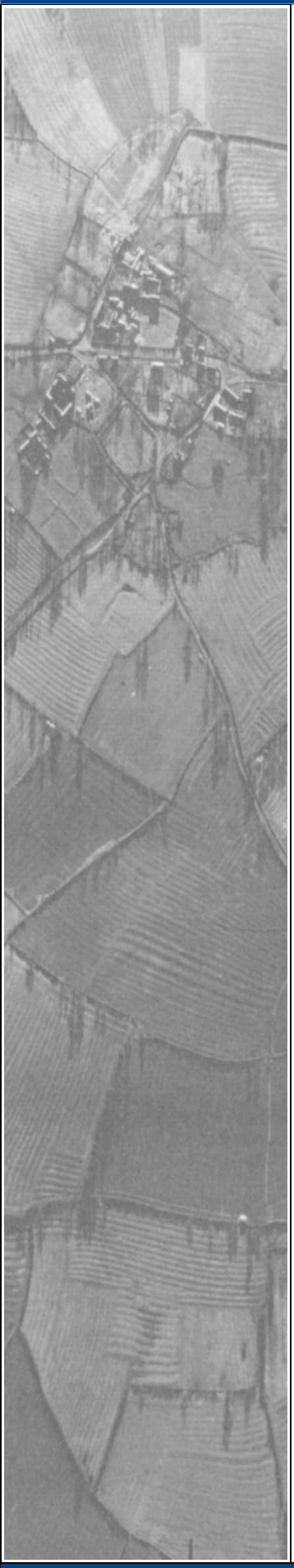

Land adjacent to Minety Substation
Charlton/Hankerton
Wiltshire

MAGNETOMETER SURVEY REPORT

for

JBM Solar Projects 14 Ltd

Kerry Donaldson & David Sabin

April 2020

Ref. no. J811

ARCHAEOLOGICAL SURVEYS LTD

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SUMMARY

A detailed magnetometer survey was carried out by Archaeological Surveys on land adjacent to Minety Substation near Minety in Wiltshire. The work was carried out prior to an application for development of a solar farm over the 100ha site. The results indicate a number of anomalies associated with a formerly mapped outfarm known as Woburn in the northern part of the site. Two possible positive curvilinear anomalies have been located along with a number of positive and negative linear and rectilinear/curvilinear anomalies within the western part of the site, but although it is possible that they are of some archaeological potential, the anomalies are not well defined and generally lack a coherent morphology. Many of the areas contain widespread magnetically variable responses to unmapped Quaternary drift deposits. Evidence for agricultural activity and land improvement were also located including land drainage and also patches of possible burning that could relate to the clearance of trees.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Pegasus Group, on behalf of JBM Solar Projects 14 Ltd, to undertake a magnetometer survey of an area of land adjacent to Minety Substation within the parishes of Charlton and Hankerton in north Wiltshire. The site has been outlined for a proposed development of a solar farm and the survey forms part of an archaeological assessment. A previous geophysical survey was carried out over c2ha outlined for a battery storage area (SUMO, 2019b). This is situated within the north western corner of Area 2 within the current scheme (see Figs 05 - 08).

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2020) and approved by Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council, prior to commencing the fieldwork.

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.

1.2.2 The methodology is considered an efficient and effective approach to archaeological prospection. 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.* Note: currently Historic England (2018) no longer support the guidelines set out in English Heritage (2008) *Geophysical survey in archaeological field evaluation* and there are currently no plans to update the document. As a consequence other sources of written guidance referring to this document may be out of date and/or contain unsupported information (e.g. Chartered Institute for Archaeologists, 2014).

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 line formats, and broken or fragmented lines used in interpretive plots may well correspond closely with truncation of archaeological features.

