ARCHAEOLOGICAL EVALUATION REPORT:

GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND OFF QUEEN ELIZABETH ROAD, LINCOLN, LINCOLNSHIRE

Planning Reference: pre-application
NGR: SK 9697 7392
AAL Site Code: LIQR 16
OASIS Reference Number: allenarc1-262795

Report prepared for Globe Consultants

By
Allen Archaeology Limited
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Allenarchaeology

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Cover image: View of the northern part of the site, looking east

Executive Summary

- Allen Archaeology Limited was commissioned by Globe Consultants to undertake a geophysical survey using magnetometry on land off Queen Elizabeth Road, Lincoln, Lincolnshire, prior to the submission of a planning application for a residential development.

- The survey has revealed very few features of potential archaeological interest. There are a number of positive linear features that are likely to represent ridge and furrow cultivation within the southern part of the site, but much of the southern part of the site is covered by areas of magnetic noise, partly relating the to the large metal fence separating the fields from the housing estate to the south, but also likely due to build-up of modern waste and ferrous material, potentially as a result of construction of the adjacent housing. The magnetic noise could potentially be masking archaeological features.

- Within the northern part of the site there are two areas with multiple small, positive linear and curvilinear features, representing natural variation in the geology of the site. A number of amorphous positive features recorded at the east end of the site may also be geological variation, pits or ponds. At the west end of the northern part of the site are two positive linear features that could represent former enclosures or field boundaries of potential archaeological interest.

1.0 Introduction

1.1 Allen Archaeology Limited (AAL) was commissioned by Globe Consultants to undertake a geophysical survey using magnetometry on land off Queen Elizabeth Road, Lincoln, Lincolnshire, prior to the submission of a planning application for a residential development.

1.2 The site works and reporting conform to current national guidelines as set out in '*Geophysical Survey in Archaeological Field Evaluation*' (English Heritage 2008), '*The Use of Geophysical Techniques in Archaeological Evaluations*' (Gaffney *et al*. 2002), and the Chartered Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2014).

2.0 Site Location and Description

2.1 The proposed development site (hereafter referred to as 'the site') is located at the northern edge of Lincoln and immediately south of the A46. The proposed development area comprises 13ha of woodland and agricultural land to the north of Queen Elizabeth Road, to the east of Burton Road and to the west of Riseholme Road. The survey area comprises a 5.8ha area at the northern part of the site and a 4.5ha area to the south, separated by an area of dense woodland and is centred on NGR SK 9697 7392.

2.2 The bedrock geology comprises Lincolnshire Limestone formation, with no overlying geological deposits recorded (http://mapapps.bgs.ac.uk/geologyofbritain/home.html).

3.0 Planning Background

3.1 A planning application is to be submitted for a residential development on the site. The client has commissioned a geophysical survey in support of this application in order to provide further information concerning the nature and extent of the archaeological resource, and to provide information to allow the planning authority to make a reasoned decision as to the determination of the planning application, and to establish any mitigation measures that may be appropriate.

3.2 The approach adopted is consistent with the recommendations of the current National Planning Policy Framework (NPPF), with the particular chapter of relevance being '*Chapter 12: Conserving and enhancing the historic environment*' (Department for Communities and Local Government 2012).

4.0 Archaeological and Historical Background

4.1 There is no evidence for prehistoric activity within the site boundaries, though a Neolithic flint scatter (LHER 55258) and a collection of Bronze Age flint blades were located approximately 900m to the northwest. To the immediate west of the site is Burton Road, which to the north continues as Middle Street, potentially following the route of a prehistoric trackway known as the Jurassic Way (Field 1985).

4.2 Iron Age pottery was also recovered approximately 900m to the northwest of the site, and the possible location of a Romano-British settlement (LHER 50557) has been suggested for an area 500–600m to the northwest of the site. This site has been identified though the collection of pottery

finds, metal objects, coins, tesserae, wall plaster and stone slabs (Bee 2003). Just to the northeast of the site, Romano-British burials were recovered during the construction of the A46 (Tudor 2014).

4.3 To the immediate east of the site lies Ermine Street, a major military and trade route running from London to Lincoln and York.

4.4 Evidence for medieval activity is scarce, with the site located on what was formerly part of the city's common fields. These may have been laid out as early as the 10th century and were enclosed in 1803 by an Act of Parliament. The boundary separating the city's common fields from those of the parish of Nettleham is aligned roughly west to east and runs through the centre of the site. A medieval artefact scatter (LHER 52335) was identified immediately to the northeast of the site on the far side of the A46.

