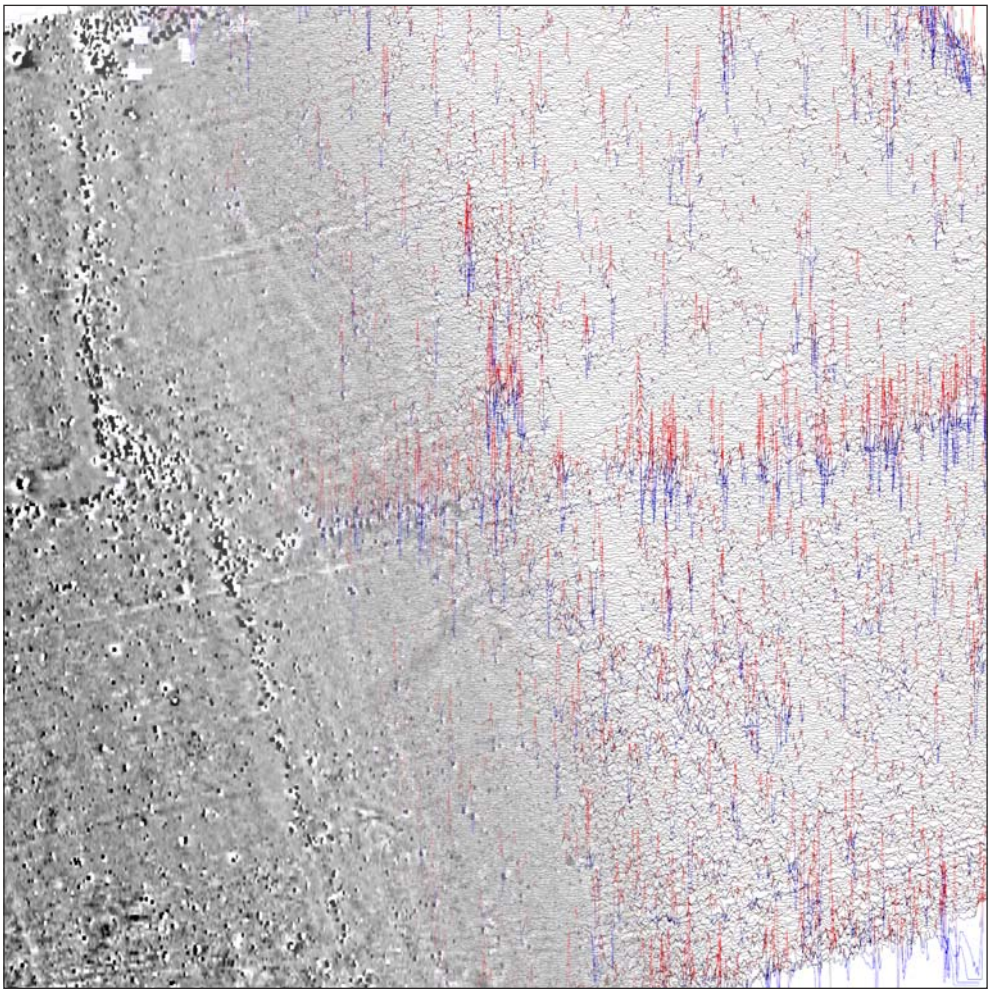
making sense of heritage

Land at Whitford Road, Bromsgrove, Worcestershire

Detailed Gradiometer Survey Report



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geoservices

Land off Whitford Road
Bromsgrove, Worcestershire

Detailed Gradiometer Survey Report

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* I = Internal Draft; E = External Draft; F = Final

Land off Whitford Road
Bromsgrove, Worcestershire

Detailed Gradiometer Survey Report

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Summary

A detailed gradiometer survey was conducted over land off Whitford Road, to the west of Bromsgrove, Worcestershire. The project was commissioned by Catesby Land Limited with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The site comprises pasture fields located between Whitford Road to the east, the M5 motorway to the west, Timberhonger Lane to the north and a modern housing development to the south. The survey area occupies the northern flank of Breakback Hill, sloping steeply downwards from south to north. Gradiometer survey was undertaken over all accessible parts of the site, a total of 22.7ha.

No anomalies of definite archaeological interest have been identified, although numerous anomalies probably representing former boundaries can be seen forming an extensive network of former field systems across the southern part of the survey area. Linear regions of increased magnetic response are consistent with further former boundaries and are likely to correspond with a field system that existed until at least the 1950s.

