Archaeological Services WYAS

Land to the east of Selborne Road
Alton
Hampshire

Geophysical Survey

Report no. 2543

November 2013

Client: Harvington Properties Ltd

Land to the east of Selborne Road
Alton
Hampshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey covering approximately 9 hectares was carried out on agricultural land to the east of Selborne Road, Alton, to inform the determination of an outline planning application for the proposed development of the site. Anomalies caused by the infilling of former gravel workings, geology, agricultural and modern activity have been identified. No anomalies of obvious archaeological origin have been noted. On the basis of the magnetic survey the archaeological potential of the site is considered to be low.

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Report Information

Client:	Harvington Properties Ltd
Address:	417 Finchley Road, Hampstead, London, NW3 6HJ
Report Type:	Geophysical Survey
Location:	Land east of Selborne Road, Alton
County:	Hampshire
Grid Reference:	SU 714 384
Period(s) of activity:	post-medieval
Report Number:	2543
Project Number:	4148
Site Code:	ALH13
OASIS ID:	archaeol11- 165685
Planning Application No.:	n/a
Museum Accession No.:	n/a
Date of fieldwork:	November 2013
Date of report:	November 2013
Project Management:	Sam Harrison BSc MSc MIfA
Fieldwork:	Tom Fildes BA Alex Schmidt BA Chris Sykes BA MSc Dan Waterfall BA
Report:	Alistair Webb BA MIfA
Illustrations:	Sam Harrison
Photography:	Chris Sykes
Research:	n/a

Authorisation for distribution: --

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PO Box 30, Nepshaw Lane South, Morley, Leeds
LS27 0UG
Telephone: 0113 383 7500.
Email: admin@aswyas.com

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Jo Vallender of The Environmental Dimension Partnership (the Consultant), on behalf of Harvington Properties Ltd (the Client), to undertake a geophysical (magnetometer) survey of land on the south-western edge of Alton, Hampshire (see Fig. 1), prior to the submission of a planning application for the proposed development of the site. The work was undertaken in accordance with a Project Design (Harrison 2013) supplied to and approved by Hannah Sluck (Hampshire County Council) and the Consultant, 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 between November 6th and November 8th 2013 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 immediately west of Borovere Farm, centred at SU 714 384, and comprises two separate land parcels separated by the A339 Selborne Road (see Fig. 2). The larger area, to the east of the A339, is bounded to the north-west by the Mid Hampshire railway line, to the north by residential properties, to the east by Borovere Farm and to the south by agricultural land and comprises three large pasture fields (see Plates 2, 3 and 4). The much smaller, triangular shaped, western part of the site, also under permanent pasture, lies to the east of Selborne Road with Winchester Road forming the western boundary (see Fig. 2). This part of the site comprises five small fields separated by post and wire fencing (see Plate 1). Agricultural land lies to the south.

The site is situated on gently sloping land at approximately 120m above Ordnance Datum (aOD), rising to the highest point of the site, approximately 130m aOD, in the north-east corner of Field 8 (see Plate 4).

Soils and geology

The underlying bedrock comprises Holywell Nodular Chalk Formation to the north-east and Zig Zag Chalk Formation to the south-west (see Fig. 2). Superficial deposits of Head – Clay, Silt, Sand and Gravel are recorded in the west of the site covering the whole of the smaller triangular shaped area (British Geological Survey 2013). There are no recorded superficial deposits across the remainder of the site. The soils are classified in the Coombe 1 association, being characterised as well-drained, calcareous fine silts (Soil Survey of England and Wales 1983).

2 Archaeological Background

No archaeological information on the PDA was available at the time of writing but it is understood that there are no known heritage assets within the site boundary. Analysis of the 1873 Ordnance Survey map shows that the field boundaries remain as shown 140 years ago. A gravel pit is shown to the west of the PDA (see below).

3 Aims, Methodology and Presentation

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim a magnetometer survey covering all of the PDA was carried out, an area of approximately 9 hectares.

The general objectives of the geophysical survey were:

- 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; and
- to prepare a report summarising the results of the survey.

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 greyscale magnetometer data. Figure 3 is an overall data interpretation plot at the same scale. Detailed data plots ('raw' and processed) and full interpretative figures are presented at a scale of 1:1000 in Figures 4 to 9 inclusive.

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 Project Design (Harrison 2013) and guidelines outlined by English Heritage (David *et al* 2008) and by the Institute for Archaeologists (IfA 2010). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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 4 to 9 inclusive)

The anomalies identified by the survey fall into a number of different types and categories according to their origin and these are discussed below and cross-referenced to specific examples and locations within the site.

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 PDA individual iron 'spike' anomalies are common but there is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the soil.

Traversing west/east across Field 8 is a high-magnitude dipolar linear anomaly, **A**, that locates the route of a buried service pipe which turns to the north-west at the northern apex of Field 7. Another buried pipe, **B**, is identified in Field 2 running north-west/south-east.

