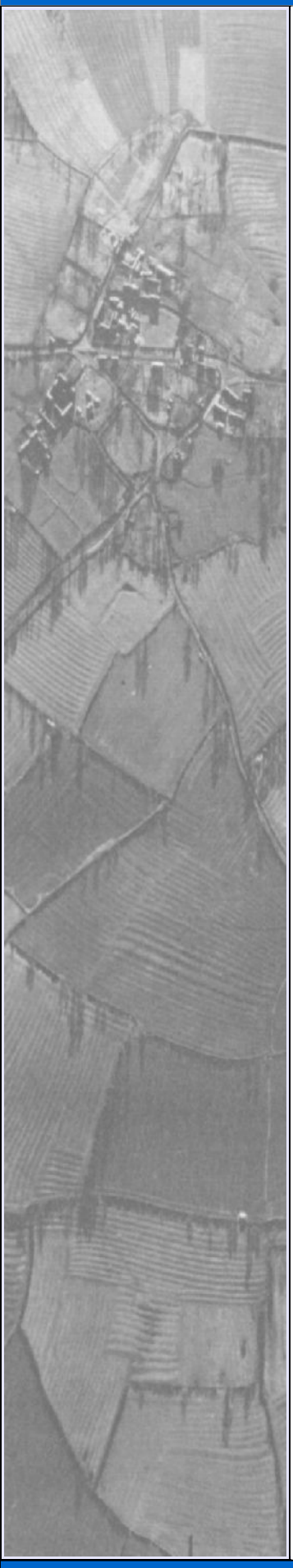

Land north of the A454
Swancote
Shropshire

MAGNETOMETER SURVEY REPORT

for

Pre-Construct Archaeology

Kerry Donaldson & David Sabin

September 2018

Ref. no. J763

ARCHAEOLOGICAL SURVEYS LTD

Land north of the A454
Swancote
Shropshire

Magnetometer Survey Report

for

Pre-Construct Archaeology

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Report by Kerry Donaldson BSc (Hons)
Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey dates – 17th & 18th September 2018
Ordnance Survey Grid Reference – **SO 73925 94050**

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SUMMARY

A geophysical survey, comprising detailed magnetometry, was undertaken by Archaeological Surveys Ltd at the request of Pre-Construct Archaeology over an area of land to the north of the A454 at Swancote to the east of Bridgnorth in Shropshire. The survey includes an area of rugby pitches, adjacent land outlined for a proposed clubhouse and lawned areas adjacent to a former country club. The results demonstrate the presence of widespread natural anomalies formed in periglacial conditions within the western part of the site, along with magnetic debris. A rectilinear feature formed by magnetically enhanced anomalies contained within a negative rectilinear anomaly may indicate a former structure, although its age and function is uncertain. Several other positive anomalies of uncertain origin were located, and it is not possible to determine whether they relate to anthropogenic activity or natural features.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Pre-Construct Archaeology to undertake a magnetometer survey of an area of land north of the A454, Swancote in Shropshire. The western part of the site has been recently developed into rugby pitches by Bridgnorth Rugby Football Club, and the survey was carried out as part of an archaeological assessment required to discharge a planning condition by Shropshire Council (15/04830/FUL).

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 with regard to the archaeological potential of 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 The survey and report generally 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) *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 Where targeting of anomalies by excavation is to be carried out, care should be taken to place trenches over solid lines or features visible on the abstraction and interpretation plots. Archaeological Surveys abstraction and interpretation avoids the use of dashed or dotted lines; broken or fragmented anomalies may well correspond closely with subsurface truncation.

1.4 Site location, description and survey conditions

1.4.1 The site is located to the north of the A454, Swancote near Bridgnorth in Shropshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SO 73925 94050, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 8ha within 5 separate survey areas. Area 1 lies in the western part of the site and comprises a number of newly formed rugby pitches. Area 2 is a car park with a surface of road scalpings located immediately east of Area 1. Area 3 has been outlined for a new club house, rugby pitch and car park and was a grass field at the time of survey. Area 4 lies within a small grass triangle to the north of the A454, and Area 5 lies within the garden of the former country club on the eastern edge of the site. Area 5 contained an open-air swimming pool, changing rooms, a number of trees and shrubs and was surrounded by tall wire mesh fencing.