A number of linear, curvilinear and pit-like anomalies have been detected within the survey area, although their lack of clear definition and limited extents makes their interpretation less certain.

Regions of near-surface geological changes have been identified, particularly around the break in slope of Breakback Hill near the centre of the southern survey area. In places, these appear to be consistent with former channels.

Several modern services can be seen within the northern part of the survey area. A region of increased magnetic response may be associated with a former rifle range that existed within the northern field.

Land off Whitford Road
Bromsgrove, Worcestershire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Catesby Land Limited. The assistance of Myron Osborne is gratefully acknowledged in this regard.

The fieldwork was directed by Laura Andrews and assisted by Rachel Chester, Clara Dickinson and Jennifer Smith. Ben Urmston processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Nikki Cook.

Land off Whitford Road
Bromsgrove, Worcestershire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Catesby Land Limited to carry out a geophysical survey of land off Whitford Road to the west of Bromsgrove, Worcestershire (**Figure 1**), hereafter "the Site" (centred on NGR 394610 270305). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The survey area comprises pasture fields and woodland off Whitford Road, some 1.4 km west of the centre of Bromsgrove (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 22.7 ha.

1.2.2 The Site is located on the northern flank of the relatively steep Breakback Hill, sloping from around 90m above Ordnance Datum (aOD) at the northern extents of the Site to over 120m aOD in the south. The survey area lies to the west of Whitford Road, east of the M5 motorway and south of Timberhonger Lane. The southern extent of the survey area was defined by a modern housing estate.

1.2.3 An archaeological desk-based assessment compiled by Wessex Archaeology prior to the survey (WA 2013) identified low to moderate potential for archaeological remains from all periods, largely through a lack of archaeological investigations having taken place within or near the Site.

1.2.4 The geology underlying the Site is recorded as the Bromsgrove Sandstone Formation with no superficial deposits. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 7th and 11th January 2013. Field conditions at the time of the survey were poor in the northern fields and acceptable in the southern field; the northern fields were waterlogged and had been churned by livestock.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS system, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT over a ±100nT range, in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Gradiometer data from the survey were subject to minimal data correction processes (**Figure 2**). These comprise a zero mean traverse function applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The geophysical surveys have been successful in identifying anomalies of probable and possible archaeological interest across the Site, along with regions of increased magnetic response and modern services. Gradiometer results are presented as greyscale and XY plots, and archaeological interpretations, at a scale of 1:2,000 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 50nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 At the northern extent of the Site, several modern services are visible. Short curving service **4000** extends southeast from the boundary to the west. Its response is lost within the magnetic disturbance associated with service **4001**, which is oriented N-S.

3.2.2 Towards the northernmost corner, several regions of magnetic disturbance and increased magnetic response **4002** are apparent. It is likely that these anomalies are associated with agricultural activity. A probable modern service runs parallel with the northeastern boundary, although its response is largely masked by magnetic disturbance associated with the boundary.

3.2.3 A band of increased magnetic response **4003** extends NE-SE across the survey area and is likely to represent a former field boundary. A short distance to the south, modern service **4004** extends approximately NE-SW; it is interesting to note that the response appears to fade as it approaches the northeastern boundary before becoming stronger, and it is possible that this indicates a break in the service.

3.2.4 Linear and pit-like anomalies **4005** are of possible archaeological interest, although little more can be determined regarding their origins. Weakly negative anomaly **4006** is likely to be modern in origin, although an archaeological interpretation cannot be discounted.

3.2.5 Near the southern extent of the northern field, curvilinear anomaly **4007** is of possible archaeological interest; it is consistent with being part of an enclosure.

3.2.6 Linear band of increased magnetic response **4008** is likely to be associated with a former field boundary. In close proximity, two curving regions of near-surface

geological responses **4009** and **4010** can be seen. These responses are typical of former channels and are oriented parallel with the slope of the hill. The northeastern extent of **4010** is more clearly defined and an archaeological origin for this response cannot be discounted although it is considered unlikely.

3.2.7 At the southwestern corner of the northern field, a linear service can be seen on the same orientation as **4001** to the north; it takes an apparent turn to the southwest near the southern field boundary.

3.2.8 At the northern extent of the southern field, linear anomaly **4011** extends NNW-SSE parallel with the nearby field boundary. Although its response is interrupted by magnetic disturbance associated with fencing, it resumes further to the south at **4012**.

3.2.9 Rectilinear anomalies **4013** and **4014** are likely to represent the corner of an enclosure, although their responses are not well defined from the magnetic background. They lie on a different orientation from the former and extant field boundaries nearby, and therefore probably date from a different period.

