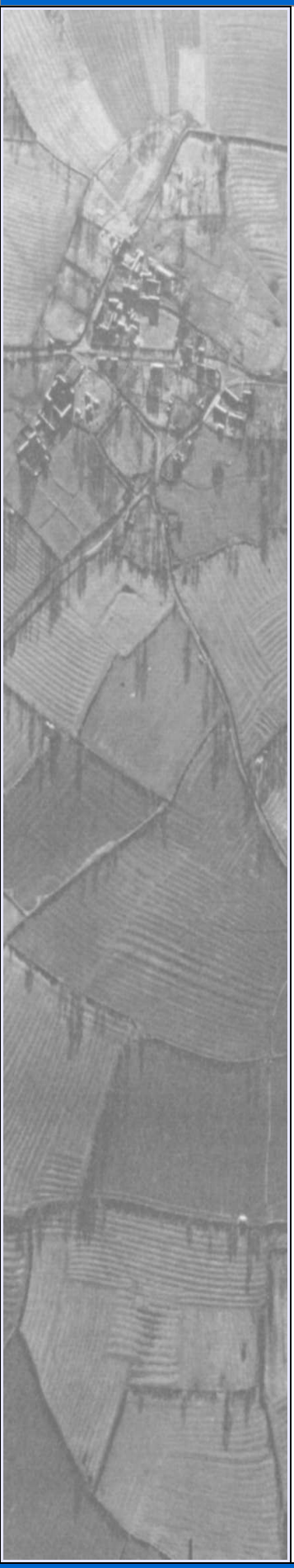

Great Western Community Forest
Common Farm
Wroughton

MAGNETOMETER SURVEY REPORT

for

Swindon Borough Council

Kerry Donaldson & David Sabin

May 2015

Ref. no. 613

ARCHAEOLOGICAL SURVEYS LTD

Great Western Community Forest
Common Farm
Wroughton

Magnetometer Survey Report

for

Swindon Borough Council

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 – 12th & 13th May 2015
Ordnance Survey Grid Reference – **SU 13670 81465**

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

Archaeological Surveys Ltd carried out a magnetometer survey at Common Farm, Wroughton within an area that has been outlined by Swindon Borough Council to be included for planting for the Great Western Community Forest. The survey area and land to the west contains a series of linear ditches that appear to pre-date the current field layout. The results of the survey show a number of predominantly negative linear anomalies, partly forming a grid that relate to a series of field drainage ditches. The site also contains a small number of discrete positive responses that appear to relate to pit-like features, although their origin is uncertain. A small number of short, weakly positive anomalies have been located in the western part of the site, but these lack definition and cannot be confidently interpreted as cut, ditch-like features.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Jonathan Wilshaw, Community Forest Officer for Swindon Borough Council, to undertake a magnetometer survey of an area of land at Common Farm to the north of Wroughton, Swindon. The site has been outlined for tree planting as part of the Great Western Community Forest. The survey forms part of an archaeological assessment of the site.

1.1.2 The site lies to the south east of an area previously surveyed ahead of a potential development of a solar farm at Common Farm (Archaeological Surveys, 2015). The tree planting is due to cover just under 8ha within two fields; however, the areas covered by this survey lie within a zone that may contain linear features identified from aerial photographs.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.

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 at Common Farm on the north western edge of Wroughton, Swindon. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 13670 81465, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 4ha within two fields containing tall mowing grass. Area 1 lies within a 2.8ha field, Area 2 covers 1.2ha within the south eastern corner of 5.4ha field.

1.3.3 The ground conditions across the site were considered to be poor for the collection of magnetometry data. Tall grass impeded survey traverses. Weather conditions during the survey were variable with periods of heavy rain and high winds.

1.4 Site history and archaeological potential

1.4.1 The Wiltshire Historic Environment Record (HER) lists that the survey area lies immediately east of a zone that contains various undated linear earthworks, possibly indicating a ploughed out field system (MWI 16586). It also lies immediately to the east of two undated ring ditches also recorded on the HER from cropmarks (MWI 16564). A previous geophysical survey on land to the north east located a number of linear features that appear to relate to ditches or gullies associated with field drainage (Archaeological Surveys, 2015).

