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Thorpe Hall
Dam Lane
Thorpe Willoughby
North Yorkshire

Geophysical Survey

September 2010

Report No. 2119

CLIENT
MAP Archaeological Consultancy Ltd

Thorpe Hall
Dam Lane
Thorpe Willoughby
North Yorkshire

Geophysical Survey

Summary

Magnetometer and earth resistance surveys were carried out on a small parcel of land at Thorpe Hall, Thorpe Willoughby, prior to the possible submission of a planning application for the construction of a new stable block and exercise ring. The survey area forms part of Thorpe Hall, a moated monastic grange which is protected as a scheduled ancient monument. Overall the results of the geophysical surveys have been disappointing with no obviously archaeological anomalies having been identified. Therefore the archaeological potential of the site, and hence the impact of the development proposals, remains unclear.

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Report Information

Client:	MAP Archaeological Consultancy Limited
Address:	Showfield Lane, Malton, North Yorkshire, YO17 6BT
Report Type:	Geophysical survey
Location:	Thorpe Hall, Thorpe Willoughby
County:	North Yorkshire
Grid Reference:	SE 5781 3165
Period(s) of activity represented:	Medieval
Report Number:	2119
Project Number:	3622
Site Code:	TWS10
Planning Application No.:	n/a
Museum Accession No.:	n/a
Date of fieldwork:	September 2010
Date of report:	September 2010
Project Management:	Alistair Webb BA MIfA
Fieldwork:	Sam Harrison BSc MSc AIfA David Williams BSc
Report:	Alistair Webb
Illustrations:	Sam Harrison
Photography:	Sam Harrison
Research:	n/a
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Authorisation for distribution: ---

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1 Introduction

Archaeological Services WYAS was commissioned by Sophie Langford of MAP Archaeological Consultancy Limited to undertake a geophysical (magnetometer and earth resistance) survey in a small paddock immediately north of Thorpe Hall, near Selby (see Fig. 1) in advance of the possible submission of a planning application for the construction of a new stable block, ancillary unit and exercise ring. The scheme of work was undertaken in accordance with the requirements of PPS5.

Site location, topography and land use

Thorpe Hall, centred at SE 5781 3165, is located on the eastern side of Dam Lane just to the north of the village of Thorpe Willoughby, approximately 4km west of Selby (see Fig. 2). The survey area comprised a rectangular parcel of land, approximately 70m by 45m, bounded by hedges to all sides located immediately north of the hall and outbuildings. The main area had been mown prior to survey but the hedges were overgrown around the periphery and there were several obstacles including an abandoned Land Rover, piles of dumped window frames and corrugated asbestos sheeting (see Plates) other building rubble and assorted debris which both restricted the area suitable for the surveys in general and adversely affected the data quality of the magnetic survey in particular.

The site was relatively flat at approximately 7m above Ordnance Datum (aOD).

Geology and soils

The solid geology comprises Bunter Sandstone overlain by permeable, fine and coarse loams of the Wigton Moor soil association. These soils are derived from river terrace and glaciofluvial drift.

2 Archaeological background

The survey area forms part of the site of Thorpe Hall moated monastic grange, a Scheduled Ancient Monument (No. 30113). The monument includes the remains of a moated manor house site which is situated on the north bank of Selby Dam, a medieval drainage channel. The moat ditch follows a rectangular circuit which is, for the most part, well defined except for the south-western corner which is partly beneath Dam Lane and partly in the garden of the hall. A north/south aligned moat sub-divides the enclosed ‘island’ which measures approximately 140m by 80m. Of the area enclosed by the ditch the south-western quadrant is occupied by Thorpe Hall whilst the eastern half is under pasture. The survey area comprises the majority of the north-western quadrant of the ‘island’.

Typically moated sites enclosed one or more ‘islands’ of dry ground on which stood domestic or religious buildings although some were used for horticulture. Thorpe Hall is a very well preserved example of its type and it is considered likely that archaeological features or deposits will survive both under the existing buildings and in the open areas. Features that may be expected include building foundations, rubbish pits and evidence of industrial activity and gardening.

3 Aims, Methodology and Presentation

Following consultation English Heritage requested that a geophysical survey be carried out across the proposal area in order to provide additional information on the possible archaeological implications of the proposed developments. As the survey area comprised part of a scheduled area a licence to carry out a geophysical survey under Section 42 of the Ancient Monumnets and Archaeological Areas Act (1979) was sought from, and approved by, English Heritage prior to the commencement of the survey.