1.4 Site location, description and survey conditions

1.4.1 The site occupies land to the east and west of Minety substation surrounding Purlieus Farm between 1.5km and 3.7km south west of Minety, but within the parishes of Charlton and Hankerton in Wiltshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 0039 8974, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 100ha within seventeen separate land parcels. Eight of these are currently pasture and nine of them arable. The topography is gently undulating with small streams passing

through the western part of the site and bordering the north eastern part. The ground cover and survey conditions are set out below.

Area	Central OS NGR	Ground cover	Survey conditions
1	400708 189767	Stubble	Waterlogged and heavily rutted in places, pylons within area.
2	400428 189832	Maize stubble	Waterlogged with widespread ruts, some areas of standing crop and rough cultivation, pylons within area.
3	400208 190006	Pasture	Waterlogged and heavily rutted on western side.
4	400467 190158	Stubble	Waterlogged and heavily rutted in places. Low area in north flooded and unsurveyable.
5	400358 190300	Rough pasture	Waterlogged and heavily rutted near northern end. Undulating ground partly due to modern soil dumping.
6	400982 189654	Pasture	Waterlogged, pylon in western part.
7	399724 190120	Pasture	Waterlogged, eastern corner unsurveyable due to boggy ground and ruts. Pylons in northern part and immediately to the south.
8	399457 189840	Pasture	Waterlogged particularly in the south. Areas of dumped soil and emerging springs in south unsurveyable.
9	399190 189845	Pasture	Very wet.
10	400085 189976	Pasture	Small area very waterlogged, boggy and rutted.
11	400273 190130	Stubble	Waterlogged and rutted.
12	400925 189853	Stubble	Wet in places.
13	401270 189526	Pasture	Waterlogged with areas of standing water along western side. Pylon in western part.
14	401170 190075	Stubble	Waterlogged and badly rutted in northern part.
15	400582 189466	Stubble	Waterlogged, very boggy and rutted in places. Unsurveyable in north western part and along eastern side.
16	400563 190018	Stubble	Waterlogged and rutted along eastern and southern sides.
17	399475 189457	Pasture	Pylon immediately adjacent to western side.

Table 1: Survey area ground cover and conditions

1.4.3 The ground conditions across the site were very variable and frequently challenging for survey. Prior to the survey the area had been subjected to exceptional amounts of rainfall beginning in October 2019 and continuing into the early part of the survey period. Agricultural activity had been badly affected with almost impossible conditions during the harvesting of maize in the later autumn of 2019. Subsequent cultivation and seed drilling had not been possible so areas of open soil remained compacted and deeply rutted (see Plate 1); as a consequence waterlogging and flooding was widespread. During the latter part of the survey period, weather conditions improved significantly although boggy and rutted areas remained.

Plate 1: Eastern part of Area 2 looking north

1.5 Site history and archaeological potential

1.5.1 The following archaeological background has been taken from the draft heritage desk-based assessment currently being prepared by Pegasus Group.

1.5.2 No archaeological heritage assets are recorded within the site. A geophysical survey of 2ha of land in the north-western part of the site, detected no anomalies of archaeological interest. Only a former pylon base, a linear anomaly that may be due to an overhead cable, and a short length of a pipe were identified (SUMO, 2017a). Another survey carried out to the east of the substation and outlined for development of a battery storage area, located a series of land drains (SUMO, 2017b).

1.5.3 A cropmark of a large curvilinear ditch is visible in the fields to the north of the site on aerial photographs dated 2006. It is not recorded by the HER but could be consistent with the remains of a large enclosure of prehistoric origin. Indications of Roman activity, comprising ten tile kilns and various scatters of Roman pottery sherds are recorded within a 1km radius of the site (NHLE 1004702; MWI9634 and MWI9635).

1.5.4 The Wiltshire HER suggests that there may have been a medieval settlement and deer park at Stonehill (MWI5313). The associated source is an article from the Wiltshire Archaeological and Natural History Magazine, which refers to a "*late*" park at Charlton, documented in 1580 and "*replacing an earlier one at Stonehill to its east*". Further clues as to the existence of a park are perhaps provided by the naming of 'Park Copse' within the western part of the site and 'Old Park Farm' *c.*630m west of the site, but no indication of a park pale can

be discerned in the extant field boundaries.