1.4.2 The presence of linear features within and adjacent to the site indicates that there is a high potential for the geophysical survey to locate such features. However, it is not possible to determine their date or archaeological significance.

1.5 Geology and soils

1.5.1 The underlying geology is from the Ampthill Clay Formation and the Kimmeridge Clay Formation (BGS, 2015).

1.5.2 The overlying soil across the site is from the Denchworth association and is a pelo-stagnogley soil. It consists of a slowly permeable, seasonally waterlogged, clayey soil (Soil Survey of England and Wales, 1983).

1.5.3 The underlying geology and soils are frequently associated with low magnetic contrast and low levels of magnetic susceptibility. 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.

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 two survey areas covering approximately 4ha.

3.1.2 Magnetic anomalies located can be generally classified as positive anomalies of an uncertain origin, negative linear anomalies associated with land management, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects.

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.

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 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 DRAINAGE DITCH	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches) or of ditches with a less magnetic enhanced fill than the surrounding soils. They relate to visible depressions within the ground surface and appear to relate to field drainage.
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	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.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 413635 181455, see Figures 03 & 04.

Anomalies with an uncertain origin

(1) - A discrete positive response is located towards the southern edge of the survey area. Another is located to the north east of this anomaly. These appear to relate to pit-like responses, but it is not possible to determine if they relate to natural or anthropogenic features.

Anomalies associated with land management

(2) - The survey area contains several negative linear anomalies with a grid formation. These correspond to linear gullies or ditches within the ground surface and are associated with field drainage. They have the same orientation as cropmark features seen immediately to the west of Wharf Road. Although the date of construction of Wharf Road is not known, it is presumably associated with the Wilts & Berks Canal Wroughton Wharf to the north (c1805), although the road may predate the wharf. These drainage ditches appear to pre-date the road and the enclosure award field layout, but their extant nature may indicate that they date to the medieval or post-medieval periods.

Anomalies associated with magnetic debris

(3) - Located at the south eastern corner of the survey area is a zone of magnetic debris. This is associated with a small enclosure and building, present within the site by 1900, but removed by 1923.

(4) - The site contains very numerous and widespread strong, discrete, dipolar anomalies which are a response to ferrous and other magnetically thermoremant objects within the topsoil.

Anomalies with a modern origin

(5) - Magnetic disturbance is caused by ferrous material within the adjacent field boundaries.

3.5 List of anomalies - Area 2

Area centred on OS NGR 413755 181470, see Figures 03 & 04.

Anomalies with an uncertain origin

(6) - A cluster of discrete positive responses are located close to the eastern edge of the survey area. Another isolated response is located further west. This type of anomaly may indicate a pit-like feature, but it is not possible to determine if they are natural or anthropogenic in origin.

(7) - The survey area contains a small number of short, very weakly positive linear anomalies. Their short and indistinct response and lack of coherent morphology prevents confident interpretation.

Anomalies associated with land management

(8) - A weakly positive linear response corresponds to a shallow linear depression that extends across this part of the field and also further north eastwards. This appears to relate to a drainage ditch or gully.

Anomalies associated with magnetic debris

(9) - Extending along the northern part of the survey area is a linear zone of magnetic debris. This relates to magnetically thermoremnant material related to a recently removed field boundary.

4 CONCLUSION

4.1.1 The detailed magnetometer survey was carried out within a zone that appears to contain a number of linear and rectilinear features, which can also be seen to the west of the site and Wharf Road. The results of the survey revealed a number of primarily negative linear anomalies, partially forming a grid which relate to these features. They are likely to be associated with drainage ditches and gullies, and although dating is not possible, they may pre-date the current field layout and Wharf Road. However, their extant nature may indicate a post-medieval or possibly medieval date.

4.1.2 A small number of discrete positive responses, that may indicate pit-like features, have also been located. It is not possible to determine if these are naturally or anthropogenically formed features. Other positive linear responses are short, weak and indistinct and do not have a coherent morphology, preventing interpretation.