3.2.10 Region of increased magnetic response **4015** surrounds a region of magnetic disturbance and is likely to be agricultural in origin.

3.2.11 Linear anomalies **4016** and **4017** are likely to represent former field boundaries. The response of **4017** becomes more sporadic towards the south, appearing as a band of increased magnetic response **4018**. This is likely to be the result of the removal and backfilling of the boundary.

3.2.12 Regions of near-surface geological changes **4019** and **4020** comprise relatively strong responses and are sufficiently strong to mask probable former boundary **4021**, which is oriented NNW-SSE.

3.2.13 Further former boundaries **4022**, **4023**, **4024** and **4025** can be seen on similar NNW-SSE orientations. The response of **4024** is somewhat sporadic, although it is likely to represent a continuous feature.

3.2.14 Linear anomaly **4026** is oriented ENE-WSW and is consistent with a former boundary.

3.2.15 Curvilinear anomalies **4027** are only weakly defined from the magnetic background and are of uncertain origin. They have been tentatively interpreted as being of possible archaeological interest, although it is possible that they are geological in origin.

3.2.16 Linear anomalies **4028** and **4029** lie on a similar orientation to **4026** and are also likely to be former boundaries, although their responses do not exhibit strong contrast with the magnetic background.

3.2.17 Curvilinear anomaly **4030** has an unusual form in plan and is considered to be of possible archaeological interest.

3.2.18 Linear anomaly **4031** is oriented NE-SW and appears to be a former boundary, further evidence of the former rectilinear field system visible elsewhere.

3.2.19 Faint rectilinear anomaly **4032** is likely to represent former field boundaries, although its response is weakly negative. This may indicate that it dates from a different period from the other former boundaries seen nearby.

3.2.20 Linear anomaly **4033** extends NE-SW across the survey area and is consistent with a former boundary or track.

3.2.21 Band of increased magnetic response **4034** extends E-W across the southern portion of the dataset, merging with other regions of magnetic disturbance at **4035**; **4018** extends northwards from **4035** and **4036** to the northeast. Region of increased response **4040** extends from **4035** to the southern boundary of the field. These anomalies are consistent with a former field system, which is likely to date from a different period from the other rectilinear field system seen elsewhere, given their dissimilar characters.

3.2.22 Further evidence of the former rectilinear field system can be seen towards the southwestern extent of the survey area at **4037** and **4038**. A cluster of pit-like anomalies can be seen to the north of **4038**; they lie within a region of near-surface geological changes, however, and may be natural in origin.

3.2.23 Curvilinear anomalies **4039** lie close to the southern field boundary and are of possible archaeological interest.

3.2.24 Further evidence of the former rectilinear field system can be seen towards the southwestern extent of the survey area at **4041** and **4042**.

3.2.25 Ploughing trends oriented parallel with the extant western and eastern boundaries can be seen throughout the southern field; further ploughing trends oriented orthogonally to these are visible and appear to respect elements of the former rectilinear field system. Other parallel linear trends are likely to indicate remnants of the former field system, although their responses are only weakly defined from the magnetic background.

4 CONCLUSION

4.1.1 The geophysical surveys have been successful in detecting anomalies of probable and possible archaeological interest within the Site, along with regions of increased response, near-surface geological changes and modern services.

4.1.2 The geophysical survey has not identified any anomalies of definitive archaeological interest and, although extensive former field systems have been identified particularly across the southern portion of the survey area, it is not clear from what period these former boundaries date.

4.1.3 Historic mapping (WA 2013) demonstrates the presence of some field boundaries in the southern part of the Site until after the 1950s; these former boundaries have been identified as regions of increased magnetic response **4018**, **4034**, **4035**, **4036** and **4040**. Curvilinear anomalies **4027** lie close to a historic former boundary.

4.1.4 It is interesting to note that a region of relatively quiet magnetic background appears to the south of **4034** and west of **4040**; the origin of this region is not clear, although it is consistent with a possible former track. It is also possible that this is the result of landscaping, with the majority of other anomalies such as the ploughing trends and former boundaries having been truncated in the process.

4.1.5 Within the northern portion of the dataset, several linear and curvilinear anomalies may be of archaeological interest, along with two probable former field boundaries. Modern service **4004** may be associated with a former rifle range (WA 2013).