1.5.5 Historic mapping from the early 19th century onwards shows the site to have been formerly subdivided into a greater number of fields than exist today. The western and far eastern parts of the site were owned by the Earl of Suffolk and Berkshire and leased to five different tenants. The central part of the site was owned by the Coles family of The Elms at Upper Minety. A small outfarm called Woburn was located in the centre of the site (MWI66764); the house, cottage, and stable described in 1897 sales particulars no longer survive, and have been replaced by a Dutch barn.

1.5.6 During the course of the survey work, areas of open soil were frequently observed in order to determine whether any cultural objects were present on the soil surface. Although conditions were less than optimum due to patchy stubble cover, soils had been subject to high levels of rainfall which revealed a lot of natural stone (mainly chert). No significant scatters or finds were observed. A lack of modern and also Industrial Period material was also considered unusual.

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is Oxford Clay with no mapped drift deposits within the survey area (BGS, 2017). However, a zone of gravel, sand, silt and clay Quaternary deposits are mapped just to the south of the site and it is possible that similar, but shallower, deposits also overlie the site. Observations across the open soil of arable areas revealed widespread and frequently dense brown chert/flint nodules. More elevated parts of the site appear to contain higher densities of this material. It is very likely that it is an unmapped Quaternary deposit that is only present in the topsoil and shallow subsoil.

1.6.2 The overlying soil across the survey area is from the Denchworth association and is a pelo-stagnogley soil. This consists of a slowly permeable, seasonally waterlogged, clayey soil (Soil Survey of England and Wales, 1983). The Soil Survey mapping may not accurately represent the soil properties of the site due to the presence of unmapped Quaternary deposits. Small exposures within the site, and cores extracted by adjacent geotechnical investigations, imply a degree of illuviation of iron with the formation of an enriched iron zone or possible narrow iron pan within the subsoil. Personal communication with the landowner revealed that the soil had been tested as acidic which would be consistent with illuviation of iron down through the soil profile.

1.6.3 Magnetometry survey carried out across similar soils has produced good results. The underlying geology and soils are, therefore, considered acceptable for magnetic survey. However, the presence of shallow Quaternary deposits of flint/chert, and the associated very low magnetic susceptibility of this material, may cause magnetic anomalies of natural origin. The consequences of iron illuviation and the formation of an iron pan is difficult to

predict but it can be associated with very low contrast positive anomalies and fills that produce negative anomalies.

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 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 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). 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®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20Hz. Due to the large site and very difficult surveying conditions, the cart was towed using an ATV in order to get across waterlogged and heavily rutted areas. 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 ±8000nT. They are linked to a Leica GS10 RTK GNSS 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 <200s.

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 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 ±8000nT 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 for Areas 1, 7, 8, 10 & 17 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.

2.3.5 Additional data processing has also been carried out for Areas 1 & 17 in the form of low pass filtering. This effectively removes high frequency variation along a traverse that has been caused by uneven ground and associated vibration. Data treated to additional processing have been compared to unprocessed data to ensure that no significant anomalies have been removed.

2.3.6 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.

2.3.7 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. 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.

2.3.8 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 GNSS, resection method, etc.

2.3.9 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.

2.3.10 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. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.11 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 a total of 17 survey areas covering approximately 100ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, anomalies associated with a former outfarm, anomalies associated with land management, linear anomalies of an agricultural 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 or pipelines.

3.1.3 Anomalies located within each survey area have been numbered and are described in 3.4 to 3.20 below with subsequent discussion in Section 4.

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 datasets; however, several areas contain small patches that were unsurveyable due to ground conditions and larger zones of high magnitude magnetic disturbance adjacent to steel pylons were avoided.