5 REFERENCES

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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

COMPOSITE
Filename: J613-mag-Area1-proc.xcp
Description: Imported as Composite from: J613-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 413528.928783891, 181550.803708495 m
Southeast corner: 413713.248783891, 181349.203708495 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 5276250

Dimensions
Composite Size (readings): 1024 x 1120
Survey Size (meters): 184 m x 202 m
Grid Size: 184 m x 202 m
X Interval: 0.18 m
Y Interval: 0.18 m

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.15
Mean: -0.09
Median: -0.12
Composite Area: 3.7159 ha
Surveyed Area: 2.4554 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Processes: 3
1 Base Layer
2 Clip from -5.00 to 5.00 nT
3 Clip from -3.00 to 3.00 nT

GPS based Proce2
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).

Area 2

COMPOSITE
Path: C:\Business\Jobs\J613 Common Farm, Wroughton\Data\Area 2\comps\
Filename: J613-mag-Area2-proc.xcp
Description: Imported as Composite from: J613-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 413706.382525901, 181544.141619245 m
Southeast corner: 413803.942525901, 181389.701619245 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 1919000

Dimensions
Composite Size (readings): 542 x 858
Survey Size (meters): 97.6 m x 154 m
Grid Size: 97.6 m x 154 m
X Interval: 0.18 m
Y Interval: 0.18 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.04
Mean: -0.10
Median: -0.10
Composite Area: 1.5067 ha
Surveyed Area: 1.0304 ha

Processes: 1
1 Base Layer

GPS based Proce3
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 Clip from -3.00 to 3.00 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.

A printed copy of the report and a PDF copy will be supplied to the Wiltshire Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

Geophysical data Area 1 - path: J613 Common Farm, Wroughton\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
comfarm1\MX\ .prm, .dgb, .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	12/05/15	D.J.Sabin
comfarm1\MX\J613-mag-Area1.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	18/05/15	K.T.Donaldson
Area1\comps\J613-mag-Area1.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	18/05/15	K.T.Donaldson
Area1\comps\J613-mag-Area1-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	18/05/15	K.T.Donaldson
Geophysical data Area 2 - path: J613 Common Farm, Wroughton\Data				
comfarm2\MX\ .prm, .dgb, .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA at.	13/05/15	D.J.Sabin
comfarm2\MX\J613-mag-Area2asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 2 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	18/05/15	K.T.Donaldson
Area2\comps\J613-mag-Area2.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	18/05/15	K.T.Donaldson
Area2\comps\J613-mag-Area2-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	18/05/15	K.T.Donaldson
Graphic data - path: J613 Common Farm, Wroughton\Data				
Area1\graphics\ J613-mag-Area1-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	18/05/15	K.T.Donaldson
Area1\graphics\ J613-mag-Area1-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	18/05/15	K.T.Donaldson
Area2\graphics\ J613-mag-Area2-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	18/05/15	K.T.Donaldson
Area2\graphics\ J613-mag-Area2-proc	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	18/05/15	K.T.Donaldson
CAD data - path: J613 Common Farm, Wroughton\CAD				
J613 version 1.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	11/05/15	K.T.Donaldson
Text data - path: J613 Common Farm, Wroughton\Documentation				
J613 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	21/05/15	K.T.Donaldson