4.1.6 Some of the ploughing trends within the southern portion of the dataset are consistent with remnants of ridge and furrow, although this cannot be determined conclusively. The fact that such ephemeral features have been identified suggests that more substantial archaeological remains would have produced detectable magnetic anomalies, should any have been present. It is possible that increasing thicknesses of alluvial or colluvial deposits may have masked such features in certain areas; the majority of the anomalies consistent with geological responses coincide with the break in slope at the northern extent of Breakback Hill.

4.1.7 Numerous ferrous responses have been identified throughout the survey area, and are relatively denser across the northern fields. This is consistent with their current use as livestock paddocks, and the remainder are likely to be associated with agricultural activity. Where particularly dense clusters of ferrous responses are seen, it is considered likely that these will be spreads of demolition and other ceramic material

5 REFERENCES

English Heritage, 2008. Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1, 2nd edition.

Wessex Archaeology, 2013. *Whitford Road, Bromsgrove, Worcestershire: Archaeology and Heritage Desk-Based Assessment*. Unpublished report 87720.01

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

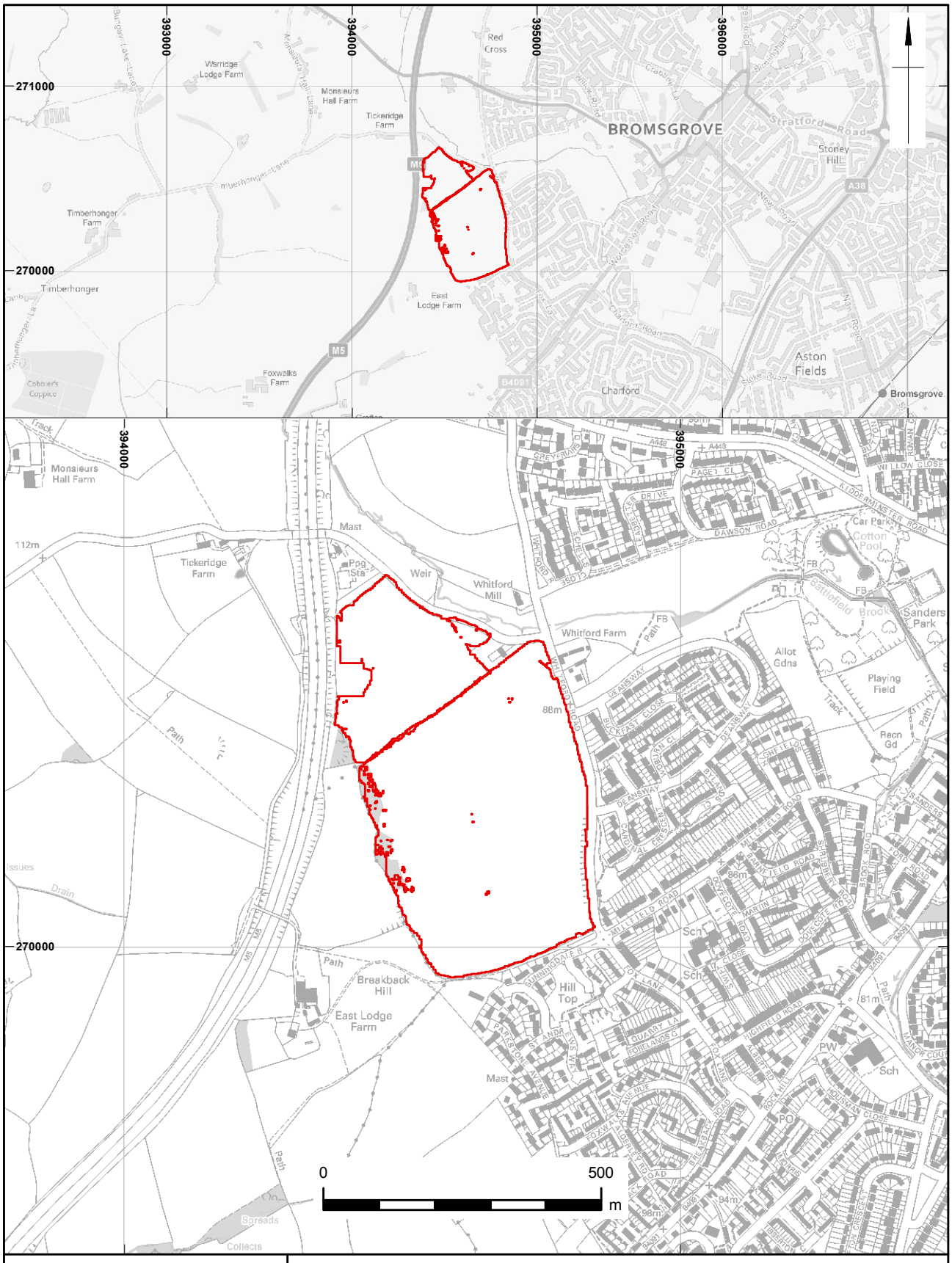
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