Plate 1: Area 1 looking north west

Plate 2: Areas 2 & 3 looking east

Plate 3: Area 4 looking east

Plate 4: Area 5 looking east

1.4.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during the survey were mainly fine.

1.5 Site history and archaeological potential

1.5.1 An Archaeological Desk-Based Assessment has been carried out by Pre-Construct Archaeology (2015). It outlines that there are a number of prehistoric flint scatters and a possible pit alignment and ringed ditch between 385m and 875m north of the site. The route of the Roman road from Greensforge in Staffordshire to the forts at Forden Gaer, Caersws and Castell Collen in Wales has been postulated to follow the modern A454, situated just to the south of the survey area. The tithe and early Ordnance Survey mapping indicates that the site was once made up of five separate land parcels, with a number of ponds or pits at the junction of the field boundaries. The former line of the A454 Wolverhampton Road is also indicated to extend along the driveway to the country club and then eastwards to the south of the garden associated with the former country club (between survey Areas 4 and 5). The road was realigned at this point during the first half of the 20th century.

1.5.2 Although there are no designated or undesignated heritage assets within the site, there is recorded land management in the form of several former land boundaries crossing the site and removed in the 20th century. The country club to the east is also likely to have associated ground works. The postulated line of the Roman road to the south could indicate that there is some potential for the site to contain previously unrecorded archaeological features.

1.6 Geology and soils

1.6.1 The underlying geology is Triassic sandstone and conglomerate from the Chester Formation with overlying glacial till deposits of clay, sand and gravel in the western part of the site (Area 1) (BGS, 2017).

1.6.2 The overlying soil across the eastern part of the site is from the Bridgnorth association and is a typical brown sand. It consists of a well drained, sandy and coarse loamy soil over soft sandstone. The soil in the west is from the Salwick association and is a stagnogleyic argillic brown earth which consists of a deep, reddish, fine loamy soil with slowly permeable subsoil and slight seasonal waterlogging. (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry carried out over similar geology and soil has produced good results. The site is, therefore, considered suitable 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 are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

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 magnetic anomalies that can be mapped by magnetic prospection.

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).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20 Hz. 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 range of recording data between ±0.1nT and ±10,000nT. They are linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA 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®MXPDA 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 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 ±10000nT and clipped for display at ±3nT for Areas 1 & 3, ±20nT for Areas 4 & 5 and ±250nT for Area 2 (Fig 03). In order to show the extreme magnitude of the responses, areas have been shown clipped at ±250nT with values over 200nT in red and under -200nT in blue (Fig 04). Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 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.

2.3.5 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. With regard to the Sensys MXPDA, 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.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2016, creating DWG (2010) 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 GPS, resection method, etc.

2.3.7 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. Appendix E sets out CAD layer names with colour and graphic content for each interpretation category, see 3.3.

2.3.8 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 each survey area.

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

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of five survey areas covering approximately 8ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, anomalies relating to land management, anomalies of a natural origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services.

3.1.3 Anomalies located within each survey area have been numbered and are described in 3.4 to 3.7 below.

3.2 Statement of data quality and factors influencing the interpretation 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 High magnitude anomalies are associated with patches of magnetic debris and ferrous material both of recent or modern origin. Low magnitude anomalies associated with archaeologically significant features may be obscured by these high magnitude responses.

3.2.3 Small areas of landscaping or made ground associated with high magnitude anomalies were encountered in the eastern part of Area 1, the car park forming Area 2 and possibly in Area 5 also. The magnetic response to a track running along the southern and south eastern parts of Area 3 was tested and revealed very high levels of magnetic disturbance caused by modern material; survey was not carried out along the track as no meaningful data could be collected.

3.2.4 Small patches of high magnitude magnetic disturbance were also associated with two steel goal posts in the western part of Area 1, steel objects and containers at the northern end of Area2 and steel fencing surrounding Areas 4 and 5.

3.2.5 Data were not collected due to the physical constraints of rough overgrown soil at the northern corner of Area 1 and trees and fencing within Areas 4 and 5.

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 basic 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 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.
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	Naturally formed magnetic anomalies are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to anomalies within more solid geology.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 373833 294013, see Figs 06 – 09.

Anomalies with an uncertain origin

(1) - A weakly positive linear anomaly is oriented north east to south west. It may relate to a natural feature (3); however, it has a similar orientation and could be a continuation of anomalies (10) seen in Area 3 to the north east.

