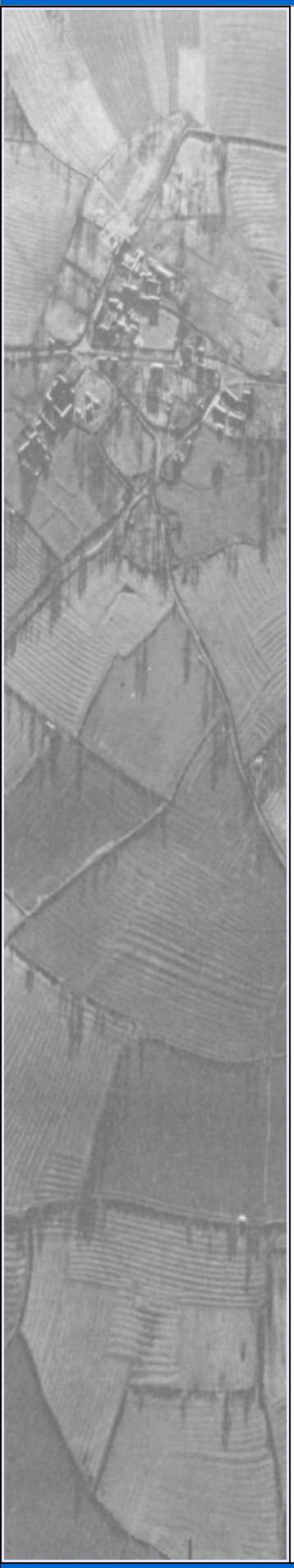

Land East of Eastboro Way
Nuneaton
Warwickshire

MAGNETOMETER SURVEY REPORT

for

Archaeology Warwickshire

Kerry Donaldson & David Sabin

May 2015

Ref. no. 609

ARCHAEOLOGICAL SURVEYS LTD

Land East of Eastboro Way
Nuneaton
Warwickshire

Magnetometer Survey Report

for

Archaeology Warwickshire

Fieldwork by David Sabin (Hons) MCIfA
Report by Kerry Donaldson BSc (Hons)
Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey dates – 29th & 30th April, 1st, 2nd & 4th May 2015
Ordnance Survey Grid Reference – **SP 38000 91125**

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CONTENTS

SUMMARY.....1

1 INTRODUCTION.....1

1.1 Survey background.....1

1.2 Survey objectives and techniques.....1

1.3 Site location, description and survey conditions.....2

1.4 Site history and archaeological potential.....2

1.5 Geology and soils.....3

2 METHODOLOGY.....3

2.1 Technical synopsis.....3

2.2 Equipment configuration, data collection and survey detail.....3

2.3 Data processing and presentation.....4

3 RESULTS.....5

3.1 General assessment of survey results.....5

3.2 Statement of data quality.....5

3.3 Data interpretation.....5

3.4 List of anomalies - Area 1.....7

3.5 List of anomalies - Area 2.....8

3.6 List of anomalies - Area 3.....8

3.7 List of anomalies - Area 4.....9

4 CONCLUSION.....9

5 REFERENCES.....10

Appendix A – basic principles of magnetic survey.....11

Appendix B – data processing notes.....12

Appendix C – survey and data information.....13

Appendix D – digital archive.....15

Appendix E – copyright and intellectual property.....17

LIST OF FIGURES

Figure 01 Map of survey area (1:25 000)

Figure 02 Referencing information (1:2000)

Figure 03 Greyscale plot of minimally processed magnetometer data (1:1500)

Figure 04 Greyscale plot of minimally processed magnetometer data (Area 4 filtered) (1:1500)

Figure 05 Abstraction and interpretation of magnetic anomalies (1:1500)

Figure 06 Greyscale plot of minimally processed magnetometer data - Areas 1 & 2 (1:1250)

Figure 07 Abstraction and interpretation of magnetic anomalies - Areas 1 & 2 (1:1250)

Figure 08 Greyscale plot of minimally processed magnetometer data (Area 4 filtered)- Area 1 north & Area 4 (1:1250)

Figure 09 Abstraction and interpretation of magnetic anomalies Area 1 north & Area 4 (1:1250)

Figure 10 Greyscale plot of minimally processed magnetometer data - Area 3 (1:1250)

Figure 11 Abstraction and interpretation of magnetic anomalies - Area 3 (1:1250)

LIST OF TABLES

Table 1: List and description of interpretation categories.....6

SUMMARY

A detailed magnetometer survey was carried out by Archaeological Surveys Ltd, at the request of Archaeology Warwickshire, over land to the east of Eastboro Way to the east of Nuneaton in north Warwickshire. The survey located a number of positive linear, rectilinear and discrete anomalies within the southern part of the site (Area 2). These have a moderately strong response compared with all the other anomalies within the site; however, they have an irregular appearance. It is, therefore, not possible to determine if they relate to naturally formed features or linear and rectilinear ditches and pits with an archaeological origin. Evidence for agricultural activity, land drainage, former field boundaries and buried services can be seen within the northern and western parts of the site (Area 1). Along the eastern side (Area 3) there is widespread magnetic debris with a small number of pit-like responses. The north eastern part of the site (Area 4) is bounded by the River Anker and contains evidence of former fluvial features as well as a number of positive linear anomalies, that although have an uncertain origin, may relate to agricultural activity or land drainage.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Archaeology Warwickshire, on behalf of Amec Foster Wheeler Environment & Infrastructure UK Limited, to undertake a magnetometer survey of an area of land to the east of Eastboro Way, Nuneaton, Warwickshire. The site has been outlined for a proposed residential development, and the survey forms part of an archaeological assessment of the site.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeology Warwickshire (2015).

