Old Hexthorpe, Doncaster
South Yorkshire

Geophysical Survey, Archaeological Evaluation
and Photographic Archive

Summary

A geophysical survey and archaeological evaluation were conducted within the grounds of the Manor House, Old Hexthorpe Doncaster. The magnetometer survey identified areas of magnetic disturbance, mainly covering the southern part of the development area. Archaeological deposits and features were identified within two of the four trial trenches and revealed features of possible medieval date and dumping of post-medieval industrial waste. A photographic record of the external north and northeast boundary wall forms part of the site archive.

ARCHAEOLOGICAL
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WYAS

Report Information

Client:	Pentrose Homes Ltd
Address:	32 Bramworth Road, Hexthorpe, Doncaster. DN4 0HZ
Report Type:	Archaeological Evaluation
Location:	Old Hexthorpe
County:	South Yorkshire
Grid Reference:	SE559 021
Period(s) of activity represented:	Medieval – early modern
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Planning Application No.:	
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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Pentrose Homes Ltd to undertake a range of archaeological investigations at the Manor House, Old Hexthorpe, approximately 2km southwest of Doncaster centre (Fig.1). Following the requirements of South Yorkshire Archaeology Service selected areas of the Manor House gardens were the subject of a geophysical survey followed by archaeological evaluation trenching. In addition a photographic archive record was made of the external face of the north and northeast boundary wall.

Site Location and Topography

Hexthorpe Manor and its grounds are situated to the south of the junction of Old Hexthorpe and Bramworth Road. The site is centred on grid reference SE 559 021 with Old Hexthorpe and Bramworth Road forming the northeast and northwest boundaries respectively. Hexthorpe Park bounds the site on the southeast and southwest sides.

The proposed development site is within the current walled garden of Hexthorpe Manor and covers the majority of the north eastern and south western areas of the garden.

The topography of the site is relatively level at around 16.5m AOD, although the underlying natural slopes toward the lower level of the adjacent park.

Soils, Geology and Land-use

The geology of the site is mapped as on the boundary between Upper Magnesian Limestone and Upper Permian Marl (BGS 1969). The overlying soils are unclassified due to their urban location but are adjacent to large areas of Brown calcareous earths (Carroll et al. 1979, Unit 40). The development site is currently occupied overgrown garden beds, lawns and orchard areas.

2 Archaeological and Historical Background

A detailed description of the development of Old Hexthorpe and its environs and the site's potential archaeological and historical significance is provided in a desk-based assessment produced by On-Site Archaeology (2006). Although Doncaster is known for its rich archaeological record and has been a centre of activity since Roman times, less is known about the settlement of Hexthorpe, although interestingly it is named in Domesday, where Doncaster is not, suggesting it was a site of considerable manorial power during the 11th century.

In 1505 the manor of Hexthorpe (then called the Manor of Doncaster) was acquired from the crown by Doncaster Corporation. The earliest reference to a manor house is Elizabethan and refers to a house 'in decay'. The site of the current Manor House is mentioned on the 1784 enclosure award and was allotted by Doncaster Corporation to 'Mayor, Alderman and

Burgesses of Doncaster, as Lords of the Manor'. The archive records show that the house on this plot was rebuilt in 1756, which probably relates to the origins of the current property.

In 1919 a valuation of the property was conducted with a view to selling it to the then tenant Mr George Woodhouse, the owner of the nearby brass foundry. Mr Woodhouse continued to live in the property until his wife's death in 1984 (On-Site Archaeology 2006).

3 Aims and Objectives

The aim of the evaluation was to establish the presence or absence of archaeological remains within accessible areas of the development plot and to assess the nature, extent, quantity and quality of survival of any archaeological remains and the impact that any proposed development would have on them. The development proposal will require removal of sections of the existing perimeter wall to the north and northeast. The wall, constructed from large dressed square blocks of limestone in regular courses, was to be preserved by record using large-format film.

4 Methodology

Geophysical survey

The geophysical (magnetometer and earth resistance) survey was undertaken in all amenable locations within the survey area on 20th January 2009. An area directly to the south of the Manor House was surveyed at the request of the client, although not in the development area. An area of approximately 0.1 hectares was surveyed in total.

A Trimble 5500 total station theodolite was used to tie the site grid into permanent landscape features, with survey stations and semi-permanent marker pegs left on site, to allow the grid to be re-located.

Detailed survey employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later downloaded to computer for processing and interpretation. Further details are given in Appendix 1. Detailed survey allows the visualisation of weaker anomalies that may not be readily identifiable by less rigorous evaluation techniques such as magnetometer (magnetic) scanning.

A Bartington Grad601 magnetic gradiometer was used during the survey with readings being taken at 0.25m intervals on zig-zag traverses 1m apart within 20m by 20m grids. The readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation using Geoplot 3 software.

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 of 0.5m gives an approximate depth penetration of 1m for most archaeological features.

The most commonly used array for archaeological evaluations is the *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 a good 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.

The survey methodology, report and any recommendations comply with 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).