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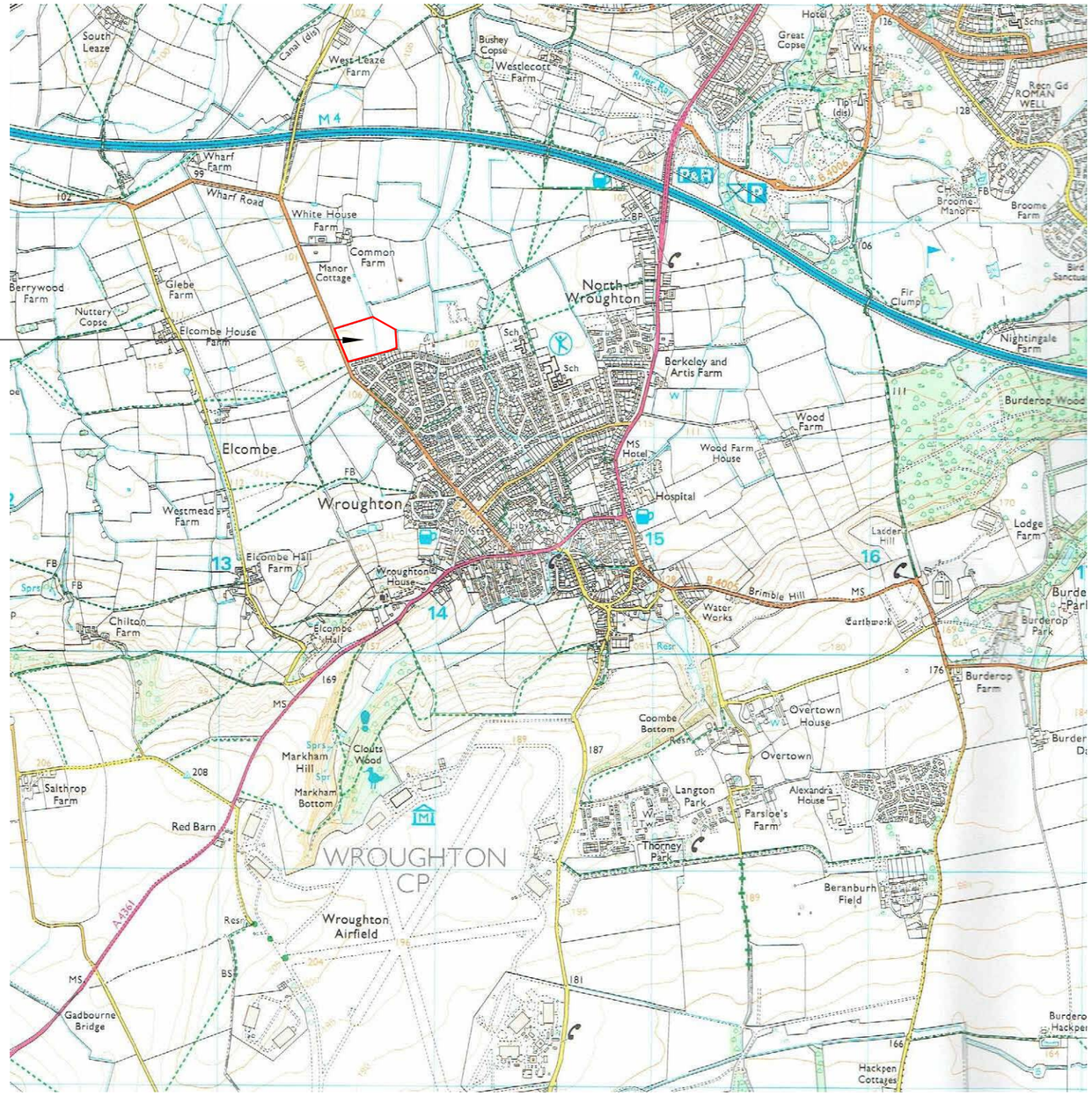
Survey location