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to determine if there are any significant archaeological remains in the area to be developed; to form an understanding of their value and their potential to shed light on the subsequent development of the area. The results of the survey will be used to inform the positioning of trial trenches covering 4% of the site.

1.2.2 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* and Institute for Archaeologists (2002) *The use of Geophysical Techniques in Archaeological Evaluations*. The work has been carried out to the Chartered Institute for Archaeologists (2014) *Standard and Guidance for Archaeological*

Geophysical Survey.

1.3 Site location, description and survey conditions

1.3.1 The site is located to the east of Eastboro Way, on the eastern edge of Nuneaton, Warwickshire. It lies directly south of the Heart of England Crematorium and east of Attleborough Fields Industrial Estate. It is bounded by the River Anker on the north eastern edge. It is centred on Ordnance Survey National Grid Reference (OS NGR) SP 38000 91125, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 15ha within four fields labelled Areas 1 - 4 for the purposes of this report. Areas 1 and 2 form the majority of the site and contained an emerging arable crop. Areas 3 and 4 are small fields forming the eastern part of the site. Area 3 contained grass and Area 4 stubble with tall wild vegetation. Some small patches within Areas 3 and 4 were unsuitable for survey due to ferrous objects and rough ground cover.

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data with the exception of the small patches mentioned above. Weather conditions during the survey were variable, but generally fine.

1.4 Site history and archaeological potential

1.4.1 There are four findspots of flint or stone objects recorded within or close to the site. This includes a group of 15 Palaeolithic objects comprising four quartzite handaxes, a flint handaxe, two choppers and four flint cores to the north of the site (Warwickshire Historic Environment Record No MWA 7498). Within the central part of the site an isolated handaxe is also recorded (HER MWA 12793). A stone axe is also recorded immediately east of the site (HER MWA 10070) and a flint scatter on the southern edge of the site (MWA 4430).

1.4.2 Situated 280m to the north west of the survey area is the medieval site of Horeston Grange (HER MWA 5142) which is recorded to have been associated with Nuneaton Priory in the 13th century and was surrounded by a moat or large ditch (HER MWA 1691).

1.4.3 The presence of flint scatters and hand tools within the site and surrounding vicinity may indicate there is some archaeological potential; however, these are generally dated to the Palaeolithic period and so are not likely to be associated with cut features. There is always potential for the geophysical survey to locate anomalies that relate to previously unrecorded archaeological remains should they be present within the site.

1.4.4 The surface conditions within the site were not suitable for the observation of cultural material during the course of the survey.

1.5 Geology and soils

1.5.1 The underlying geology is from the Mercia Mudstone Group with overlying deposits of Anker Sand and Gravel within Areas 1 and 2 and alluvial deposits within Areas 3 and 4 (BGS, 2013).

1.5.2 The overlying soil across the site is from the Whimple 3 association and is a stagnogleyic argillic brown earth. It consists of a reddish, fine loamy or fine silty over clayey soil (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry carried out over similar geology and soil has produced variable results, sometimes with low levels of magnetic susceptibility and also potentially containing naturally formed features. However, cut features of archaeological potential may be located where human activity has altered the magnetic characteristics of the soil sufficiently. The underlying geology and soils are therefore considered acceptable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5

fluxgate gradiometers spaced 0.5m apart with readings recorded at 100 Hz. The gradiometers have a range of recording data between 0.1nT and 10,000nT. The system is linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA computer system.

2.2.2 Data are collected along a series of parallel survey transects wherever possible. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps maintain the correct separation between adjacent traverses.

2.2.3 Data are not collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).

2.3 Data processing and presentation

2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display using TerraSurveyor.

2.3.2 The data are collected between limits of ±10000nT and clipped for display. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.18m along each survey track. A zero median traverse function is required in order to remove fixed offset values present within the sensors which do not undergo a zeroing procedure in the field. The approach ensures that the gradiometer sensors are very accurately aligned and fixed to the vertical magnetic field and are not influenced by localised magnetic fields or disturbed by vibration. Although a zero median traverse algorithm can remove anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

2.3.3 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on any processes, such as clipping, carried out on the data. A filtered image is also displayed for Area 4 where a high pass filter is applied to smooth data and remove slight variations along survey tracks caused by rapid fluctuations in temperature and uneven ground surfaces.

2.3.4 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot.

2.3.5 The raster images are combined with base mapping using ProgeCAD

Professional 2014, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GPS, resection method, etc.

2.3.6 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area.

2.3.7 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of four survey areas covering approximately 15ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, linear anomalies of an agricultural origin, anomalies associated with land management, anomalies with a natural origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines. Anomalies located within each survey area have been numbered and are described below.

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset. Localised magnetic disturbance associated with ferrous pipelines is unlikely to obscure anomalies of archaeological potential.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading CAD layer names and plot colour	Description and origin of anomalies
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management AS-ABST MAG BOUNDARY AS-ABST MAG LAND DRAIN	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation. Land drains can appear in a classic herringbone pattern of interconnected multiple dipolar linear anomalies, or as parallel linear anomalies. The multiple dipolar response indicates a ceramic land drain.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL AS-ABST MAG RIDGE AND FURROW	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.
Anomalies with a natural origin AS-ABST MAG NATURAL FEATURES	Naturally formed magnetic anomalies are are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguished from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE AS-ABST MAG SERVICE	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 437920 291100, see Figures 09 – 09.

Anomalies with an uncertain origin

(1) - The survey area contains a number of weakly positive linear and a very small number of discrete positive anomalies. While some may relate to agricultural activity they are barely distinguishable from the background soil response and lack a coherent morphology.