Evaluation trenching

Four trenches were excavated within the proposed development area on the 10th-12th February 2009. The trench locations were largely governed by available open areas within the garden unrestricted by trees, shrubs and established mounds of garden waste/compost. The perimeter of the garden contained a number of mature trees with extant Tree Preservation Orders and trenches therefore avoided areas that may have caused root disturbance. Trench 1 was specifically sited as close as possible to the position of a possible lean-to building shown adjacent to the perimeter wall on a map of 1784 (Fig. 2).

The area of each trench was excavated by a mechanical excavator fitted with a toothless ditching bucket. Topsoil and overburden were removed in level spits under direct archaeological supervision until the first archaeological horizon or undisturbed natural was reached. The exposed surfaces and sections were then inspected for the presence of archaeological remains and deposits with further cleaning and excavation being conducted by hand.

Linear features were subject to 10% sample excavation with each section measuring not less than 1m in length. Discrete features were half sectioned to record their shape and form. Field sections were produced at scales of 1:10 or 1:20 where appropriate and field plans were produced at a scale of 1:50. All plans and sections included spot heights reduced to two decimal places relative to ordnance datum.

A photographic archive of all excavations was created using 35mm black and white negative and colour transparency film. Daily record shots were created using digital media.

The location of each trench was surveyed using a Series 600 Geodimeter Total Station Theodolite and fixed in relation to nearby landmarks and a nearby National Grid benchmark.

All investigations were undertaken in accordance with recognised professional standards (English Heritage 1991, Institute for Archaeologists 2008) and ASWYAS established methodologies (ASWYAS 2005). The primary archive is listed in Appendix 4 and a concordance of contexts in Appendix 5.

Photographic record

A photographic record of the north and northeast boundary wall was undertaken on 20th January 2009 using a tripod-mounted medium format (Mamiya 645) camera. The record was black and white using Ilford Professional HP5 Plus 220 film. Detailed overlapping shots were taken every 20m at 90 degrees to the external face. A number of general shots of the wall in its context were also taken. Access to the internal wall was restricted by dense ivy coverage and the presence of trees and shrubs and the number of photographs was therefore limited to a few exposed areas. This overall record was supplemented by a small number of high-resolution digital images.

The site and photographic archives will be deposited with Doncaster Museum, South Yorkshire. A photocopy record of the photographic prints is presented in Appendix 6.

5 Results

Magnetometer survey (Figures 3-5)

The magnetometer survey has identified an area of magnetic disturbance covering the southern part of the development area. This type of anomaly is caused by ferrous objects or other magnetic material in the topsoil/subsoil. Iron 'spikes' (see Appendix 3) have been located in the garden area and are typical of small ferrous material deposited in the topsoil/subsoil.

Four small areas of magnetic enhancement have been identified in the survey. These may be archaeological in origin although given the amount of modern material on the surface throughout the site it is probable that these anomalies are modern.

Earth resistance survey (Figures 6-8)

The earth resistance survey has identified a number of small areas of high resistance. These are not considered to be archaeological in nature. The largest response from the high resistance areas are in the south of the survey and represent possible pit type anomalies.

A low resistance anomaly in the south of the survey area may have been caused by water accumulation near to the high resistance anomalies described above. Other low resistance anomalies are probably caused by conductive material or water retention in the ground.

The results and subsequent interpretation of data from the geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. The size of the actual survey area may have had an impact on the anomalies that were identified in the survey; confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

Trench 1

Trench 1 measured 10 m by 4 m and was positioned on a WNW-ESE adjacent to the curving northern boundary wall in the approximate location of a building depicted on a map of 1784.

Approximately 0.5 m below material derived from garden beds (001) and a modern hardcore surface, two post-holes (006/008) and a curvilinear feature (010) were identified that were cut into natural strata (Fig. 9). Feature 010 was seen to enter the trench at its eastern end and run for 6.5 m before curving to the south-west and exiting the excavated area. Two sections were excavated through this feature that revealed an irregular profile 1.1 m in width and 0.23 m in depth containing a single fill (009) of light greyish-brown sandy clay. Within one section linear 010 was cut on its southern side by a post-hole (008) (Fig 9. S.2). This post-hole measured 0.25 m in length, 0.19 m in width and 0.38 m in depth with a single fill (007) similar to that of 009. Packing stones were observed around top of the post-hole although neither of the fills yielded any artefacts.

A second post-hole (006) was identified against the southwestern edge of the trench in its western corner. Post-hole 006 was 0.49 m in diameter and was 0.31 m in depth with a single fill (005) of mid greyish-brown sandy clay (Fig 9. S.1). No finds were recovered from the fill, however a single sherd of shell tempered pottery (Plate 5) was found within the vicinity of this post-hole during pre-excavation cleaning.

Later garden features were recorded within the northern and eastern sections. The northern section showed a square cut feature excavated through the border soil (Fig. 9). The eastern section demonstrated the relationship of the border bed to a former path to its south.

Trench 2

Trench 2 measured 10 m by 3 m and was positioned on a north-west to south-east alignment to the south of Trench 1. This trench revealed topsoil over natural strata at approximately 0.4 m in depth. The natural comprised sands and gravels that became gradually more gravelly to the west with a patch of yellow silty clay in the south-west corner. There were no archaeological features or finds within this trench.

