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South-east Bicester
Phase II
Oxfordshire

Geophysical Survey

Report no. 2744

March 2015

South-east Bicester
Phase II
Oxfordshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 16 hectares, was carried out on agricultural land south-east of Bicester, prior to the submission of a planning application for the proposed development of the site. Anomalies indicative of ridge and furrow cultivation and modern activity have been identified. Although the site borders on to Akeman Street, a Roman road, no anomalies of obvious archaeological potential have been identified, either adjacent to the road or elsewhere within the application area. On the basis of the survey the archaeological potential of the site is considered to be low.

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Report Information

Report Type:	Geophysical Survey
Location:	Ambrosden, near Bicester
County:	Oxfordshire
Grid Reference:	SP 602 206
Period(s) of activity:	post-medieval/modern
Report Number:	2744
Project Number:	4380
Site Code:	BIC15
OASIS ID:	archaeol11- 208448
Planning Application No.:	
Museum Accession No.:	n/a
Date of fieldwork:	March 2015
Date of report:	March 2015
Project Management:	Sam Harrison BSc MSc MCIfA
Fieldwork:	Ross Bishop BA
	Alex Schmidt BA
Report:	Alistair Webb BA MCIfA
Illustrations:	Sam Harrison
Photography:	Site staff
Research:	n/a

Authorisation for distribution: ----------

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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by the Environmental Dimension Partnership (EDP - the Consultant), on behalf of their client, to undertake a geophysical (magnetometer) survey on land to the south-east of Bicester (see Fig. 1). The work was undertaken in order to inform a possible planning application for the proposed development of the site. The work was undertaken in accordance with policy contained within the National Planning Policy Framework (DCLG 2012), in line with current best practice (CIfA 2014; David *et al.* 2008) and to a Project Design (Harrison 2015) approved by the Consultant and Richard Oram, Oxfordshire County Council. The survey was carried out between March 16th and March 20th 2015 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The proposed development area (PDA) comprises an irregularly shaped parcel of land, centred at SP 602 206, located 1km north of Ambrosden and 2km south-east of Bicester. The survey covered approximately 16 hectares over three adjoining fields which border the A41 to the south. All of the site was under permanent pasture (see plates) and agricultural land extends to all other sides. The PDA is flat and situated at approximately 75m above Ordnance Datum (aOD).

Soils and geology

The underlying bedrock mainly comprises mudstone of the Peterborough Member. No superficial deposits are recorded (British Geological Survey 2015). The soils in this area are classified in the Wickham 2 association, characterised as slowly permeable seasonally waterlogged loams over clay (Soil Survey of England and Wales 1983).

2 Archaeological Background

Data collected from the Oxfordshire Historic Environment Record (OHER) as part of a Desk-Based Assessment (Environmental Dimension Partnership *in prep.*) has established that there are no designated or known non-designated heritage assets within the site. In the wider area, the OHER records the presence of two Bronze Age ring ditches (MOX5027, 5188) 1km to the east and 1km south-east of the site. Finds of early Iron Age to Roman pottery and coins have also been found 1km to the south-east (MOX 5005). The course of the Roman road of Akeman Street runs close to the southern boundary of the site (MOX5014) and there is the potential for the presence of unrecorded archaeology associated with activity in relation to this to be present within the site.

3 Aims and Methodology

Magnetometer Survey

The aim of the geophysical survey as described in the WSI (Harrison 2015) is to, as far as possible, identify the presence or absence, and extent and layout, of buried archaeological remains across the PDA, through the interpretation of magnetic anomalies identified following the processing of data gathered during the survey.

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. Features such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the Earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney and Gater 2003). Further information on types of anomaly is provided as Appendix 1.

During this survey Bartington Grad601 magnetic gradiometers were used, as specified in the WSI. The instruments were calibrated to take readings at 0.25m intervals on zig-zag traverses 1m apart within a series of 30m by 30m grids resulting in 3600 readings per 30m grid square. The data was stored in the memory of the instrument before being downloaded to a lap-top computer every day in preparation for data processing and interpretation. The survey grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model) providing an accuracy greater than 0.01m. The locations of the survey grid and anomalies are available as a DXF file. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Data Processing

Geoplot 3 (Geoscan Research) software was used to process the data and present it in this report in XY trace plot and greyscale formats. In the XY plot format the data shown is 'raw' with no processing other than grid biasing having been done. An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from 'iron spikes'. The data in the greyscale images has been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial

data constructs so as to maximise the clarity and interpretability of the archaeological anomalies.