A large area of magnetically disturbed readings, **C**, noted in Field 5 and also in Field 4 corresponds with an area of former gravel pits that are recorded on the first edition Ordnance Survey mapping of 1873; in this area the bedrock geology is overlain with the superficial head deposits. The high magnitude readings are due to the magnetic properties of the material used to backfill the former workings.

Geological Anomalies

A dense cluster of anomalies in Field 8, **D**, are prominent in the data set to the south of the pipe, **A**. There are no recorded superficial deposits in this part of the site and there is no apparent pattern that might indicate an archaeological origin. However, it is considered likely that these anomalies are likely to have a geological origin, perhaps being due to outcropping bedrock geology or possibly to ground disturbance relating to the cutting of the trench for the pipe immediately to the north.

In Field 7 curvilinear anomaly, **E**, correlates with the approximate position and alignment of the geological boundary between the Holywell Nodular Chalk, to the north-east, and the Zig Zag Chalk to the south-west (see Fig. 2) and is also oblique to the ridge and furrow anomalies (see below).

Agricultural Anomalies

Series of parallel linear trend anomalies are visible in the three largest fields (6, 7 and 8). In Field 8 they are aligned south-west/north-east whilst in Field 6 and Field 7 they are north-west/south-east. These anomalies are agricultural in origin being caused by ridge and furrow ploughing. The characteristic striped appearance of the anomalies reflects the magnetic contrast between the former ridges and soil-filled furrows.

Two other linear trend anomalies, **F** and **G**, have been identified. A definite origin for both anomalies is uncertain but on balance they are considered most likely to be caused by agricultural activity. Anomaly **F** in Field 7 is aligned north-north-west/south-south-east on the same alignment as the ridge and furrow anomalies identified across all of this field. This anomaly stands out as it is of higher magnitude than the ridge and furrow anomalies and may be indicative of a ploughing headland. In Field 6 Anomaly **G**, is aligned north-west/south-east at an oblique angle to the ridge and furrow anomalies. This anomaly is interpreted as being caused by a field drain.

5 Conclusions

Anomalies resulting from 19th century gravel extraction, agricultural and modern activity and geological variation have been identified by the survey. However, no anomalies of obvious archaeological potential have been identified and on this basis the site is assessed as of low archaeological potential based solely on the results of the magnetometer survey.

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.