(2) - A number of weak and indistinct positive anomalies are located close to the southern edge of the survey area. It is possible that they are associated with anomalies (14) located immediately to the south within Area 2.

(3) - A small number of positive linear and possible rectilinear anomalies are located in the south western part of the survey area. It is possible that these are a continuation of anomalies (14) seen within Area 2 to the east.

(4) - The survey area contains a small number of negative linear anomalies. It is possible that they are associated with positive anomalies (1).

(5) - In the northern part of the survey area (Figs 08 & 09) is a possible fragmented negative and partly positive curvilinear anomaly.

Anomalies associated with land management

(6 & 7) - Two weakly positive linear anomalies, associated with strong, discrete dipolar responses and magnetic debris, relate to the location of former field boundaries.

(8) - A series of weakly multiple dipolar linear anomalies are located within the northern part of the survey area (Figs 08 & 09). This type of response indicates the presence of ceramic land drains. Two similar isolated responses can also be seen to the south of former field boundary (6) and adjacent to the eastern field boundary.

Anomalies with an agricultural origin

(9) - In the north western corner of the survey area are a series of parallel linear anomalies that appear to indicate former ridge and furrow.

(10) - In the south western part of the survey area, a series of very indistinct parallel linear anomalies also appear to relate to a series of ridge and furrow oriented north to south.

Anomalies associated with magnetic debris

(11) - A broad linear zone of magnetic debris, located in the western part of the

survey area, is likely to be a response to magnetically thermoremnant material such as brick and tile that has been used to consolidate a track or path. Other zones of such material are associated with the lines of former field boundaries.

(12) - A patch of strongly magnetic debris, in the north eastern part of the survey area is a response to ferrous and other magnetically thermoremnant material used to infill a pond.

Anomalies with a modern origin

(13) - The western part of the survey area contains strong, multiple dipolar anomalies that relate to buried interconnected services. It is possible that another, non-magnetic service lies along the line of former field boundary (6) as an inspection chamber is evident as a patch of magnetic disturbance at the western end close to anomaly (12).

3.5 List of anomalies - Area 2

Area centred on OS NGR 438000 291035, see Figures 06 & 07.

Anomalies with an uncertain origin

(14) - A number of positive linear, possible rectilinear and discrete anomalies appear to form a group of features with a response of 3-20nT. The linear and rectilinear anomalies have quite an irregular appearance, and although this type of response may relate to naturally formed features, it is possible that they relate to cut, ditch-like features. There are two large irregularly shaped pit-like features, with a response of up to 20nT and dimensions of 9.2m by 4.8m and 6.2m by 4.5m. Other pit-like anomalies have a response of 4-13nT and are more round in shape.

Anomalies associated with magnetic debris

(15) - Strong, discrete, dipolar anomalies are a response to ferrous and other magnetically thermoremnant objects within the topsoil.

3.6 List of anomalies - Area 3

Area centred on OS NGR 438195 291085, see Figures 10 & 11.

Anomalies with an uncertain origin

(16) - The northern part of the survey area contains a very small number of discrete positive responses. It is possible that these relate to naturally formed features.

Anomalies with an agricultural origin

(17) - A number of parallel linear anomalies appear to relate to agricultural activity.

Anomalies associated with magnetic debris

(18) - In the southern part of the survey area a patch of magnetic debris is associated with a recently removed field boundary and area of hard standing.

(19) - The survey area contains widespread and numerous strong, discrete, dipolar anomalies which may have been spread through the process of manuring.

3.7 List of anomalies - Area 4

Area centred on OS NGR 438130 291245, see Figures 08 & 09.

Anomalies with an uncertain origin

(20) - The survey area contains a number of positive linear anomalies. It is possible that these relate to agricultural activity or possible land drainage, but their origin is uncertain.

(21) - A small number of discrete positive responses may relate to naturally formed features.

Anomalies with a natural origin

(22) - The survey area contains several amorphous positive responses. The eastern edge of the survey area is bounded by the River Anker and these responses appear to relate to former fluvial features.

Anomalies with a modern origin

(23) - A short section of a multiple dipolar, linear anomaly extends across the central part of the survey area and may relate to a buried service or pipe.

4 CONCLUSION

4.1.1 Across the majority of the site the responses are very weak and indistinct, with some evidence for former ridge and furrow, land drainage and former land boundaries within Area 1. A curvilinear anomaly is located in the northern part of Area 1, but it is indistinct and cannot be confidently interpreted. A number of short or fragmented very weakly positive linear anomalies can be seen within Area 1 but they are very indistinct and lack a coherent morphology.

4.1.2 Several positive linear, possible rectilinear and discrete anomalies have been located within Area 2 in the southern part of the site. Although these have an irregular form they have a much stronger response and more distinct morphology than the majority of the other anomalies across the site. While a natural origin cannot be ruled out, the linear, rectilinear and discrete anomalies may relate to former cut features. It is possible that they may extend to the west and north into Area 1.

4.1.3 Area 3 only contains a very small number of discrete positive responses that may relate to natural features, and also widespread strong, discrete, dipolar anomalies. Area 4, to the north, is bounded by the River Anker and contains evidence for former fluvial features, as well as a number of positive linear anomalies that may relate to agricultural activity or land drainage.

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Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±20nT and ±10nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero (destripe) Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise differences between the baseline value of gradiometer sensors.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks and modern agricultural features.