3.2.2 The majority of the survey areas appear to contain discrete and linear anomalies of variable magnitude relating to naturally formed features. These are likely to have been formed within shallow Quaternary deposits and may be as a result of freeze - thaw actions and associated solifluction/gelifluction. They may also relate to former widespread woodland cover.

3.2.3 Linear anomalies caused by cultivation, rutted ground and land drainage are also widespread across the site. It is possible that some anomalies may also relate to a former 4x4 course and associated soil dumping.

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 with an agricultural origin	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing. This category does not include agricultural features of early date or considered to be of archaeological potential (e.g. animal stockades, enclosures, farmsteads, etc).
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 associated with 19th century outfarm	Anomalies can be negative, generally relating to foundations/walling or positive, depending on material used in construction eg brick. Burning can

	also result in magnetic enhancement. This category relates to anomalies associated with formerly mapped features.
Anomalies associated with ground disturbance/quarrying	Magnetically variable anomalies which may be negative indicating a response to geology/drift deposits and/or positive indicating an increased depth of topsoil. Very strongly magnetic anomalies are a response to highly magnetic material of modern origin which can be used to infill a quarry depression. It should be considered that former quarry pits may be of archaeological potential.

Table 2: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area 1 centred on OS NGR 400708 189767, see Figs 05 & 06.

3.4.1 Area 1 contains a small patch of magnetic enhancement (1), similar to those seen in Areas 12 & 14. It is not clear if these relate to natural variations in the geology/drift deposits or if they relate to burning or tree removal. Other anomalies relate to natural deposits and land drainage.

3.5 List of anomalies - Area 2

Area 2 centred on OS NGR 400428 189832, see Figs 05 & 06.

3.5.1 Area 2 contains a very strongly magnetic curvilinear anomaly (2) which appears to form a ring, approximately 7m across. It lies on the junction of a mapped field boundary and circle of trees and an association is possible. Other anomalies relate to natural deposits and land drainage.

3.6 List of anomalies - Area 3

Area 3 centred on OS NGR 400208 190006, see Figs 07 – 10.

Anomalies associated with outfarm

(3) - Positive anomalies indicate moderately magnetically enhanced features (20-70nT) that are likely to relate to magnetically thermoremnant material, such as brick, associated with the former outfarm recorded as Woburn. Sales particulars from 1897 mention a house, a cottage and a stable. Two buildings are indicated on the tithe map and a single building on the 1st edition OS map. The eastern half was removed by the early 20th century. There are additional responses to the mapped features, but they are likely to be associated.

Anomalies with an uncertain origin

(4) - Two circular clusters of discrete positive responses are located in the north western part of the survey area. It is possible that these pit-like features are of anthropogenic origin and could be associated with the former outfarm, but this is uncertain.

(5) - Positive linear anomalies in the eastern part of the survey area are poorly defined and it is not possible to determine if they relate to cut features. They may correlate with a low bank.

Anomalies associated with land management

(6) - A number of linear anomalies relate to formerly mapped land boundaries.

Anomalies with an agricultural origin

(7) - A series of parallel linear anomalies is indicative of former ridge and furrow.

3.7 List of anomalies - Area 4

Area 4 centred on OS NGR 400467 190158, see Figs 07 & 08.

Anomalies with an uncertain origin

(8) - A patch of magnetically enhanced material that has been disturbed by modern ploughing. This type of response is likely to relate to burning, such as a bonfire, but could relate to the burning of trees.

(9) - Positive responses that lack a coherent morphology and could relate to naturally formed features.

Anomalies associated with land management

(10) - Two positive linear anomalies are associated with a formerly mapped field boundary.

(11) - Weak, multiple dipolar, linear anomalies are associated with land drains.

3.8 List of anomalies - Area 5

Area 5 centred on OS NGR 400358 190300 see Figs 07 & 08.

3.8.1 Area 5 contains zones of magnetic debris likely to relate to ground consolidation. The landowner has indicated former soil dumping within this

field. Former ridge and furrow and more modern agricultural activity or land drainage is also evident.

