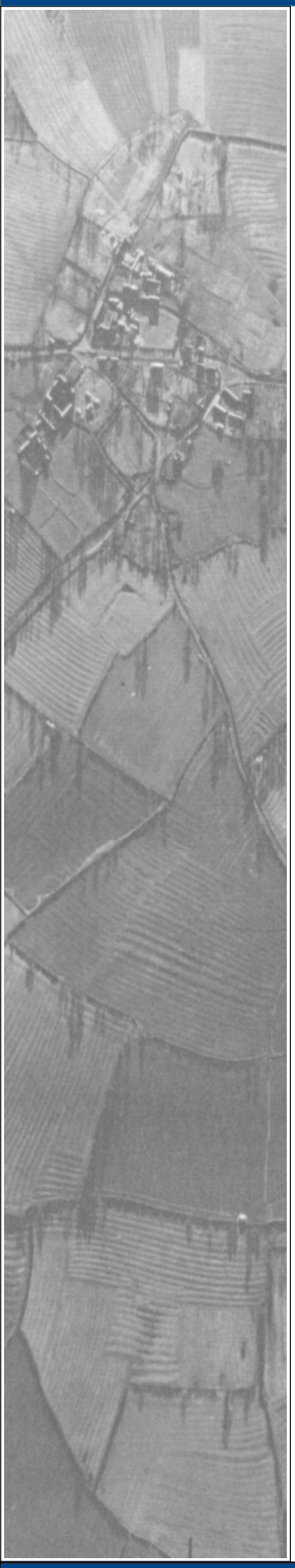

Manningford Bohune Estate
North Newnton
Wiltshire

MAGNETOMETER SURVEY REPORT

for

Wessex Woodland Management

Kerry Donaldson & David Sabin

June 2025

Ref. no. J1048

ARCHAEOLOGICAL SURVEYS LTD

Manningford Bohune Estate
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Wiltshire

MAGNETOMETER SURVEY REPORT

for

Wessex Woodland Management

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Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

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SUMMARY

Detailed magnetometry was carried out at North Newnton by Archaeological Surveys Ltd ahead of a tree planting scheme. The site contains earthworks purported to relate to plot boundaries and platforms associated with the medieval settlement. The survey located a number of anomalies within the south eastern corner of the site that appear to relate to cut and magnetically enhanced features with archaeological potential. Elsewhere the anomalies are generally very weak and lack a clearly defined morphology; however, there is potential that these could relate to further archaeological features within the area of platforms along the roadside. Several linear boundaries separate the plots and these have a differing magnetic response depending on their extant form or if they have been infilled with modern material. A former watercourse running through the north eastern and central part of the site has also been infilled with modern magnetic material.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Wessex Woodland Management to undertake a magnetometer survey of an area of land on the Manningford Bohune Estate at North Newnton, near Pewsey in Wiltshire. The site contains earthworks purported to relate to land plots and platforms associated with the medieval settlement of North Newnton. The site has been outlined for a proposed tree planting scheme and the survey forms part of an archaeological assessment.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to tree planting within the site. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 Geophysical survey can provide useful information on the archaeological potential of a site; however, the outcome of any survey relies on a number of factors and as a consequence results can vary. The success in meeting the aims and objectives of a survey is, therefore, often impossible to predetermine.

1.3 Standards, guidance and recommendations for the use of this report

1.3.1 Archaeological Surveys Ltd is a Registered Organisation with the Chartered Institute for Archaeologists (CIfA) and both company directors are Members of

the Chartered Institute for Archaeologists (MCIfA) and have therefore been assessed for their technical competence and ethical suitability and abide by the CIfA Codes of Conduct. The survey and report follow the recommendations set out by: European Archaeological Council (2015) Guidelines for the Use of Geophysics in Archaeology; Institute for Archaeologists (2002) The use of Geophysical Techniques in Archaeological Evaluations. The work has been carried out to the Chartered Institute for Archaeologists (2014, updated 2020) Standard and Guidance for Archaeological Geophysical Survey.

1.3.2 Archaeological Surveys Ltd provide a detailed geophysical survey report and it is recommended that where possible the contents should be considered in full. The Summary provides a brief overview of the results with more detail available in the Discussion and/or Conclusion. The *List of anomalies* within the Results provides a detailed assessment of the anomalies within separate categories which can be useful in inferring a level of confidence to the interpretation. Quality and factors influencing the interpretation of anomalies is also set out within the results.