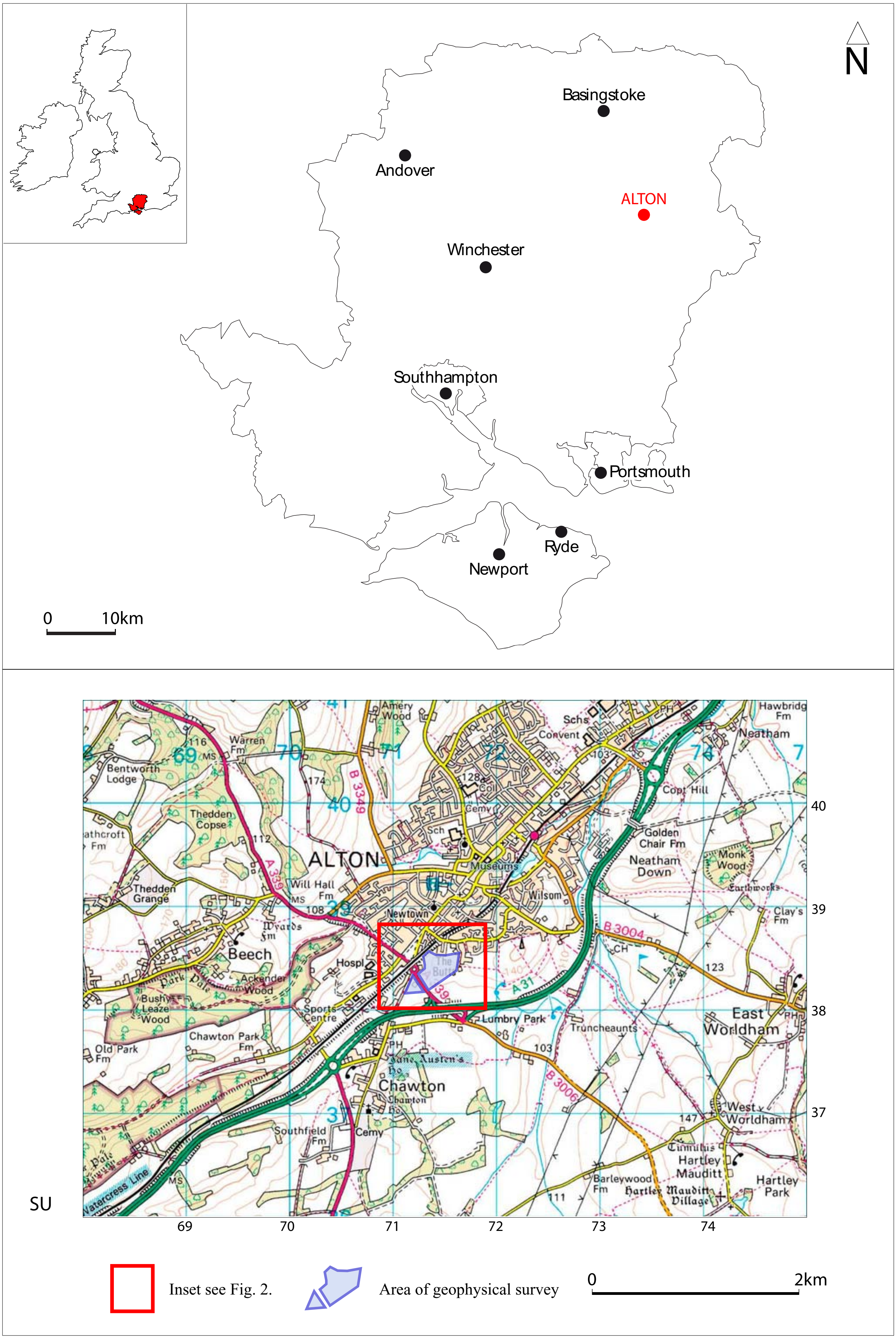


Fig. 1. Site location

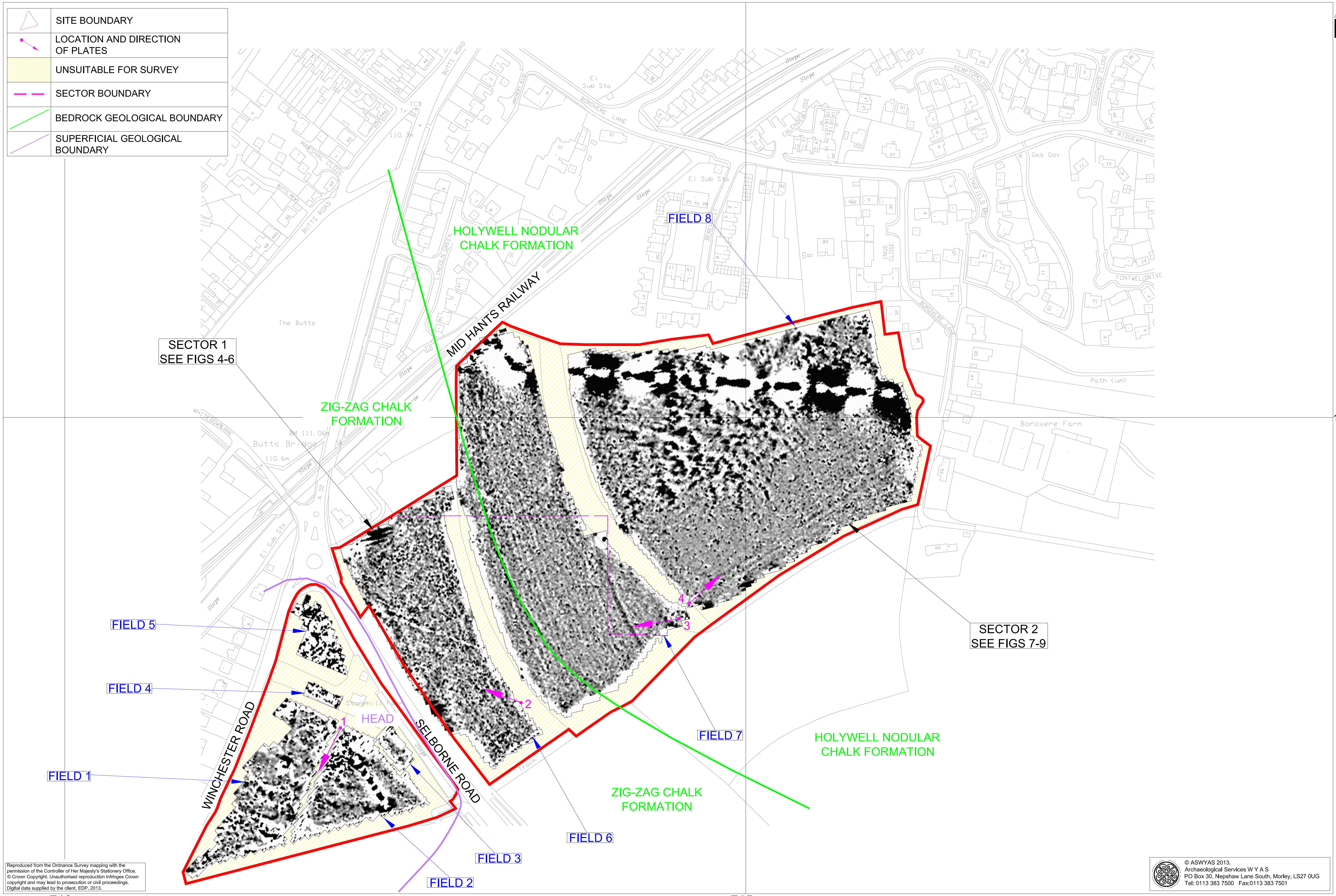


Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A3)