Appendix C – survey and data information

Area 1 minimally processed data

COMPOSITE
Filename: J609-mag-Area1-proc.xcp
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSBB36
Northwest corner: 437752.05782869, 291325.407073207 m
Southeast corner: 438156.33782869, 290918.607073207 m
Direction of 1st Traverse: 90.4428275917651 deg
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 6568500

Dimensions
Composite Size (readings): 2246 x 2260
Survey Size (meters): 404 m x 407 m
Grid Size: 404 m x 407 m
X Interval: 0.18 m
Y Interval: 0.18 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 2.02
Mean: -0.08
Median: -0.09
Composite Area: 16.446 ha
Surveyed Area: 8.2217ha

Processes: 1
1 Base Layer

GPS based Proce3
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 Clip from -5.00 to 5.00 nT

Area 2 minimally processed data

COMPOSITE
Filename: J609-mag-Area2-proc.xcp
Description: Imported as Composite from: J609-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 437863.247500313, 291092.7664814 m
Southeast corner: 438155.927500313, 290964.0664814 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 3479500

Dimensions
Composite Size (readings): 1626 x 715
Survey Size (meters): 293 m x 129 m
Grid Size: 293 m x 129 m
X Interval: 0.18 m
Y Interval: 0.18 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 1.55
Mean: -0.06
Median: -0.09
Composite Area: 3.7668 ha
Surveyed Area: 2.478 ha

Processes: 1
1 Base Layer

GPS based Proce3
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 Clip from -5.00 to 5.00 nT

Area 3 minimally processed data

COMPOSITE
Filename: J603-mag-Area3-proc.xcp
Description: Imported as Composite from: J603-mag-Area3.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 438158.746105382, 291204.819184993 m
Southeast corner: 438255.046105382, 290960.559184993 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 1812250

Dimensions
Composite Size (readings): 535 x 1357
Survey Size (meters): 96.3 m x 244 m
Grid Size: 96.3 m x 244 m
X Interval: 0.18 m
Y Interval: 0.18 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 1.48
Mean: -0.05
Median: -0.08
Composite Area: 2.3522 ha
Surveyed Area: 1.3268 ha

Processes: 1
1 Base Layer

GPS based Proce3
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 Clip from -5.00 to 5.00 nT

Area 4 minimally processed data

COMPOSITE
Filename: J609-mag-Area4-proc.xcp
Description: Imported as Composite from: J609-mag-Area4.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 438073.676558893, 291338.92035747 m
Southeast corner: 438210.696558893, 291161.61035747 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 1895250

Dimensions
Composite Size (readings): 806 x 1043
Survey Size (meters): 137 m x 177 m
Grid Size: 137 m x 177 m
X Interval: 0.17 m
Y Interval: 0.17 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 0.97
Mean: -0.06
Median: -0.08
Composite Area: 2.4295 ha
Surveyed Area: 1.0476 ha

Processes: 1
1 Base Layer

GPS based Proce3
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 Clip from -5.00 to 5.00 nT

Area 4 filtered data

COMPOSITE
Filename: J609-mag-Area4-hpf.xcp
Description: Imported as Composite from: J609-mag-Area4.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 438073.57655887, 291339.020357494 m
Southeast corner: 438210.77655887, 291161.620357494 m
Collection Method: Randomised

Sensors: 5
Dummy Value: 32702

Source GPS Points: 1895250

Dimensions
Composite Size (readings): 686 x 887
Survey Size (meters): 137 m x 177 m
Grid Size: 137 m x 177 m
X Interval: 0.2 m
Y Interval: 0.2 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 0.83

Mean: 0.02
Median: -0.01
Composite Area: 2.4339 ha
Surveyed Area: 1.0536 ha

Processes: 1
1 Base Layer

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 High pass Uniform (median) filter: Window dia: 500
4 Clip from -5.00 to 5.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

Three printed copies of the report and a PDF copy will be supplied to the Warwickshire Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS). A summary of the survey will also be supplied to *West Midlands Archaeology.*

Archive contents:

Geophysical data - path: J609 Nuneaton\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
nun1\MX\ nun2\MX\ nun3\MX\ nun4\MX\ .prm, .dgb., disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	29/04/15 02/05/15 04/05/15 04/05/15	D.J.Sabin D.J.Sabin D.J.Sabin D.J.Sabin
nun1\MX\J609-mag-Area1.asc nun2\MX\J609-mag-Area2.asc nun3\MX\J609-mag-Area3.asc nun4\MX\J609-mag-Area4.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	02/05/15 12/05/15 12/05/15 12/05/15	D.J.Sabin K.T.Donaldson K.T.Donaldson K.T.Donaldson
Area1a\comps\J609-mag-Area1a.xcp Area1b\comps\J609-mag-Area1b.xcp Area2\comps\J609-mag-Area2.xcp Area3\comps\J609-mag-Area3.xcp Area4\comps\J609-mag-Area4.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	05/05/15 05/05/15 12/05/15 12/05/15 12/05/15	D.J.Sabin D.J.Sabin K.T.Donaldson K.T.Donaldson K.T.Donaldson
Area1a\comps\J609-mag-Area1a-proc.xcp Area1b\comps\J609-mag-Area1b-proc.xcp Area2\comps\J609-mag-Area2-proc.xcp Area3\comps\J609-mag-Area3-proc.xcp Area4\comps\J609-mag-Area4-proc.xcp Area4\comps\J609-mag-Area4-proc-hpf.xcp	TerraSurveyor 3.0.23.0	Processed composite data files (zmt and clipping to ±5nT).	05/05/15 05/05/15 12/05/15 12/05/15 12/05/15 12/05/15	D.J.Sabin D.J.Sabin K.T.Donaldson K.T.Donaldson K.T.Donaldson K.T.Donaldson
Graphic data - path: J609 Nuneaton\Data				
Area1\graphics\ J609-mag-Area1-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±5nT.	05/05/15	D.J.Sabin
Area1\graphics\ J609-mag-Area1-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	05/05/15	D.J.Sabin
Area2\graphics\ J609-mag-Area2-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±5nT.	12/05/15	K.T.Donaldson
Area2\graphics\ J609-mag-Area2-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	12/05/15	K.T.Donaldson
Area 3\graphics\ J609-mag-Area3-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±5nT.	12/05/15	K.T.Donaldson
Area3\graphics\ J609-mag-Area3-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	12/05/15	K.T.Donaldson
Area4\graphics\ J609-mag-Area4-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±5nT.	12/05/15	K.T.Donaldson
Area4\graphics\ J609-mag-Area4-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	12/05/15	K.T.Donaldson
Area4\graphics\ J609-mag-Area4-proc-hpf.tif	TerraSurveyor 3.0.23.0	TIF file showing a high pass filtered greyscale plot clipped to ±5nT.	12/05/15	K.T.Donaldson
Area42\graphics\ J609-mag-Area4-proc-hpf.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	12/05/15	K.T.Donaldson
CAD data - path: J609 Nuneaton\CAD				
J609 version 1.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	05/05/15	K.T.Donaldson
Text data - path: J609 Nuneaton\Documentation				
J609 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	15/05/15	K.T.Donaldson