Archaeological Surveys Ltd

Geophysical Survey
Great Western Community Forest
Common Farm
Wroughton

Map of survey area

Survey location

Site centred on OS NGR
SU 13670 81465

SCALE 1:25 000

0m 500m 1000m

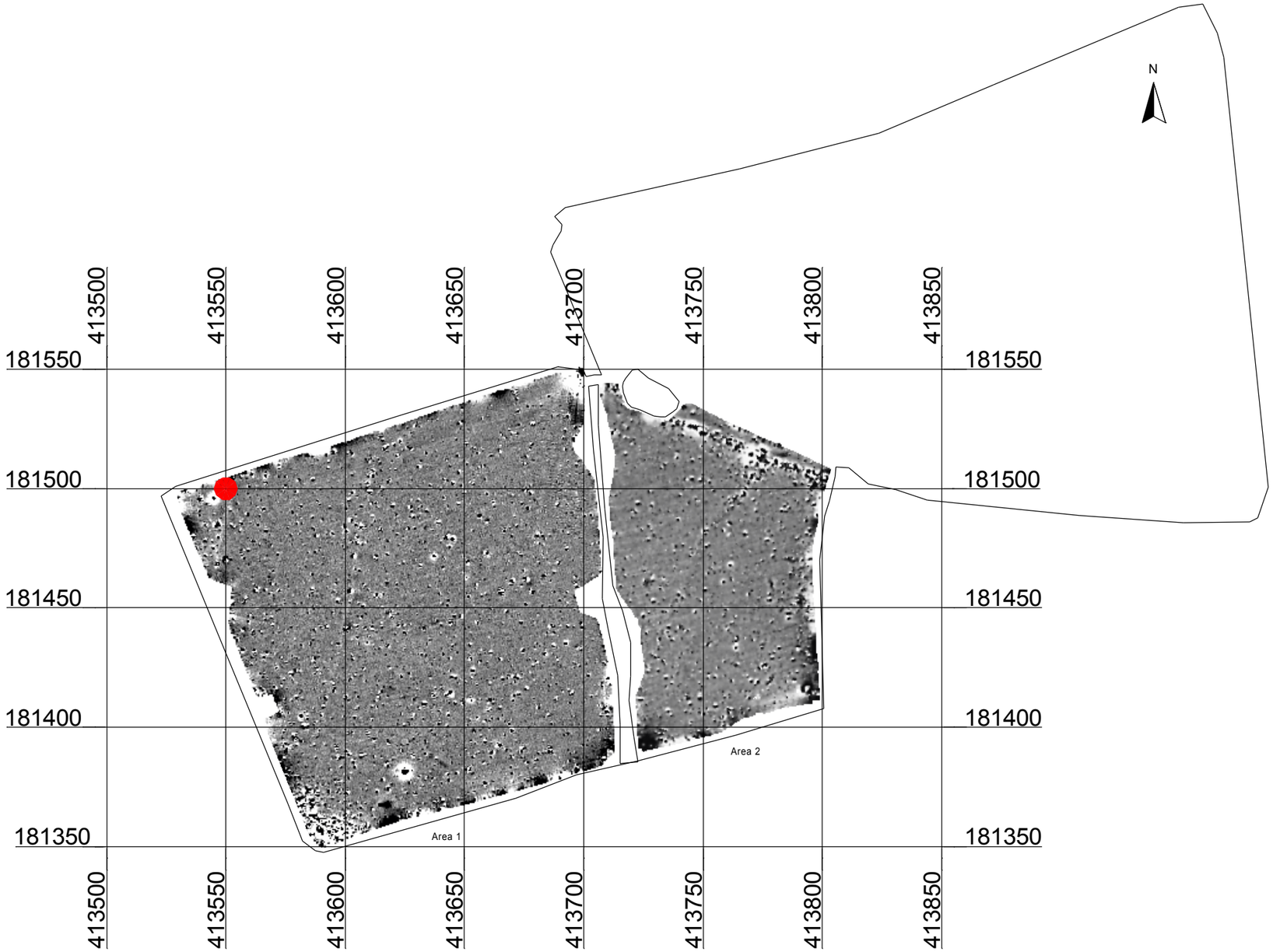
SCALE TRUE AT A3

FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Great Western Community Forest
Common Farm
Wroughton