The general aim of the geophysical survey was to establish and clarify the nature of the archaeological resource within the proposed development area.

Specifically the survey sought to provide information about the nature and possible interpretation of any anomalies identified during the survey and thereby determine the presence or absence and likely extent of any buried archaeological remains. The survey covered all of the proposed development area that was suitable for survey.

The survey area was set-out with a Trimble 5800 VRS differential GPS and tied in to temporary reference points that were left in place following completion of the fieldwork for accurate geo-referencing. The locations of the temporary reference points are shown on Figure 2 and their Ordnance Survey co-ordinates tabulated in Appendix 2.

Magnetometer survey

Bartington Grad601 instruments were used to take readings at 0.25m intervals on zig-zag traverses 1m apart within 20m by 20m grids so that 1800 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.

Earth resistance survey

A Geoscan RM15 resistance meter was used during the earth resistance survey, with the instrument logging each reading automatically at 1m intervals on traverses 1m apart. The mobile probe spacing was 0.5m with the remote probes 15m apart and at least 15m away from the grid under survey. This mobile probe spacing gives an approximate depth penetration of up to 1m for most archaeological features. Further details are given in Appendix 2.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey mapping is shown in Figure 1. Figure 2 is a more detailed site location showing the processed magnetometer data and the locations of the survey reference points superimposed on a scanned and enlarged image of an Ordnance Survey base map provided by the client. The processed and unprocessed data and interpretations are presented at a scale of 1:500 in Figures 3, 4 and 5.

Further technical information on the equipment used, data processing and geophysical survey methodologies are given in Appendix 1 and Appendix 2. Appendix 3 details the survey location information and Appendix 4 describes the composition and location of the site archive. A copy of the Section 42 licence is included as Appendix 5.

The survey methodology, report and any recommendations comply with the methodology and guidelines outlined by English Heritage (David *et al.* 2008) and by the IfA (Gaffney, Gater and Ovenden 2002). 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

Magnetometer survey

The data from the magnetic survey is characterised by very strong magnetic readings caused by the presence of the Land Rover and other ferrous and/or fired material which is incorporated within the various piles of dumped debris across the survey area. Against this background it is impossible to identify any responses from potentially archaeological features across the majority of the survey area. The only part of the survey area that is relatively unaffected by the magnetic disturbance is the north-western corner and no anomalies can be discerned here.

Resistance survey

It is similarly difficult to identify any potentially archaeological anomalies in the resistance survey data. Several very vague linear trends have been identified in the middle of the survey area, aligned south-west/north-east or perpendicular to this. However, it is impossible to ascribe an interpretation and even identifying these trends as anomalies must be considered highly tentative. Two vaguely rectangular areas of high resistance have been noted along the western edge of the survey area. Again it is impossible to ascribe an origin.

5 Discussion and Conclusions

It is always difficult to interpret the results of geophysical surveys on small sites because of the problem in determining a context for the data – establishing what is the normal background and then identifying the anomalous responses against that background. It is doubly difficult on a site where there may be an elevated expectation of encountering archaeological remains but there is nothing of obvious potential, which is the case here.

On this site the ground conditions have also been detrimental to a successful survey outcome, particularly in the case of the magnetometer survey where the magnetic disturbance has masked the much weaker responses from any archaeological features, if present.

The resistance survey has at least identified some variation across the site but there is no obvious pattern that might lend weight to an archaeological interpretation. It is consequently considered probable that most of the variation will be due to changes in the depth, composition and compaction of the soils. Some vague linear trends in the centre of the site have been noted but suggesting an archaeological cause would be highly speculative. Similarly areas of high resistance on the western edge also stand out but this is in an area bordered by an overgrown hedge and may merely be indicative of reduced soil moisture content due to the vegetation.

Overall the results of the geophysical surveys have been disappointing with no obviously archaeological anomalies having been identified. On balance the archaeological potential of the site, and hence the impact of the development proposals, remains unclear.

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.