Anomalies associated with land management

(2) - A fragmented positive linear anomaly extends towards the south western corner of the survey area and may be associated with a formerly mapped boundary ditch.

Anomalies with a natural origin

(3) - Much of the survey area contains widespread weakly positive linear and curvilinear anomalies. These relate to natural features caused by freeze-thaw action under periglacial conditions.

Anomalies associated with magnetic debris

(4) - Highly magnetic debris appears to be situated in the part of the field where several former field boundaries were mapped as joining with one or more ponds or

pits, which also extend into the northern part of Area 2. It appears that these ponds or pits were back-filled with highly magnetic material.

(5) - Small zones of less strongly magnetic debris may relate to spreads of dumped material or associated with former burning.

(6) - The entire site contains widespread and numerous strong, discrete, dipolar anomalies that relate to ferrous and other magnetically thermoremnant objects, such as brick and tile, distributed within the topsoil.

Anomalies with a modern origin

(7) - Magnetic disturbance from rugby goalposts.

3.5 List of anomalies - Area 2

Area centred on OS NGR 373942 294002, see Figs 10 & 11.

Area 2 is a car park with a layer of road scalpings. The entire survey area contains magnetic debris which is highly magnetic. This indicates a material containing steel or iron which is likely to relate to a sub-base constructed of broken reinforced concrete.

3.6 List of anomalies - Area 3

Area centred on OS NGR 373996 294060, see Figs 10 & 11.

Anomalies with an uncertain origin

(8) - Situated in the north western part of the survey area are positive anomalies forming a rectangular feature. The response varies, generally 20-30nT, with discrete peaks at over 50nT in the northern part and over 90nT in the south eastern corner. The positive responses are surrounded by a negative rectilinear anomaly and split in the north by a negative linear anomaly. The dimensions are approximately 10.2m by 5.2m and are indicative of a possible structure. Several discrete positive responses are located to the south west and these may be associated. It is not possible to determine if this has archaeological potential, or if it relates to a more recent structure, such as a barn; however, none have been mapped from the tithe map onwards.

(9) - Amorphous positive response with several discrete positive responses to the north could relate to cut features. However, they lack a coherent morphology and it is not possible to determine if they are anthropogenic or if they relate to naturally formed features.

(10) - A group of positive responses that are discrete, linear and amorphous could have a similar origin to anomalies (9). They are very weak (<1nT) and indistinct.

(11) - A zone of magnetic enhancement could be associated with anomalies (9) and (10); however, whether they are natural or anthropogenic in origin cannot be determined.

(12) - Irregularly shaped positive linear anomalies situated to the east of (9) could relate to cut features. The response is 2-9nT which could indicate magnetic enhancement from anthropogenic activity. However, the site contains widespread magnetic debris and a modern origin is possible.

Anomalies associated with land management

(13) - Two parallel positive linear anomalies relate to a formerly mapped field boundary likely to have been removed during the late 20th century. It is associated with magnetic debris (15) which indicates material has been used to backfill or consolidate it. The parallel positive linear anomalies could indicate double ditches flanking a former trackway, but this part of the survey area has also been used as a modern track.

Anomalies with a natural origin

(14) - Weakly positive linear and curvilinear anomalies appear to be associated with further natural anomalies.

Anomalies associated with magnetic debris

(15) - Magnetic debris has been spread along the line of a former field boundary and also agricultural track. Other patches are evident elsewhere and relate to dumped material used for infill and/or ground consolidation.

Anomalies with a modern origin

(16) - A water pipe extends towards the centre of the survey area to the line of the former field boundary.

3.7 List of anomalies - Areas 4 & 5

Area 4 centred on OS NGR 374117 294037 and Area 5 centred on OS NGR 374110 294112, see Figs 10 & 11.

Areas 4 and 5 contain magnetic debris and magnetic disturbance. Area 5 contains a number of pipes or services.

4 CONCLUSION

4.1.1 The detailed magnetometry revealed a widespread pattern of naturally formed anomalies within the western part of the site in the area utilised for rugby pitches (Area 1). Very strongly magnetic debris within a narrow strip used as a car park (Area 2) indicates a sub-base containing recycled ferrous and other magnetically thermoremnant materials. Highly magnetic material has also been used to infill former ponds/pits.