4.5 Immediately to the west of the site, the park and gardens for Burton Hall were created in the post-medieval period (LHER 56491).

4.6 Within the northeast part of the site two circular, undated cropmarks (LHER 52277) were identified by OGS Crawford in 1930 from aerial photographs. There are also undated ditches located to the southwest of the site (LHER 70523).

4.7 Immediately to the south of the site is part of one of Lincoln's largest council estates. Ermine West was mainly constructed between 1952 and 1958 and its other half, Ermine East, lies to the either side of Riseholme Road, which follows the route of Ermine Street.

5.0 Methodology

5.1 The geophysical survey consisted of a detailed gradiometer survey of the maximum available area of the site, totalling 10.3ha. The survey was undertaken in a series of 30m grids across the site. The very western end of the southern area was not surveyed as it was too overgrown.

5.2 The fieldwork was carried out by a team of three experienced geophysicists over a period of three days, Tuesday 30th August to Thursday 1st September 2016. The survey area was located using a Leica GS08 RTK NetRover GPS. This accurately 3D plotted the area of investigation and tied it into the National Grid.

5.3 The survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an on-board automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the on-board data logger.

5.4 Data collection was undertaken in a zigzag traverse pattern, using a sample interval of 0.25m and a traverse interval of 1m.

Summary of Survey Parameters

5.5 Fluxgate Magnetometer

Instrument: Bartington Grad601-2 Dual Fluxgate Gradiometer

Sample Interval:	0.25m
Traverse Interval:	1.00m
Traverse Separation:	1.00m
Traverse Method:	Zigzag
Resolution:	0.1nT
Processing Software:	3.0.29.3
Surface Conditions:	A combination of stubble and short grass
Area Surveyed:	10.3 hectares
Date Surveyed:	Tuesday 30th August to Thursday 1st September 2016
Surveyor:	Robert Evershed BSc (Hons) and Ryan Godbold
Survey Assistant:	Nicola Grayson
Data Interpretation:	Robert Evershed BSc (Hons) and Ryan Godbold

Data Collection and Processing

5.6 The grids were marked out with tape measures and were recorded using the Leica GS08 Netrover. A north-south alignment is preferable as the fluxgate gradiometer is set up and balanced with respect to the cardinal points. Since the data is plotted as north-south traverses there is considerable merit sampling the north-south response of a magnetic anomaly with as many data points as is possible, this is accomplished because the density collected along the traverse line is greater than that between traverses (Aspinall *et al*. 2008). On this occasion the data was on a north-northwest to south-southeast alignment due to the orientation of the fields and the pre-programmed grids.

5.7 The data collected from the survey has been analysed using Terrasurveyor 3.0.29.3. The resulting data set plots are presented with positive nT/m values and high resistance as black and negative nT/m values and low resistance as white.

The data sets have been subjected to processing using the following filters:

- De-striping
- Clipping
- De-staggering

5.8 The de-stripe process is used to equalise underlying differences between grids or traverses. Differences are most often caused by directional effects inherent to magnetic surveying instruments: instrument drift, instrument orientation (for example off-axis surveying or heading errors) and delays between surveying adjacent grids. However, the de-stripe process is used with care as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.

5.9 The clipping process is used to remove extreme data point values which can mask fine detail in the data set. Excluding these values allows the details to show through.

5.10 The de-staggering process compensates for data correction errors caused by the operator commencing the recording of each traverse too soon or too late. It shifts each traverse forward or backwards by a specified number of intervals.

5.11 Plots of the data are presented in processed linear greyscale (smoothed) with any corrections to the measured values or filtering processes noted, and as separate simplified graphical interpretations of the main anomalies detected.

6.0 Results

6.1 For the purposes of interpreting the anomalies, the survey data has been processed to the values of -3 to 3 nT/m (Figure 3). This enhances faint anomalies that may otherwise not be noted in the data, with a number of anomalies identified across the data set, and these are discussed in turn and noted as single or double digit numbers in square brackets.

6.2 A large proportion of the southern part of the site is covered with magnetic noise [1] and [2]. There were varying readings across these areas, closest to the southern border the readings were as high as -100 to 100 nT/m and relate to a large metal fence separating the fields from the housing estate to the south. Away from the effect of the fence the readings within these areas ranged from -10 to 10 nT/m with frequent larger spikes. This likely indicated that there is considerable modern detritus or ferrous material within the field, probably built up over time, possibly relating to the construction of the housing estate to the south. The large amount of magnetic noise could potentially be masking archaeological features.