Trench 3

Trench 3 measured 10 m by 3 m and was positioned on a slight north-east / south-west alignment within the former orchard area of the garden. This trench also revealed topsoil over a mid reddish brown sandy silt natural horizon at a depth of approximately 0.4 m. There were no archaeological features or finds within this trench.

Trench 4

Trench 4 measured 9 m by 4 m and was orientated on a north-west to south-east alignment within the south-western corner of the proposed development area.

Immediately below the turf was a compacted deposit (011) of industrial waste comprising slag, bricks and firebricks with occasional metalwork and rubber fittings. This deposit measured between 0.4 and 0.5 m in depth and was extremely well compacted with some of the bricks encapsulated within the slag lumps.

At the northern end of the trench deposit 011 gave way to a light grey silty clay (012) that measured 0.16 m in depth. At the base of 012, within the northern corner of the trench, a thin deposit of black ash was recorded (013). Approximately 0.6 m along the length of the trench, deposit 012 cuts a mid greyish brown silty clay deposit (014) that included gritty fragments and slag fragments. Deposit 014 continued for the rest of the length of the trench and was seen across its full width (Fig. 11, S.5).

Below deposits 012 and 014 at the northern end of Trench 4 a linear spread of cobbles was recorded (018) at a depth of approximately 0.67 m. This spread seamed to have a defined southern edge but its other limits were not within the bounds of the trench. The cobbles were compacted into a red silty clay natural deposit (017) that was exposed to a width of 1 m beyond the southern edge of the 018. A single sherd of $15^{th}/16^{th}$-century pot was recovered from the surface of 017.

Clay 017 was cut by the northern edge (015) of a very large feature of undetermined spread and depth that was backfilled with layers of loose deposits that included industrial waste (016, Plate 4). A small sondage was machine excavated in the south-east corner of the trench to test the depth of 016. The excavation was stopped at approximately 1.4 m as the loose makeup of 016 started to collapse into the sondage. The bottom of the feature was not established.

6 Artefact Record

Twenty sherds of mixed post-medieval ceramic material were recovered from garden soil 001 in Trench 1. The assemblage included fragments of clay flower pots, drainage pipe and glazed 19^{th}/early 20^{th}-century china. One sherd of medieval shell tempered pottery was recovered from Trench 1 within the vicinity of post-hole 005. A single sherd of 15^{th} or 16^{th} century brown glazed ware was recovered from above clay layer 017 within Trench 4.

A representative sample of the industrial waste and the firebricks that constituted the majority of deposit 011 in Trench 4 was also recovered.

7 Discussion

The evaluation trenches at the Manor House, Old Hexthorpe showed the presence of established garden soils, with thin to non-existent subsoils, over natural geology but also identified areas of probable early 20^{th}-century disturbance and the potential for the survival of medieval features and finds.

Trench 1 revealed evidence of domestic garden activity with an established bed against the perimeter wall bounded on its southern side by a pathway, the route of which is still recognisable in the current garden layout. Below this evidence of earlier activity was apparent with two post-holes and an associated curvilinear feature. None of these features yielded any direct dating evidence, although a large sherd of shell tempered ware recovered close to one of the post-holes suggests that they could be early medieval in origin. No evidence for structures as depicted on 18th-century mapping was present within Trench 1, although the choice of trench location was restricted by present tree and shrub cover and may therefore have not been best targeted.

Trench 4 exhibited evidence of greater disturbance in the 19th or early 20th centuries with deposits containing large amounts of industrial waste; a feature that shows as an anomaly on the geophysics earth resistance plot (Figs 6-9). These deposits seemed to infill a large deep cut (015) whose limits were not traceable within the excavation.

The desk-based assessment (On-Site Archaeology 2006) records that the tenants, and subsequent owners, of the Manor House in 1919 were Mr and Mrs Woodhouse, the owners of the nearby Woodhouse and Company brass foundry. This may explain the source of the industrial waste seen in Trench 4. The location of a wall on the 2nd edition Ordnance Survey, coincides with the northern limit of cut 015, the observed cobble surface (018) would possibly have abutted its northern side.

10 Conclusions

The features exposed within Trench 1 are the earliest features identified on the site. The nature and full extent of this activity could not be determined within the limits of the evaluation trench. The close proximity of these features to the potential 18th-century building could indicate an association, however the evidence collated remains inconclusive.

The lack of archaeological remains within Trenches 2 and 3 suggests that prior to enclosure within the grounds of Hexthorpe Manor any activity in these areas caused minimal belowground disturbance and left no evidence.

The deposits and features in Trench 4 are in stark contrast to the rest of the site. The presence of cut 015 and its backfill suggest a large deep feature used to deposit waste industrial material, possibly as a method of levelling or as a foundation material.