4.1.2 Within the central part of the site (Area 3), positive responses appear to be surrounded by negative rectilinear anomalies that may indicate a former structure. It is not possible to determine the age or function of the features, but no agricultural buildings have been mapped from the tithe map onwards. A former field boundary crosses the survey area and appears as a double-ditched anomaly with associated magnetic debris that indicates back-filling or consolidation. Other positive responses within the survey area lack a coherent morphology and it is not possible to determine if they have a natural or anthropogenic origin.

4.1.3 In the eastern part of the site (Areas 4 & 5) the data indicate the presence of magnetic debris and magnetic disturbance associated with ferrous material of modern origin.

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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. It has been found that clipping data to ranges between ±5nT and ±3nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero (destripe) Median/Mean Traverse

The median (or mean) of 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 baseline value of gradiometer sensors.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks, modern agricultural features and other large magnetic bodies within or adjacent to survey areas.

Low Pass Filtering

A mathematical process used to remove high frequency anomalies relating to uneven ground, vibration, etc.

Appendix C – survey and data information

Area 1

Filename: J763-mag-Area1-proc.xcp
Description: Imported as Composite from: J763-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 373685.2415, 294166.93 m
Southeast corner: 373976.54, 293865.43 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 1325300
Dimensions
Composite Size (readings): 1942 x 2010
Survey Size (meters): 291 m x 302 m
Grid Size: 291 m x 302 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.16
Mean: 0.04
Median: 0.00
Composite Area: 8.7827 ha
Surveyed Area: 4.832 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 2

Filename: J763-mag-Area2.xcp
Description: Imported as Composite from: J763-mag-Area2.asc
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 373894.26, 294079.48 m
Southeast corner: 373992.51, 293925.28 m
Source GPS Points: 72500
Dimensions
Composite Size (readings): 655 x 1028
Survey Size (meters): 98.3 m x 154 m
Grid Size: 98.3 m x 154 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 276.25
Min: -275.00
Std Dev: 159.48
Mean: 1.93
Median: 1.23
Composite Area: 1.515 ha
Surveyed Area: 0.27728 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -250.00 to 250.00 nT

Area 3

Filename: J763-mag-Area3.xcp
Description: Imported as Composite from: J763-mag-Area3.asc
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 373904.88, 294158.28 m
Southeast corner: 374075.13, 293948.88m
Source GPS Points: 569800
Dimensions
Composite Size (readings): 1135 x 1396
Survey Size (meters): 170 m x 209 m
Grid Size: 170 m x 209 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.45
Mean: -0.01
Median: 0.03
Composite Area: 3.565 ha
Surveyed Area: 2.2058 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 4

Filename: J763-mag-Area4.xcp
Description: Imported as Composite from: J763-mag-Area4.asc
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 374088.30, 294050.14 m
Southeast corner: 374148.75, 294015.643 m
Source GPS Points: 31600
Dimensions
Composite Size (readings): 403 x 230
Survey Size (meters): 60.5 m x 34.5 m
Grid Size: 60.5 m x 34.5 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 22.10
Min: -22.00
Std Dev: 13.45
Mean: -0.62
Median: 0.18
Composite Area: 0.20855 ha
Surveyed Area: 0.098926 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -20.00 to 20.00 nT

Area 5

Filename: J763-mag-Area5-proc.xcp
Description: Imported as Composite from: J763-mag-Area5.asc
Northwest corner: 374064.06, 294170.82 m
Southeast corner: 374141.61 294049.32m
Source GPS Points: 120300
Dimensions
Composite Size (readings): 517 x 810
Survey Size (meters): 77.6 m x 122 m
Grid Size: 77.6 m x 122 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 22.10
Min: -22.00
Std Dev: 10.43
Mean: -0.42
Median: 0.10
Composite Area: 0.94223 ha
Surveyed Area: 0.36161 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -20.00 to 20.00 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 Shropshire Historic Environment Record with printed copies on request. Greyscale images as TIF with TFWs can also be made available to the HER along with the CAD abstraction layers as a DWG if necessary. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J763-mag-**[area number/name]**.asc J763-mag-**[area number/name]**.xcp J763-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J763-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J763-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J763 report.odt	Report text in Open Office odt format

Table 2: Archive metadata

Appendix E – CAD layers for abstraction and interpretation plots

The table below sets out Archaeological Surveys Ltd CAD layer names with associated colours and graphical content. Where CAD files are available layers may be extracted for further CAD/GIS use. Note: hatched polygon boundaries are contained within layers with the RGB colour code 254, 255, 255 (near white) in order to prevent their visibility.