Appendix E – copyright and intellectual property

This report may contain material that is non-Archaeological Surveys Ltd copyright (eg Ordnance Survey, Crown Copyright) or the intellectual property of third parties, which we are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Archaeological Surveys Ltd. Users remain bound by the conditions of the Copyright, Design and Patents Act 1988 with regard to multiple copying and electronic dissemination of this report.

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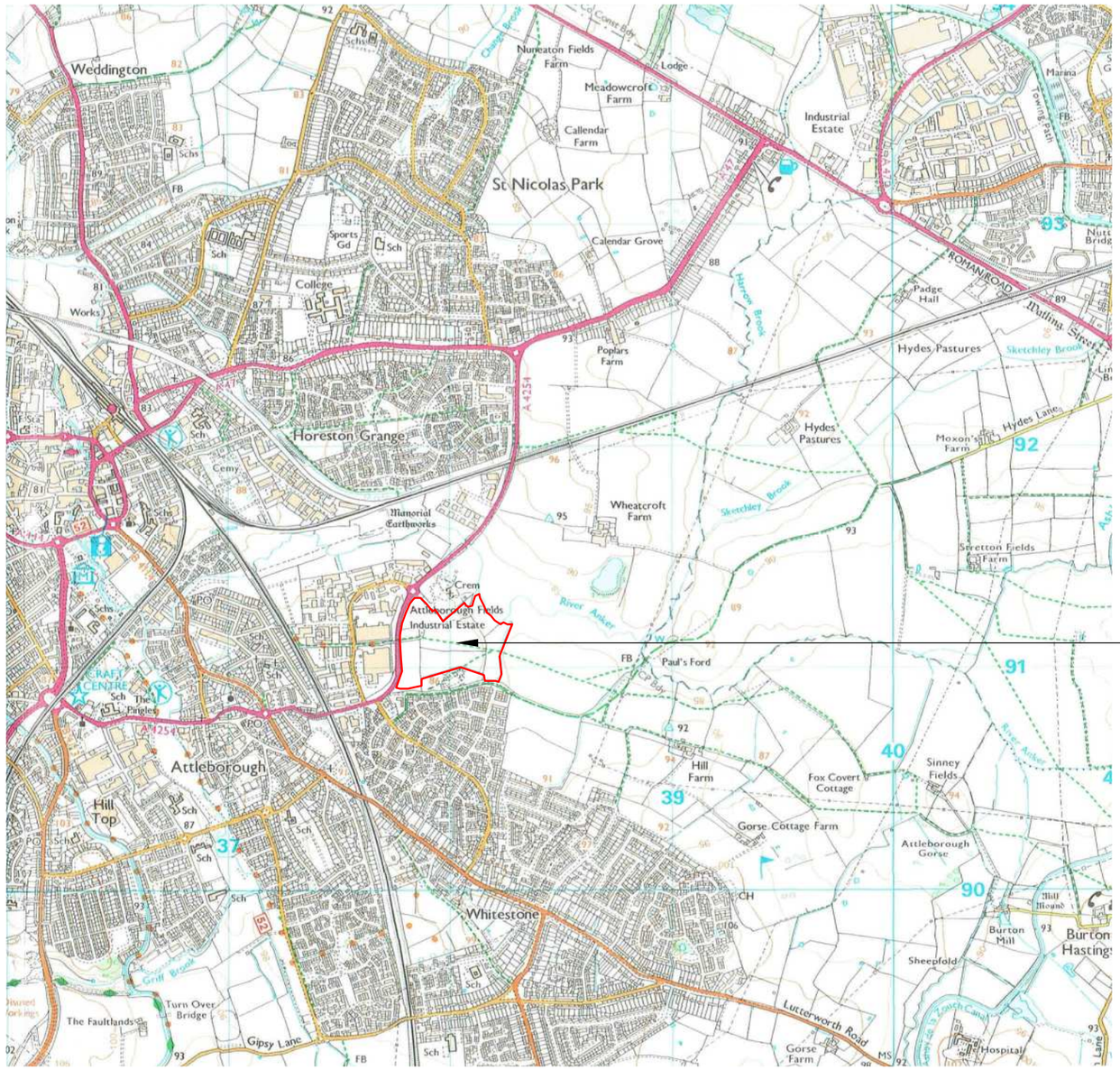
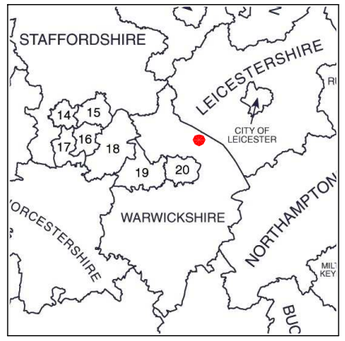
Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Map of survey area