1.3.3 It is recommended that the full report should always be considered when using data and interpretation plots; where this is not possible, in the field for example, the abstraction and interpretation plots should retain their colour coding and be used with a corresponding legend.

1.3.4 Magnetic anomalies may relate to features within the topsoil, subsoil or within the underlying solid or superficial geology. Anomalies are created by contrasting magnetic susceptibility; however, this is not necessarily consistent with changes in soil texture or colour and may not be contained within well defined features. Magnetic contrast and the magnitude of anomalies does not necessarily correlate with the volume or thickness of magnetic material present. The vertical component of the magnetic field is measured by the magnetometer and this falls rapidly with distance from the sensor, it may not be possible to distinguish weak features within the topsoil from deeper features containing more magnetic material.

1.3.5 Interpretation of anomalies relies on detailed analysis of the data. The morphology of anomalies and their magnitude are important factors in the interpretation process. Wherever possible, supporting information is used, e.g. LiDAR, early mapping and desk-based assessments. However, anomalies often cannot be confidently interpreted without intrusive investigation and as such are categorised as of uncertain origin; this classification may include anomalies relating to archaeological features.

1.4 Site location, description and survey conditions

1.4.1 The site is located to the north of Broad Street, on the Manningford Bohune Estate in North Newnton near Pewsey, Wiltshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 12700 57746, see Figs 01 and

02.

1.4.2 The geophysical survey covers approximately 2.5ha within a single grassland field. It contains earthworks purported to relate to land plots and house platforms associated with the medieval settlement of North Newnton. The southern edge of the site lies at approximately 100m AODN with land sloping down slightly towards the north. The area is surrounded by mature trees with the exception of the southern side where there is a hedgerow bounding Broad Street, which is the lane between North Newnton and Hilcott. To the north of the site a small tributary of the River Avon runs from west to east. Residential dwellings are located off the south western and south eastern corners of the site.

1.4.3 The ground conditions across the site were generally considered to be suitable for the collection of magnetometry data. However, the perimeter of the field and a zone adjacent to a small pond in the northern part of the field were surrounded by unmown grass which was unsurveyable. Parts of the site were difficult to traverse due to uneven ground related to earthworks. Weather conditions during the survey were fine.

Plate 1: Survey area looking west

1.5 Site history and archaeological potential

1.5.1 The site contains a number of earthworks visible within the field and identified on LiDAR imagery through the National Mapping Programme (Carpenter & Winton, 2011) as a series of building platforms and narrow plots that extend northwards from the road towards a former course of a stream. They have

been recorded on the Wiltshire Historic Environment Record (no: MWI13569) as being associated with the settlement of North Newnton which has Saxon origins. The earliest record was when the settlement was granted to Athelheim by Alfred in AD892 and then by Athelstan to St Mary's Abbey in Wilton in AD934. North Newnton remained under the abbey ownership until the Dissolution in 1539 when it was granted to William Herbert, 1st Earl of Pembroke.

1.5.2 As the site contains earthworks associated with the medieval settlement of North Newnton there is potential for the survey to locate buried archaeological features.

1.5.3 During the course of the survey a number of linear earthworks and depressions were observed. It was considered likely that some of the earthworks were related to modern tree removal and scrapes of uncertain date. The southern part of the field contained numerous animal burrows.

1.6 Geology and soils

1.6.1 The underlying geology is from the West Melbury Marly Chalk Formation with overlying alluvial deposits within the northern half of the site (BGS, 2025).

1.6.2 The overlying soil across the majority of the site is from the Thames association (814a) and is a pelo-calcareous alluvial gley soil. It consists of a stoneless, mainly calcareous, clayey soil affected by ground water. Observations during the survey confirmed the presence of gleying. The soil along the southern edge of the site is from the Blewbury association (511d) which is a typical brown calcareous earth and consists of a well drained, calcareous, clayey soil (Soil Survey of England and Wales, 1983).

