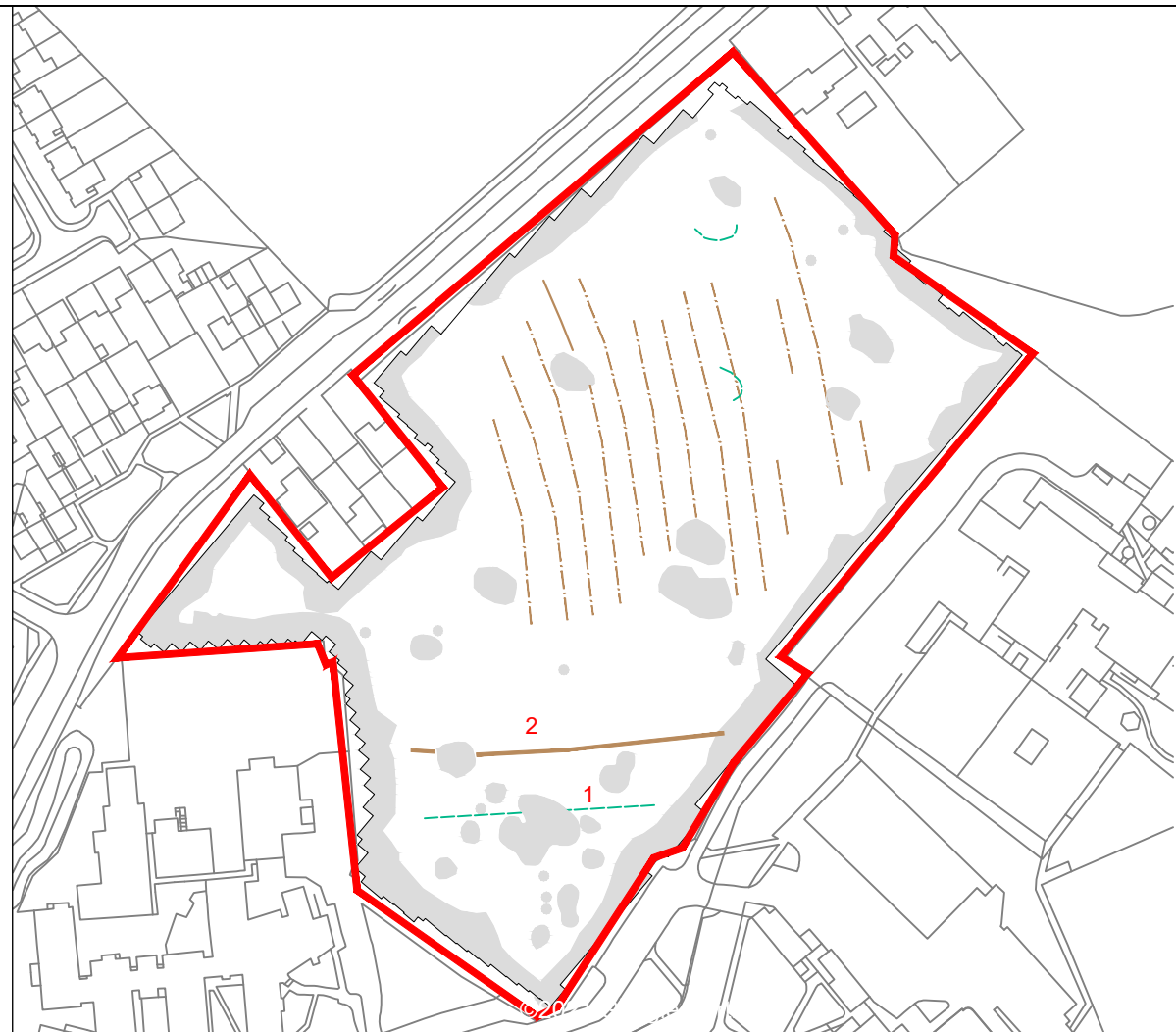


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Client: Albion Archaeology

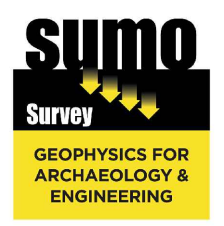
Project: 05752 - Kingsland Centre, Houghton Regis, Bedfordshire

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KEY

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	Former field boundary (corroborated)
	Agriculture (ridge and furrow)
	Ferrous