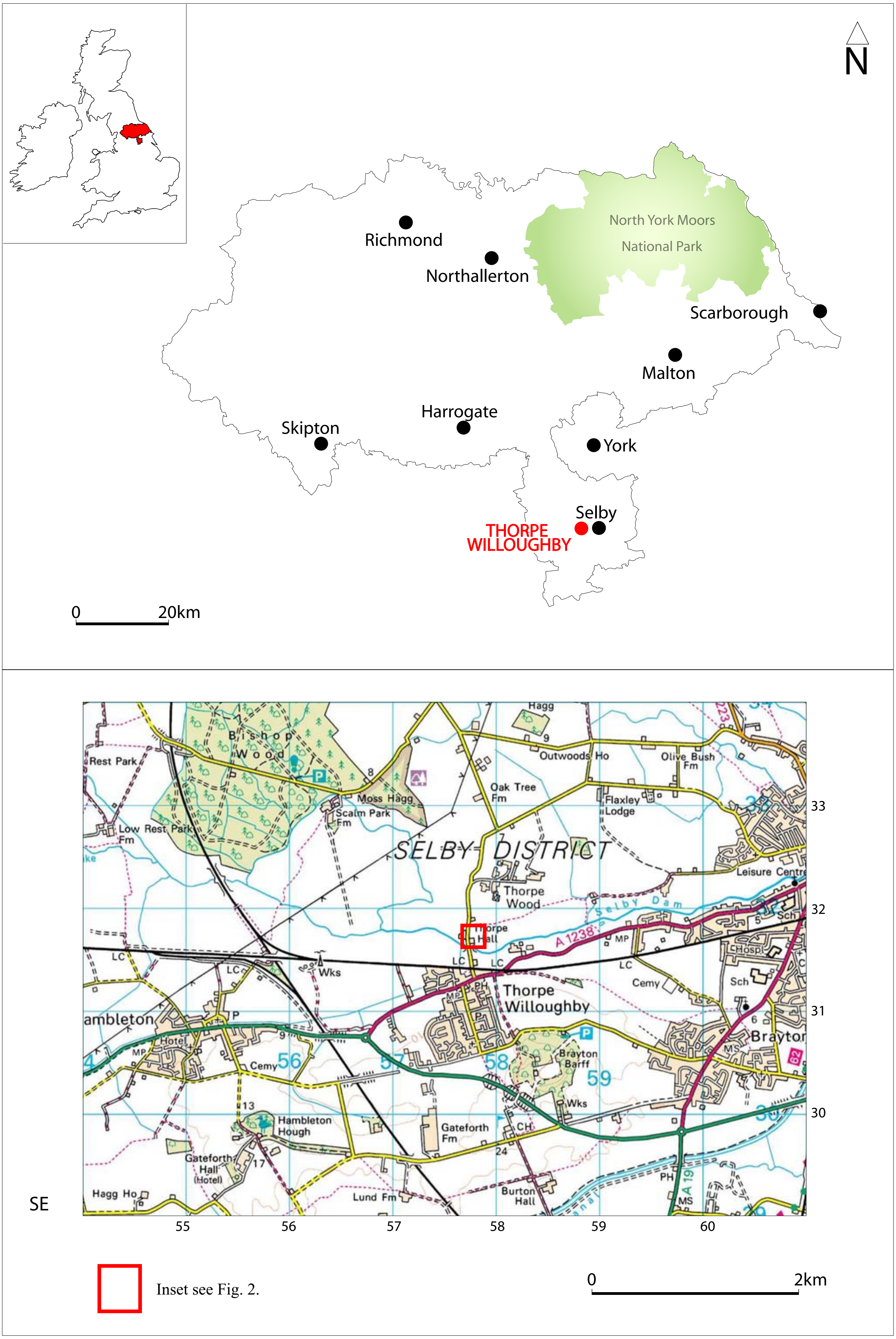


Fig. 1. Site location