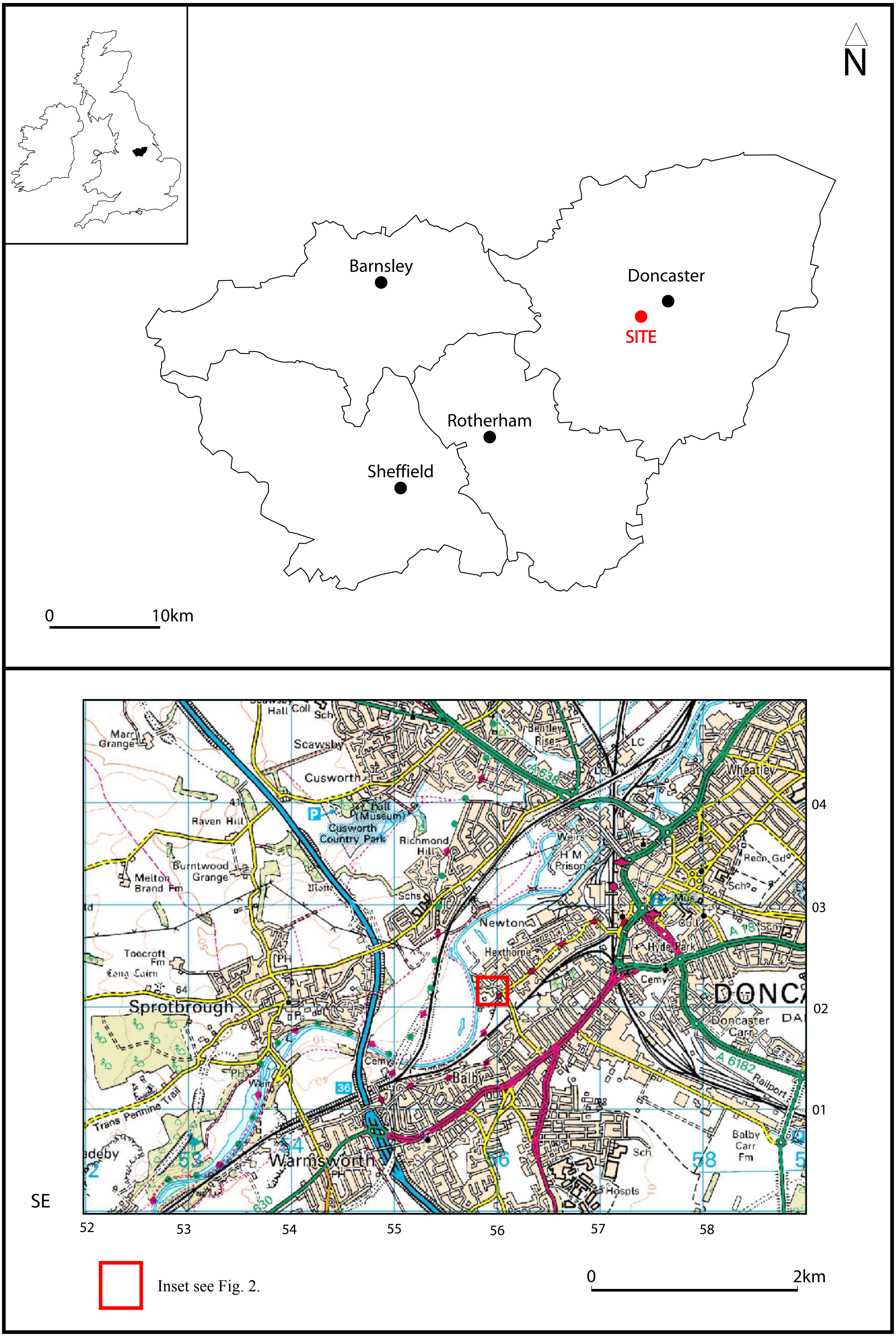

Fig. 1. Site location

Fig 2. Trench locations (1:500 @ A4)

Fig. 3. Processed greyscale magnetometer data (1:500 @ A4)

Fig. 4. Unprocessed magnetometer data (1:500 @ A4)