Presentation

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays the processed magnetometer data from the whole survey at a scale of 1:2500 with an overall interpretation plot at the same scale displayed in Figure 3. Detailed data plots ('raw' and processed) and interpretative figures are presented at a scale of 1:1000 in Figures 4 to 12 inclusive.

Further information on magnetic survey and characterisation and interpretation of anomaly types are given in Appendix 1. Appendix 2 describes the composition and location of the site archive and Appendix 3 reproduces the OASIS entry.

The survey methodology, report and any recommendations comply with the Project Design (Harrison 2015) and guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014).

Disclaimers

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services WYAS staff.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

4 Results and Discussion

Overview

The magnetic background across the survey area is characterised by numerous 'spike' anomalies throughout giving the data a 'speckled' appearance. These responses are most frequent to the west of the site in Field 1 and the western half of Field 2 (see Fig. 3). It is not clear as to the cause of these anomalies; there are no recorded superficial deposits which can give rise to this type and density of anomalies if magnetic gravels are present. One possibility

is that the recorded anomalies are due to the spreading of organic waste on the fields; similar effects have been recorded recently on sites where organic waste has been spread and it is thought that the anomalies may be caused by the decomposition process. However, despite the presence of this ferrous background there is no reason, based on the soils and geology, that the magnetometer survey could not have identified any significant archaeological remains, if present.

Ferrous Anomalies

Ferrous anomalies, as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling (and see above).

A linear dipolar anomaly, **A**, running parallel with the A41 along the southern site boundary is caused by a sub-surface pipe.

Three discrete areas where the data is characterised by extremely high magnitude readings are identified, none of which correspond with any obvious surface feature. **B** is located immediately south of an extant farm building in an area which is shown as marshy ground on the first and second edition OS mapping. It is suggested that this area of disturbed readings is due to the infilling of this poorly drained land.

A square area of high magnitude readings, **C**, in the south-eastern corner of Field 1, correlates with a small rectangular enclosure within which a structure is recorded on the 1899 OS map edition. It is likely that the magnetic disturbance is due to the spreading of material following the demolition of this structure which is not recorded on the first or third edition mapping.

An irregular spread of high magnitude readings, **D**, identified in the south-western corner of Field 1 is also likely to be due to the dumping/spreading of magnetic material, perhaps around a gateway.

Other magnetic disturbance around the periphery of the site and along field boundaries is due to the proximity of ferrous material in the boundaries or adjacent buildings.

Agricultural Anomalies

Broad, slightly curving parallel linear anomalies are identified in Field 3 to the east of the site on two alignments, east/west and north-west/south-east. These anomalies are indicative of post-medieval and ridge and furrow cultivation.

Possible Archaeological Anomalies

Three linear trend anomalies, **E**, **F** and **G**, of uncertain origin are identified. In all cases an archaeological cause is considered unlikely.

Discontinuous linear anomaly **D** runs for 75m on a south-westerly bearing from the northern boundary of Field 3. The most likely cause is considered to be a drain.

Two parallel linear anomalies, **F** and **G**, run on a broadly northern orientation 50m from the southern site boundary in Field 2. These trend anomalies are parallel and immediately east of the area of disturbance, **C**, attributed to a demolished structure. It is thought that these anomalies are associated with this 19th century building/enclosure.

5 Conclusions

Anomalies due to ridge and furrow cultivation and late 19th century and modern activity have been recorded. Large numbers of discrete ferrous responses are interpreted as probably being due to the spreading of organic waste. The survey has not identified any anomalies of obviously archaeological origin, although the site does border a Roman road to the south. Three anomalies of uncertain origin are recorded and, although an archaeological cause for any or all three of these anomalies cannot be dismissed, modern or agricultural causes are considered more likely. Therefore, on the basis of the survey, the archaeological potential of the site is considered to be very low.

