ARCHAEOLOGICAL SERVICES WYAS

Land at Great Horwood Buckinghamshire

Geophysical Survey

Report no. 2596

April 2014

Client: Taylor Wimpey South Midlands

REGISTERED IA ORGANISATION

Land at Great Horwood
Buckinghamshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey covering 2.1 hectares was carried out on agricultural land at Great Horwood, Buckinghamshire, to provide an evaluation of the archaeological potential prior to the proposed development of the site. No anomalies of archaeological significance have been identified by the survey. Anomalies indicative of ridge and furrow cultivation have been recorded in the survey, however these are likely to be of local historical interest only. On the basis of the geophysical survey the archaeological potential of the site is considered to be low.

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Report Information

Client:	Taylor Wimpey South Midlands
Address:	ACD Archaeology Ltd, Rodbourne Rail Business Centre, Grange Lane, Malmesbury, SN16 0ES
Report Type:	Geophysical Survey
Location:	Great Horwood
County:	Buckinghamshire
Grid Reference:	SP 776 311
Period(s) of activity:	Post-medieval
Report Number:	2596
Project Number:	4230
Site Code:	GHW14
OASIS ID:	archaeol11-176404
Planning Application No.:	
Museum Accession No.:	n/a
Date of fieldwork:	March 2014
Date of report:	April 2014
Project Management:	David Harrison BA MSc MIfA
Fieldwork:	Chris Sykes BA MSc
	Thomas Fildes BA
Report:	Sam Harrison BSc MSc MIfA
Illustrations:	Sam Harrison BSc MSc MIfA
Photography:	Chris Sykes
Research:	n/a

Authorisation for distribution: --

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Cert. No. 125

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by ACD Archaeology Ltd. (the Consultant) on behalf of Taylor Wimpey South Midlands (the Client) to undertake a geophysical (magnetometer) survey of agricultural land to the east of Great Horwood, prior to the determination of a planning application for the proposed development of the land. The work was undertaken in accordance with a Project Design (Harrison 2014) supplied to and approved by the BCC archaeological advisor to AVDC, with guidance contained within the National Planning Policy Framework (2012) and in line with current best practice (David *et al.* 2008). The survey was carried out on March 26th 2014 in order to provide additional information on the archaeological potential of the site.

Site location, topography and land-use

The Proposed Development Area (PDA) is situated to the east of the historic core of Great Horwood, Buckinghamshire (see Fig. 1) and comprises a single rectangular-shaped pasture field, centred at SP 7753 3099 (see plates), measuring 2.1 hectares. The site is located south of Little Horwood Road and is to the south of Weston Road and The Close, and immediately east of a caravan park on Willow Road. Hedgerows bound the site to the south and east (see Fig. 2). The field slopes down from 125m above Ordnance Datum (aOD) in the north-east to 119m aOD in the south-west.

Soils and geology

The underlying bedrock comprises Weymouth Member – mudstone overlain by superficial deposits of till and glaciofluvial sands and gravels (British Geological Survey 2014).

The soils in this area are classified in the Hanslope association, characterised as slowly permeable calcareous clays (Soil Survey of England and Wales 1983).

2 Archaeological Background

An Archaeology and Heritage Assessment (ACD Archaeology 2014) for the proposed development identified no known heritage assets within the PDA, although the site is located on the edge of a known medieval or earlier settlement and earlier, prehistoric activity is recorded within the wider landscape. The layout of the field remains the same as when it was enclosed in the mid-19th century, with residual ridge and furrow earthworks surviving in the north-western corner of the field. The Archaeology and Heritage Assessment concludes that the site has a low archaeological potential and that '*it is extremely unlikely that remains worthy of preservation in situ exist within the site*'.

3 Aims, Methodology and Presentation

The aims and objectives of the programme of geophysical survey are to gather sufficient information to establish the presence/absence, character and extent of any archaeological remains within the specific areas to be impacted by the proposed development), and to inform further strategies should they be necessary.

The aims of the survey are:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features;
- to produce a comprehensive site archive and report.

Magnetometer survey

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). Bartington Grad601 magnetic gradiometers were used during the survey, taking readings at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 is a large scale (1:2500) location plan displaying the processed magnetic data. Detailed data plots (‘raw’ and processed) and an interpretative figure are presented at a scale of 1:1000 in Figures 3, 4 and 5.

Further technical information on the equipment used, data processing and survey methodologies is given in Appendix 1 and Appendix 2. Appendix 3 describes the composition and location of the site archive.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2014) and guidelines outlined by English Heritage (David *et al.* 2008) and by the Institute for Archaeologists (IfA 2013).

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 staff.