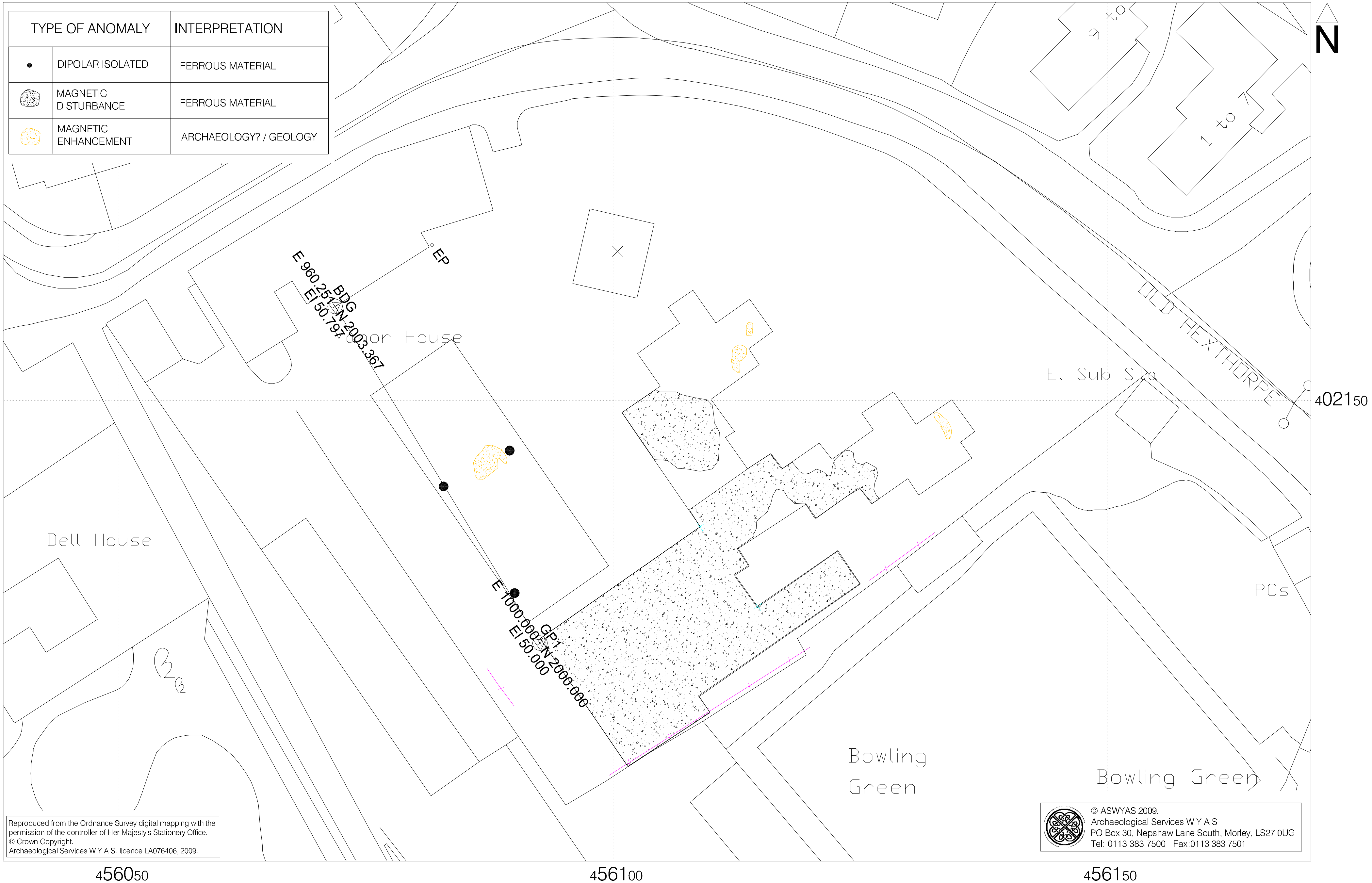

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Fig. 5. Interpretation of magnetometer data (1:500 @ A4)

Fig. 6. Processed greyscale earth resistance data (1:500 @ A4)