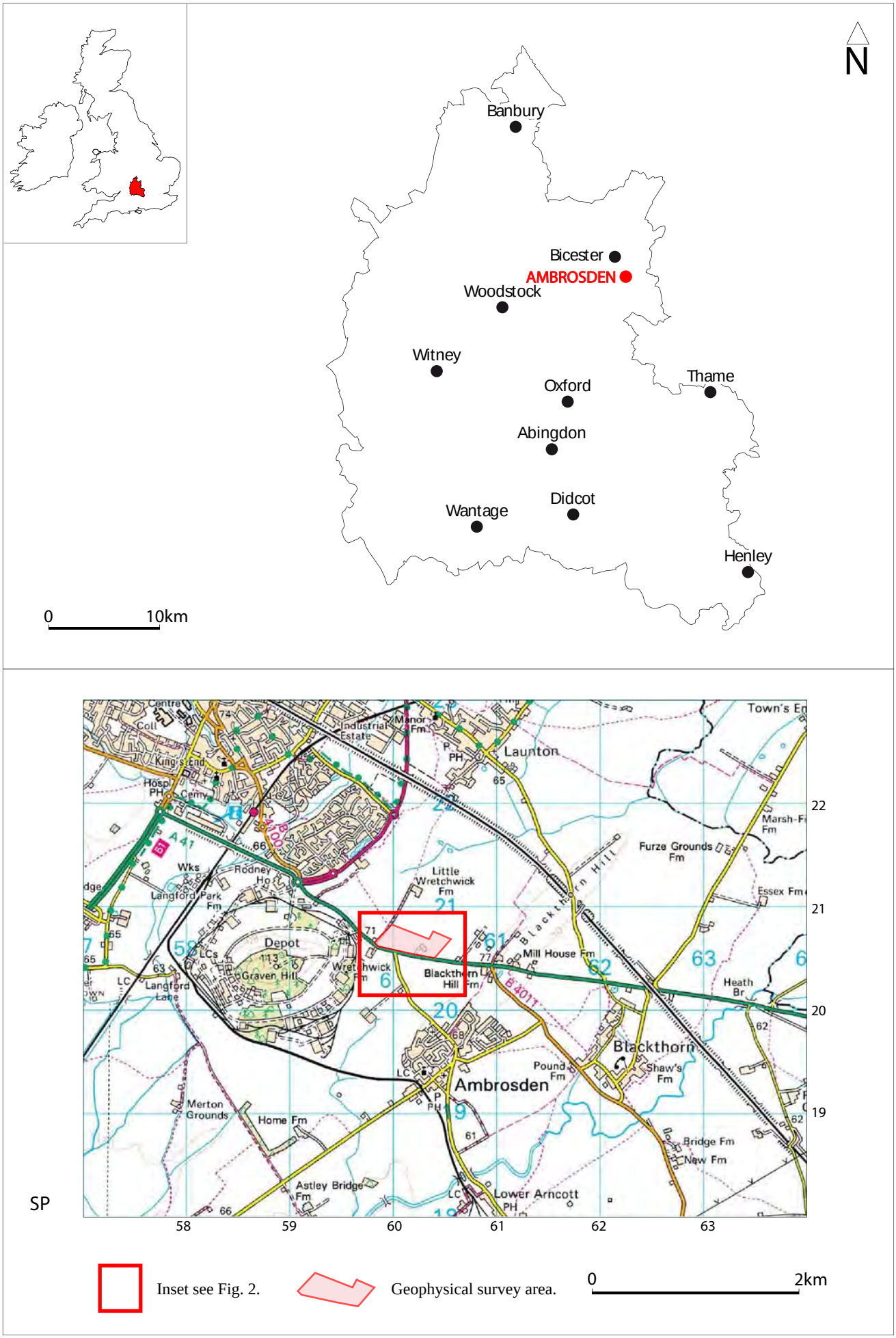

Fig. 1. Site location

PROPOSED DEVELOPMENT AREA

LOCATION AND DIRECTION OF PLATES

SECTOR BOUNDARY

ROMAN ROAD

SECTOR 1
SEE FIGS 4-6

SECTOR 2
SEE FIGS 7-9

SECTOR 3
SEE FIGS 10-12

FIELD 1

FIELD 2

FIELD 3

AKEMAN STREET

A41

PLOUGHLEY ROAD

2.0

-1.0

nT

N

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

4600 00

4605 00

2205 00

0 100m

Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A3)

	PROPOSED DEVELOPMENT AREA
	SECTOR BOUNDARY
	ROMAN ROAD

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	DIPOLAR LINEAR	SERVICE PIPE
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	RIDGE AND FURROW
	LINEAR TREND	UNKNOWN