3.9 List of anomalies - Area 6

Area 6 centred on OS NGR 400982 189654, see Figs 11 & 12.

Anomalies with an uncertain origin

(12) - A weakly positive linear anomaly appears to have been truncated by ploughing. It is not clear if it relates to a cut feature. Other linear anomalies have also been located within the survey area, but again, their origin is uncertain.

Anomalies with a natural origin

(13) - A positive linear anomaly is associated with a linear depression in the ground surface. This relates to a former water channel that extends northwards.

3.10 List of anomalies - Area 7

Area 7 centred on OS NGR 399724 190120, see Figs 13 & 14.

Anomalies with an uncertain origin

(14) - A number of positive and negative linear anomalies can be seen in the northern part of the survey area. Although this type of response can suggest former land division, it is possible that they are associated with naturally formed features within the underlying geology.

(15) - The eastern part of the survey area contains a small number of positive responses. They could relate to burning.

(16) - In the south eastern corner of the survey area are a line of four discrete positive responses. Although these appear pit-like, they also appear to be extending towards a former pylon base. It is not clear if they are associated with the former pylon or if they relate to cut features.

Anomalies associated with land management

(17) - The eastern part of the survey area contains positive and negative linear anomalies that are associated with formerly mapped field boundaries.

(18) - The western part of the survey area contains numerous land drains.

Anomalies with a modern origin

(19) - Strong, discrete, dipolar anomalies, in groups of four, relate to five former pylon bases. Some are associated with magnetic debris, likely to relate to ground consolidation at the time of construction, or possibly demolition.

3.11 List of anomalies - Area 8

Area 8 centred on OS NGR 399457 189840, see Figs 15 – 18.

Anomalies with an uncertain origin

(19) - Positive curvilinear anomalies have similar characteristics to a ring-ditch feature with an 8m diameter. Although it is not clear if it does relate to a cut feature, or naturally formed anomalies, their archaeological potential should be considered.

(20) Within the north western part of the survey area are a number of positive and negative linear and rectilinear anomalies. They lie within a zone of naturally formed anomalies, and it is not clear if they are associated as they appear to have rectilinear elements and an archaeological origin is possible.

(21) - At least six discrete positive responses appear to be grouped in a ring formation. These are associated with an area containing springs; however, the origin of the magnetic enhancement is uncertain. Shallow circular depressions were noted in the vicinity.

Anomalies associated with land management

(22) - Positive linear anomalies relate to formerly mapped field boundaries.

(23) - Much of the survey area contains land drains.

Anomalies with a natural origin

(24) - Two zones of magnetically variable responses relate to variations within the underlying soils and geology.

Anomalies with a modern origin

(25) - A strong, multiple dipolar, linear anomaly relates to a service crossing the north eastern part of the survey area.

3.12 List of anomalies - Area 9

Area 9 centred on OS NGR 399190 189845, see Figs 15 & 16.

Anomalies with an uncertain origin

(26) - An L-shaped negative linear anomaly with associated positive response appears to relate to a possible former boundary feature; however, none has been mapped in this position.

(27) - A discrete positive response, it is not clear if it relates to a natural or anthropogenic feature.

Anomalies associated with land management

(28) - A negative linear anomaly relates to a formerly mapped field boundary.

3.13 List of anomalies - Area 10

Area 10 centred on OS NGR 400085 189976, see Figs 07 – 10

3.13.1 Area 10 contains mainly magnetic debris and a former pylon base.

3.14 List of anomalies - Area 11

Area 11 centred on OS NGR 400273 190130, see Figs 07 & 08.

3.14.1 Area 11 contains widespread magnetically variable responses associated with the underlying geology. There appears to be a positive rectilinear anomaly and also other negative and positive linear anomalies, but it is not clear if they have any association with anthropogenic activity or if they are also of natural origin.