Survey location



Survey location

Site centred on OS NGR
SP 38000 91125

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02

437800 291250

SCALE 1:2000

0m 20 40 60 80 100m

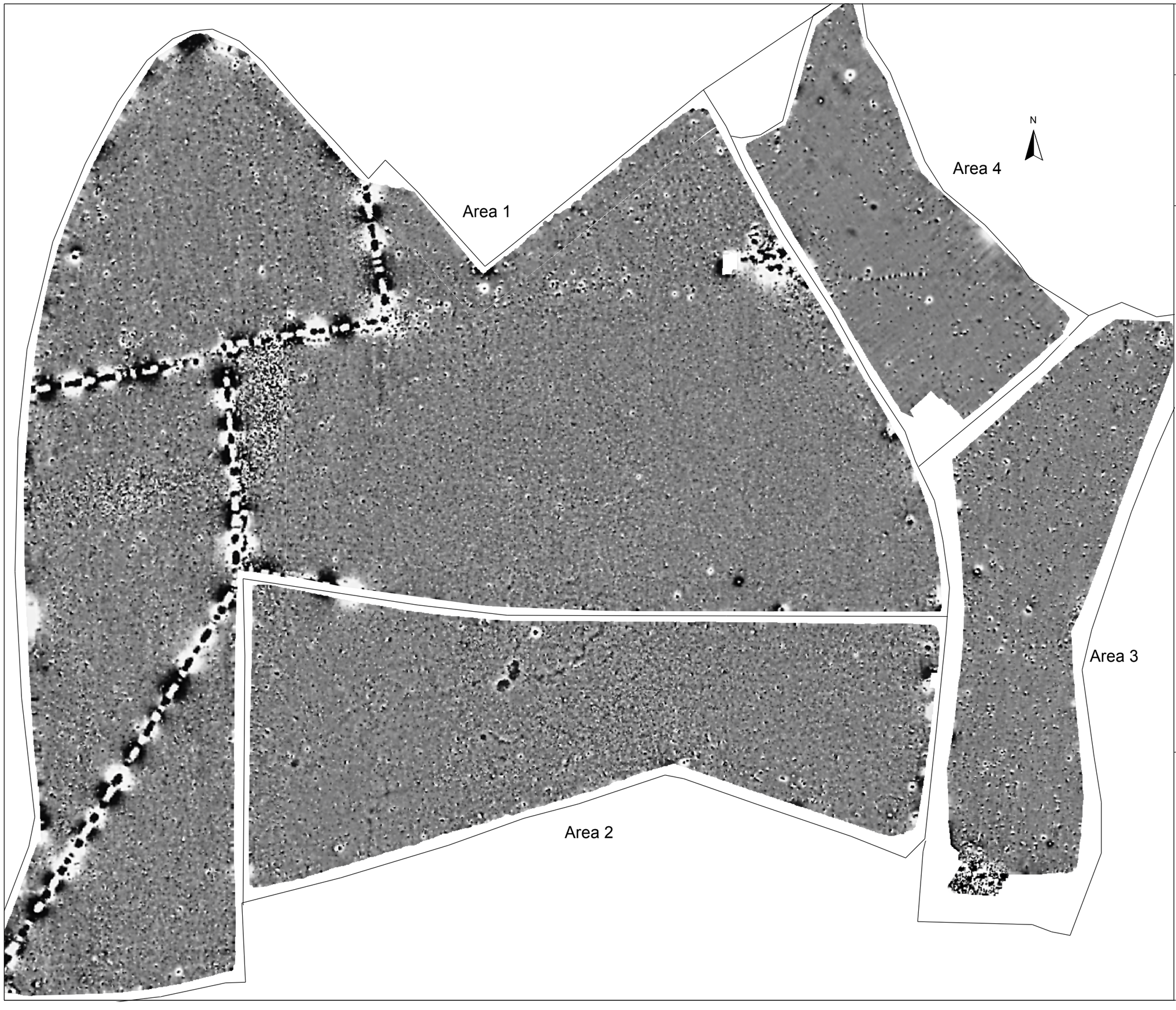
SCALE TRUE AT A3

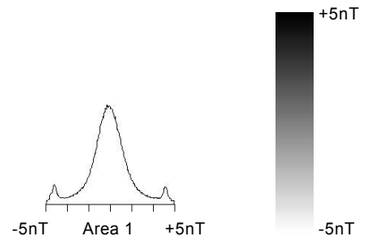
FIG 02

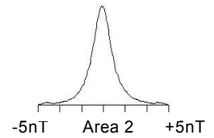
Archaeological Surveys Ltd

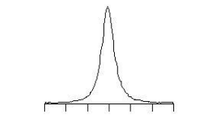
Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

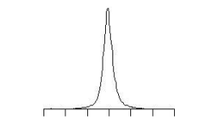
Greyscale plot of minimally processed magnetometer data