SECTOR 1
SEE FIGS 4-6

SECTOR 2
SEE FIGS 7-9

SECTOR 3
SEE FIGS 10-12

FIELD 1

FIELD 2

FIELD 3

A

B

C

D

E

F

G

AKEMAN STREET

A41

PLOUGHLEY ROAD

N

460000

460500

220500

0 100m

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Fig. 3. Overall interpretation of magnetometer data (1:2500 @ A3)

SECTOR BOUNDARY

N

2.0

-1.0

nT

FIELD 1

2208 00

2206 00

4600 00

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0 30m

Fig. 4. Processed greyscale magnetometer data; Sector 1 (1:1000 @ A3)

SECTOR BOUNDARY

N

FIELD 1

220800

220600

460000

20.0 nT/cm

0 30m

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Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 5. XY trace plot of minimally processed magnetometer data; Sector 1 (1:1000 @ A3)

— —	SECTOR BOUNDARY

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL

N

FIELD 1

D

C

220800

206000

460000

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

0 30m

Fig. 6. Interpretation of magnetometer data; Sector 1 (1:1000 @ A3)

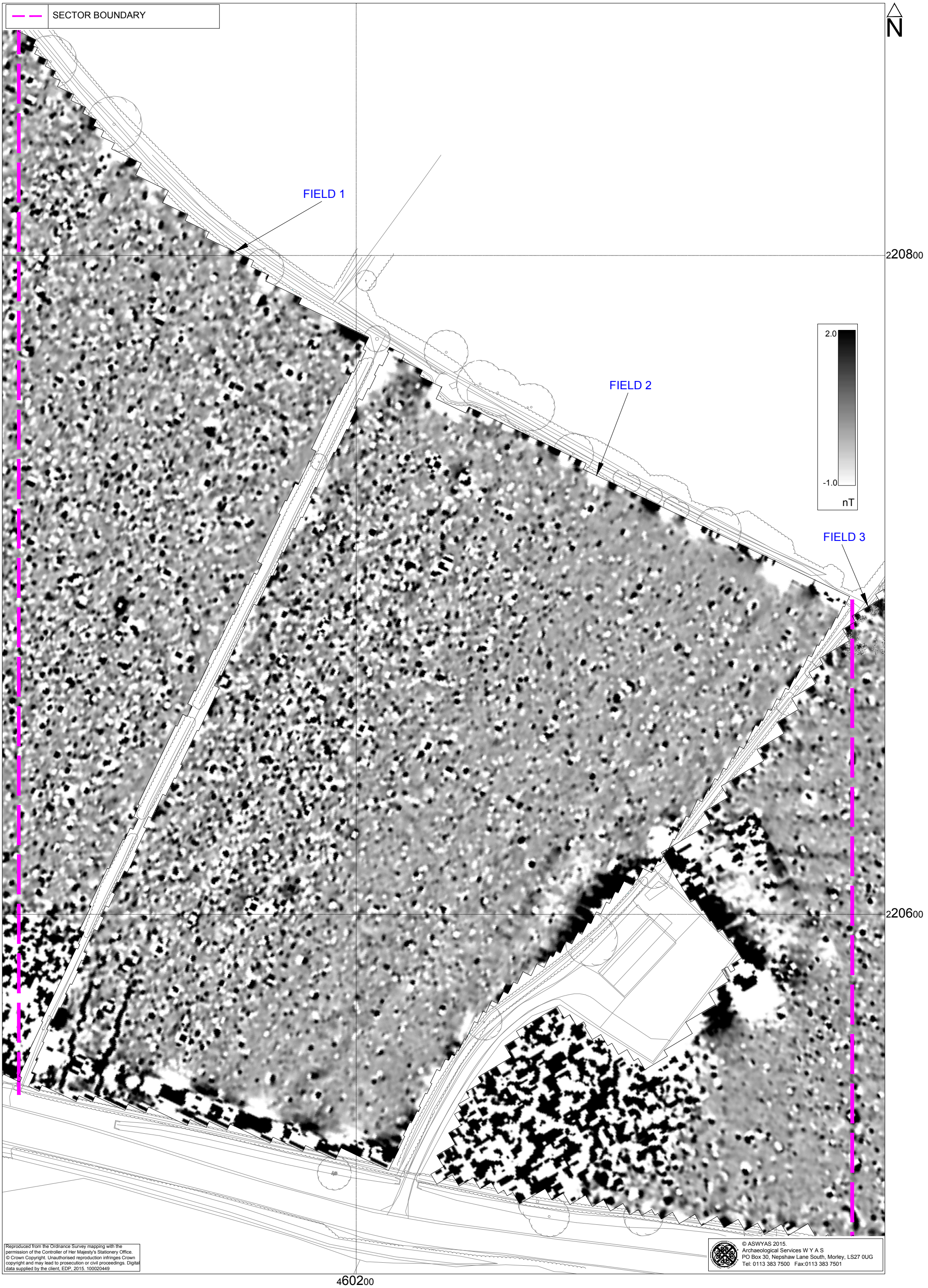

Fig. 7. Processed greyscale magnetometer data; Sector 2 (1:1000 @ A3)

SECTOR BOUNDARY

N

FIELD 1

FIELD 2

FIELD 3

220800

220600

20.0 nT/cm

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

460200

Fig. 8. XY trace plot of minimally processed magnetometer data; Sector 2 (1:1000 @ A3)