6.3 The magnetic noise [3], -10 to 30 nT/m, is partly down to the fence along the eastern border of the site and a set of small stables at the southeast corner of the field.

6.4 The areas of magnetic noise [4] and [5], -8 to 2 nT/m and -20 to 10 nT/m respectively, are likely to relate to areas of modern detritus or ferrous material within the field boundaries, or to small areas of dumped waste material.

6.5 The parallel negative linear features across the northern part of the site [6] and [7], -1 to -3 nT/m, represent modern tractor tracks, visible in the field at the time of survey.

6.6 Within the northern part of the site there are two areas of positive linear and curvilinear anomalies [8] and [9]. These have produced readings of 2 to 4 nT/m and most likely represent natural variations in geology.

6.7 The linear positive anomaly [10], 10 to 20 nT/m with some higher spikes, is likely to represent a large field drain or a modern service. It was not apparent in the field to the north, suggesting it may turn to follow the field boundary.

6.8 There are a small number of roughly parallel positive linear features [11] and [12], oriented approximately east to west within the southeastern part of the site. These have produced readings of 2 to 3 nT/m and are likely to represent ridge and furrow cultivation.

6.9 At the west end of the northern part of the site there are a couple of positive linear features [13], 2 to 3 nT/m. These could represent former enclosures, field boundaries or possibly field drains.

6.10 The group of positive amorphous and linear or curvilinear anomalies [14], 2 to 3 nT/m, could represent pits, ditches, soil-filled hollows or former ponds, but may reflect natural geological variation, similar to [8] and [9].

6.11 The negative linear anomaly [15], -3 to -8 nT/m, could represent cultivation activity associated with [11] and [12], or possibly a former ditch, path or track.

6.12 Scattered randomly throughout the site are a number of strong and weak dipolar responses, examples of which are highlighted as [16]. The characteristic dipolar response of pairs of positive and negative ‘spikes’ suggest near-surface ferrous metal or other highly fired material in the ploughsoil.

7.0 Discussion and Conclusions

7.1 The survey has revealed very few features of potential archaeological interest. There are a number of positive linear features that are likely to represent ridge and furrow cultivation within the southern part of the site, although this part of the site is mostly covered by areas of magnetic noise, partly relating the to the large metal fence separating the fields from the housing estate to the south, but also likely due to build-up of modern waste and ferrous material, potentially as a result of construction of the adjacent housing. The magnetic noise could potentially mask more subtle archaeological features.

7.2 Within the northern part of the site there are two areas with multiple, small, positive linear and curvilinear features, which are very likely to represent natural variation in the underlying geology. Perhaps the most convincing feature of potential archaeological interest is the linear anomaly [13] at the west end of the site, describing a possible field boundary or enclosure.

8.0 Effectiveness of Methodology

8.1 The non-intrusive evaluation methodology employed was for the most part appropriate to the scale and nature of the northern part of the site. Magnetometry was the prospection technique best suited to the identification of archaeological remains there. Other techniques would have required further justification and may have proved too time consuming or cost-prohibitive. However, due to the large metal fence separating the southern half of the site from the adjacent housing estate the results were severely compromised within this area and it is possible that the presence of archaeological remains have been masked by magnetic noise.

9.0 Acknowledgements

9.1 Allen Archaeology Limited would like to thank Globe Consultants for this commission.

10.0 References

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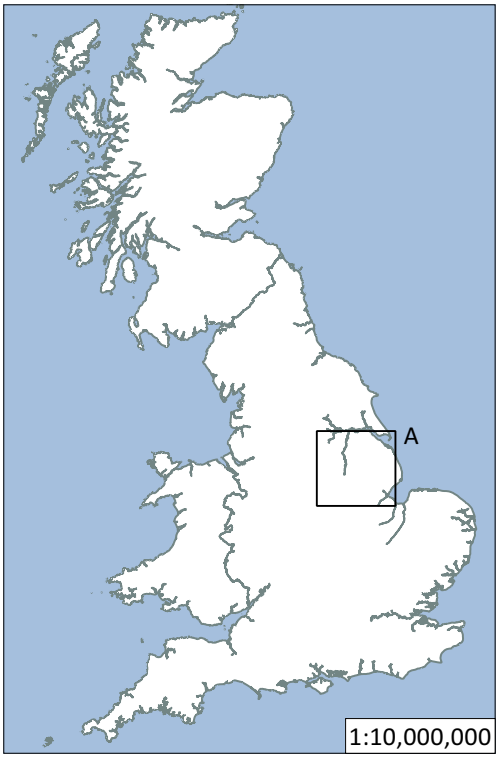