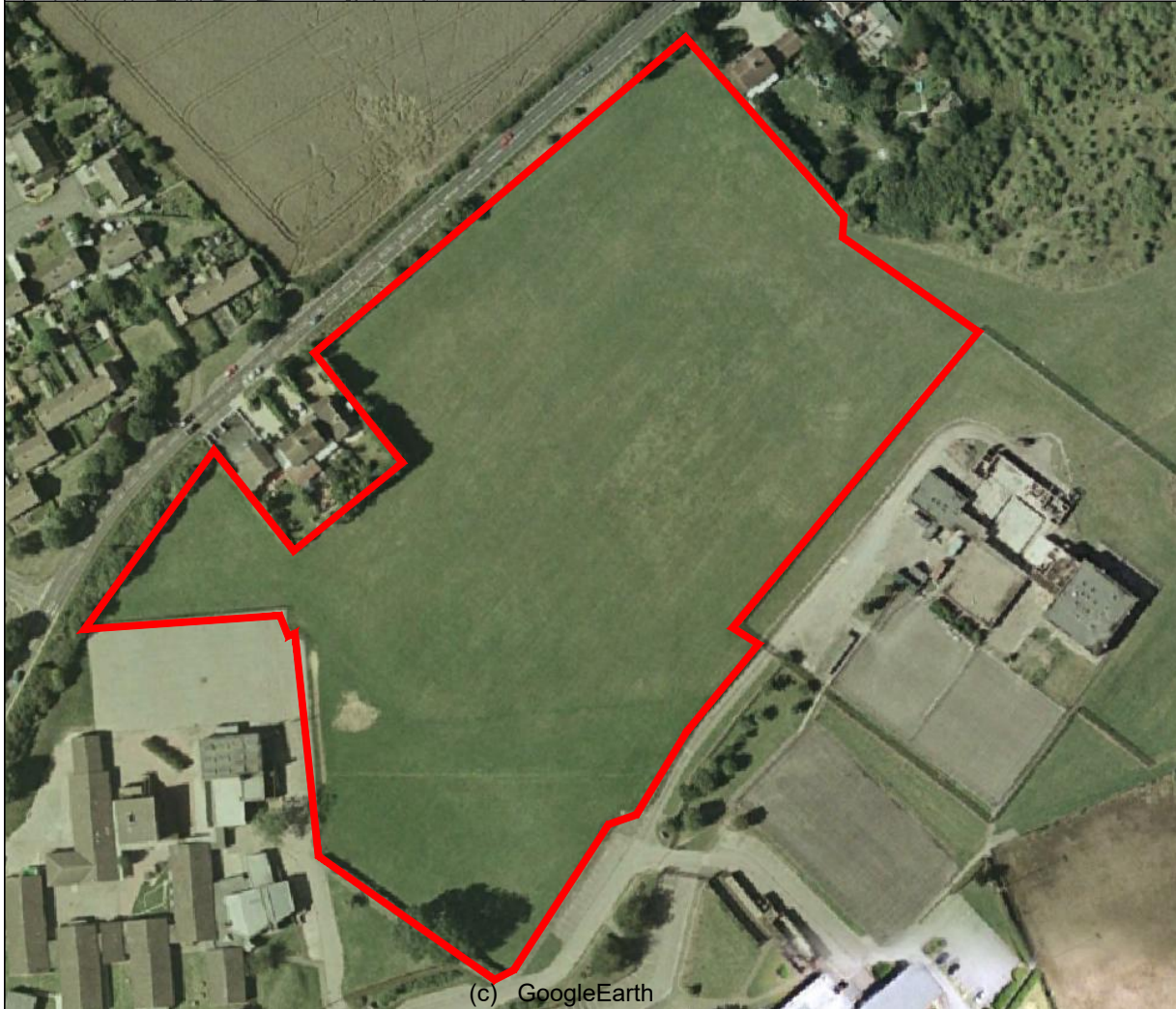
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Client: Albion Archaeology

Project: 05752 - Kingsland Centre, Houghton Regis, Bedfordshire

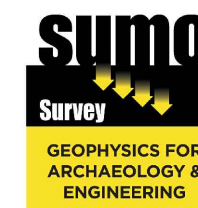
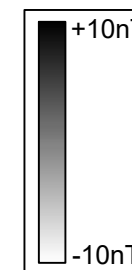
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(c) GoogleEarth