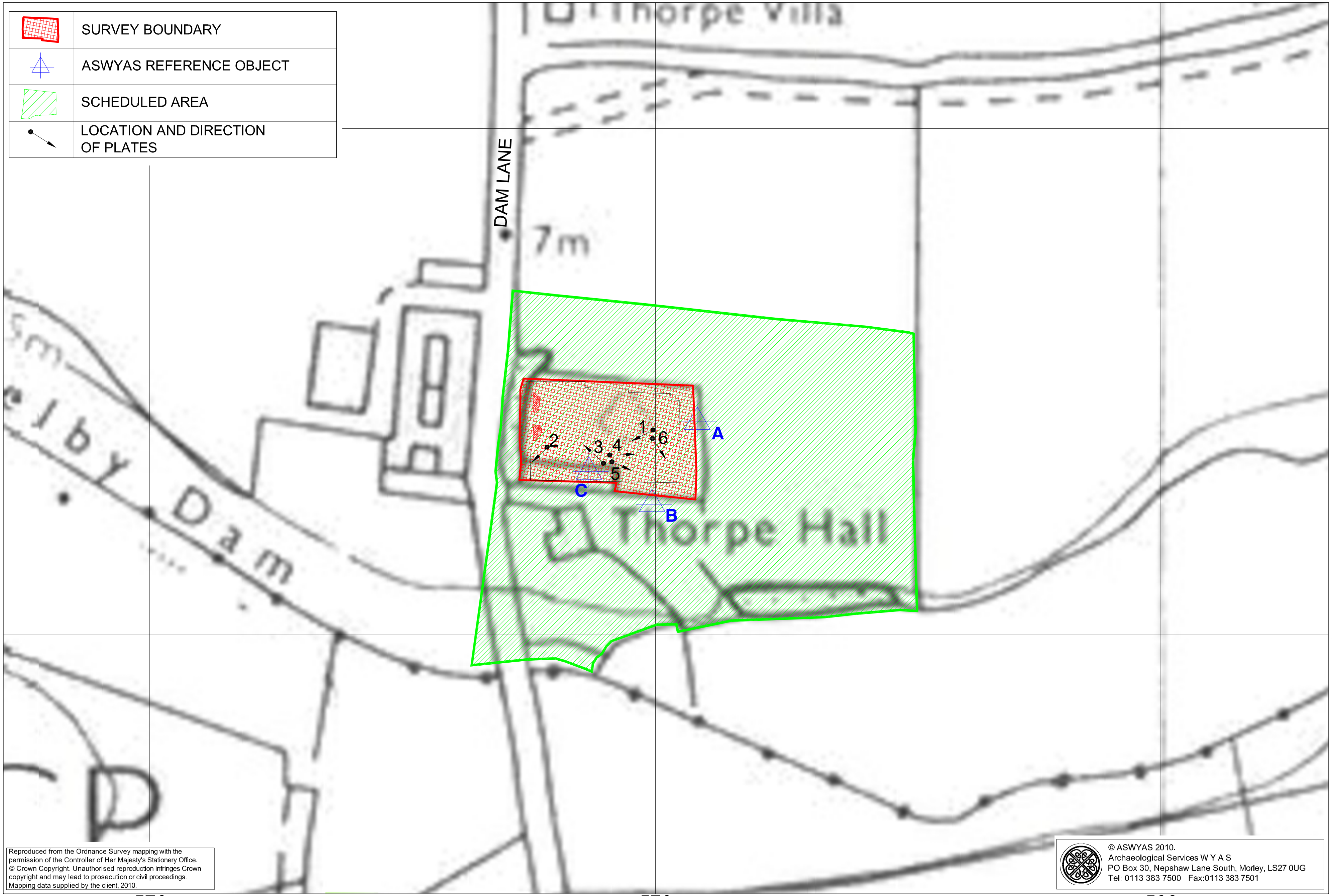


Fig. 2. Site location showing scheduled area (1:2000 @ A4)

