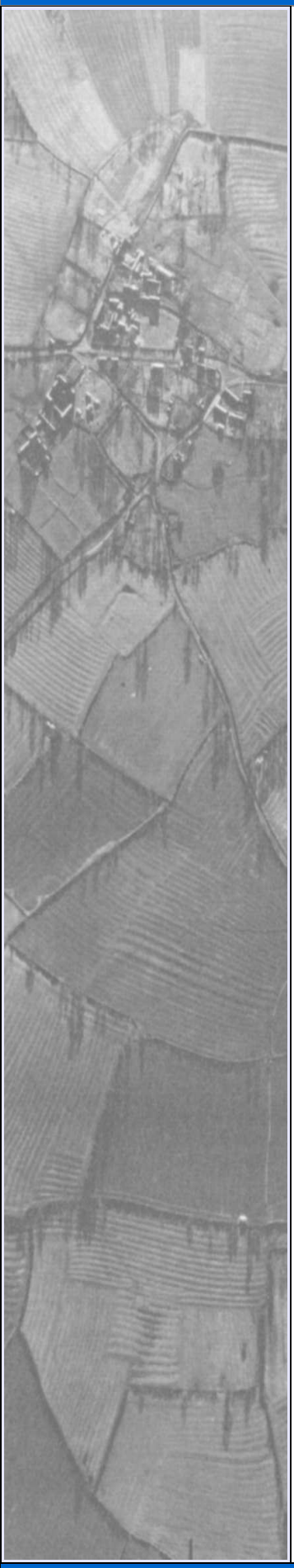

Phase II Foden Park
Streethay
Lichfield
Staffordshire

MAGNETOMETER SURVEY REPORT

for

Cotswold Archaeology

Kerry Donaldson & David Sabin

May 2018

Ref. no. J744

ARCHAEOLOGICAL SURVEYS LTD

Phase II Foden Park
Streethay
Lichfield
Staffordshire

Magnetometer Survey Report

for

Cotswold Archaeology

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

Survey dates – 18th & 19th April 2018
Ordnance Survey Grid Reference – SK 13450 10820

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SUMMARY

Detailed magnetometry was carried out within a single 9ha field at Streethay near Lichfield by Archaeological Surveys Ltd. Several fragmented positive linear responses were located but these relate to formerly mapped boundary ditches. Two small areas containing weakly positive responses, close to patches of magnetic debris, have also been located, but it is not possible to determine if they relate to cut features and if they have a any association with the magnetic debris. Natural features, relating to the drainage pattern across the site and periglacial freeze-thaw action, have also been located along with a number of land drains.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Cotswold Archaeology, on behalf of Miller Homes, to undertake a magnetometer survey of an area of land at Streethay near Lichfield. The land to the east is under development as Phase I Foden Park and the current survey applies to Phase II Foden Park.

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 development 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: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* 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 at Streethay House Farm, to the north of Lichfield in Staffordshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SK 13450 10820, see Figs 01 and 02. Phase I Foden Park is under construction on land immediately to the east.

Plate 1: Survey area looking south west towards Lichfield

1.4.2 The geophysical survey covers approximately 9ha within a single arable field which contained stubble at the time of survey. The land generally falls towards

the north east and at the time of survey this lower area was partly waterlogged. Field boundaries were mainly hedgerows, although the eastern boundary was post and rail fencing with Heras steel mesh panels. Heras was also located immediately beyond the southern hedgerow. Above ground galvanised steel tubing was also noted at the north eastern corner of the field and within a small section of the eastern boundary.

1.4.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Sources of magnetic disturbance outlined above were considered to be very minor and unlikely to significantly influence the survey results. Weather conditions during the survey were very warm.

1.5 Site history and archaeological potential

1.5.1 A Cultural Heritage Assessment was undertaken by Cotswold Archaeology (2011) for Phase I Foden Park, situated immediately to the east. This outlines that within the field immediately north east of the present survey area (Phase II) there are cropmarks indicating linear ditches, a square enclosure and a ring ditch. An area of worked flint chips was located by a metal detectorist approximately 150m south west of the survey area, with also a number of Roman coins from the 1st and 2nd centuries within the same field to the south west, likely to relate to a hoard. Undated sandstone ashlar blocks, interpreted as relating to a possible medieval chapel, were also identified in the same location. Situated at the eastern edge of the survey area is the metal detecting findspot of four incomplete Roman copper alloy fibula brooches. Geophysical survey also carried out within the Phase I land to the east identified very few archaeological features (Bartlett, 2011) and subsequent evaluation revealed some evidence for prehistoric activity and post medieval marl extraction. A number of undated linear ditches may represent field boundaries pre-dating the post medieval period (Cotswold Archaeology, 2015).

