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SERVICES
WYAS

Land off Bridlington Road, Hunmanby, North Yorkshire

Geophysical Survey

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Land off Bridlington Road, Hunmanby, North Yorkshire.

Geophysical Survey

Contents

Summary

A geophysical (fluxgate gradiometer) survey, covering approximately 1 hectare, was carried out adjacent to Hunmanby Industrial Estate. Magnetic anomalies caused by ridge and furrow ploughing and a relict field boundary have been identified. Other anomalies are probably due to modern activity. No anomalies of a probable archaeological origin have been identified.

Archaeological Services WYAS

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1. Introduction and Archaeological Background

1.1 Archaeological Services WYAS, was commissioned by Ms A. Finney, of MAP Archaeological Consultancy Ltd., to carry out a geophysical (fluxgate gradiometer) survey at a 1.2 hectare site on the outskirts of Hunmanby, North Yorkshire (see Fig. 1).

1.2 The site is on the junction of Bridlington Road with the access road to Hunmanby Industrial Estate (centred at TA 1035 7660) on a greenfield plot that is subject to a planning application for further light industrial units (see Fig. 2).

1.3 On the day of the survey (August 21st 2000) the site was under rough pasture having been mown prior to the survey. The field itself was extremely uneven with areas of tipping in the south-west corner and on the eastern edge. The north-east corner was also unsuitable for survey due to dense scrub vegetation. It was also very badly drained in this part of the site. A steel paling fence on the northern and western sides precluded survey within 10m. Consequently the survey covered approximately 0.8 hectares.

1.4 The site lies on the geological boundary between Cretaceous Chalk and a series of Lower Cretaceous formations which include Weald Clay.

1.5 No information was provided about the archaeological background to the site.

1.6 The objectives of the survey were:

- to establish the presence, extent and character of any archaeological magnetic anomalies within the survey area.

2. Methodology and Presentation

2.1 The survey was carried out in accordance with English Heritage Guidelines (David 1995).

2.2 All figures reproduced from Ordnance Survey mapping are done so with the permission of the controller of Her Majesty's Stationary Office. © Crown copyright. West Yorkshire Archaeology Service: licence 076406.

2.3 A site location plan, derived from digital data supplied by the client, showing the greyscale processed magnetic data is presented at a scale of 1:500 in Figure 2. An interpretation of the results at the same scale is shown in Figure 3 with the X-Y trace plots displayed in Figure 4. Further details on data processing and display are given in Appendix 1.

3. Results and Discussion

3.1.1 Ubiquitous across the whole site are 'iron spike' responses (see Appendix 1) which are indicative of ferrous material in the topsoil or subsoil. These responses might be caused by archaeological artefacts but without supporting evidence they are assumed not to be of archaeological significance. Only the largest 'spike' responses are shown on the interpretation. In the northern half of the site there are several clusters of these responses suggesting deliberate tipping. No other anomalies have been identified in this part of the site.

3.1.2 Dividing the site into two halves is an earthwork ridge aligned from west to east. This is probably a lynchet that has resulted from the ridge and furrow ploughing that has taken place in the southern half of the site. In fact an intermittent positive linear response locating the former field division can be identified on the greyscale plot with the linear magnetic anomalies caused by the ridge and furrow ploughing responses terminating at the former field boundary.

3.2 The only other anomaly that has been identified is a short, negative, linear response running from south-west to north-east that appears to cut the ridge and furrow responses. Whilst an archaeological origin cannot be discounted a recent non-archaeological cause such as an infilled drain or service pipe trench is thought more likely.

4. Conclusions

4.1 Apart from evidence indicating that ridge and furrow ploughing has taken place over the southern half of the site there is no indication of any other probable archaeological anomalies.

The results and subsequent interpretation of geophysical surveys should not be treated as an absolute representation of the underlying archaeology. It is normally only possible to prove the archaeological nature of anomalies through intrusive means such as by trial excavation.

Bibliography

Clark, A.J. (1990). *Seeing Beneath the Soil,* B.T. Batsford Ltd.

David, A. (1995). *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines No. 1.* English Heritage.