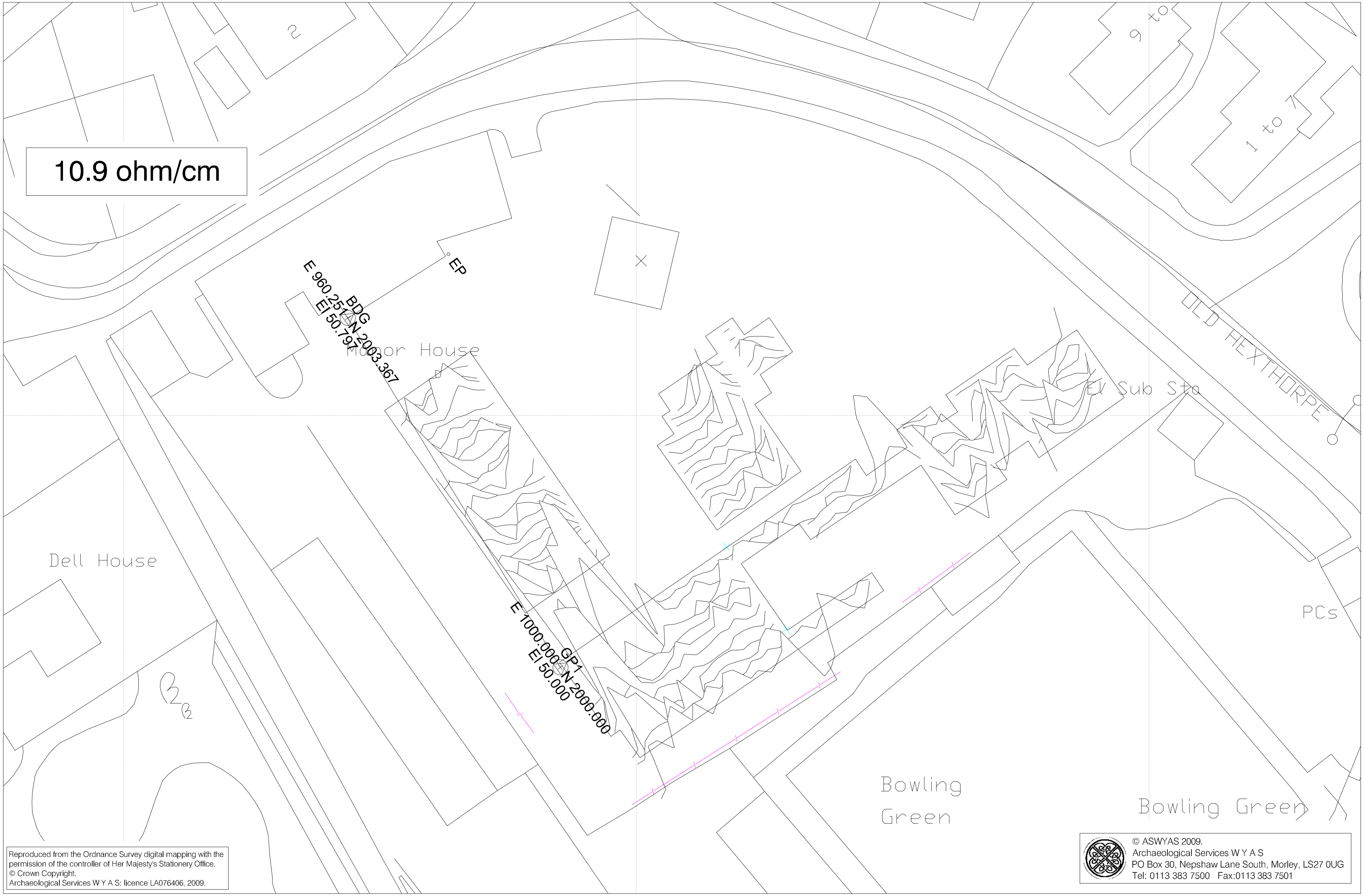

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Fig. 7. Unprocessed earth resistance data (1:500 @ A4)

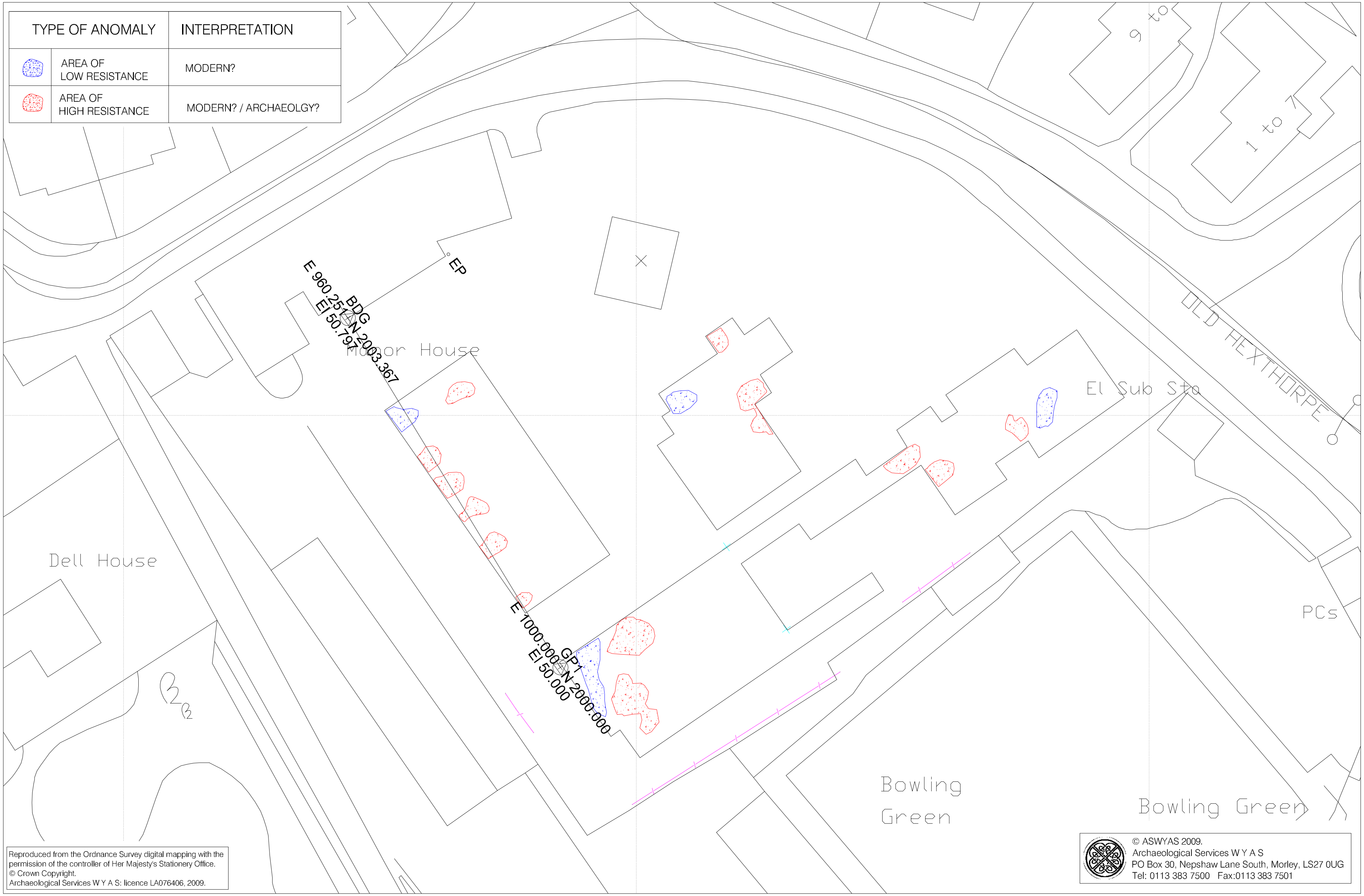

Fig. 8. Interpretation of earth resistance data (1:500 @ A4)