1.5.2 The 1849 Tithe Map for Streethay Township shows a number of linear boundaries that are no longer depicted on the 1883 First Edition Ordnance Survey map. A former pond is situated at the eastern edge of the site, with two further ponds to the west.

1.5.3 The location of the Roman brooches within the site indicates that there is potential for possible archaeological features to be present. Formerly mapped field boundaries may also relate to geophysical anomalies.

1.5.4 The surface conditions within the site were generally unsuitable for the observation of cultural material during the course of the survey. However, several fire-cracked pebbles were noted in the northern half of the field.

1.6 Geology and soils

1.6.1 The underlying geology is Triassic pebbly and gravelly sandstone from the

Helsby Sandstone Formation with overlying head deposits in the north eastern corner (BGS, 2017).

1.6.2 The overlying soil across the site is from the Bromsgrove association and is a typical brown earth. It consists of a well drained, reddish, coarse, loamy soil over sandstone (Soil Survey of England and Wales, 1983).

1.6.3 The general drainage pattern through the site appears to run from the south west towards the north east. Adjacent to the north east corner the soil was waterlogged at the time of survey

1.6.4 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 is manifest 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. 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 high pass filtering. This effectively removes low frequency variation along a traverse that has been caused by large magnetic bodies, cultivation or rapid temperature change. Low pass filtering has also been carried out. This effectively removes high frequency variation along a traverse that has been caused by uneven ground and associated vibration. Data treated to additional processing has 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. 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.

2.3.7 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.

2.3.8 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. Appendix E sets out CAD layer names with colour and graphic

content for each interpretation category, see 3.3.

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.

2.3.10 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model and/or contour plot derived from GNSS height data automatically logged during the survey and the Environment Agency's LiDAR data. The GNSS heights are converted from the ETRS89 ellipsoid using the National Geoid Model OSGM02 to obtain ODN (Ordnance Datum Newlyn) + the GNSS antenna height (approximately 1.5M). Shaded relief plots and contours are created using Surfer 15.

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.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over approximately 9ha within a single arable field.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, anomalies associated with land management, anomalies with a natural origin, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects. Anomalies located within each survey area have been numbered and are described in 3.4 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 Some small zones of magnetic disturbance are present adjacent to the eastern and southern boundaries and at the north eastern corner of the field. These are associated with above ground steel Heras fencing and steel tubing. The zones are very unlikely to obscure anomalies of archaeological potential and additional filtering has been carried out to minimise the area affected. Both filtered and unfiltered data are analysed to ensure no significant anomalies are removed by the additional processing.

3.2.3 The results demonstrate the potential for moderately strong contrast between the magnetic susceptibility of the natural soil/geology and the fill of former boundary ditches. There is, however, evidence for naturally formed anomalies, caused by fluvial action and periglacial conditions, that may be confused with

features of anthropogenic origin.

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. 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 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 centred on OS NGR 413450 310820, see Figs 03 – 05.

Anomalies with an uncertain origin

(1) - Positive responses situated in the northern part of the site and close to zones of weakly magnetic debris (9) could relate to the magnetically enhanced fill of cut features; however, they lack any coherent morphology.

(2) - A small group of weakly positive responses is situated in the eastern part of the survey area. They are poorly defined and could relate to natural features.

(3) - A negative linear anomaly could relate to land drainage.

Anomalies associated with land management

(4) - A fragmented positive linear anomaly extends across the northern part of the survey area. The response indicates a cut, linear ditch, with at least one land drain extending towards it. A former boundary ditch is depicted on the 1849 Tithe Map of Streethay Township in a similar position.

(5) - A fragmented positive linear anomaly appears to extend towards anomaly (4) from the eastern edge of the survey area. This is likely to relate to a former boundary ditch also indicated on the Tithe Map.