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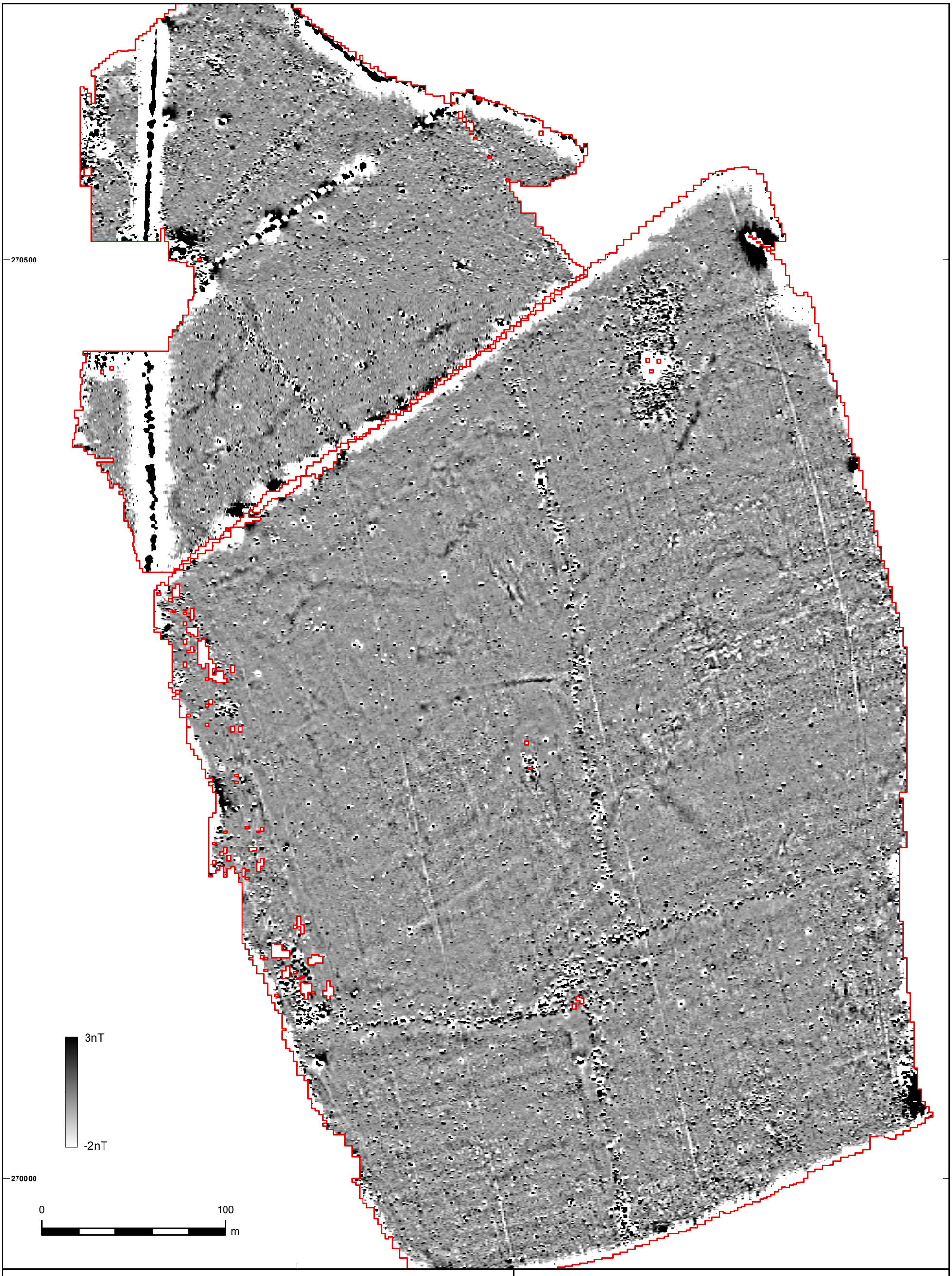
Site location and survey extents