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

● 413550 181500

SCALE 1:2000

0m 20 40 60 80 100m

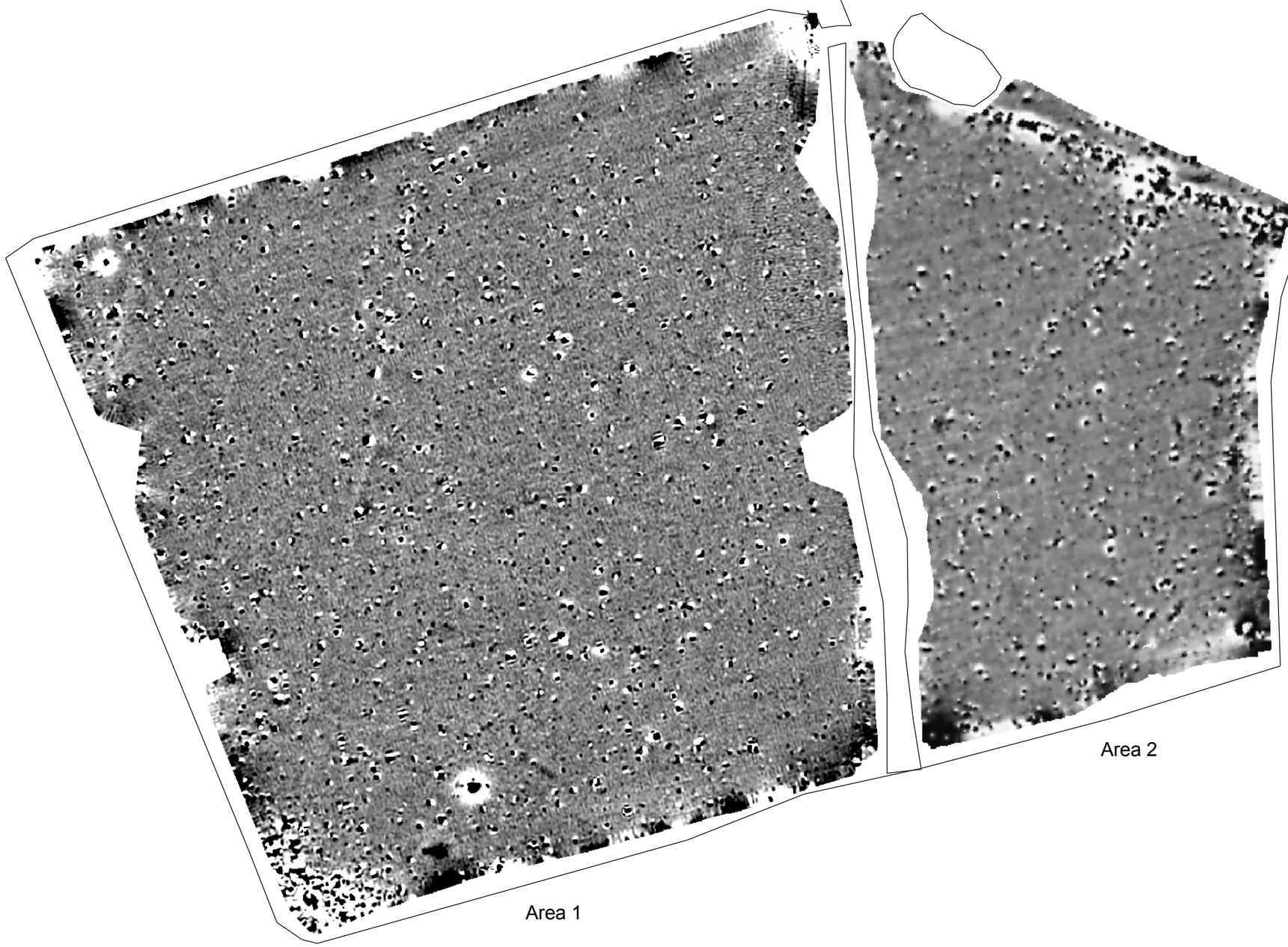
SCALE TRUE AT A3

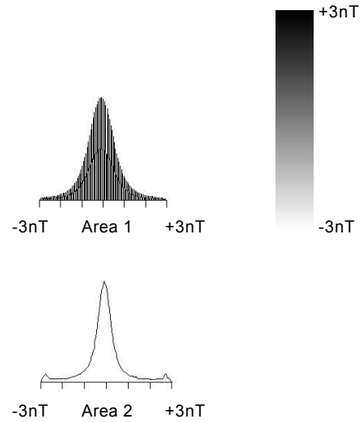
FIG 02

Archaeological Surveys Ltd

Geophysical Survey
Great Western Community Forest
Common Farm
Wroughton

Greyscale plot of minimally processed magnetometer data





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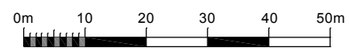