4 Results and Discussion (see Figs 3, 4 and 5)

No anomalies of archaeological potential have been identified by the geophysical survey. Several anomalies have been identified which fall into two different categories according to their origin.

The results and subsequent interpretation of data from the geophysical survey 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.

Ferrous Anomalies

Ferrous responses, either as individual 'spike' anomalies or more extensive areas of magnetic disturbance, are typically caused by modern ferrous (magnetic) debris, either on the ground surface or in the plough-soil, or are due to the proximity of magnetic material in field boundaries, buildings or other above ground features. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation as ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. Throughout the site iron spike anomalies are common and there is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Areas of disturbance around the periphery of the PDA are due to ferrous material forming part of, or incorporated into, the field boundaries or to the proximity of residential properties and caravans to the north and west.

Agricultural Anomalies

A series of parallel, slightly sinuous trends have been identified throughout the PDA. These are characteristic of the medieval and post-medieval agricultural practice of ridge and furrow cultivation, evidence of which survives as low earthworks, especially in the north-west. The characteristic striped appearance to the data in these fields is a result of the magnetic contrast between the now part-filled furrows and the ridges. Whilst this cultivation may be of local historical interest it is unlikely to be of any archaeological significance.

A single linear anomaly has been identified in the north-east of the site. This is thought to be agricultural in origin.

5 Conclusions

The data is dominated by frequent ferrous 'spike' anomalies caused by scatters of modern ferrous debris within the topsoil or possibly a magnetic response from the superficial deposits and by the linear anomalies indicative of ridge and furrow cultivation, which survive as faint earthworks. Consequently, on the basis of the geophysical survey, the archaeological potential of the site is considered to be low.