0 50m

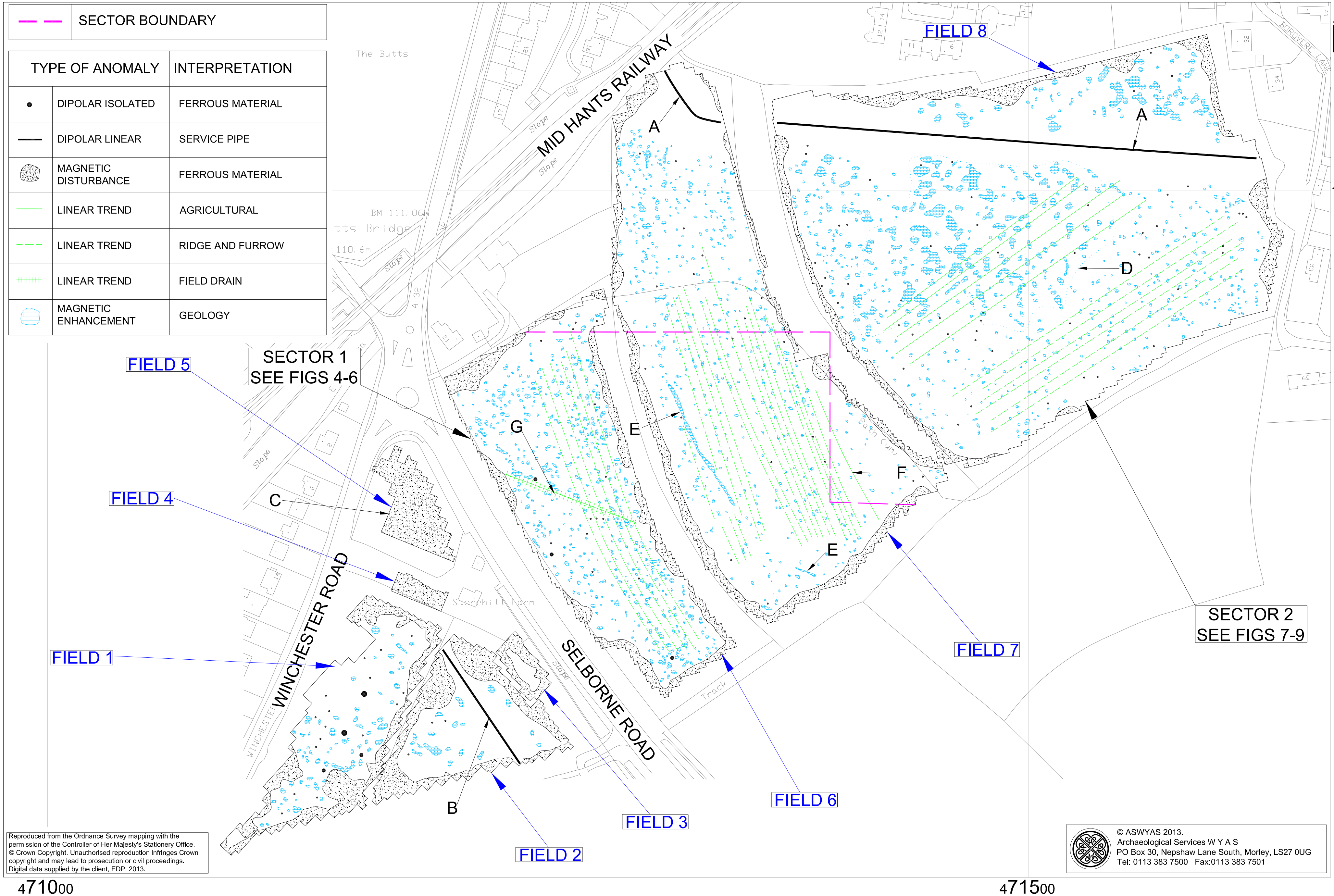


Fig. 3. Overall interpretation of magnetometer data (1:2500 @ A4)