Report sub-heading and associated CAD layer names	Colour with RGB index		Layer content
Anomalies with an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG NEG LINEAR UNCERTAIN		Blue 0,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
Anomalies relating to land management			
AS-ABST MAG BOUNDARY		127,0,0	Line, polyline or polygon (solid or cross hatched ANSI37)
Anomalies associated with magnetic debris			
AS-ABST MAG DEBRIS		132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR		132, 132, 132	Solid donut, point or polygon (solid)
Anomalies with a modern origin			
AS-ABST MAG DISTURBANCE		132, 132, 132	Polygon (hatched ANSI31)
AS-ABST MAG SERVICE		132, 132, 132	Line or polyline
Anomalies with a natural origin			
AS-ABST MAG NATURAL FEATURES		Yellow 255,255,0	Polygon (cross hatched ANSI37)

Table 3: CAD layering

Appendix F – copyright and intellectual property

This report may contain material that is non-Archaeological Surveys Ltd copyright (eg Ordnance Survey, Crown Copyright) or the intellectual property of third parties, which we are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Archaeological Surveys Ltd. Users remain bound by the conditions of the Copyright, Design and Patents Act 1988 with regard to multiple copying and electronic dissemination of this report.

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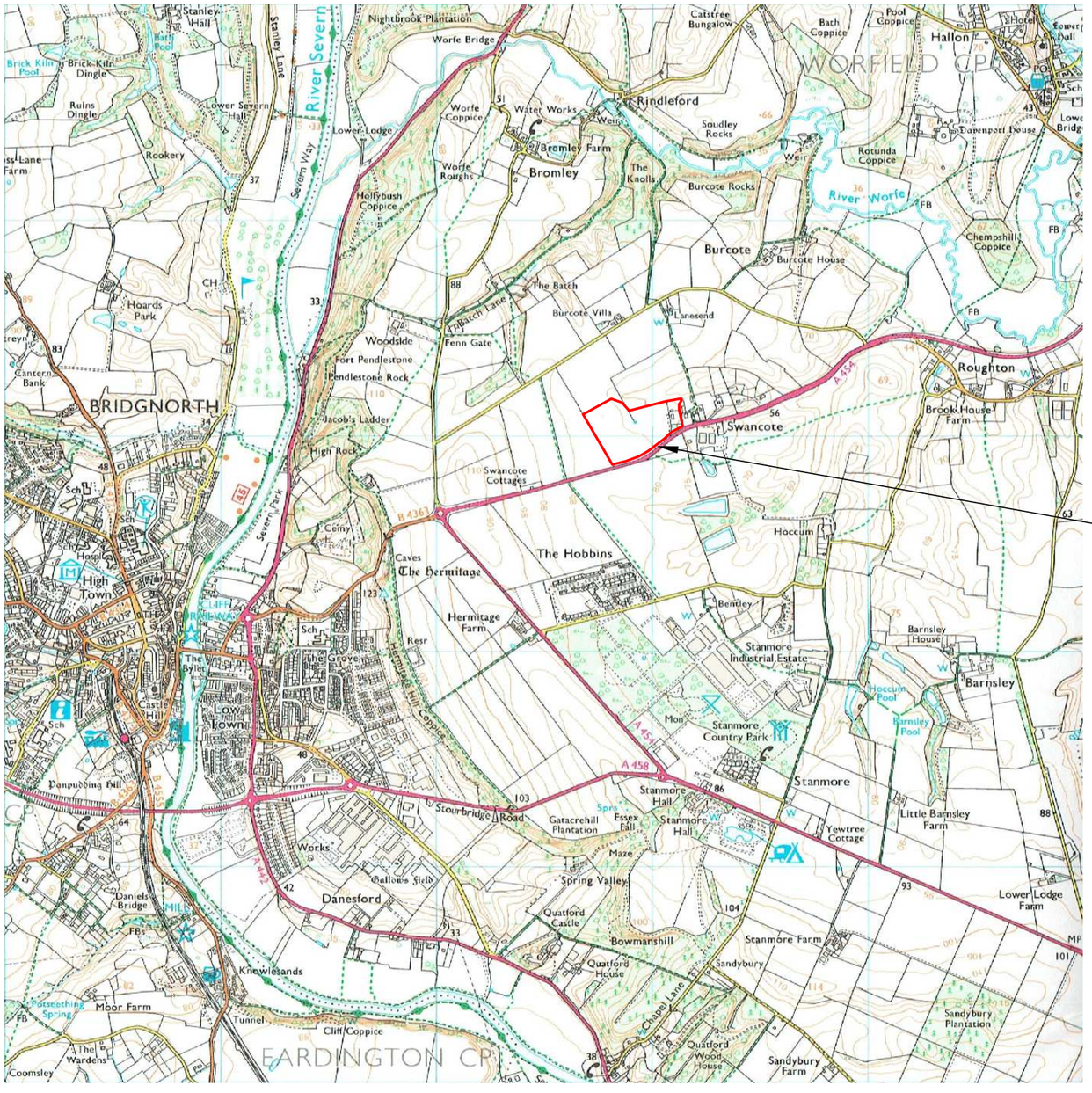


Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Map of survey area

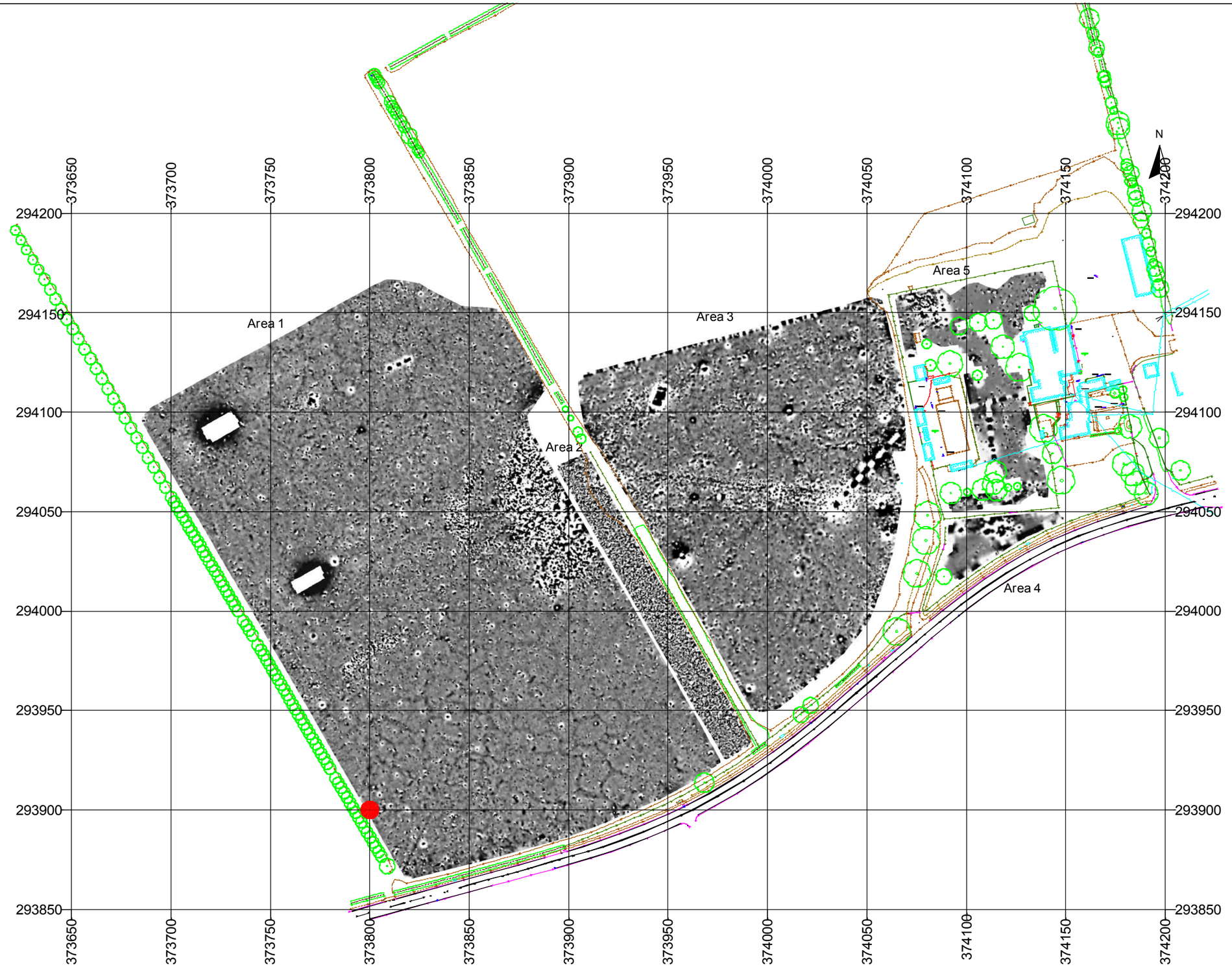
Site centred on OS NGR SO 73925 94050

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01



Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02

● 373800 293900

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

FIG 02

Area 1

Area 2

Area 3

Area 5

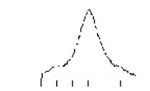
Area 4

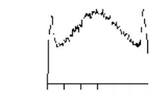
N

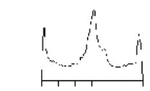
Archaeological Surveys Ltd

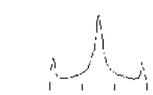
Geophysical Survey
Land north of the A454
Swancote
Shropshire