(c) GoogleEarth



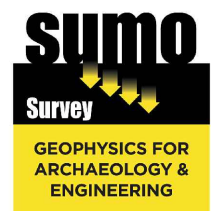
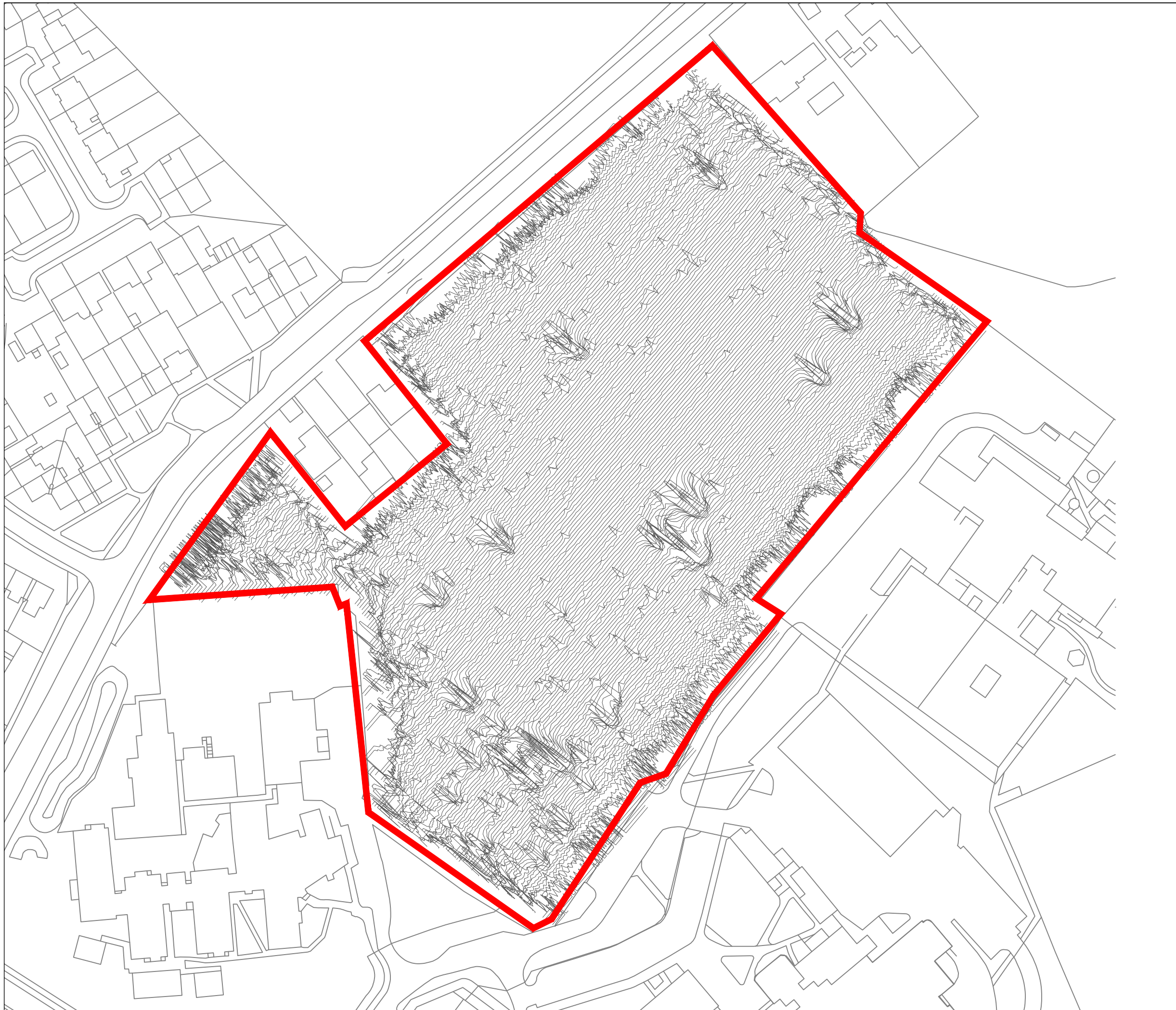
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Minimally Processed Data - Greyscale Plot