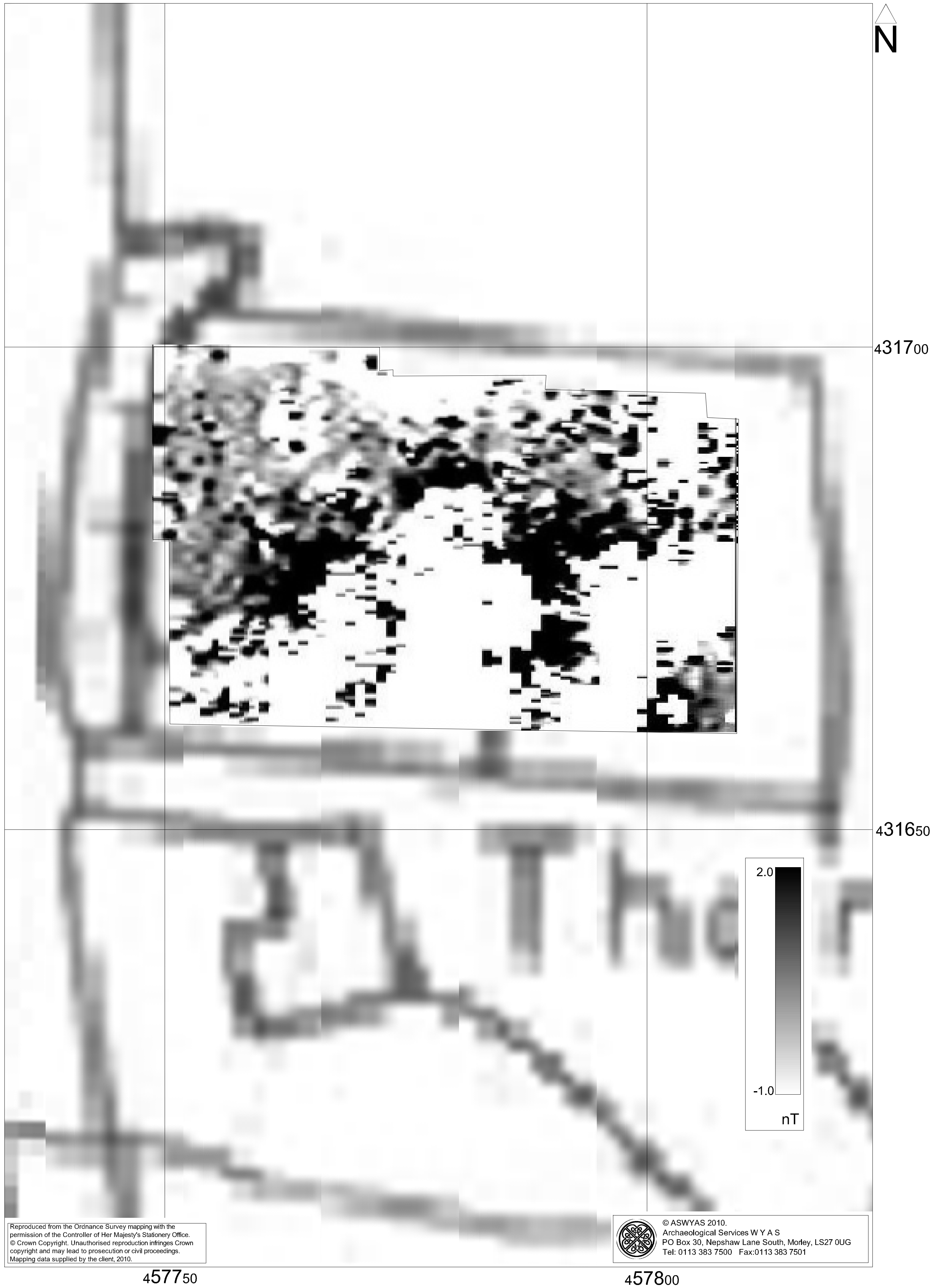