Acknowledgements

Fieldwork

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Report

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Graphics

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Figures

Appendices

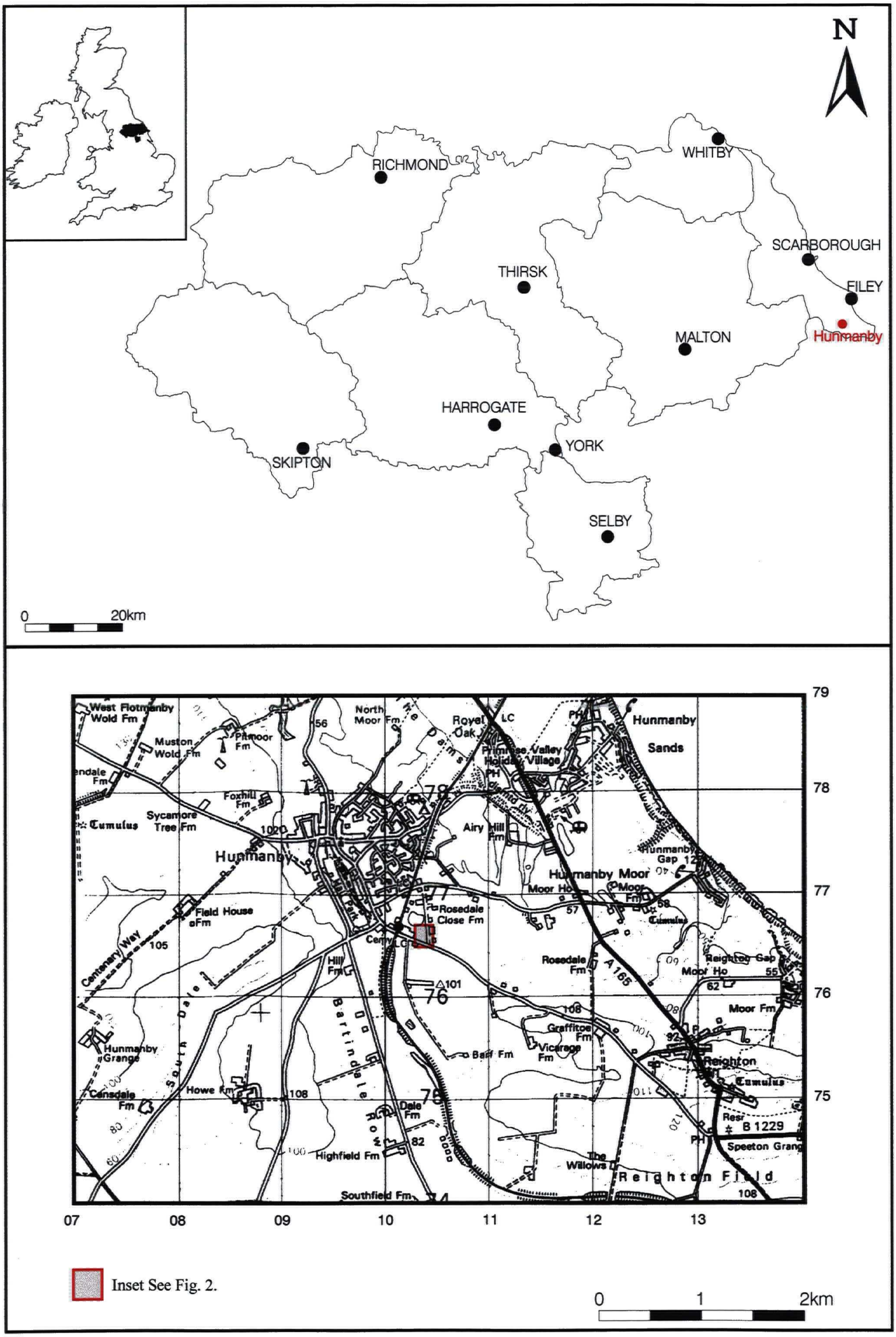

Fig. 1. Site location

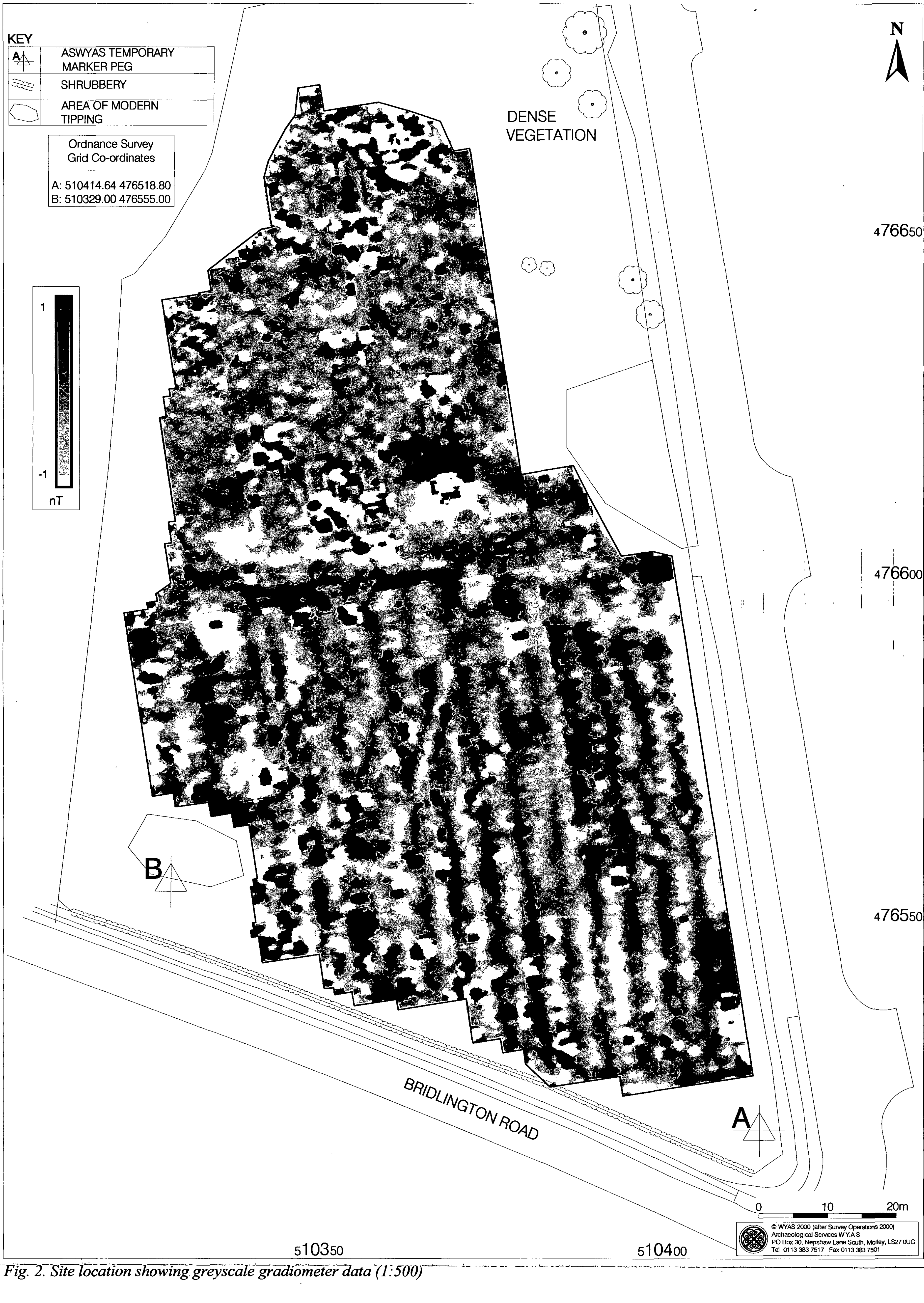

Fig. 2. Site location showing greyscale gradiometer data (1:500)

Fig. 3. Interpretation of gradiometer data (1:500)