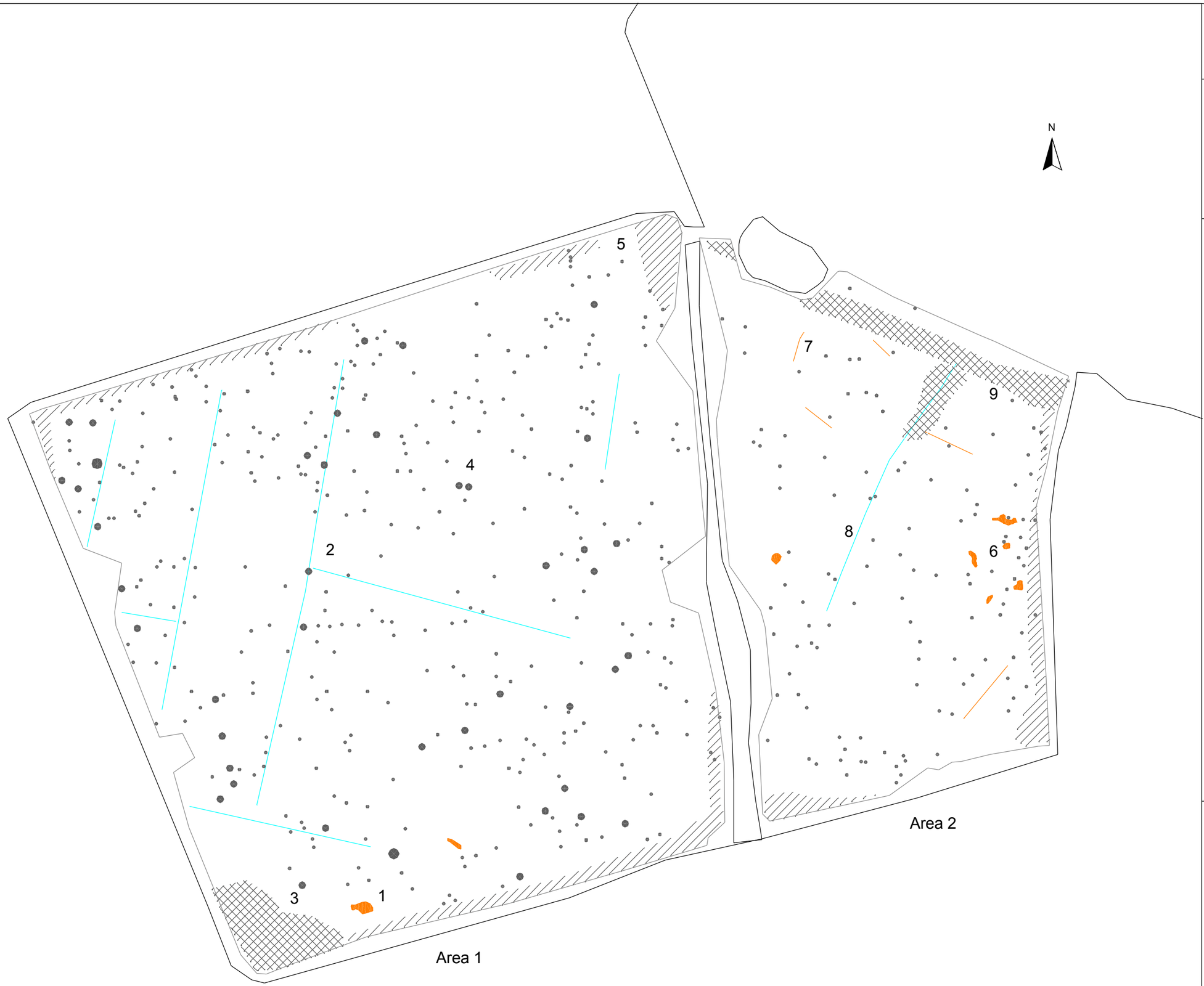
SCALE TRUE AT A3

FIG 03

Archaeological Surveys Ltd

Geophysical Survey
Great Western Community Forest
Common Farm
Wroughton

Abstraction and interpretation of magnetometer anomalies



- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - drainage ditch
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 04