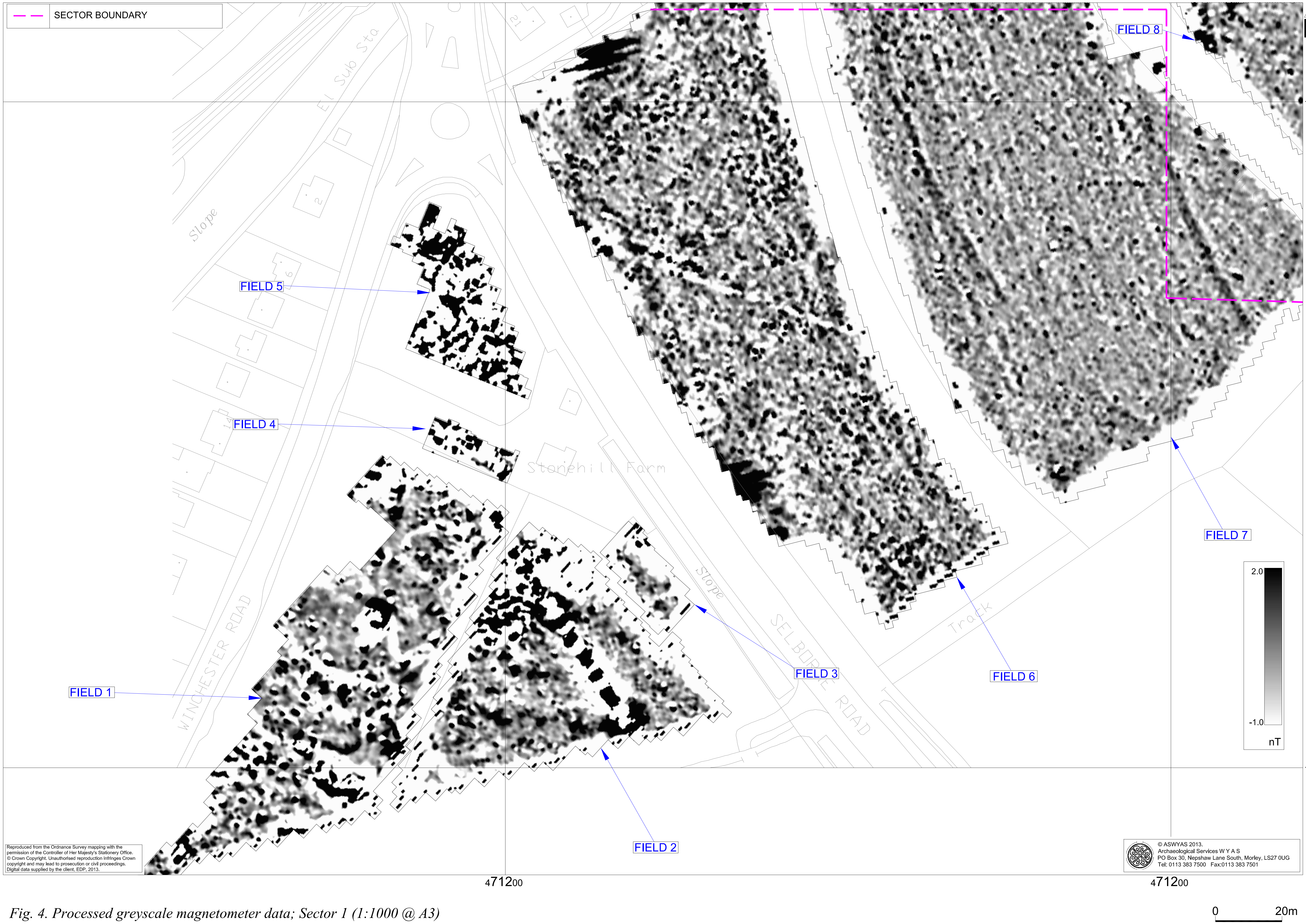
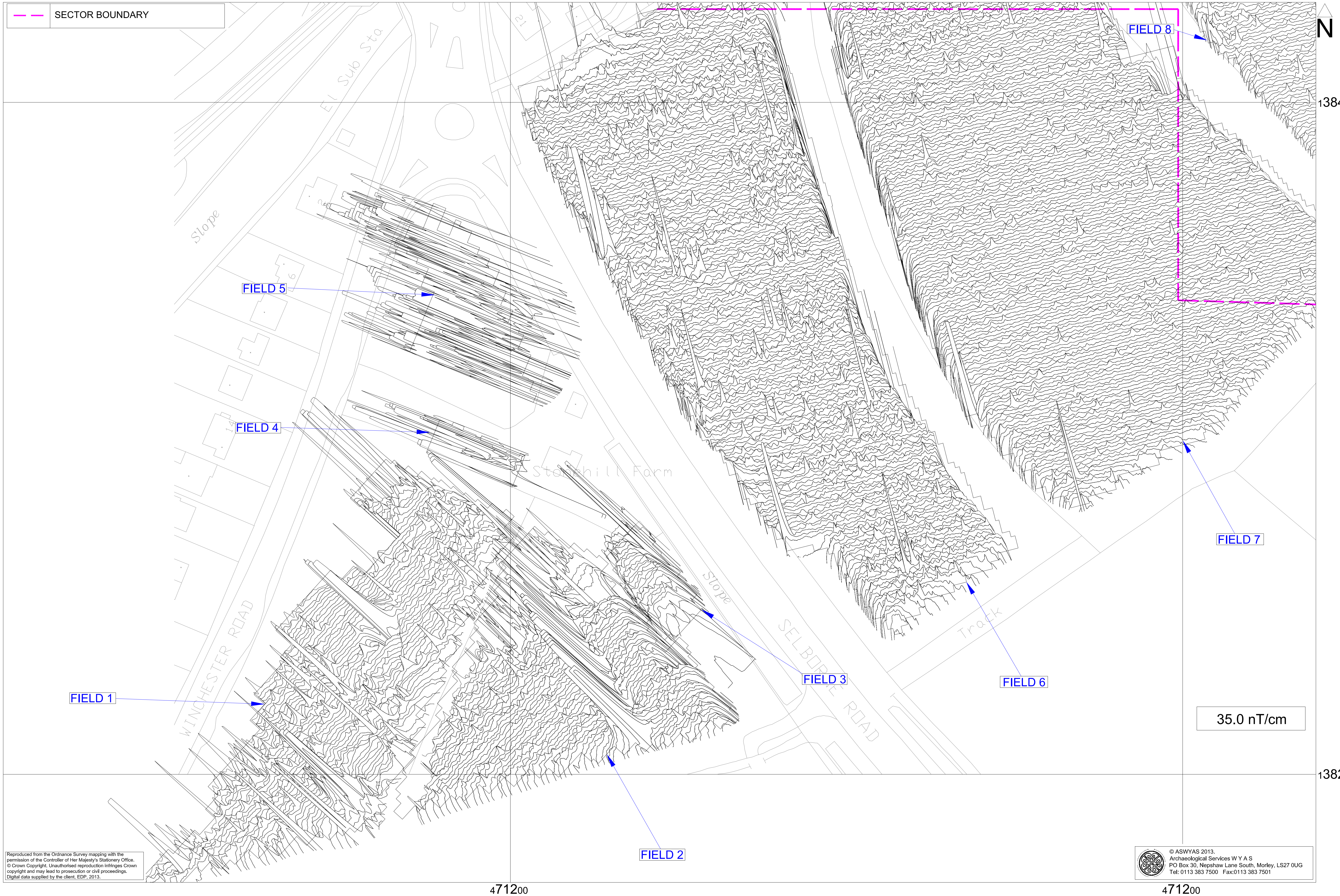