1.6.3 The underlying geology and soils are frequently associated with low magnetic contrast and low levels of magnetic susceptibility, particularly where soils are gleyed. However, cut features of archaeological potential may be located where human activity has altered the magnetic characteristics of the soil sufficiently. The underlying geology and soils are, therefore, considered acceptable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance (also known as thermoremanence) are factors associated with the formation of localised magnetic fields.

2.1.2 Iron minerals within the soil may become altered by burning and the break

down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce positive magnetic anomalies that can be mapped by magnetic prospection. In addition, where soil is displaced by material of comparatively low magnetic susceptibility, such as many types of sedimentary rock, anomalies of negative value may occur which could be indicative of structural remains.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T). Additional details are set out in 2.2 below and within Appendix A.

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO® MX V3 6 channel cart-based system. The instrument has 6 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20Hz which equates to a survey resolution of 0.5m by 0.15m. The cart is pushed at walking speed and not towed. Each sensor is not zeroed in the field as the vertical axis alignment is precisely fixed leaving sensor offsets that are removed during data processing. The fixing of the vertical alignment ensures the sensors are not unduly influenced by localised magnetic fields and that the vertical component of a magnetic anomaly is measured. The gradiometers have a recorded range of ±3000nT, and resolution is approximately 0.1nT. They are linked to a Leica GS10 RTK GNSS with data recorded by SENSYS MonMX software on a rugged notebook computer system.

2.2.2 Due to the fixed offsets within the fluxgate sensors, as a result of the manufacturing and tensioning process, the survey data do not provide a visually useful dataset until a zero median traverse algorithm is applied. It is recognised that this has the potential to affect some anomalies detrimentally by removing linear features orientated parallel to survey transects. However, this has not been noted as a particular problem with the system due to the high resolution data collection, generally long length of traverses and variability within the magnetic characteristics of a linear anomaly.

2.2.3 Data are collected along a series of parallel survey transects to achieve 100% coverage of the surveyable land. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps maintain the correct separation between adjacent traverses. Data are not

collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).

2.2.4 Fluxgate sensors are highly sensitive to temperature change and this manifests as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift, data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <100s.

2.3 Data processing and presentation

2.3.1 Magnetic data collected by the MAGNETO® MX V3 cart-based system are initially prepared using SENSYS MAGNETO® DLMGPS software. The software effectively allocates a geographic position for each data point and can compensate for fixed offsets present within the FGM650 sensors. The offsets are positive or negative values present on all fluxgate gradiometer sensors. Some systems use manual or electronic balancing to effectively zero the sensors; however, this is a short term measure that is prone to drift through temperature changes and vibration and can easily be incorrectly set due to localised magnetic fields. The FGM650 sensors are very accurately aligned to the vertical magnetic gradient and are highly stable showing negligible drift on long traverses. The offset values are removed using TerraSurveyor software.

2.3.2 Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display within TerraSurveyor. The removal of the offset values (compensation) of the sensors is also carried out in TerraSurveyor using a zero median traverse function. Data are then considered to be minimally processed. Note: without the zero median traverse function it is not possible to create a meaningful data plot as all sensors have a different offset value. Although a zero median traverse algorithm can remove anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

2.3.3 The minimally processed data are collected between limits of ±3000nT and clipped for display at ±3nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 Additional data processing has been carried out in the form of both low pass and high pass filtering. Low pass filtering effectively removes high frequency variation along a traverse that has been caused by uneven ground and associated vibration. High pass filtering effectively removes low frequency variation along a traverse that has been caused by large magnetic bodies, cultivation or rapid temperature change. Data treated to additional processing

have been compared to unprocessed data to ensure that no significant anomalies have been removed.

2.3.5 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on processing.

2.3.6 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. Minimally processed data are considered by the manufacturer to be data that are compensated by SENSYS MAGNETO DLMGPS software, see 2.3.1 and 2.3.2. Note: traceplots are not considered to be appropriate as they do not provide an accurate or useful assessment of the magnetic anomalies due to the very high density of data collection. In addition, traceplots cannot be meaningfully plotted against base mapping and in areas of complexity traces may be lost or highly confused. Traceplots may be used to demonstrate characteristic magnetic profiles across discrete features where it is considered beneficial.

2.3.7 The raster images are combined with base mapping using ProgeCAD Professional 2021, creating DWG (2018) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GNSS, resection method, etc.