(6) - A fragmented positive linear anomaly extends across the centre of the survey area. It appears to relate to a field boundary mapped in 1849 but removed, along with (4) and (5), by 1884.

(7) - A number of land drains are evident within the field, mostly draining to the eastern edge.

Anomalies with a natural origin

(8) - A magnetically variable zone is located parallel with anomaly (4). It relates to a former fluvial feature marking the drainage trend from south west to north east.

(9) – In the southern part of the field a series of negative linear anomalies relate to 'patterned ground' formed in periglacial conditions. The negative anomalies probably relate to the very low magnetic susceptibility of pebbles that have been sorted into distinct features by freeze-thaw action. They are relatively shallow and will occur within the subsoil.

Anomalies associated with magnetic debris

(10) - Zones of very weakly magnetic debris are located in the north western part of the site, close to anomalies (1). It is not possible to determine the origin of the

material; however, a number of fire-cracked pebbles were noted in the vicinity at the time of survey and an archaeological origin is possible.

(11) - A patch of magnetic debris is situated close to anomalies (2), and also close to a land drain. It is not possible to determine if this has archaeological potential.

(12) - Magnetic debris in the north eastern part of the site appears to relate to material within the low lying natural feature (8) and also at the edge of the field. It is likely to relate to material used for ground consolidation.

4 CONCLUSION

4.1.1 The results of the detailed magnetometer survey reveal the location of several former field boundaries that are mapped on the 1849 Tithe Map but have been removed by 1884. Two small groups of weakly positive anomalies have been located, close to patches of weakly magnetic debris, but it is not possible to determine if the positive responses relate to cut features.

4.1.2 The survey has also located naturally formed anomalies associated with drainage from south west to north east across the site, and caused by 'patterned ground' formed in periglacial conditions.

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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

Minimally processed magnetometer data

Filename: J744-mag-proc.xcp
Description: Imported as Composite from: J744-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 413235.663, 311011.369 m
Southeast corner: 413688.663, 310609.969 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 2413900
Dimensions
Composite Size (readings): 3020 x 2676
Survey Size (meters): 453 m x 401 m
Grid Size: 453 m x 401 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.83
Mean: 0.02
Median: 0.00
Composite Area: 18.183 ha
Surveyed Area: 8.7311 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0
Processes: 1
1 Base Layer
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

Filtered magnetometer data

Filename: J744-mag-lpf-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.69
Mean: 0.02
Median: 0.00
Composite Area: 18.183 ha
Surveyed Area: 8.7311 ha
Processes: 1
1 Base Layer
GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Lo pass Uniform (median) filter: Window dia: 13
5 High pass Uniform (median) filter: Window dia: 250
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 Staffordshire Historic Environment Record with printed copies on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS). A summary of the survey will also be supplied to *West Midlands Archaeology*.

Archive contents:

File type	Naming scheme	Description
Data	J744-mag-**[area number/name]**.asc J744-mag-**[area number/name]**.xcp J744-mag-**[area number/name]**-proc.xcp J744-mag-**[area number/name]**-proc-lpf-hpf.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J744-mag-**[area number/name]**-proc.tif J744-mag-**[area number/name]**-proc-lpf-hpf.xcp	Image in TIF format
Drawing	J744-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J744 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)
Anomalies relating to land management			
AS-ABST MAG BOUNDARY		127,0,0	Line, polyline or polygon (solid or cross hatched ANSI37)
AS-ABST MAG LAND DRAIN		Cyan 0,255,255	Line or polyline
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)
Anomalies with a natural origin			
AS-ABST MAG NATURAL FEATURES		Yellow 255,255,0	Polygon (cross hatched ANSI37)

Table 3: CAD layering

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Survey location

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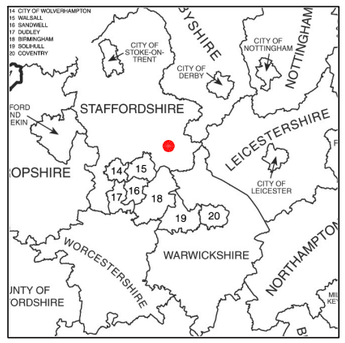
Geophysical Survey
Phase II Foden Park
Streethay
Lichfield
Staffordshire