Greyscale plot of minimally processed magnetometer data

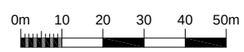








SCALE 1:1500



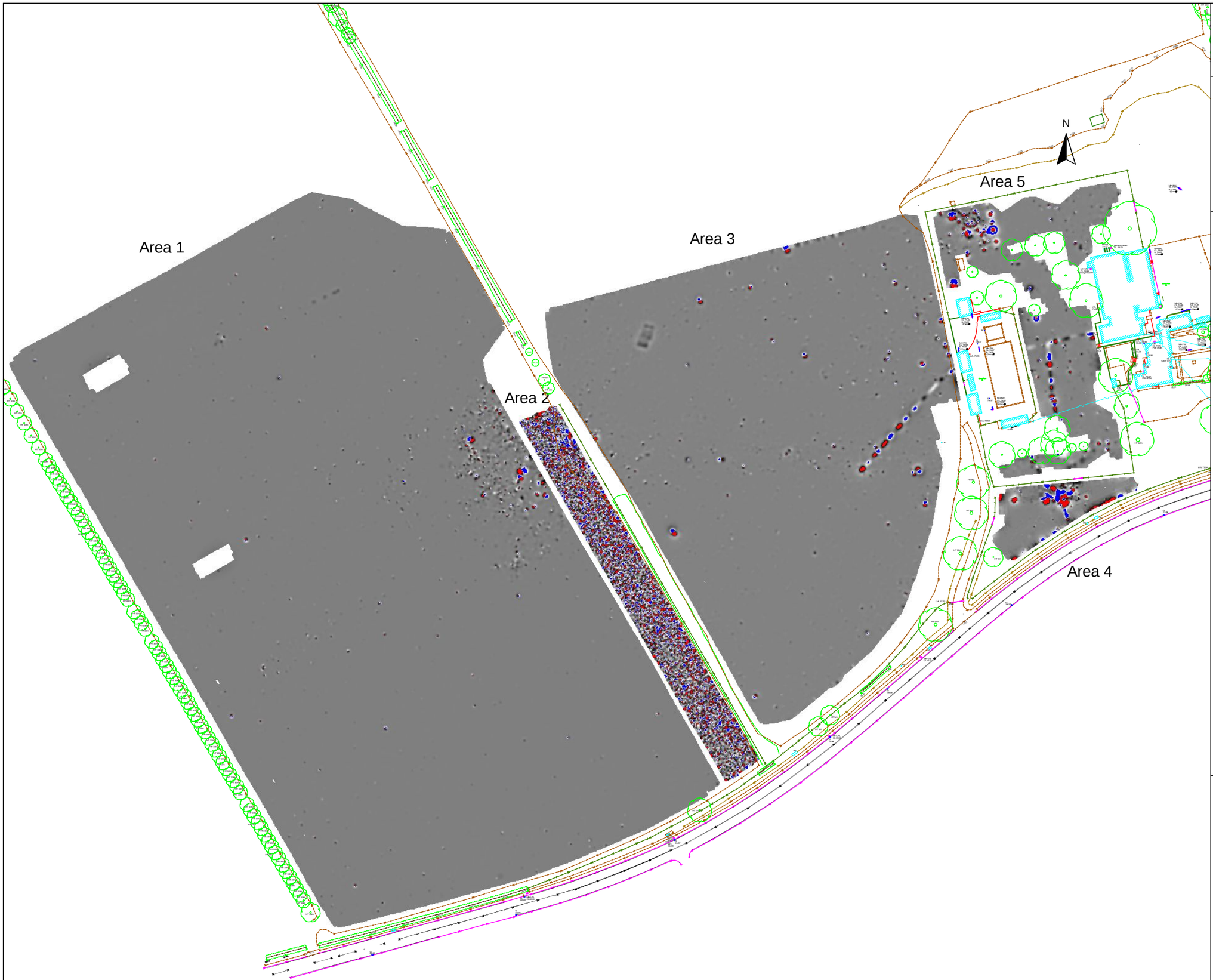
SCALE TRUE AT A3

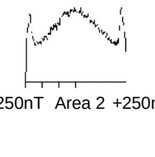
FIG 03

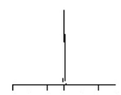
Archaeological Surveys Ltd

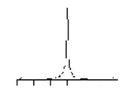
Geophysical Survey
Land north of the A454
Swancote
Shropshire

Greyscale plot of minimally processed magnetometer data clipped at ±250nT

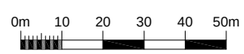








SCALE 1:1500



SCALE TRUE AT A3

FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Abstraction and interpretation of magnetic anomalies

Area 1

Area 2

Area 3

Area 4

Area 5

N

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear/curvilinear anomaly - of natural origin
- Discrete positive response - possible pit-like feature
- Discrete positive response - of natural origin
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Area 1

Area 2

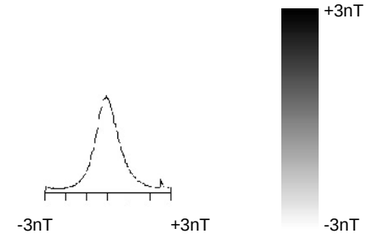
Area 3

N

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Greyscale plot of minimally processed magnetometer data - Area 1 north west



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 06

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Abstraction and interpretation of magnetic anomalies - Area 1 north west

Area 1

Area 2

Area 3

N

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible former field boundary
- Positive linear/curvilinear anomaly - of natural origin
- Discrete positive response - of natural origin
- 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