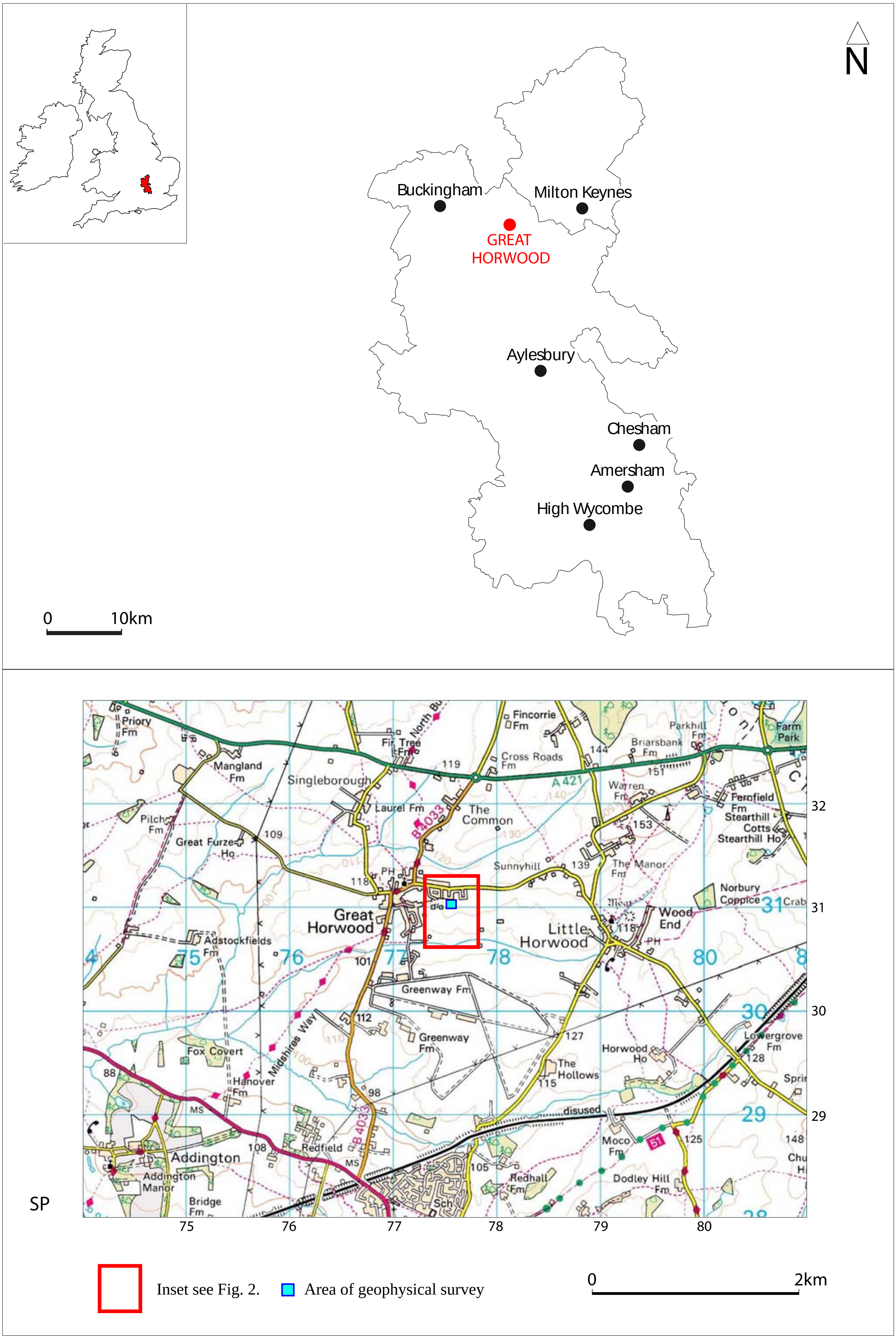

Fig. 1. Site location

Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A4)

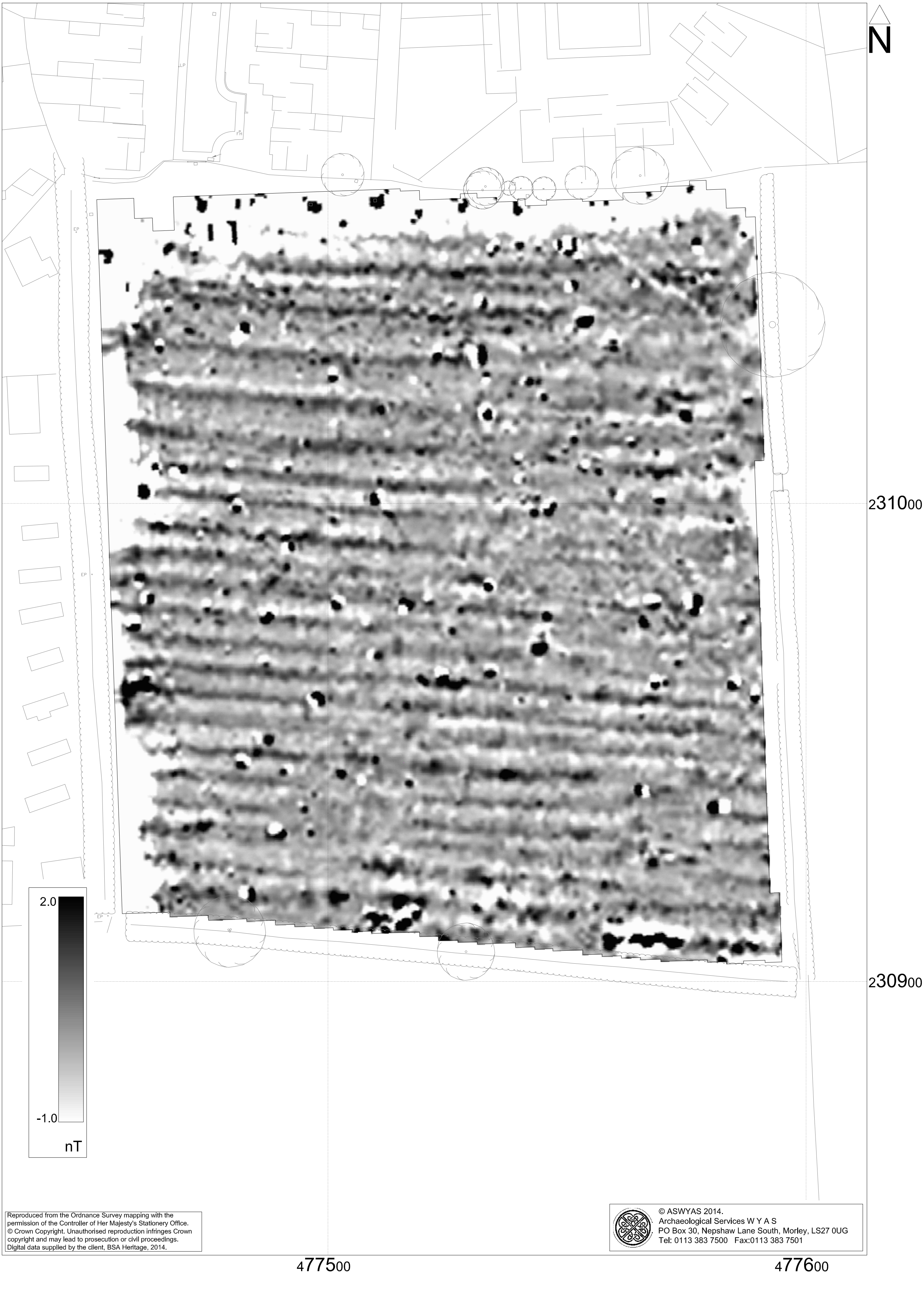

Fig. 3. Processed greyscale magnetometer data (1:1000 @ A4)