2.3.8 An abstraction and interpretation is drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.9 A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within the survey area. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.10 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model plot derived from the Environment Agency's LiDAR data. Shaded relief plots and contours are created using Surfer 15 (Azimuth:135, Altitude:45, Z factor:10), (Fig 06).

2.3.11 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

2.4 Supplementary measurement of magnetic susceptibility

2.4.1 Magnetic susceptibility is an important factor in the formation of magnetic

anomalies located by a magnetometry survey, see 2.1. Accurate measurement of the magnetic susceptibility of soil, subsoil and underlying geology may enhance the results of the magnetometry survey by providing an assessment of magnetic contrast within a site. Where sampling of topsoil only is possible, measurement may assist in understanding whether the soil is likely to be associated with strong, moderate or weak anomalies, which may be a result of low levels of iron minerals, waterlogging, etc. Accurate measurement may also assist in determining industrial activity and the presence of layers or features not visually or texturally apparent on excavation.

2.4.2 Supplementary measurement of soil magnetic susceptibility is not considered part of the main objective of the survey and is discussed in section 3.2 below as a factor influencing the formation of anomalies.

2.4.3 Measurements are achieved using a Bartington MS2 Magnetic Susceptibility Meter with MS2B sensor. Small soil samples are measured in 10 cubic centimetre plastic pots after accurately weighing, generally each sample is subdivided and at least 3 separate measurements are made in order to provide a mean value, or assess variability due to ferrous contamination and other factors. Measurement can be made at low or high frequency, generally low frequency measurements are made but occasionally high frequency measurements are also recorded as the frequency dependence of a soil may be informative.

2.4.4 The measurements are converted to mass specific readings using SI units for bulk density. Archaeological Surveys express the measurements as X_{lf} or X_{hf} for low frequency or high frequency magnetic susceptibility respectively with units of $10^{-8}m^3kg^{-1.}$

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of 2.5ha within a single grassland field.

3.1.2 Magnetic anomalies located can be generally classified as positive responses of archaeological potential, positive and negative anomalies of an uncertain origin, linear anomalies associated with land management, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects.

3.1.3 Anomalies located within each survey area have been numbered and are described in 3.4 below with subsequent discussion in Section 4.

3.2 Data quality and factors affecting the interpretation or formation of anomalies

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset.

3.2.2 Magnetic contrast generally appears poor due to weak anomalies. The area also contains a number of linear zones of magnetic debris probably relating to infill of linear ditches and a former fluvial channel with soil contaminated by ferrous objects.

3.2.3 In order to provide further understanding of the magnetic characteristics of the soil, two topsoil samples were taken and their mass specific magnetic susceptibility was measured, see 2.4. A sample from the southern part of the field in the vicinity of earthworks produced an average low frequency mass specific magnetic susceptibility (X_{lf}) of 11.6 $10^{-8}m^3kg^{-1}$; a sample from the northern part of the field away from earthworks, and on gleyed soil, produced a value of 8.79 $10^{-8}m^3kg^{-1}$. The two values are similar and indicate low levels of magnetic enhancement consistent with agricultural soils located away from intensive human activity. The slightly lower level of the northern sample is probably related to more frequent waterlogging and gleying of the soil on slightly lower lying ground. However, the samples may not be representative of the whole site or of deeper layers as mixing may be poor due to lack of deep cultivation. The soils within the wider area are known to generally produce poor magnetic contrast particularly where anthropogenic activity is of relatively low intensity.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A general explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, see Table 1.

Interpretation category	Description and origin of anomalies
Anomalies with archaeological potential	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc. The category is used where there is a high level of confidence which may be due to additional supporting information where morphology is unclear or uncharacteristic.
Anomalies with an uncertain origin	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation. Land drains can appear in a classic herringbone pattern of interconnected multiple dipolar linear anomalies, or as parallel linear anomalies. The multiple dipolar response indicates ceramic land

	drains.
Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, hearths and nail spreads from former wooden structures or rooves and may, therefore, be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.
Anomalies with a natural origin	Magnetically enhanced pit-like anomalies associated with the removal of trees.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Area centred on OS NGR 412700 157746, see Figs 03 – 05.