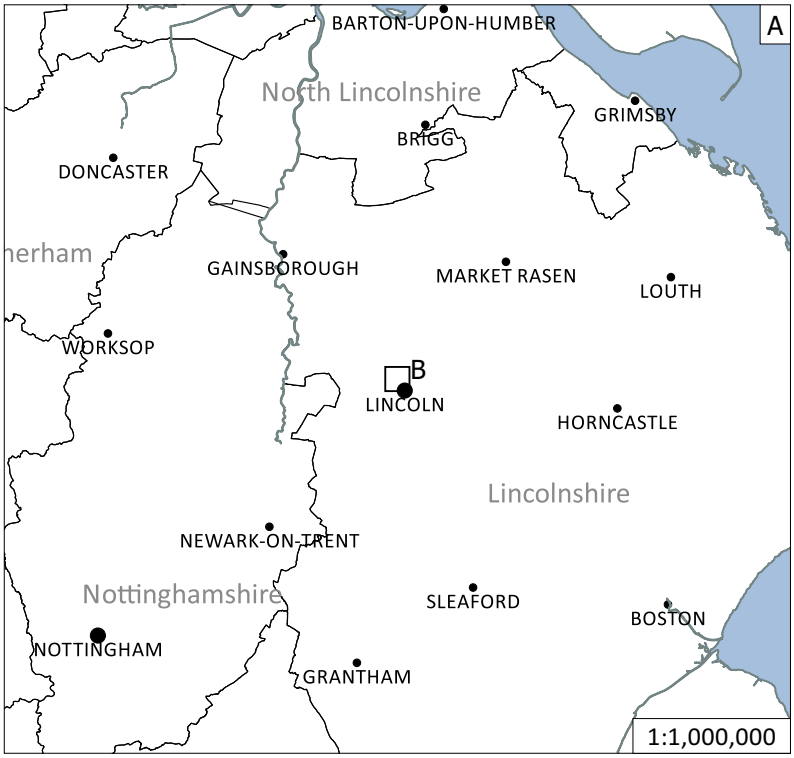

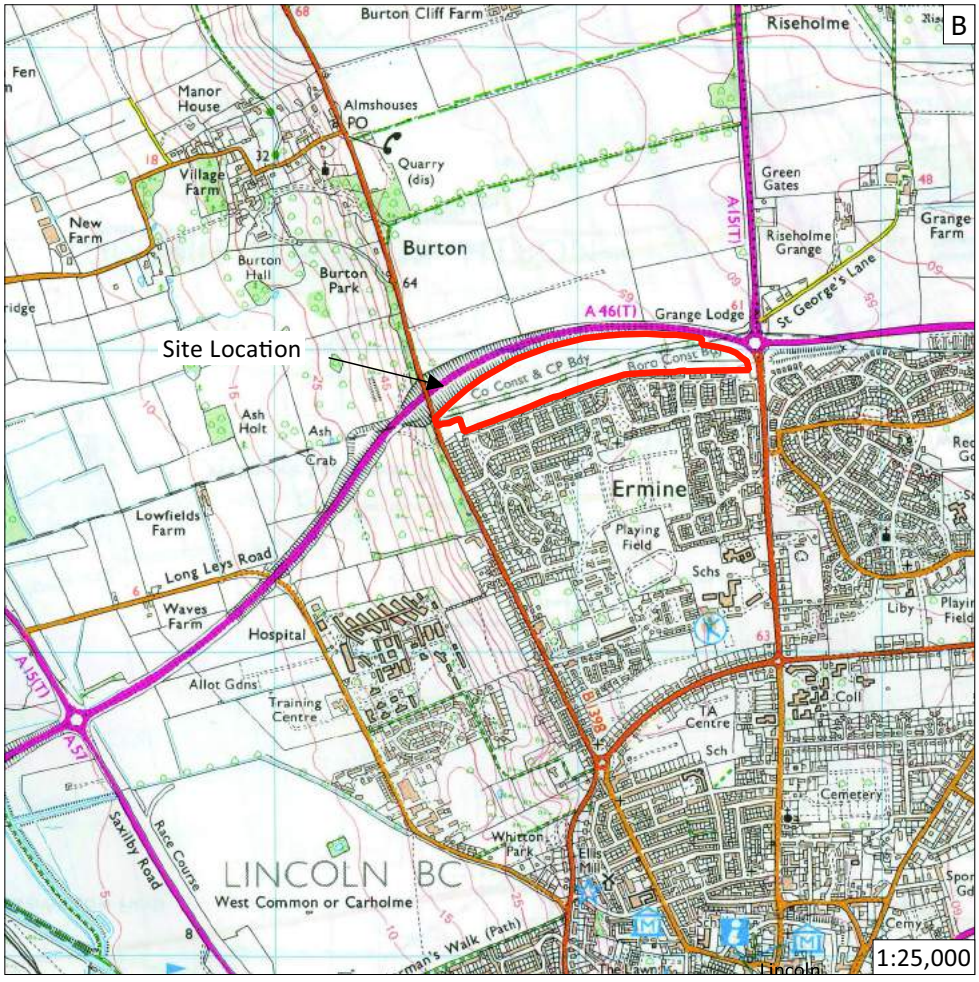

Figure 1: Site location outlined in red

Site Code	LIQR 16
Scale	1:10,000,000 1:1,000,000 1:25,000 @ A4