Client:
Albion Archaeology

Project:
05752 - Kingsland Centre, Houghton Regis,
Bedfordshire

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Fig No:
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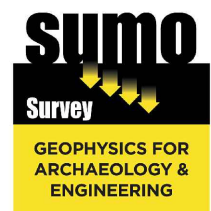
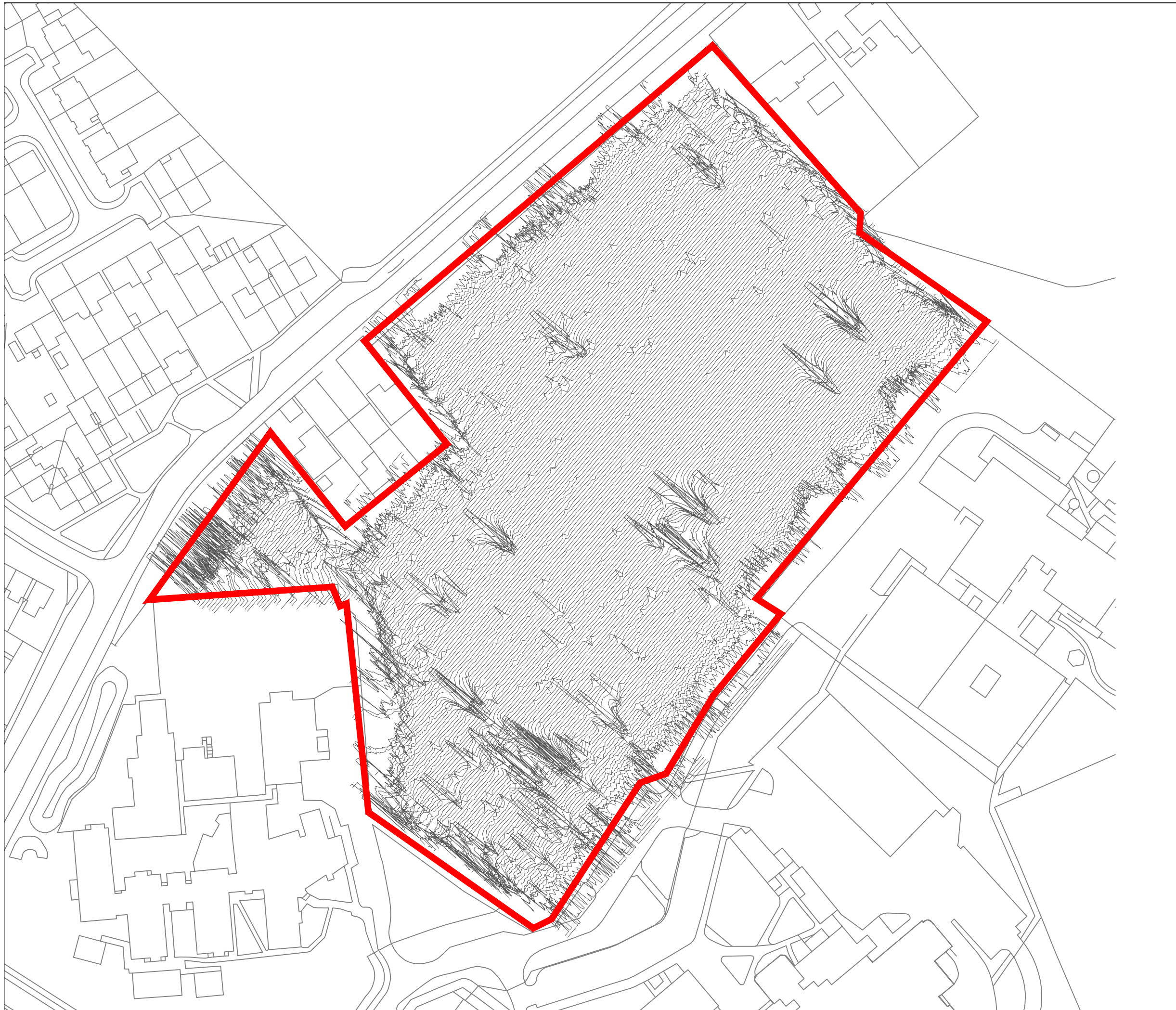
Title:
XY Trace Plot (clipped at +/-15nT)

Client:
Albion Archaeology

Project:
05752 - Kingsland Centre, Houghton Regis,
Bedfordshire

Scale:
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1:1200 @ A3

Fig No:
08



Title:
XY Trace Plot (clipped at +/-50nT)

Client:
Albion Archaeology

Project:
05752 - Kingsland Centre, Houghton Regis,
Bedfordshire

Scale:
0 metres 60
1:1200 @ A3

Fig No:
09

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.

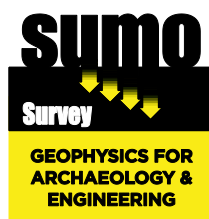
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement 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.

Summary for sumogeop1-503761

OASIS ID (UID)	sumogeop1-503761
Project Name	Geophysical Survey at Kingsland Centre, Houghton Regis, Bedfordshire
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	05752
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	20-Dec-2021 - 20-Dec-2021
Location	Kingsland Centre, Houghton Regis, Bedfordshire NGR : TL 02930 25125 LL : 51.9151552154061, -0.504902239472461 12 Fig : 502930,225125
Administrative Areas	Country : England County : Bedfordshire District : Central Bedfordshire Parish : Houghton Regis
Project Methodology	A temporary grid system was 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 magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Ridge and furrow cultivation is clearly recorded in the data; other linear responses indicate a former field boundary and a buried service or drain. Numerous ferrous responses are the result of goal posts on the sports field.
Keywords	Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types Ridge And Furrow - MEDIEVAL - FISH Thesaurus of Monument Types
HER	Central Bedfordshire HER - unRev - STANDARD
HER Identifiers	
Archives	



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

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