Fig. 4. Processed greyscale magnetometer data; Sector 1 (1:1000 @ A3)



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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)

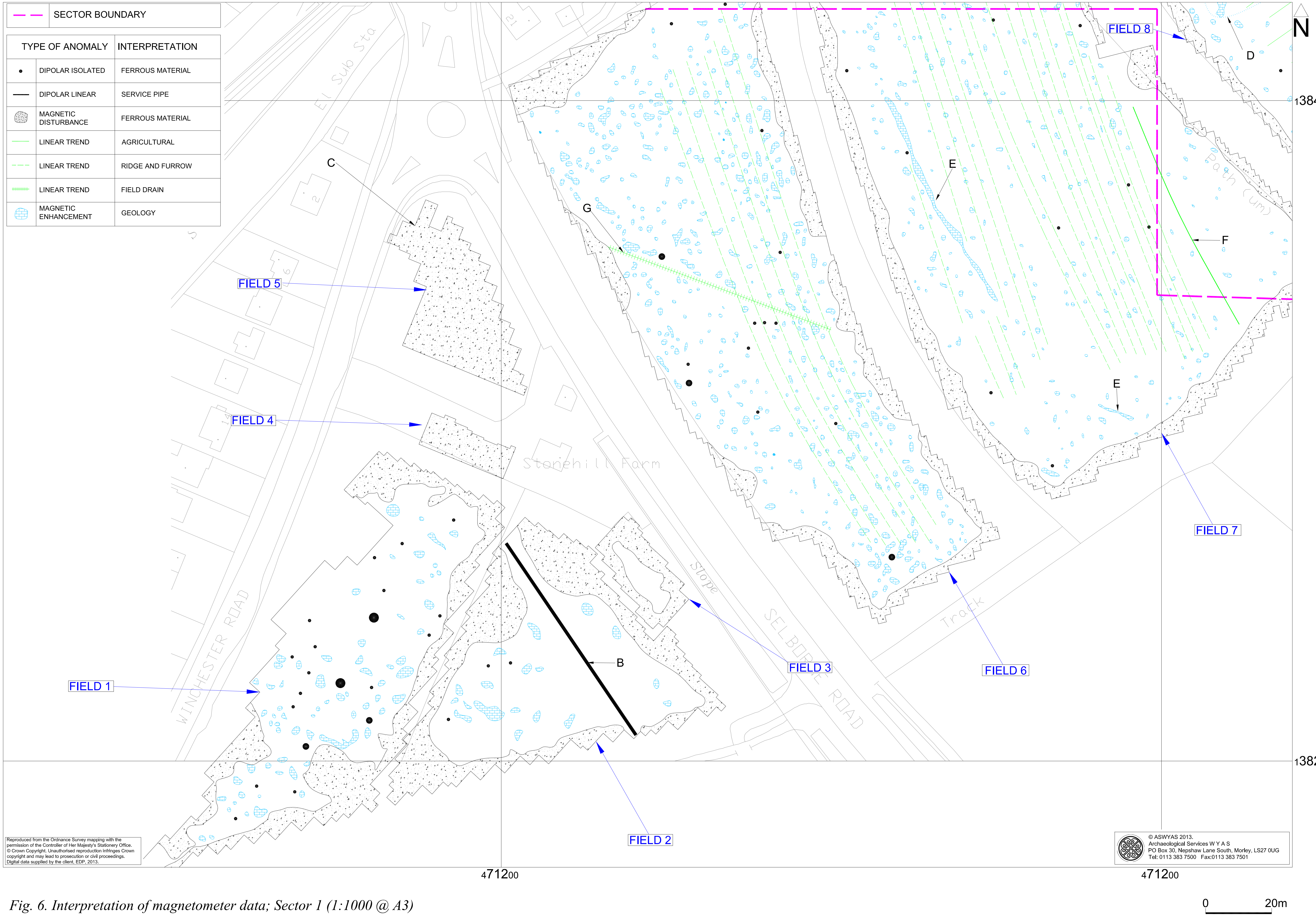

Fig. 6. Interpretation of magnetometer data; Sector 1 (1:1000 @ A3)

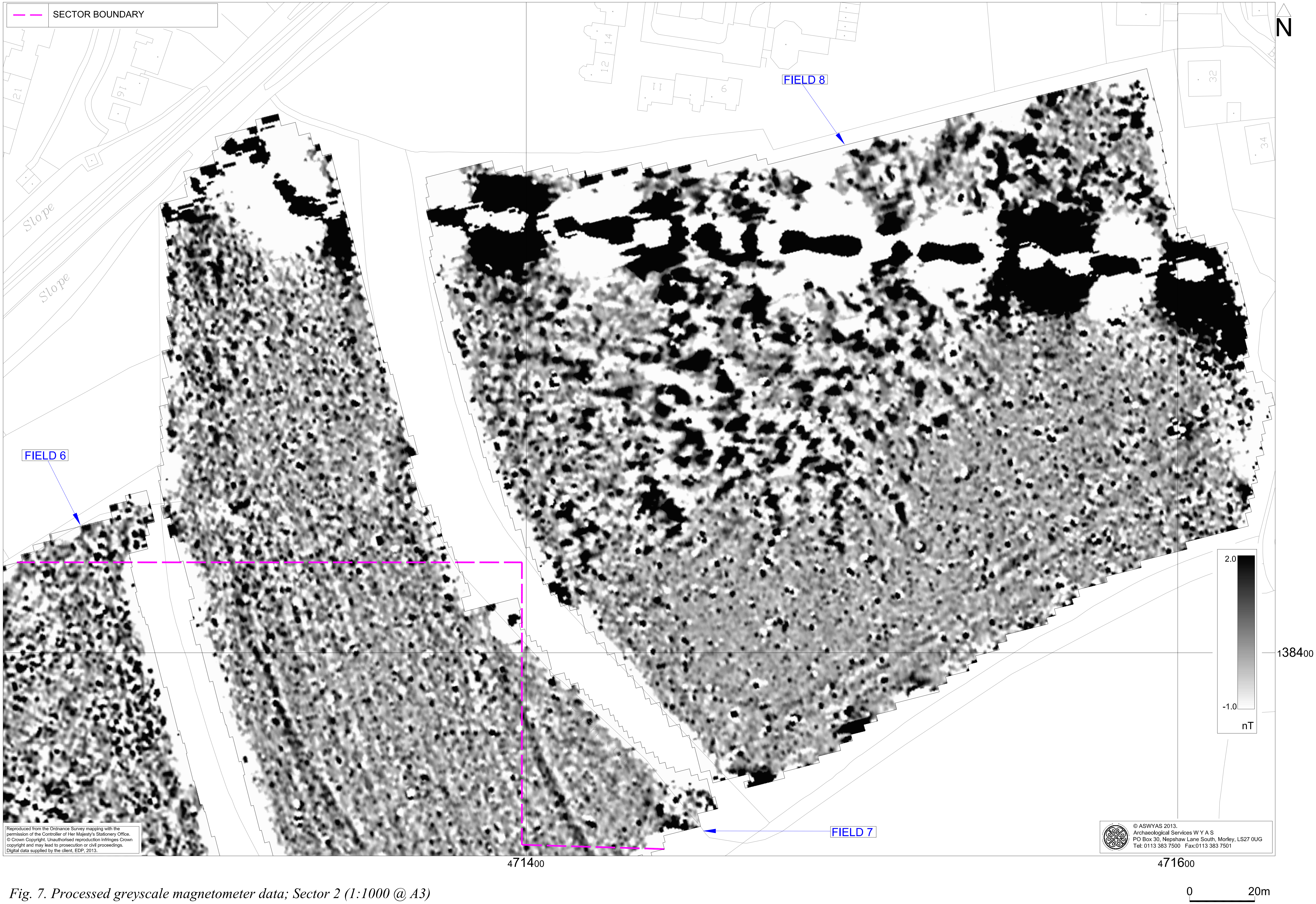

Fig. 7. Processed greyscale magnetometer data; Sector 2 (1:1000 @ A3)