Drawn by	R Evershed
Date	05/09/16

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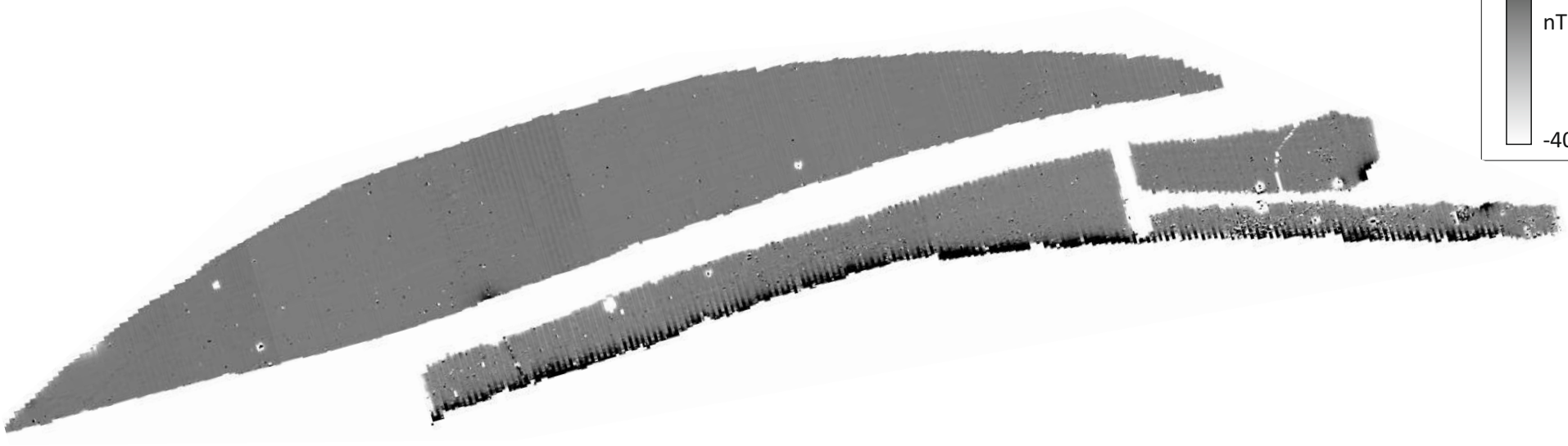
N

Raw data (clipped to +/- 40 nT)