Anomalies of archaeological potential

(1) – A number of positive linear anomalies are located in the south eastern part of the site. Although this part of the site was mapped as a separate land parcel containing an orchard until the later 20th century, the magnetic enhancement may indicate cut features associated with former settlement and/or features relating to the former farmstead immediately to the east.

Anomalies with an uncertain origin

(2) – A number positive linear and discrete anomalies are evident within the southern part of the site. While they are very weak and indistinct, several are similar to and in the vicinity of anomalies (1). There is potential that these could also relate to settlement features, although they lack a coherent morphology.

(3) – Patches of magnetic enhancement are located close to anomalies (1) and (2). They are located within the southern part of the site and the enhancement could be derived from settlement.

(4) – A group of positive anomalies appear to lie between two former boundaries at the western end of the site. They also appear to have been truncated by negative linear anomalies. Other pit-like anomalies lie at the southern end of the plot.

Anomalies associated with land management

(5 – 7) – A number of linear boundary features can be seen extending northwards from the road, towards an infilled channel (9). These correspond with earthwork features seen on LiDAR imagery and may relate to former settlement boundaries

separating plots of land into narrow strips. Some of the boundaries are associated with magnetic debris (5) which relates to modern ferrous material used to back-fill where lines of trees have been removed in the 20th century. Another is associated with a line of pits, also where trees have been removed (6), but soil-filled, rather than filled with ferrous material. Others are very weakly positive and/or negative (7).

(8) – Land drains can be seen towards the north eastern corner of the site.

Anomalies associated with magnetic debris

(9) – A sinuous zone of magnetic debris extends along the lower ground in the centre of of the site and relates to modern material used to infill the former water course.

(10) – The site contains widespread and numerous strong, discrete, dipolar anomalies and small patches of magnetic debris. As there has been modern infill and ground make-up it is not clear if all of these responses relate to modern ferrous and other magnetically thermoremnant objects, or if any could be associated with settlement.

4 DISCUSSION

4.1.1 The site contains a number of former land plots, divided into narrow strips by boundaries and with platforms along the southern edge that have been attributed to relating to medieval settlement. These can be seen on LiDAR imagery (Fig 06) and while there is some magnetic response, the anomalies tend to be weak and poorly defined. Several anomalies (1) in the south eastern part of the site appear to relate to a linear ditch and magnetically enhanced features that could relate to the settlement. A number of other anomalies (2 & 3) also seen within mainly the southern part of the site could also relate to settlement features; however, they are very weak and lack a clear morphology.

4.1.2 The former plot boundaries have a variable response, depending on if they are extant banks or ditches, or if they contain magnetic material. Several are associated with magnetic debris (5) which relates to modern ferrous material used as infill when trees along the boundaries were removed in the 20th century. A former water course has also been infilled with modern ferrous and other magnetically thermoremnant material, such as brick/tile (9). Although the LiDAR shows earthworks relating to water meadows in the north western part of the site, the alluvial soils in this area are gleyed which tends to be associated with low magnetic susceptibility and a lack of magnetic contrast.

4.1.3 Two magnetic susceptibility samples demonstrate only very low levels of magnetic enhancement within the topsoil and are consistent with the formation of very weak anomalies with poor magnetic contrast. It is unclear whether this

relates solely to the characteristics of the soil and underlying geology or whether it is an indication of only low intensity agricultural use of the land. It is known that other archaeological sites in the Pewsey Vale have produced poor results using magnetometry (Linford, Linford & Payne, 2013; Hardwick & Payne, 2014).

5 CONCLUSION

5.1.1 The geophysical survey located a small number of positive anomalies in the south east corner of the site that could be associated with the medieval settlement at North Newnton. Other positive responses in the southern part of the site could also be be related, but they are generally weak and lack a coherent morphology. A number of linear boundaries have a varying magnetic response depending on whether they are extant banks or ditches and if they are associated with removed trees where hollows have been infilled. The course of a former water channel that extends across the north eastern and central part of the site has also been infilled with modern material.

5.1.2 The very weak anomalies are consistent with very low magnetic susceptibility which was confirmed by measurement of two topsoil samples. However, it is uncertain as to whether the low readings obtained are related solely to the characteristics of the topsoil, subsoil, geology and hydrology of the site, or whether they are an indicator of relatively low intensity anthropogenic activity.