Map of survey area



● Survey location

Site centred on OS NGR
SK 13450 10820

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01

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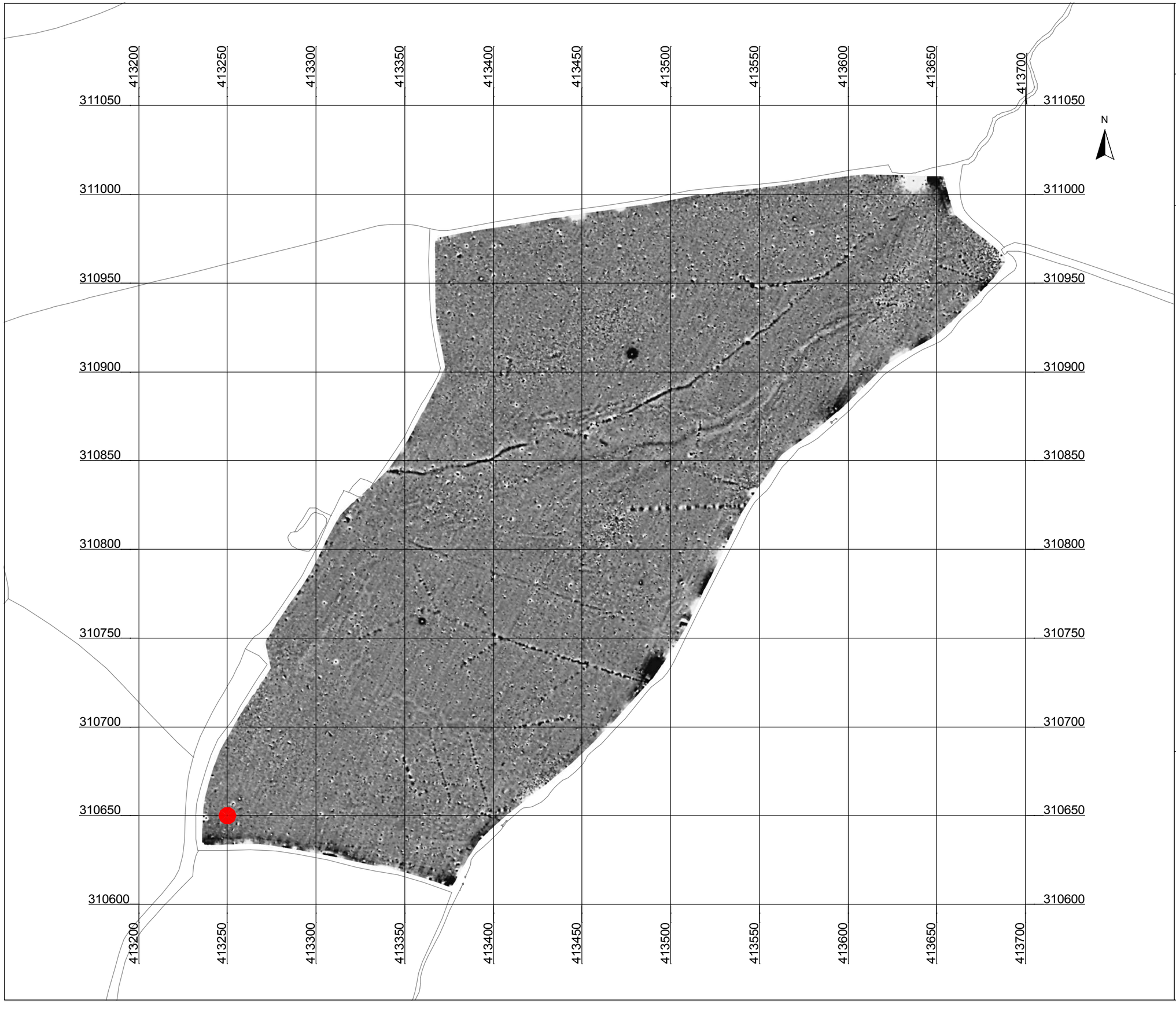
Staffordshire