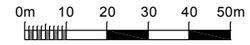








SCALE 1:1500



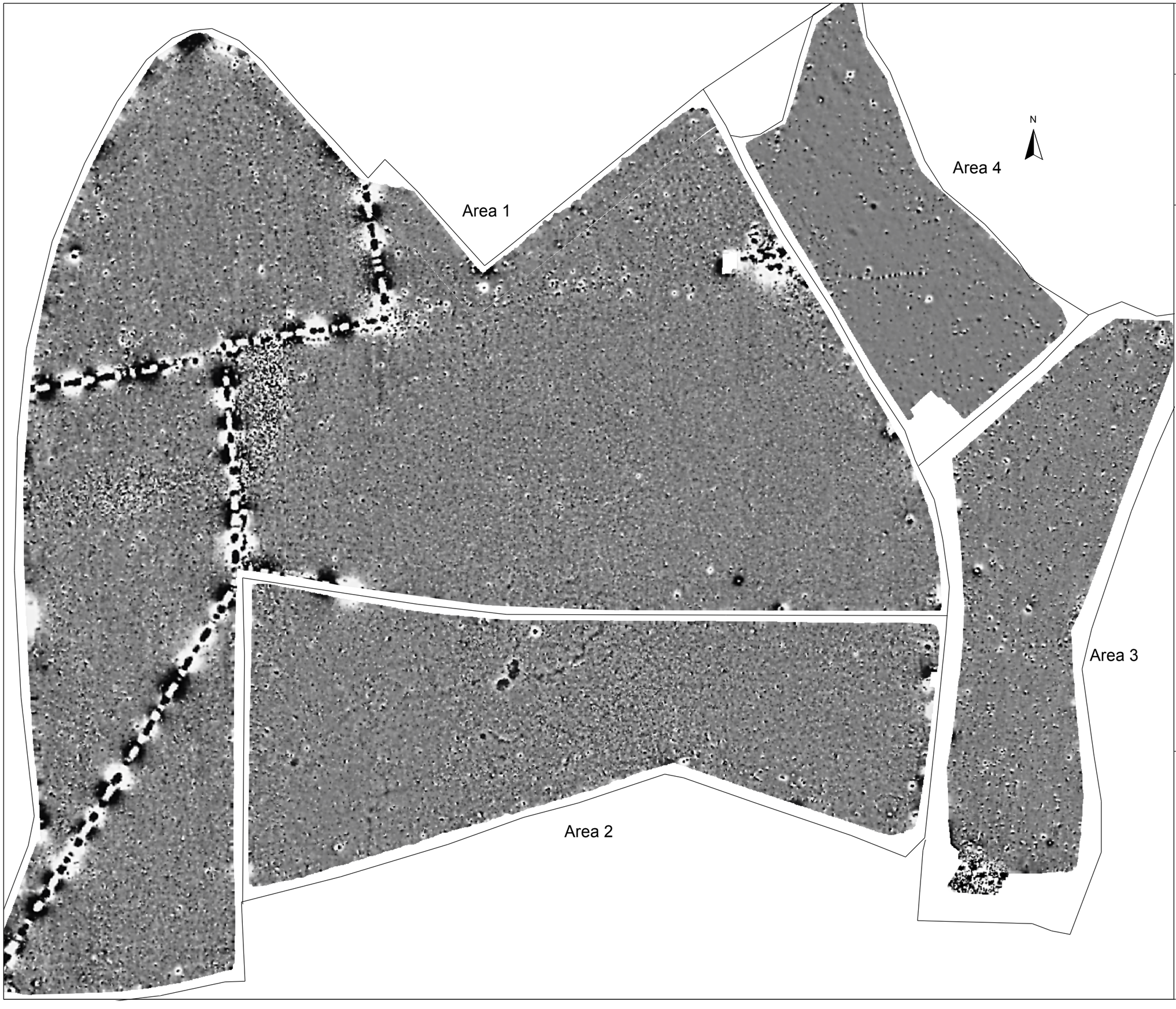
SCALE TRUE AT A3

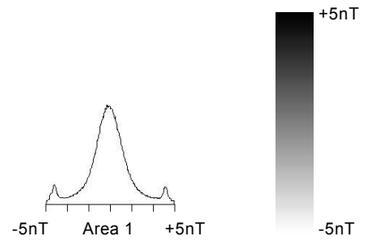
FIG 04

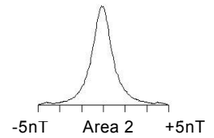
Archaeological Surveys Ltd

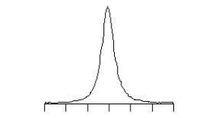
Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

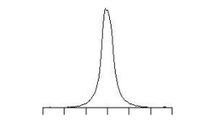
Greyscale plot of minimally processed magnetometer data - (Area 4 filtered)



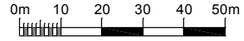








SCALE 1:1500



SCALE TRUE AT A3

FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Abstraction and interpretation of magnetometer anomalies

Area 1

Area 2

Area 3

Area 4

N

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Linear anomaly - of agricultural origin
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Area 1

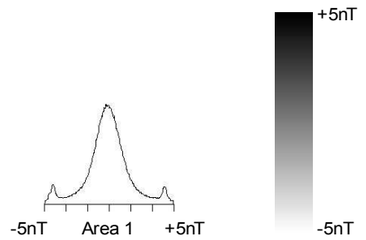
Area 2

N

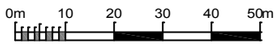
Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Greyscale plot of minimally processed magnetometer data - Areas 1 & 2



SCALE 1:1250



SCALE TRUE AT A3

FIG 06

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Abstraction and interpretation of magnetometer anomalies - Areas 1 & 2