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

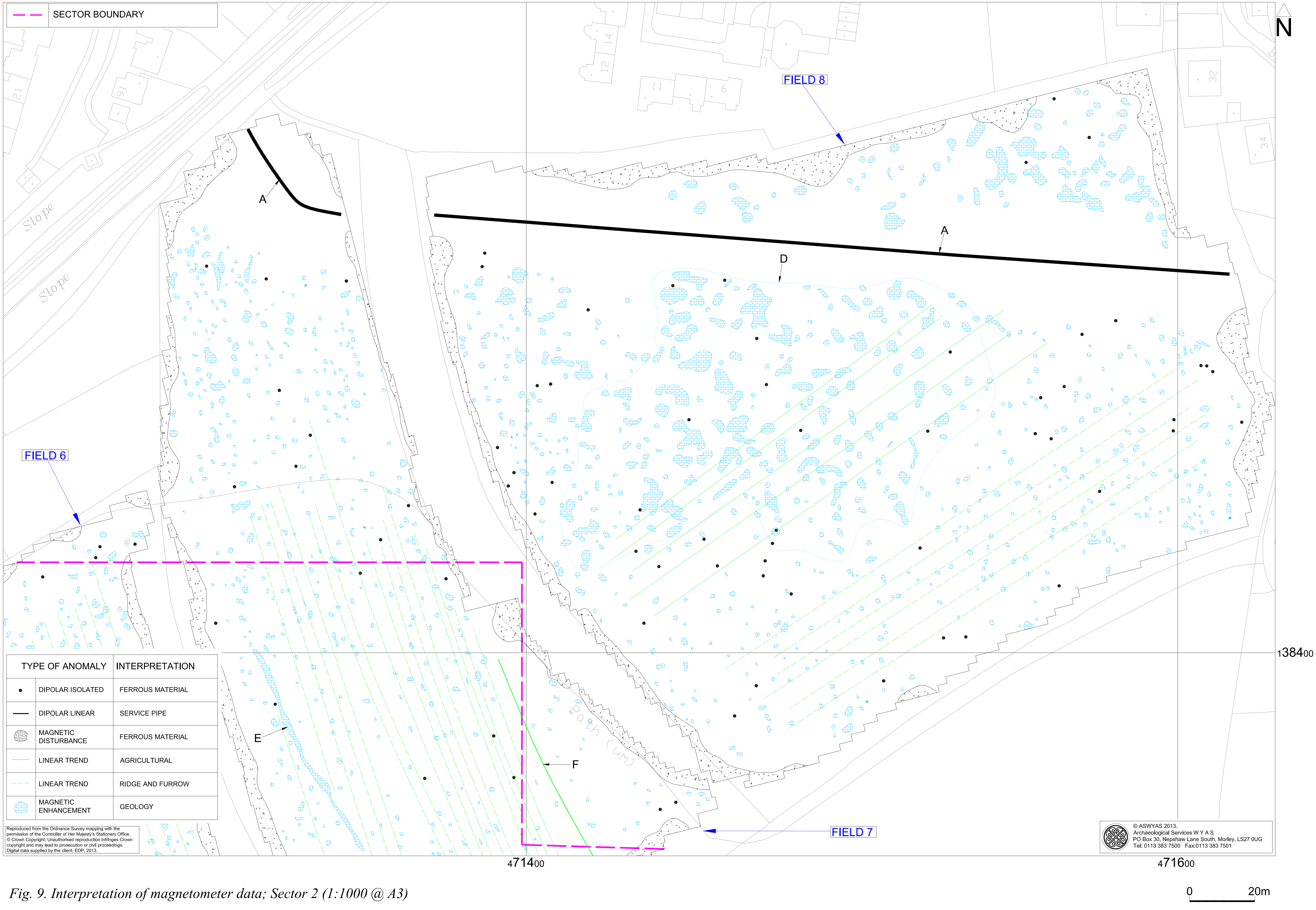

Fig. 9. Interpretation of magnetometer data; Sector 2 (1:1000 @ A3)


Plate 1. General view of Field 1 and Field 2, looking south-west


Plate 2. General view of Field 6, looking north-west


Plate 3. General view of Field 7 towards Field 6, looking west


Plate 4. General view of Field 8, looking north-west

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.

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 Hampshire Historic Environment Record).

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