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

413300 310650



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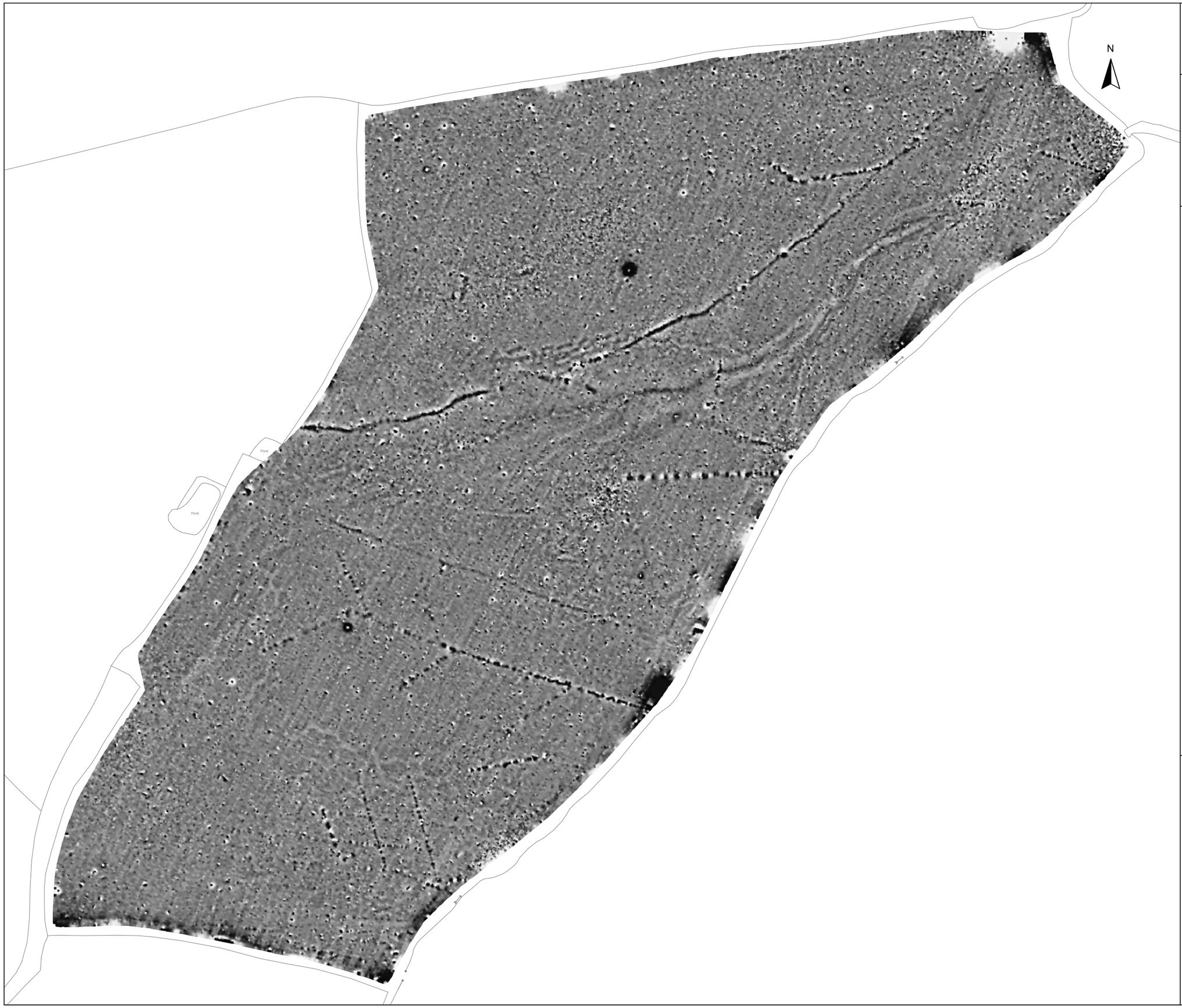
0m 20 40 60 80 100m

SCALE TRUE AT A3

FIG 02



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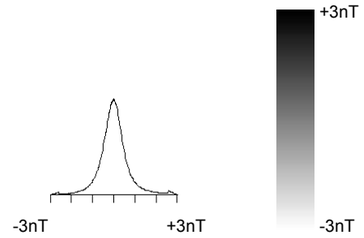
Greyscale plot of minimally processed magnetometer data