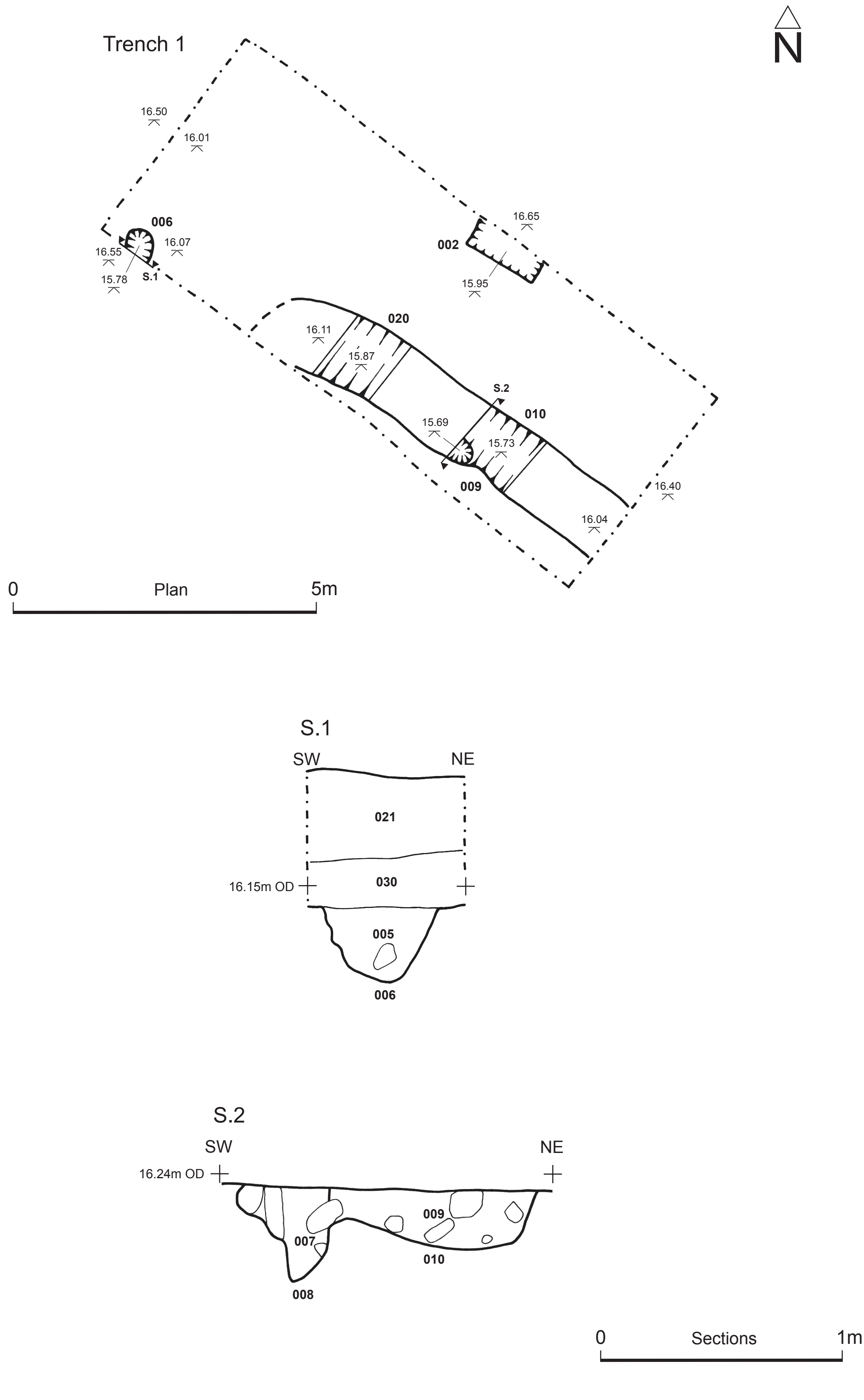

Fig. 9. Trench 1 plan and sections

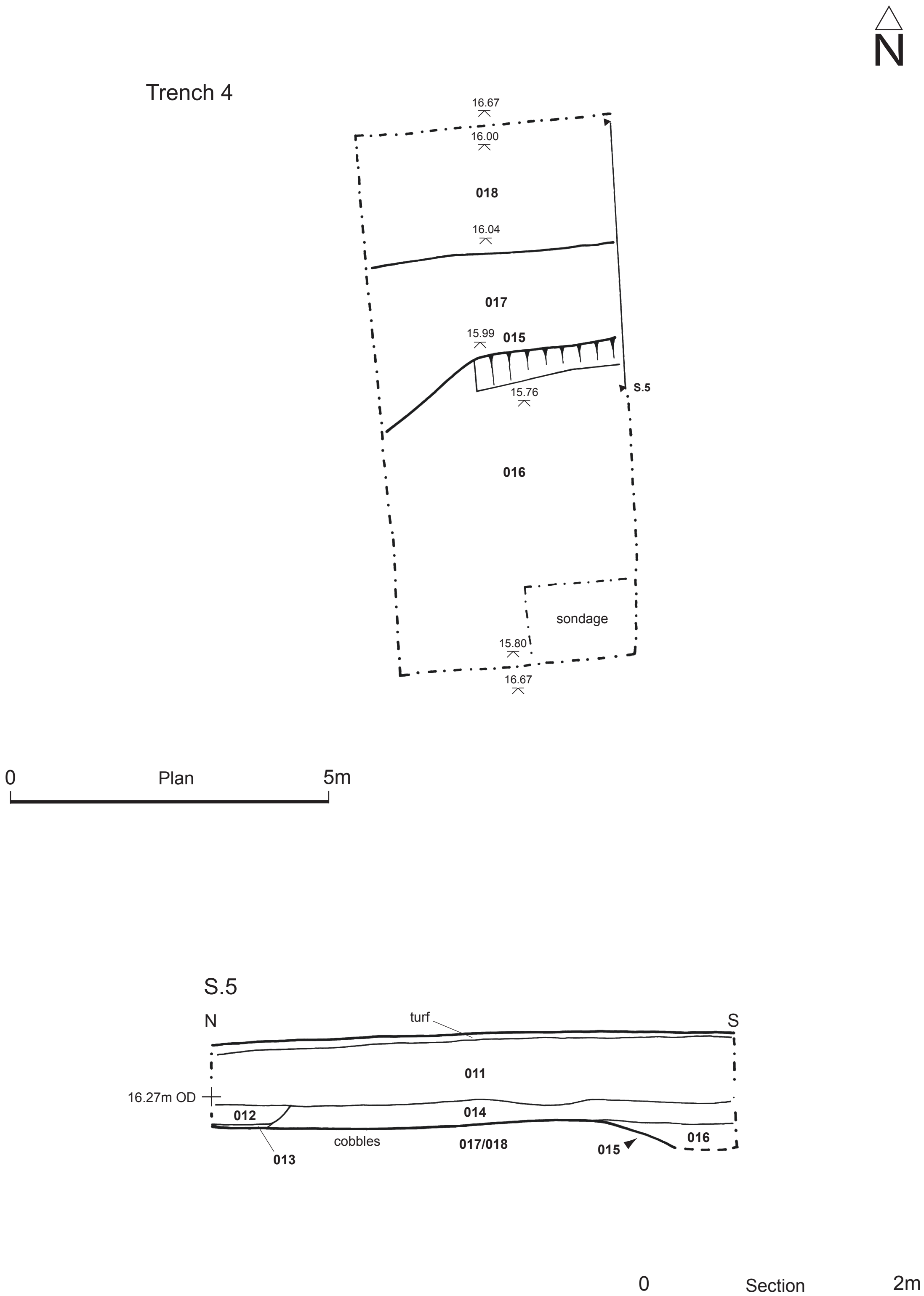

Fig. 10. Trench 4 plan and section

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

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

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. An agricultural origin, either ploughing or land drains is 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. 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 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 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 1600 readings were obtained for each 20m by 20m grid. 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: 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 and AutoCAD 2008) 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 Sites and Monument Record Office).

Appendix 4: Inventory of primary archive

File No	Description	Quantity
1	Trench record sheet	4
1	Context register	2
1	Drawing register	1
1	Drawing sheet number record	1
1	Levels data	2
1	Sample register	1
1	Finds and samples record	1
1	Context cards (001-030)	30
1	Photograph record sheet (Film nos 8579 and 8580)	2
1	Colour transparencies (Film no 8579)	1
1	Black and white contact sheet (Film no 8580)	1
1	Black and white negatives (Film no 8580)	1