3.15 List of anomalies - Area 12

Area 12 centred on OS NGR 400925 189853, see Figs 19 & 20.

Anomalies with an uncertain origin

(29) - L-shaped positive linear anomaly is associated with a patch of magnetic debris. The response indicates an association with burning; however, the origin of the burning is uncertain.

(30) - Two patches of magnetic enhancement could relate to burning, possibly associated with tree removal but this is uncertain.

3.16 List of anomalies - Area 13

Area 13 centred on OS NGR 401270 189526, see Figs 11 & 12.

Anomalies with an uncertain origin

(31) - The survey area contains a number of positive linear anomalies. They do not appear to relate to any formerly mapped field boundaries, and it is possible that they have an association with land drainage.

Anomalies with a natural origin

(32 & 33) - Two positive linear anomalies relate to extant shallow linear depressions in the ground surface. Anomaly (32) extends north westwards to continue as anomaly (13) in Area 6, Anomaly (33) appears in an unusual place topographically, but also relates to a shallow linear depression. These appear to relate to former water channels, but it is possible that they may have been associated with anthropogenic activity.

3.17 List of anomalies - Area 14

Area 14 centred on OS NGR 401170 190075, see Figs 19 & 20.

Anomalies with an uncertain origin

(34) - An L-shaped strongly positive linear response indicates an association with intense burning. It is not clear if this has a modern origin or if it is of archaeological potential.

(35) - A large number of discrete, pit-like anomalies can be seen towards the north western corner of the survey area. It is possible that these are related to the natural variations in the underlying geology or possibly associated with tree boles.

(36) - Two patches of magnetic enhancement, similar to those seen to the south in Area 12, appear to relate to burning. Such responses can indicate former bonfires, but could have an association with tree removal.

3.18 List of anomalies - Area 15

Area 15 centred on OS NGR 400582 189466, see Figs 21 & 22.

Anomalies with an uncertain origin

(37) - Located towards the southern end of the survey area are a number of parallel

positive linear anomalies. While they may relate to naturally formed features, this type of response could be indicative of former trackway ditches.

Anomalies with a natural origin

(38) - Widespread magnetically variable responses relate to naturally formed features. Although no superficial deposits have been mapped in the area, drift deposits of sand, silt, clay and gravel have been mapped from 200m south of the survey area. These anomalies are likely to relate to shallow drift deposits formed in the Quaternary period.

3.19 List of anomalies - Area 16

Area 16 centred on OS NGR 400563 190018, see Figs 05 & 06.

3.19.1 Area 16 contains widespread magnetically variable responses relating to natural variations in the underlying geology and soils. A small number of discrete positive responses and positive linear anomalies can also be seen, but it is likely that they also relate to naturally formed features.

3.20 List of anomalies - Area 17

Area 17 centred on OS NG R 399475 189457, see Figs 23 & 24.

Anomalies with an uncertain origin

(39) - A positive curvilinear anomaly appears to form a ring-ditch feature with a 12.5m diameter. It is not certain that it relates to an archaeological feature, but this should be considered.

(40) - The southern half of the survey area contains numerous positive and negative linear and curvilinear anomalies. They lack a coherent morphology for them to be confidently interpreted as cut features of archaeological potential, and an association with natural variations within the underlying geology is possible.

Anomalies with an agricultural origin

(41) - A series of linear anomalies appear to relate to former ridge and furrow.

Anomalies associated with land management

(42) - A weak, multiple dipolar, linear anomaly extends to the south of the position of a formerly mapped field boundary and relates to a land drain. Another extends towards it from the south and a series of land drains can be seen in the north.

Anomalies associated with magnetic debris

(43) - Strong, discrete, dipolar anomalies form a sinuous linear formation and relate to ferrous objects associated with the line of a formerly mapped field boundary.