FIG 07

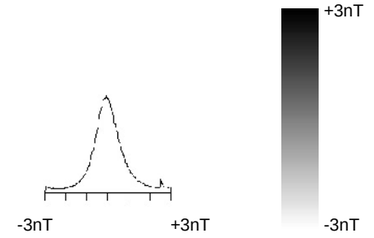
Area 2

N

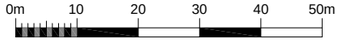
Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Greyscale plot of minimally processed magnetometer data - Area 1 south west



SCALE 1:1000



SCALE TRUE AT A3

FIG 08

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Abstraction and interpretation of magnetic anomalies - Area 1 south west

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible former field boundary
- Positive linear/curvilinear anomaly - of natural origin
- Discrete positive response - of natural origin
- 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

FIG 09

Area 2

Area 3

Area 4

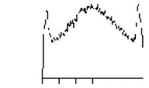
Area 5

N

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

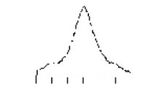
Greyscale plot of minimally processed magnetometer data - Areas 2 to 5



-250nT Area 2 +250nT

+250nT

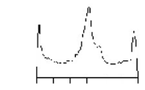
-250nT



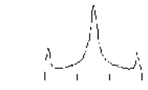
-3nT Area 3 +3nT

+3nT

-3nT



-20nT Area 4 +20nT

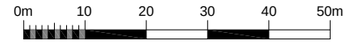


-20nT Area 5 +20nT

+20nT

-20nT

SCALE 1:1000



SCALE TRUE AT A3

FIG 10

Archaeological Surveys Ltd

Geophysical Survey
Land north of the A454
Swancote
Shropshire

Abstraction and interpretation of magnetic anomalies - Areas 2 to 5

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear/curvilinear anomaly - of natural origin
- Discrete positive response - possible pit-like feature
- Discrete positive response - of natural origin
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 11