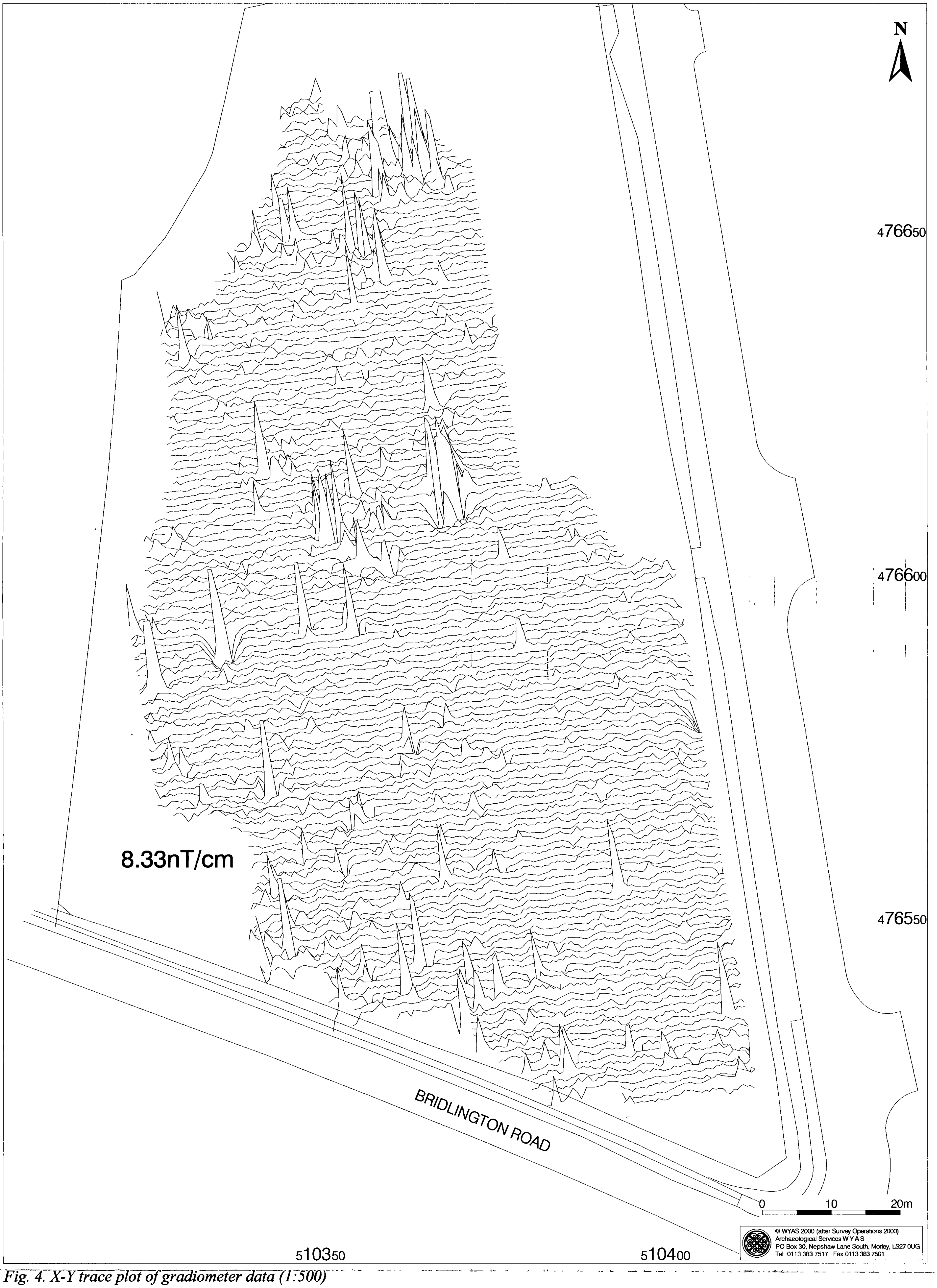

Fig. 4. X-Y trace plot of gradiometer data (1:500)

Appendix 1

Magnetic Survey: Technical Information

1. Magnetic Susceptibility and Soil Magnetism

1 1 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)

1 2 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 Less magnetic material such as masonry or plastic service pipes which intrude into the topsoil may give a negative magnetic response relative to the background level