40

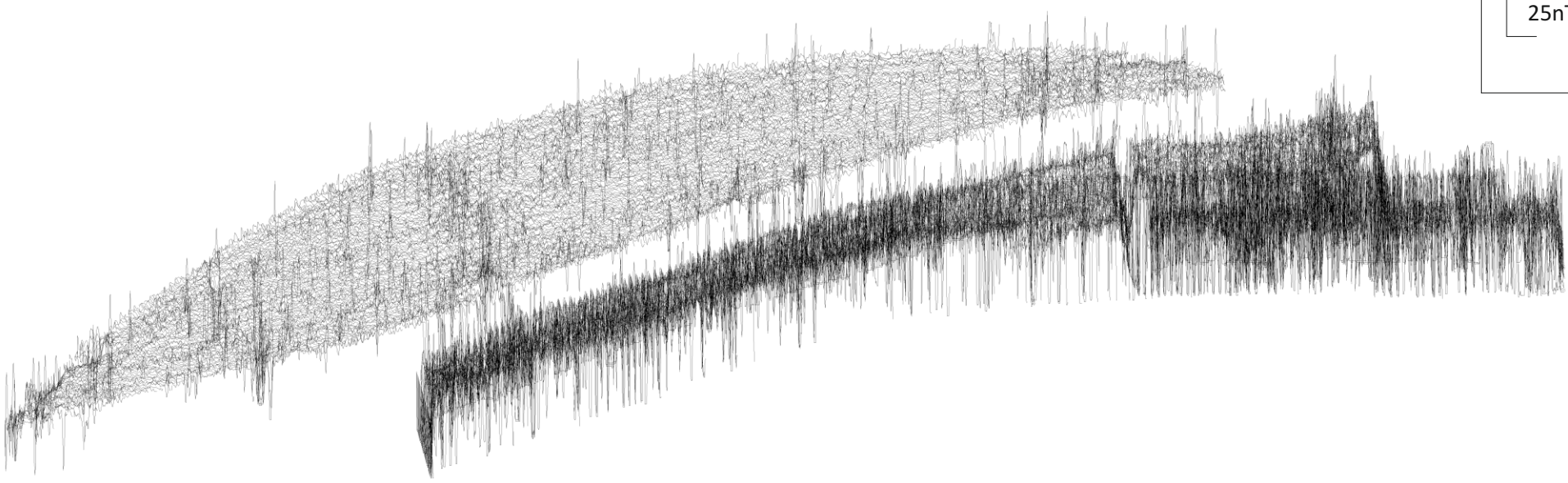
nT

-40



Trace Plot (ZMT and clipped to +/- 25nT)

25nT



0 400m

Scale 1:4,000

Site Code	LIQR 16
Scale	1:4,000 @ A3
Drawn by	R Evershed
Date	02/09/16

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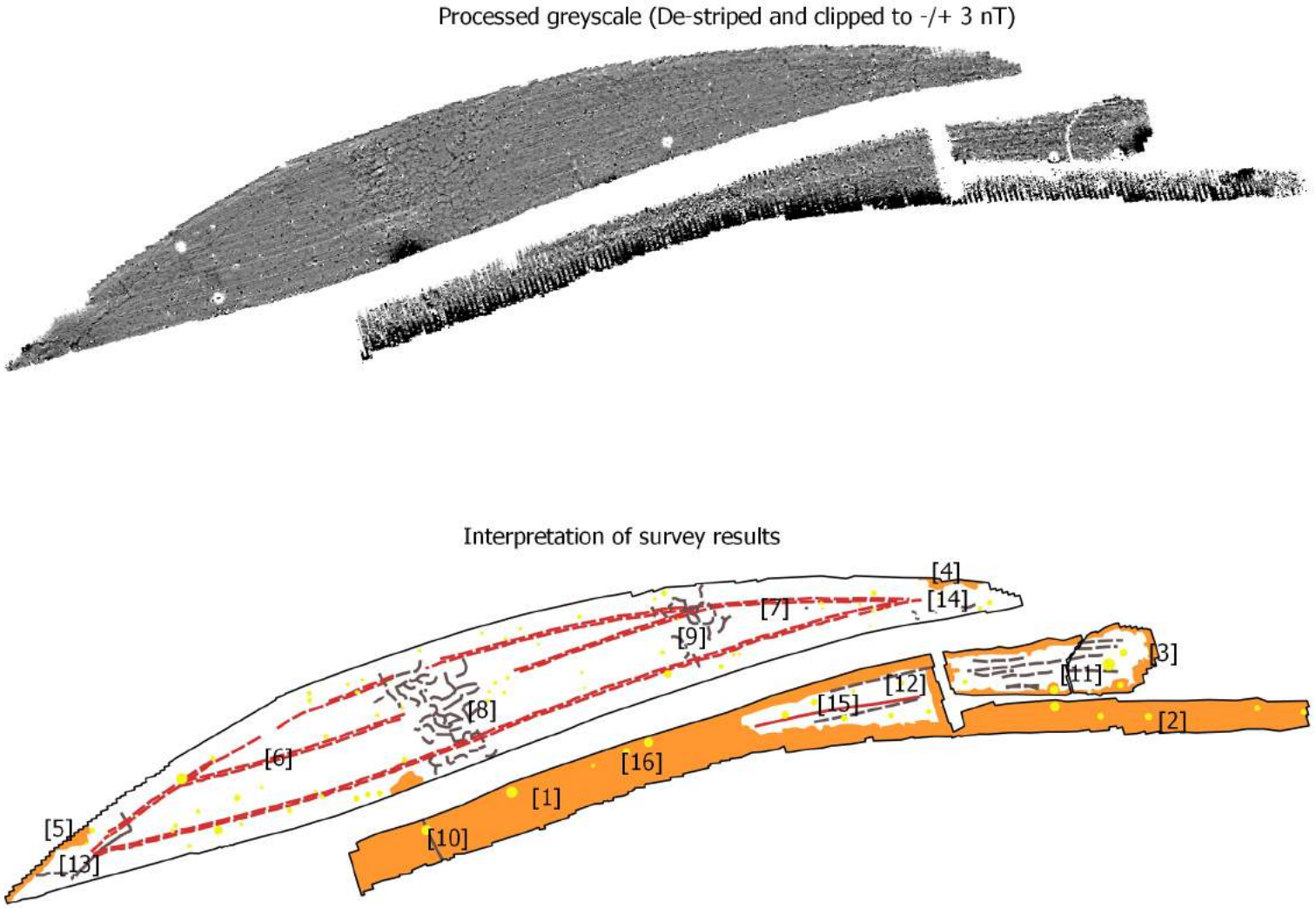
Figure 2: Greyscale raw data and processed trace plot