1	Digital photo record sheet (Download no)	1
1	Site drawings	4
2	Boundary wall photographic archive	1
2	Film 1: Frames 1,2,3,5,6,7,8,10,11,12,13,14,15,17,18	15
2	Film 2: Frames 1,2,4,5,6,8,12,13,14,15,17	11
2	Negative sheets	2

Appendix 5: Concordance of contexts

Context	Trench	Description	Artefacts and environmental samples
001	1	Fill of 002	Slag x 1, shell x 1, pottery x 20
002	1	Cut of Garden Feature	
003	1	Fill of 004	
004	1	Cut of garden feature	
005	1	Fill of 006	Sample 2
006	1	Cut of Post-hole	
007	1	Fill of 008	Sample 1
008	1	Cut of Post-hole	
009	1	Fill of 010	
010	1	Cut of curvilinear feature	
011	4	Compacted slag layer	CBM x 1, Slag x 2
012	4	Light grey clay layer	
013	4	Ash deposit below 012	
014	4	Mid greyish brown silt	
015	4	Cut of large feature	
016	4	Upper fill of 015	
017	4	Red clay	Pottery x 1
018	4	Cobbled surface	
019	1	Fill of 020 (same as 009)	
020	1	Cut of curvilinear (same as 010)	
021	1	Dark gravel/hardcore	
022	1	Modern burnt deposit	
023	1	Modern burnt deposit	
024	1	Garden soil fill of 025	
025	1	Cut of border garden bed	
026	1	Path makeup	
027	1	Layer below 026	
028	1	Subsoil	
029	1	Dark gravel/hardcore (same as 021)	
030	1	Layer below 021	

Appendix 6: Photographic Survey

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