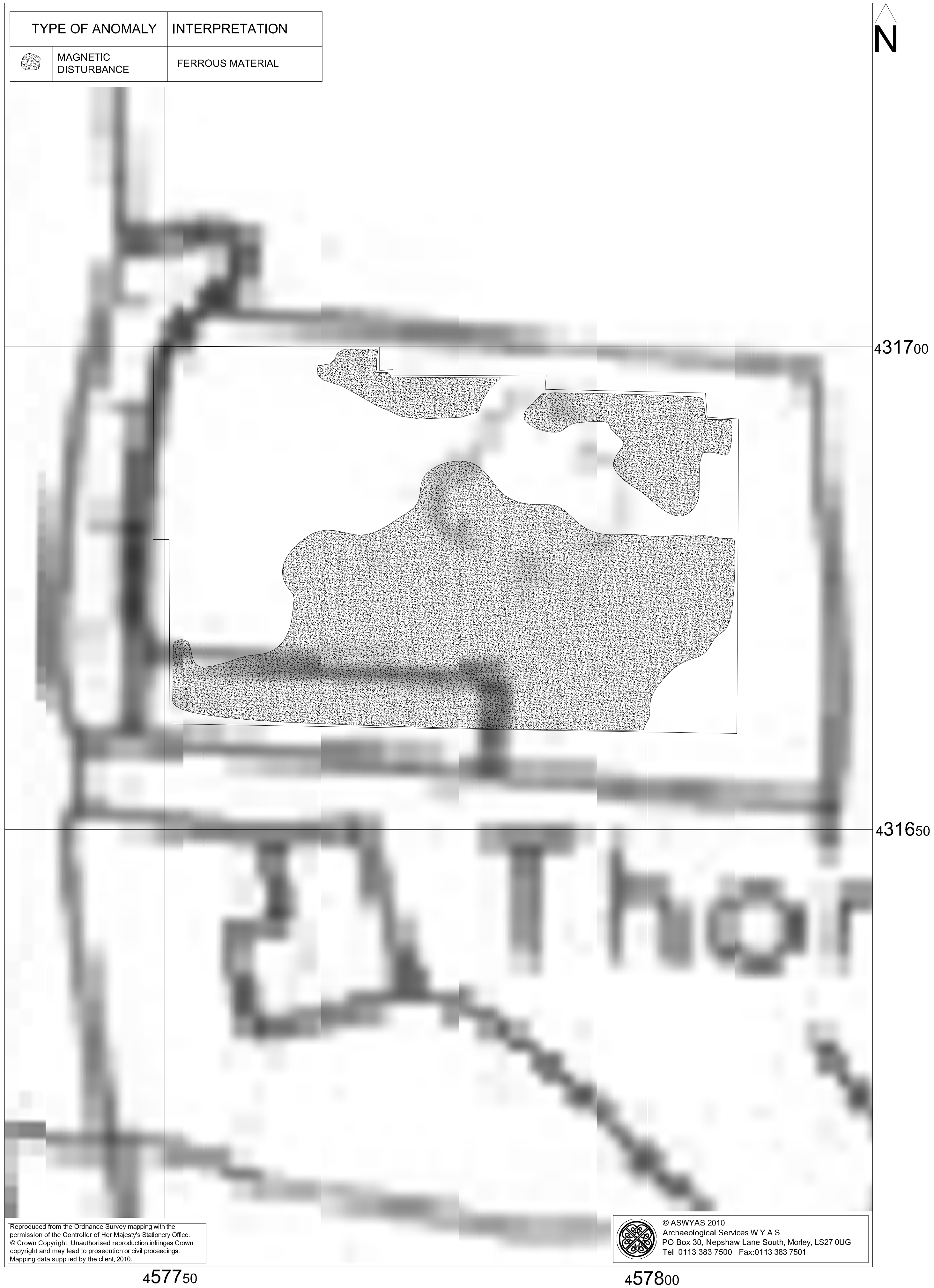