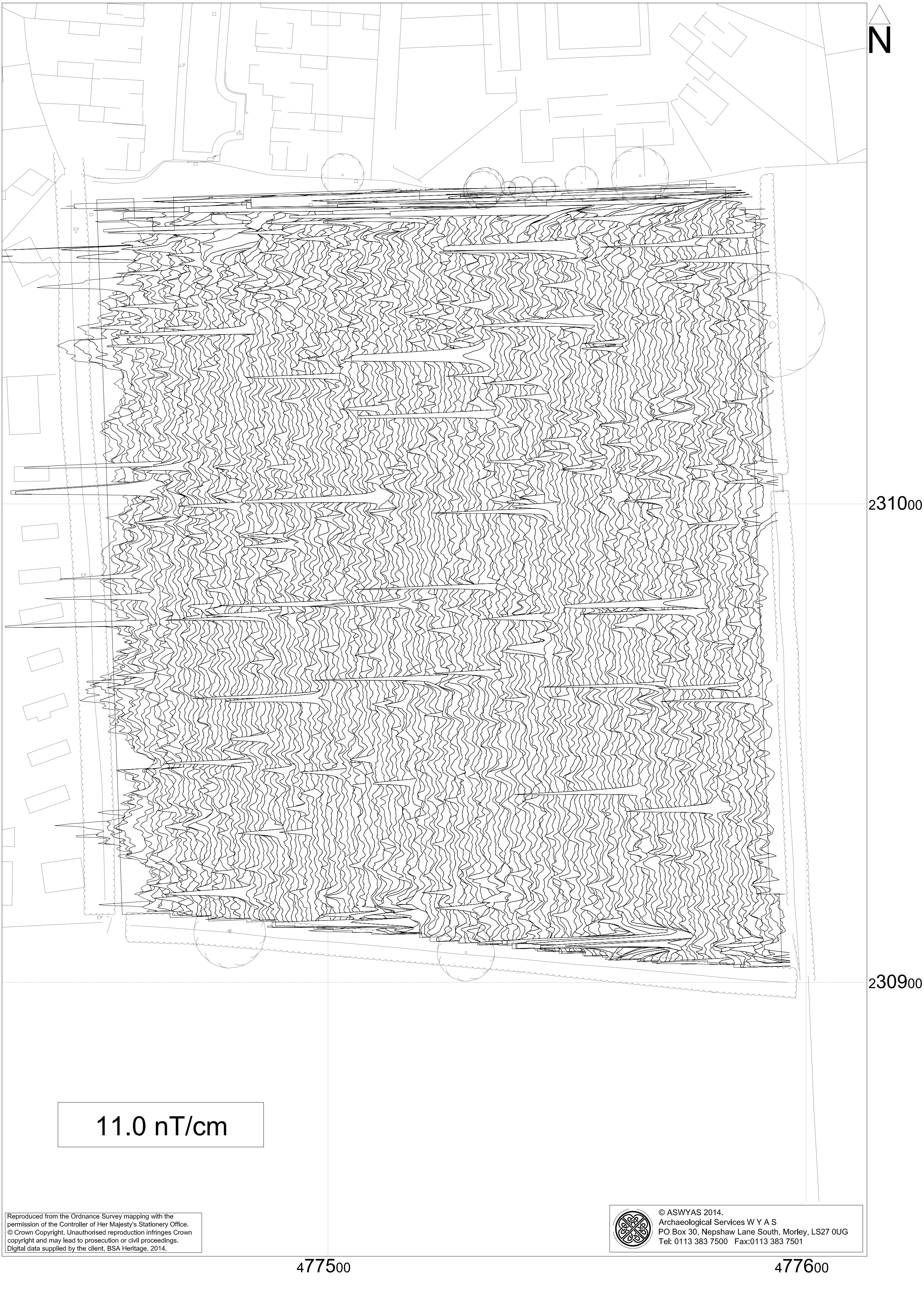

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1000 @ A4)