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Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material. Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field. Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried magnetic field. The difference between the two sensors will relate to the strength of the magnetic field created by the buried feature.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

High Pass Filter

Removes low frequency anomalies within the data that are not considered to be archaeologically significant and may be natural in origin. A window passes over the data, the mean of all the data within the window is subtracted from the centre value. The size of the window is adjusted as is the weighting which may be uniform or Gaussian. The process is used to improve the visibility of anomalies of interest.

Low Pass Filter

Removes high frequency anomalies or 'noise' within datasets and provides a smoother output. A window passes over the data, the mean of all the data within the window is used to replace the centre value. The size of the window is adjusted as is the weighting. The process is used to improve the visibility of anomalies of interest.

Zero Median/Mean Traverse

The median (or mean) of data from each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise differences between the offset values of the gradiometer sensors. The process can remove archaeological features that run along a traverse but with the high resolution datasets created by the Sensys FGM650 sensors and the method of data collection this has not been a notable problem. In fact, the removal of offsets using software avoids carrying out a balancing procedure on site, which inevitably can never be done in magnetically clean conditions and results in improperly aligned fluxgate sensors and/or electronic adjustment values.

Appendix C – survey and data information

Minimally processed data

Filename: J1048-mag-proc.xcp
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 412569.56, 157828.042 m
Southeast corner: 412807.31, 157674.44 m
Collection Method: Randomised
Sensors: 6
Dummy Value: 32702
Dimensions
Survey Size (meters): 238 m x 154 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 883830, Recorded: 883836

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.24
Mean: 0.00
Median: 0.02
Composite Area: 3.6518 ha
Surveyed Area: 2.5086 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.37.0
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (UTM to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Filtered data

Std Dev: 1.14
Mean: 0.00
Median: 0.01
Composite Area: 3.6518 ha
Surveyed Area: 2.5086 ha
Processes: 1
1 Base Layer

GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (UTM to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Lo pass Uniform (median) filter: Window dia: 13
6 Clip from -3.00 to 3.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

A PDF copy will be supplied to the Wiltshire Historic Environment Record with greyscale images and abstraction layers made available on request. The report will also be uploaded to OASIS, the online system for reporting archaeological investigations and linking research outputs and archives. The digital data will be archived with the Archaeology Data Service (ADS).

Archive contents:

File type	Naming scheme	Description
Data	J1048-mag.asc J1048-mag.xcp J1048-mag-proc.xcp J1048-mag-proc-hpf-lpf.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data TerraSurveyor filtered data
Graphics	J1048-mag-proc.tif J1048-mag-proc-hpf-lpf.tif	Image in TIF format
Drawing	J1048-**[version number]**.dwg	CAD file in 2018 dwg format
Report	J1048 report.odt	Report text in LibreOffice odt format

Table 2: Archive metadata

Appendix E – copyright and intellectual property

www.archaeological-surveys.co.uk
info@archaeological-surveys.co.uk
Tel: 01249 814 231

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Map of survey area

Survey location

Site centred on OS NGR
SU 12700 57745

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

412550 412600 412650 412700 412750 412800 412850

157850 157800 157750 157700 157650

North Newnton Wood

Pond

Falkner's Cottage

N

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

412700 157750

Survey tracks

Survey track start

Survey track stop

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Greyscale plot of minimally processed magnetometer data

North Newnton Wood

N

Pond

Falkner's Cottage

-3nT +3nT

+3nT

-3nT

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Greyscale plot of filtered magnetometer data

North Newnton Wood

N

Pond

Falkner's Cottage

+3nT

-3nT

-3nT

+3nT

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Abstraction and interpretation of magnetic anomalies

North Newnton Wood

N

Pond

Falkner's Cottage

1
2
2
3
4
5
5
6
7
8
9
10

- Positive linear anomaly - magnetically enhanced feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - former plot boundary
- Weak multiple dipolar linear anomaly - land drain
- Discrete positive response - possible pit-like feature
- Discrete positive response - pit associated with tree removal
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Manningford Bohune Estate
North Newnton
Wiltshire

Digital Terrain Model

Derived from Environment Agency's LiDAR data 1m resolution

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 06