Figure 1



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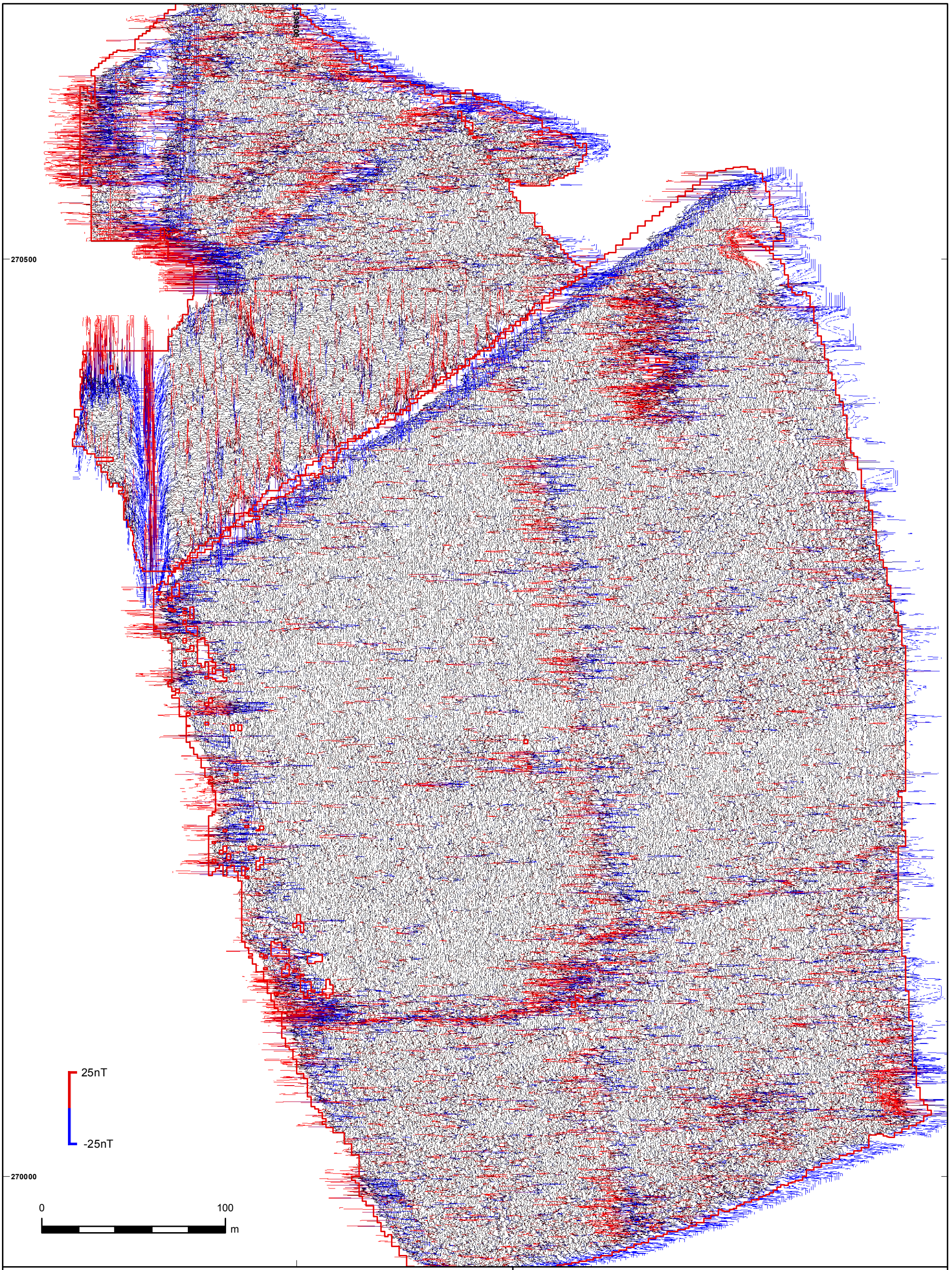
Greyscale

Figure 2



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XY trace

Figure 3

394500

270500

4000 4001 4002 4003 4004 4005 4006 4007 4008 4009 4010 4011 4012 4013 4014 4015 4016 4017 4018 4019 4020 4021 4022 4023 4024 4025 4026 4027 4028 4029 4030 4031 4032 4033 4034 4035 4036 4037 4038 4039 4040 4041 4042

Survey Extents
Ferrous
Probable Archaeology
Possible Archaeology
Modern Service
Increased Magnetic Response
Superficial Geology
Trend
Ploughing

270000

0 100 m

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Interpretation

Figure 4

wessex archaeology

salisbury rochester sheffield edinburgh

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