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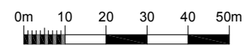
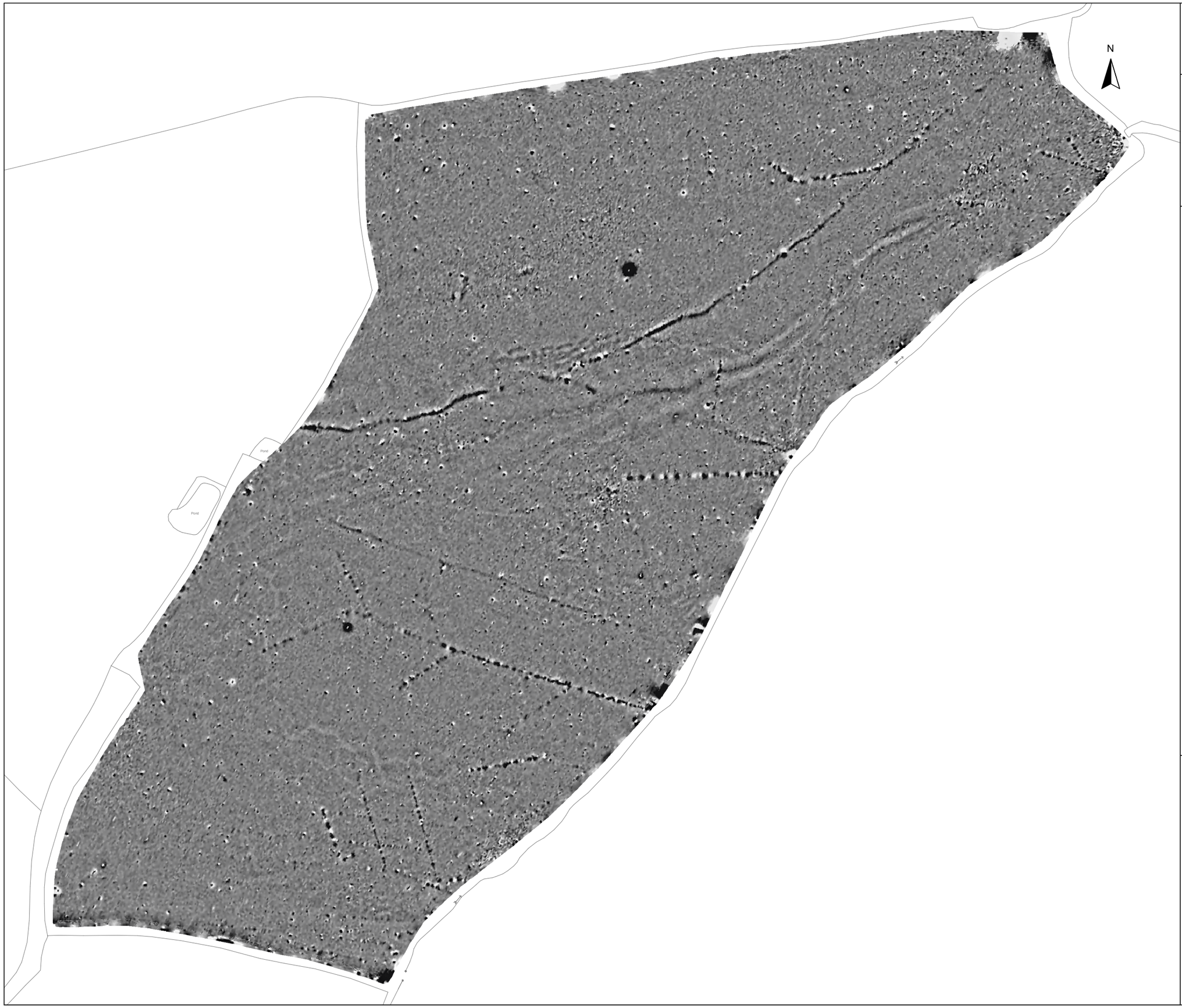


SCALE TRUE AT A3

FIG 03



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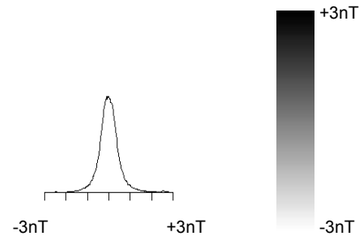
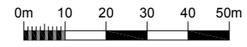
Greyscale plot of filtered magnetometer data



SCALE 1:1500



SCALE TRUE AT A3

FIG 04

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Abstraction and interpretation of magnetic anomalies

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

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05