0 25m

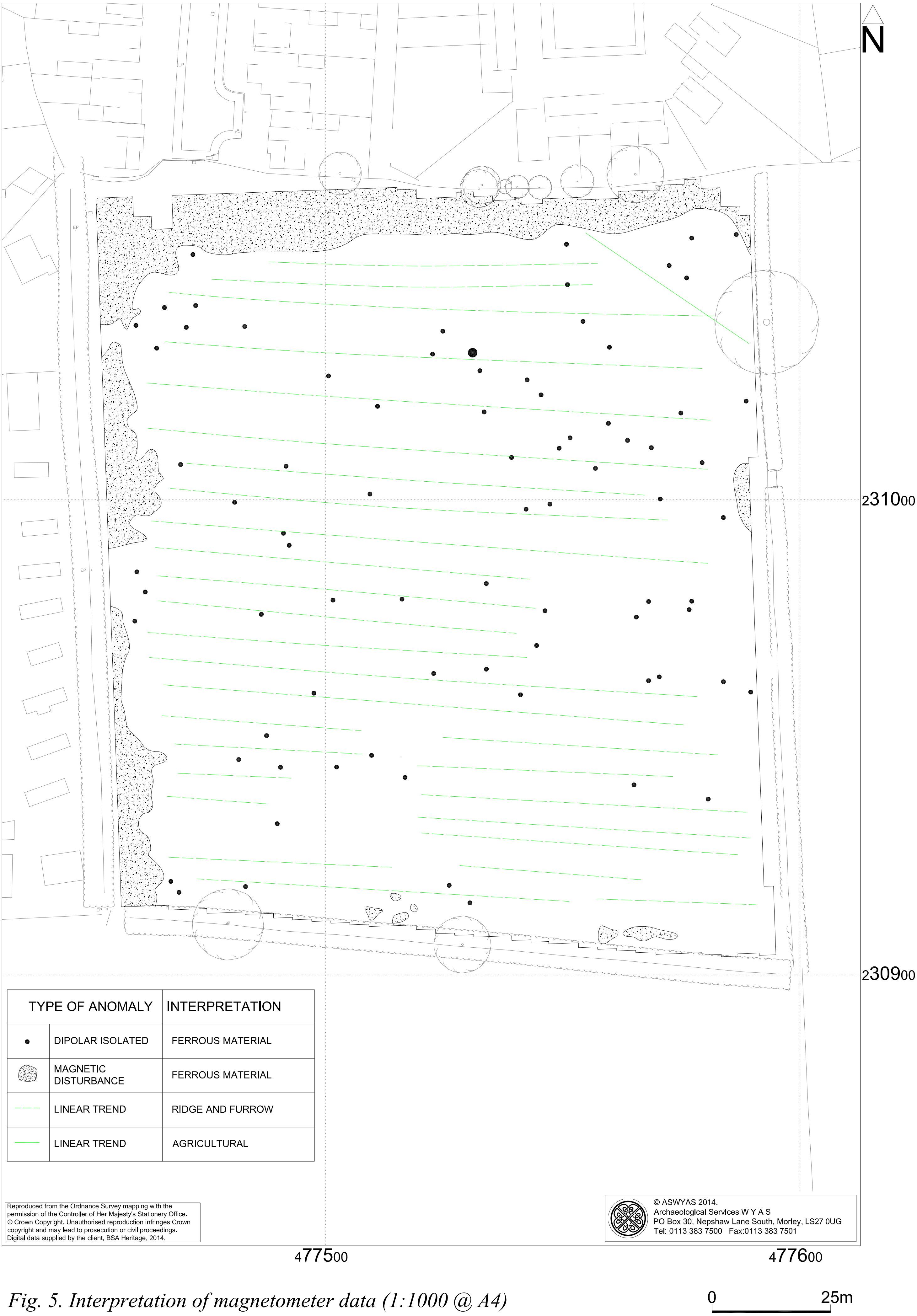

Fig. 5. Interpretation of magnetometer data (1:1000 @ A4)

Plate 1. General view of survey area, looking south

Plate 2. General view of survey area, looking north-east

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 so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue 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.

Methodology: Magnetic Susceptibility Survey

There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the sample. For field surveys a Bartington MS2 meter with MS2D field loop is used due to its speed and simplicity. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

Methodology: Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that a ‘negative’ scanning result should be validated by sample detailed magnetic survey (see below).

The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.25m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

Data Processing and Presentation

The detailed gradiometer data has been presented in this report in XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. 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 and to maximise the clarity and interpretability of the archaeological anomalies.

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'. Geoplot 3 software was used to create the XY trace plots.

Geoplot 3 software was used to interpolate the data so that 3600 readings were obtained for each 30m by 30m grid. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 2: Survey location information

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The accuracy of this equipment is better then 0.01m. 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.

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

Appendix 3: 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.

Upon completion of the project ASWYAS will make their work accessible to the wider research community by submitting digital data and copies of the report on line to OASIS and lodging the digital archive 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 Buckinghamshire Historic Environment Record).

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