1 3 The magnetic susceptibility of the soil can also be enhanced significantly by heating This can lead to the detection of features such as hearths, kilns or burnt areas

2. Types of Magnetic Anomaly

2 1 The types of response mentioned above can be divided into five main categories

2.2 Isolated Dipolar Anomalies (Iron Spikes)

2 2 1 These responses are typically caused by ferrous objects on the surface or in the topsoil Whilst they could be caused by archaeological artefacts, unless there is supporting evidence for an archaeological interpretation, then iittle emphasis is given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring

2.3 Areas of Magnetic Disturbance

2 3 1 These responses can have several causes and are often associated with burnt material, such as industrial waste or other strongly magnetised/fired material They are usually assumed to have a modern origin unless there is other supporting information Ferrous fencing can be a major source of magnetic

disturbance as they produce very strong magnetic responses that can mask weaker archaeological anomalies

2.4 Positive Curvi/Linear Anomalies

2.4 1 They are commonly caused by infilled ditches which may be archaeologically significant Former or current agricultural practice can also result in these anomalies

2.5 Isolated Positive Anomalies

2 5 1 These anomalies can exhibit a magnitude of response of between 2nT and 300nT and can be caused by pits or post holes, ovens or kilns They can also be caused by natural/geological features on certain geologies It can often be very difficult to establish an anthropogenic origin without intrusive investigation

2.6 Negative Linear Anomalies

2 6 1 These are normally very faint and are commonly caused by features such as plastic water pipes which are less magnetic than the surrounding soils and geology They too can be caused by natural features on some geologies

3. *Methodology*

3.1 Magnetic Susceptibility Survey

3 1 1 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 resuhs in a bulk value that it not necessarily fully representative of the constituent components of the sample 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 Magnetic susceptibility readings were not taken as part of this evaluation

3.2 Gradiometer Survey

3 2 1 There are two main methods of using the fluxgate gradiometer for commercial evaluations The first of these is referred to as scanning and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10-15m 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, as in this case In favourable circumstances scanning may be used to map out the full extent of features located during a detailed survey

3 2 2 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 5m 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

3 2 3 The Geoscan FM36 fluxgate gradiometer and ST1 sample trigger were used for the detailed gradiometer survey Readings were taken, on the 0 1nT range, at 0 5m intervals on zig-zag traverses 1m apart within 20m by 20m square grids

3.3 Data Processing and Presentation

3 3 1 The detailed gradiometer data has been presented in this report in X-Y trace and greyscale formats The former option shows the 'raw' data with no processing other than grid biasing whilst in the latter the data has been selectively filtered to remove spurious errors such as striping effects and edge discontinuities caused by instrument drift and inconsistencies in survey technique caused by poor field conditions

3 3 2 An X-Y 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 at 10nT 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' In-house software (XY3) was used to create the X-Y trace plots

3 3 3 In-house software (Geocon 9) was used to interpolate the data so that 1600 readings were obtained for each 20m by 20m grid Contors software was used to produce the greyscale images All greyscale plots are displayed in the range −1nT to 2nT, unless otherwise stated, using a linear incremental scale

Appendix 2

Survey location information

The site grid was laid out using a Geotronics Geodimeter 600 series theodolite and was tied in to the road edge and to the steel paling fence on the western periphery of the site Two semi-permanent marker stakes were left on site (Fig 2 – A and B) The greyscale plot was then overlain on a digital map base supplied by the client as a 'best fit' and Ordnance Survey co-ordinates obtained for the two marker points

It should be noted that the Ordnance Survey co-ordinates for 1 2500 digital maps have an error of +/- 1 08m at a 99% degree of confidence These errors should be taken into account during any re-location of the site grid

The ASWYAS site grid is accurate to within +/- 0 1m of the grid co-ordinates supplied by the client 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 the raw data, grid location information, report text (Word 97), and compressed (CorelDraw6) files of the graphics
- a full copy of the report

At present the archive is held by Archaeological Services WYAS ahhough it is anticipated that it will eventually be lodged with the Archaeology Data Service (ADS) Brief details will 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 relevant Sites and Monument Record Office)