0 30m

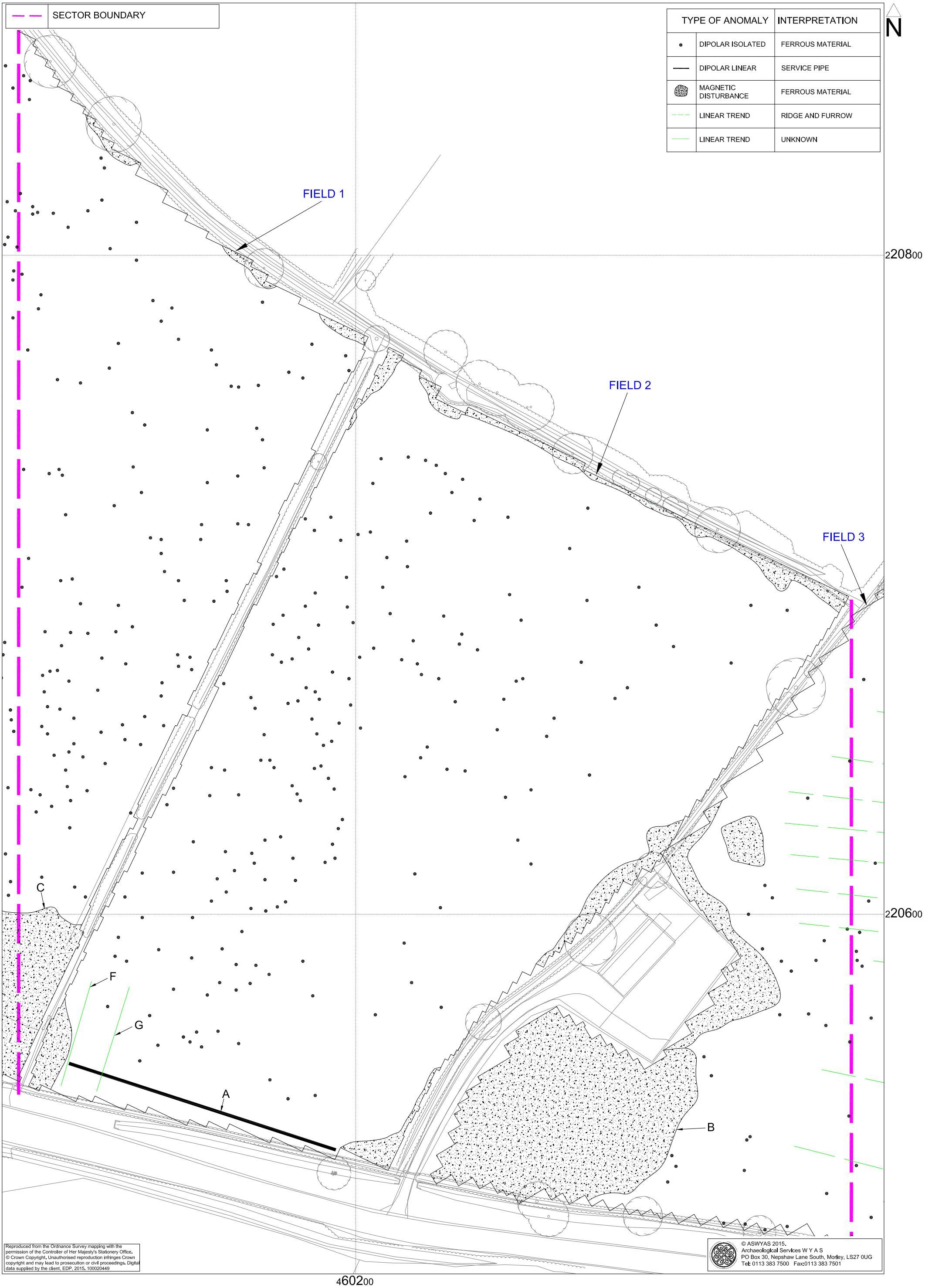

Fig. 9. Interpretation of magnetometer data; Sector 2 (1:1000 @ A3)

SECTOR BOUNDARY

N

FIELD 3

2208 00

2206 00

2.0

-1.0

nT

4604 00

4606 00

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Archaeological Services W Y A S
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Tel: 0113 383 7500 Fax:0113 383 7501

0 30m

Fig. 10. Processed greyscale magnetometer data; Sector 3 (1:1000 @ A3)

SECTOR BOUNDARY

N

FIELD 3

220800

220600

460400

460600

20.0 nT/cm

0 30m

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 11. XY trace plot of minimally processed magnetometer data; Sector 3 (1:1000 @ A3)

— —	SECTOR BOUNDARY

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	FIELD DRAIN
	LINEAR TREND	UNKNOWN

N

220800

FIELD 3

E

220600

460400

460600

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

0 30m

Fig. 12. Interpretation of magnetometer data; Sector 3 (1:1000 @ A3)

Plate 1. General view of Field 1, looking south-west

Plate 2. General view of Field 2, looking north

Plate 3. General view of Field 3, looking north

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough. An advantage of magnetic susceptibility over magnetometry is that a certain amount of occupational activity will cause the same proportional change in susceptibility, however weakly magnetic is the soil, and so does not depend on the magnetic contrast between the topsoil and deeper layers. Susceptibility survey is therefore able to detect areas of occupation even in the absence of cut features. On the other hand susceptibility survey is more vulnerable to the masking effects of layers of colluvium and alluvium as the technique, using the Bartington system, can generally only measure variation in the first 0.15m of ploughsoil.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Appendix 2: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Oxfordshire Historic Environment Record).

Appendix 3: OASIS Form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: archaeol11-208448

Project details

Project name	South-east Bicester, Phase II: Geophysical Survey