Fig. 3. Processed greyscale magnetometer data (left) and earth resistance data (right) (1:500 @ A3)

Fig. 4. XY trace plot of unprocessed magnetometer data (left) and greyscale of unprocessed earth resistance data (right) (1:500 @ A3)



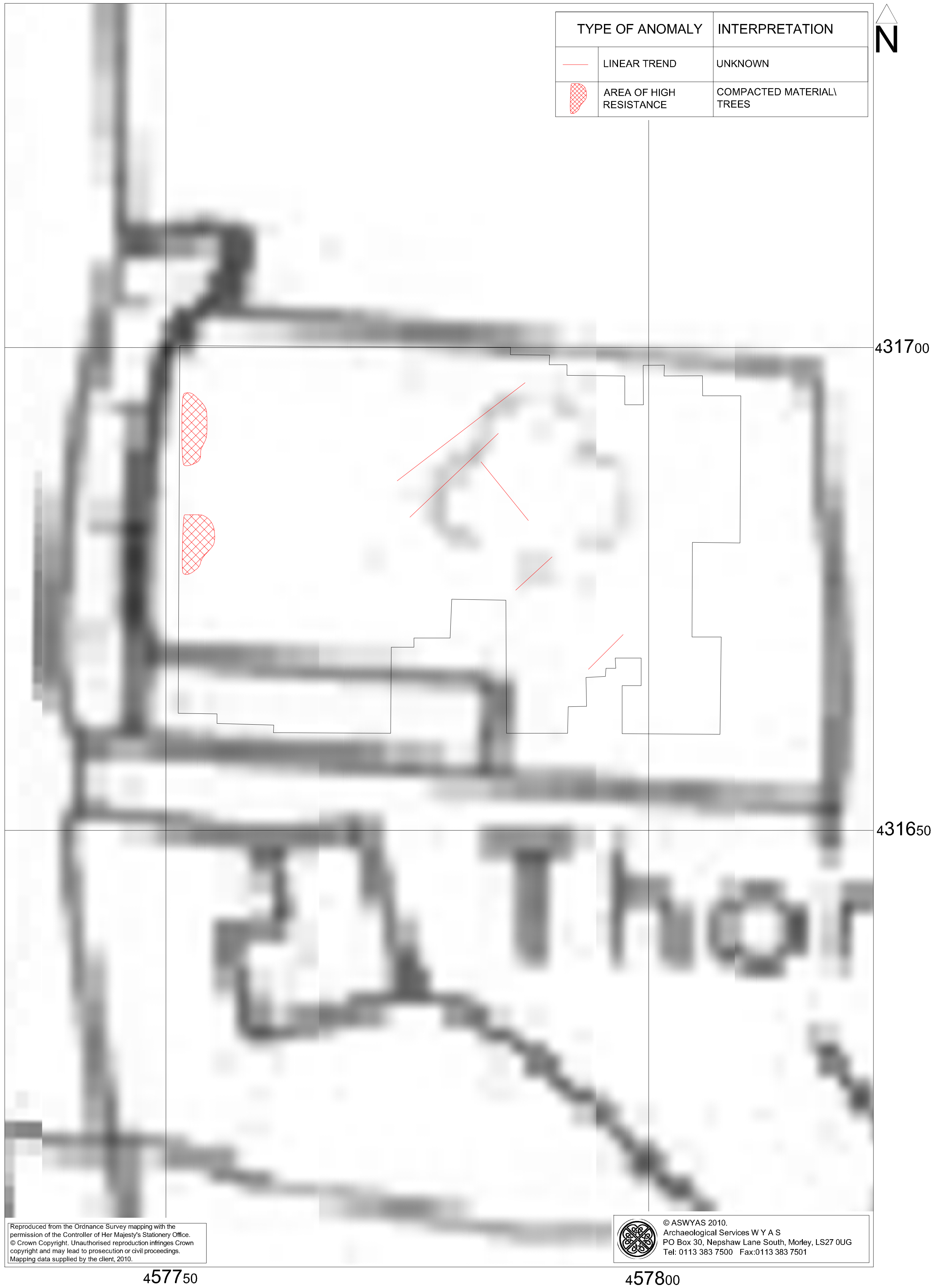


Fig. 5. Interpretation of magnetometer data (left) and earth resistance data (right) (1:500 @ A3)

Plate 1. General site shot, looking south-west.

Plate 2. Resistance survey in progress in south-western corner of site.

Plate 3. North-western part of survey area, looking north-west.

Plate 4. Eastern edge of site, looking east.

Plate 5. Southern edge of site, looking S-S-E towards south-eastern corner.

Plate 6. South-eastern corner of site, looking south-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 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 20m by 20m 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 any 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. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 2: Earth Resistance survey: technical information

Soil Resistance

The electrical resistance of the upper soil horizons is predominantly dependant on the amount and distribution of water within the soil matrix. Buried archaeological features, such as walls or infilled ditches, by their differing capacity to retain moisture, will impact on the distribution of sub-surface moisture and hence affect electrical resistance. In this way there may be a measurable contrast between the resistance of archaeological features and that of the surrounding deposits. This contrast is needed in order for sub-surface features to be detected by a resistance survey.

The most striking contrast will usually occur between a solid structure, such as a wall, and water-retentive subsoil. This shows as a resistive high. A weak contrast can often be measured between the infill of a ditch feature and the subsoil. If the infill material is soil it is likely to be less compact and hence more water retentive than the subsoil and so the feature will show as a resistive low. If the infill is stone the feature may retain less water than the subsoil and so will show as a resistive high.

The method of measuring variations in ground resistance involves passing a small electric current (1mA) into the ground via a pair of electrodes (current electrodes) and then measuring changes in current flow (the potential gradient) using a second pair of electrodes (potential electrodes). In this way, if a structural feature, such as a wall, lies buried in a soil of uniform resistance much of the current will flow around the feature following the path of least resistance. This reduces the current density in the vicinity of the feature, which in turn increases the potential gradient. It is this potential gradient that is measured to determine the resistance. In this case, the gradient would be increased around the wall giving a positive or high resistance anomaly.

In contrast a feature such as an infilled ditch may have a moisture retentive fill that is comparatively less resistive to current flow. This will increase the current density and decrease the potential gradient over the feature giving a negative or low resistance anomaly.

Survey Methodology

The most widely used archaeological technique for earth resistance surveys uses a twin probe configuration. One current and one potential electrode (the remote or static probes) are fixed firmly in the ground a set distance away from the area being surveyed. The other current and potential electrodes (the mobile probes) are mounted on a frame and are moved from one survey point to the next. Each time the mobile probes make contact with the ground an electrical circuit is formed between the current electrodes and the potential gradient between the mobile and remote probes is measured and stored in the memory of the instrument.