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

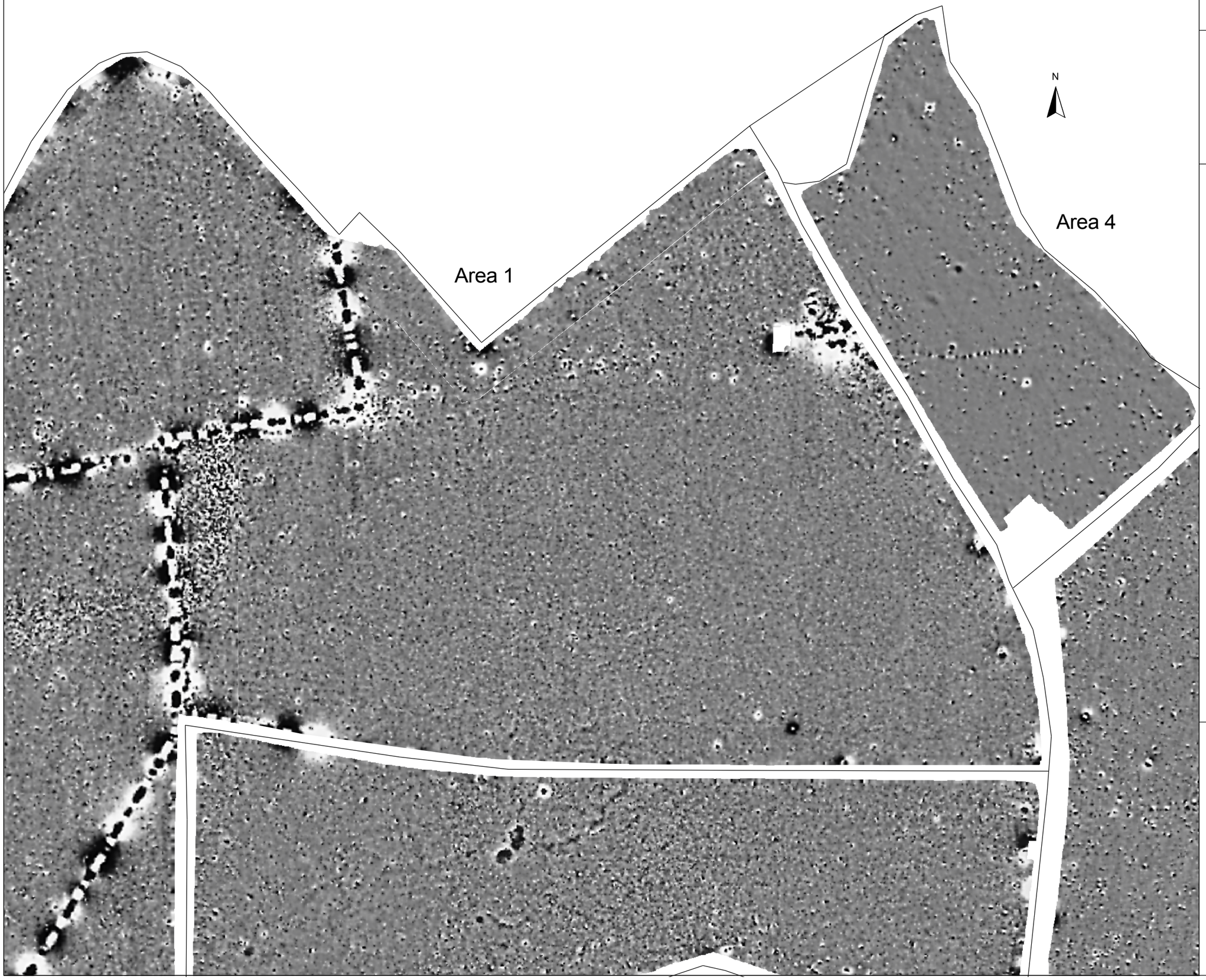
0m 10 20 30 40 50m

SCALE TRUE AT A3

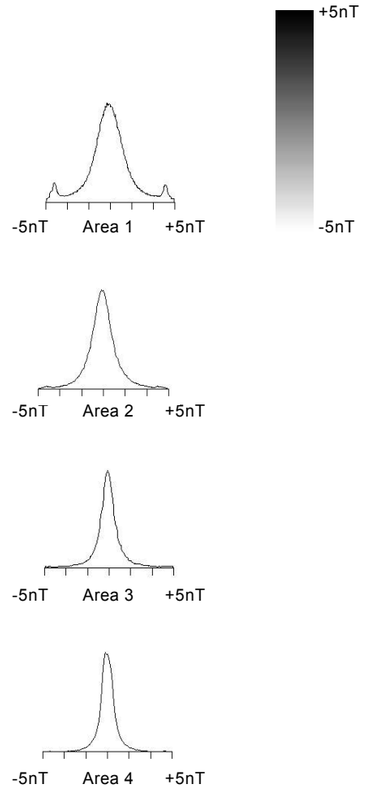
FIG 07

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire



Greyscale plot of minimally processed magnetometer data - Area 1 north & Area 4



SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 08

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Abstraction and interpretation of magnetometer anomalies - Area 1 north & Area 4

Area 1

Area 4

N

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Linear anomaly - of agricultural origin
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

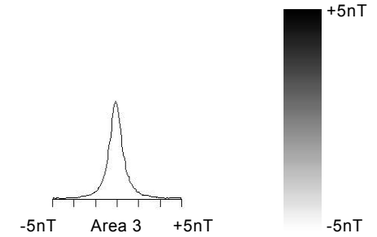
SCALE TRUE AT A3

FIG 09

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Greyscale plot of minimally processed magnetometer data - Area 3



Area 1

Area 4

N

Area 3

Area 2

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 10

Archaeological Surveys Ltd

Geophysical Survey
Land East of Eastboro Way
Nuneaton
Warwickshire

Abstraction and interpretation of magnetometer anomalies - Area 3

Area 1

Area 2

Area 3

Area 4

N

8
12
21
22
6
20
23
16
1
17
4
2
14
19
15
18

- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 11