Short description of the project	A geophysical (magnetometer) survey, covering approximately 16 hectares, was carried out on agricultural land south-east of Bicester, prior to the submission of a planning application for the proposed development of the site. Anomalies indicative of ridge and furrow cultivation and modern activity have been identified. Although the site borders on to Akeman Street, a Roman road, no anomalies of obvious archaeological potential have been identified, either adjacent to the road or elsewhere within the application area. On the basis of the survey the archaeological potential of the site is considered to be low.
Project dates	Start: 16-03-2015 End: 20-03-2015
Previous/future work	Not known / Not known
Any associated project reference codes	BIC15 - Sitecode
Any associated project reference codes	4380 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N\A None
Monument type	N\A None
Significant Finds	N\A None
Significant Finds	N\A None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology (other)	Peterborough Member

Drift geology (other)	NONE
Techniques	Magnetometry

Project location

Country	England
Site location	OXFORDSHIRE CHERWELL BICESTER South-east Bicester, Phase II
Study area	16.00 Hectares
Site coordinates	SP 602 206 51.8802708671 -1.12533423513 51 52 48 N 001 07 31 W Point

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Environmental Dimension Partnership
Project design originator	Archaeological Services WYAS
Project director/manager	Harrison, S.
Project supervisor	Schmidt, A.
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive recipient	N/A
Digital Contents	"other"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	South-east Bicester, Phase II, Oxfordshire: Geophysical Survey
Author(s)/Editor(s)	Webb, A.
Other bibliographic details	Report Number 2744
Date	2015
Issuer or publisher	ASWYAS
Place of issue or publication	Morley

Description	A4 blue comb bound report
Entered by	Sam Harrison (sharrison@aswyas.com)
Entered on	9 April 2015

OASIS:

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