A Geoscan RM15 resistance meter was used during this survey, with the instrument logging each reading automatically at 1m intervals on traverses 1m apart. The mobile probe spacing was 0.5m with the remote probes 15m apart and at least 15m away from the grid under survey. This mobile probe spacing of 0.5m gives an approximate depth of penetration of 1m for most archaeological features. Consequently a soil cover in excess of 1m may mask, or significantly attenuate, a geophysical response.

Data Processing and Presentation

All of the illustrations incorporating a digital map base were produced in AutoCAD 2008 (© Autodesk).

The resistance data is presented in this report in greyscale format with a linear gradation of values and was obtained by exporting a bitmap from the processing software (Geoplot v3.0; Geoscan Research) into AutoCAD 2008. The data has been processed and has also been interpolated by a value of 0.5 in both the X and Y axes using a sine wave (x)/x function to give a smoother, better defined plot.

Appendix 3: 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 locations of the temporary reference points left on site are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below. The internal accuracy of these markers is better than 0.01m. The survey grids were then super-imposed onto a scanned and enlarged base map provided by the client to produce the displayed block locations (digital data was not provided - see disclaimer below). 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.

Temporary reference points were left on site (see Fig. 2). The Ordnance Survey reference points are listed below. Please note these co-ordinates were obtained from a scanned and enlarged hard copy of a map base. Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Station	**Easting**	**Northing**	**Elevation (aOD)**
A	457816.5570	431683.9870	6.64m
B	457798.6630	431651.4530	7.34m
C	457773.6830	431664.2590	7.21m

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

Appendix 4: 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 2007) files.
- 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 relevant Historic Environment Record).

Appendix 5: Section 42 Licence

ENGLISH HERITAGE
YORKSHIRE & THE HUMBER REGION

Mr Sam Harrison
West Yorkshire Archaeology Service
PO Box 30
Morley
LEEDS
LS27 0UG

Direct Dial: 01904 601988
Direct Fax: 01904 601999

Our ref: AA/AA22456/5

Dear Mr Harrison

Ancient Monuments and Archaeological Areas Act 1979 (as amended) section 42 - licence to carry out a geophysical survey

THORPE HALL, THORPE WILLOUGHBY, ACASTER SELBY, SELBY, NORTH YORKSHIRE
Case No:SL00000734
Monument no 30113

I refer to your application dated 6 August 2010, to carry out a geophysical survey at the above site.

English Heritage is empowered to grant licences for such activity and I can confirm that we are prepared to do so as set out below.

By virtue of powers contained in section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) English Heritage hereby grants permission for geophysical survey of THORPE HALL, for the areas shown on the map that accompanied your application (copy attached). This permission is subject to the following conditions.

1. The permission shall only be exercised by WYAS, Sam Harrison and by no other person. It is not transferable to another individual.

2. The permission shall commence on Monday 16 August 2010 and shall cease to have effect on Friday 03 December 2010.

3. A full report summarising the results of the survey and their interpretation shall be sent to Keith Emerick, Lucie Hawkins, NYCC, and to Paul Linford of the English Heritage Geophysics Team at Fort Cumberland (Fort Cumberland Road, Eastney, Portsmouth, Hampshire, PO4 9LD), no later than 1 month after the completion of the survey.

You are also asked to complete and return the enclosed questionnaire about the survey to the Geophysics Team, Fort Cumberland (address as above), in order to assist with maintenance of our national database of geophysical surveys. Information from this questionnaire will be entered onto our database as a preliminary record which would be updated when you send to us a copy of the full report. If the work is to be done by a contractor could you please pass the form on to the surveyor.

Being part of our survey database, some details of your survey will be made publicly accessible on the Internet, although no images or data sets will be included. We will assume you have no objection to this unless you let us know to the contrary.

This letter does not carry any consent or approval required under any enactment, bye-law, order or regulation other than section 42 of the 1979 Act (as amended).

You are advised that the person nominated under this licence to carry out the activity should keep a copy of this licence in their possession in case they should be challenged whilst on site.

Yours sincerely

J Lrome

pp **Keith Emerick**
Ancient Monuments Inspector
E-mail: Keith.Emerick@english-heritage.org.uk
cc

Bibliography

David, A., N. Linford, P. Linford and L. Martin, 2008. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines (2nd edition)* English Heritage

Gaffney, C., Gater, J. and Ovenden, S. 2002. *The Use of Geophysical Techniques in Archaeological Evaluations*. IFA Technical Paper No. 6