N

Key

- Positive Anomaly
- Negative Anomaly
- Magnetic Noise
- Dipolar Anomaly
- Site Boundary

3 nT -3

Site Code	LIQR16
Scale	1:4,000 @ A4
Drawn By	R Godbold
Date	05/09/16

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0 200 m

Figure 3: Processed greyscale plot and interpretation

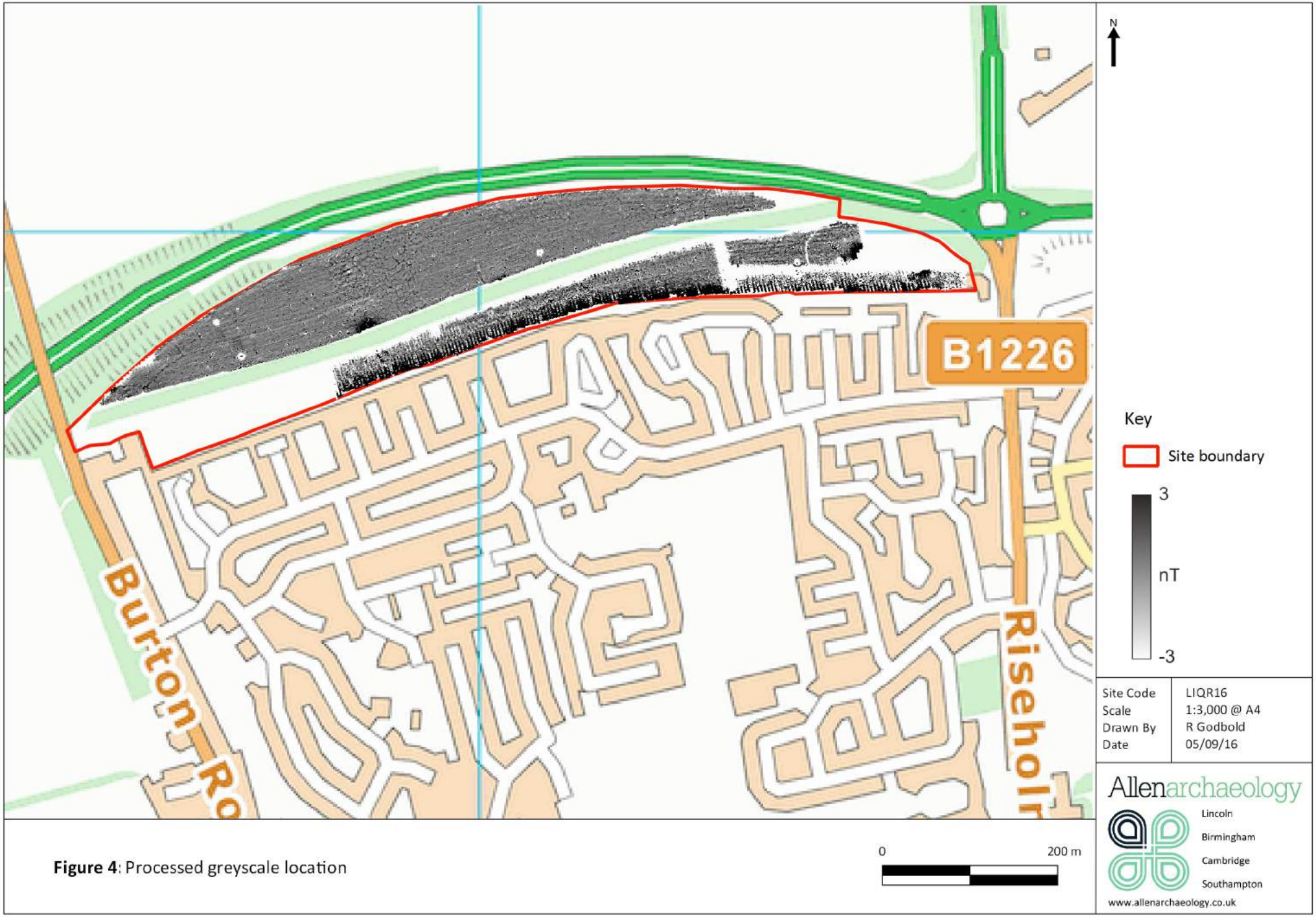

Figure 4: Processed greyscale location

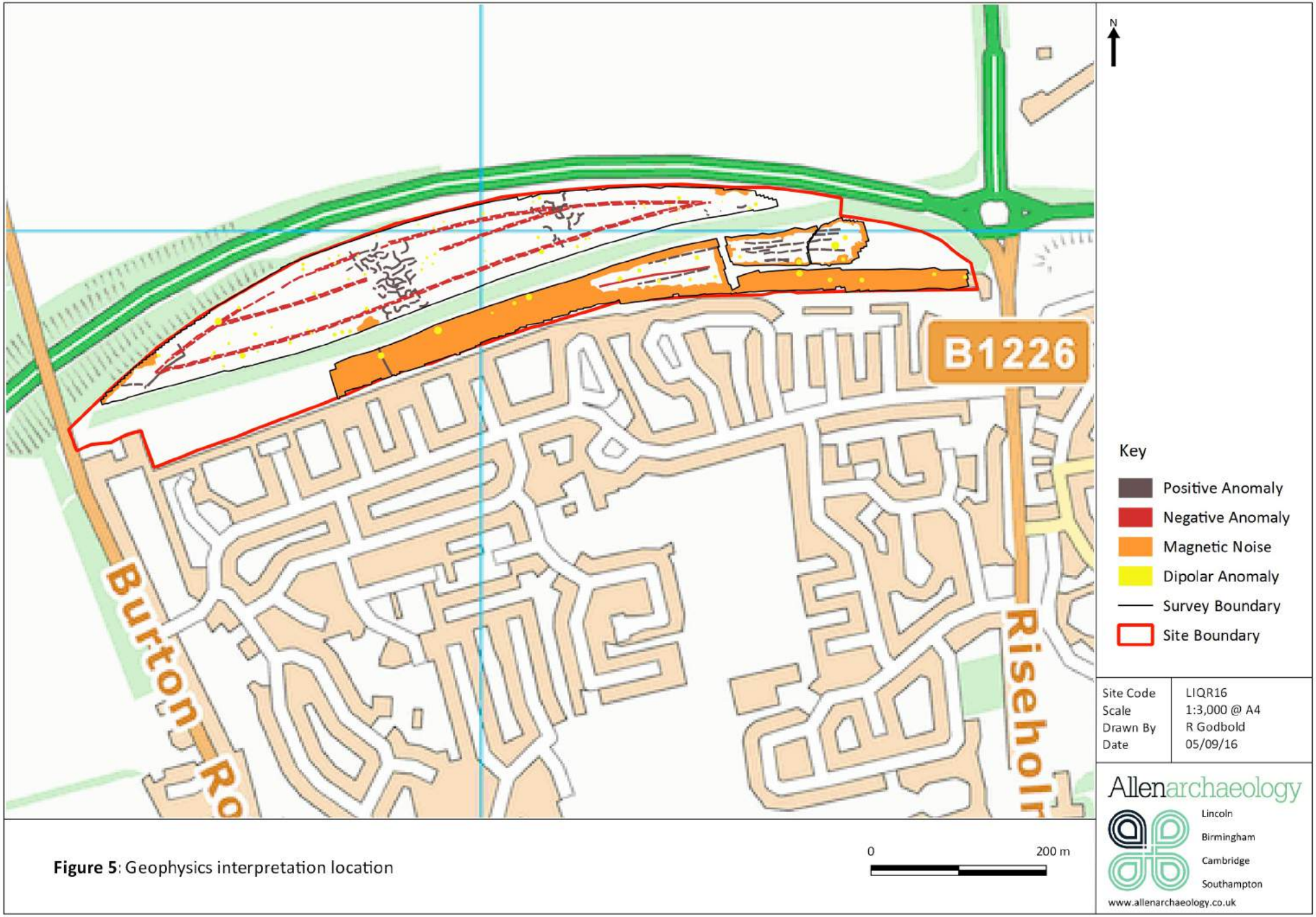

Figure 5: Geophysics interpretation location

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