4 DISCUSSION

4.1.1 The geophysical survey located very few anomalies that could be confidently attributed to archaeological features across the seventeen survey areas within the 100ha site. Those with most potential (3) are located in the northern central part of the site, within Area 3, and relate to a former 19th century outfarm known as Woburn. Sales particulars from 1897 state that " *here is a substantial unfinished stone and stone-slated House (the timber in which is all of oak), which may be readily converted into two cottages. Attached is a Cottage and stone-built Stable. The yards are all pitched. The Water supply is good and abundant*". Some of the anomalies relate to mapped structural remains, but others are not mapped features but appear to be associated with magnetically thermoremnant material such as brick. Also within this area are two circular groups of pit-like anomalies, although whether they relate to features such as removed trees or have another anthropogenic origin is uncertain. Area 2 in the central part of the site contains a very strongly magnetic curvilinear anomaly (2). It lies on the junction of a formerly mapped field boundary and circle of trees and an association is likely.

4.1.2 Two areas within the western part of the site (Areas 8 and 17) contain positive curvilinear anomalies (19 & 39) which have characteristics consistent with possible ring-ditch features with a 8m and 12.5m diameter. Both of these areas contain a number of positive and negative linear and rectilinear/curvilinear responses in the vicinity, but they tend to lack a coherent morphology, and it is not clear if any of the anomalies relate to cut features or if they relate to natural variations within the underlying geology and soils.

4.1.3 There is widespread variation within the shallow geology and subsoil, with almost all of the survey areas containing zones of naturally formed anomalies as a consequence. Although the geology is mapped as mudstone from the Oxford Clay Formation, there appears to be in many places a shallow overlying layer of flint/chert nodules deposited during the Quaternary period. Drift deposits are mapped just to the south of the site but it appears that shallow, unmapped deposits cross much of the site as well. In the south eastern part of the site, positive, sinuous linear anomalies (13, 32 & 33) correspond to shallow linear depressions within the ground surface that relate to former water channels, although an association with anthropogenic activity cannot be discounted.

4.1.4 Several of the areas in the north eastern part of the site contain small patches

of magnetic enhancement. Although this can relate to modern burning, it is possible that there is an association with tree clearance. Areas 12 and 14 also contain L-shaped positive linear anomalies which also appear to have an association with burning, but their origin is uncertain.

5 CONCLUSION

5.1.1 The results of the detailed magnetometry indicate that there are very few anomalies that appear to relate to archaeological features. Several anomalies appear to be associated with the former outfarm of Woburn, and other anomalies may relate to burning associated with tree removal.

5.1.2 In the western part of the site there are two positive curvilinear anomalies, that could relate to ring-ditches, with several positive and negative linear and curvilinear/rectilinear anomalies within the vicinity. However, there is a lack of coherent morphology, as well as widespread variable responses of natural origin also in the vicinity, and it is not possible to confidently determine their archaeological potential.

5.1.3 Various discrete and linear anomalies of natural origin are likely to relate to shallow Quaternary deposits, mainly flint/chert nodules, that are unmapped across the site. In addition, some anomalies may also relate to alteration of the magnetic properties of an iron enriched subsoil or iron pan.

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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.

Despike

Removal of data points that exceed the mean/median/threshold by selecting a window size of data points and replace by mean/median/threshold. Magnetic spikes can be caused iron objects on the surface or within the topsoil. Despike can improve the appearance of data and remove extreme readings that may affect further processing.

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

Area 1

Filename: J811-mag-Area1-proc-hpf-lpf.xcp
Description: Imported as Composite from: J811-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 400522.39 189881.23m
Southeast corner: 400894.09, 189668.68 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 831700
Dimensions
Composite Size (readings): 2478 x 1417
Survey Size (meters): 372 m x 213 m
Grid Size: 372 m x 213 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.99
Mean: 0.03
Median: 0.00
Composite Area: 7.9005 ha
Surveyed Area: 4.4284 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0
GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Lo pass Uniform (median) filter: Window dia: 8
6 Clip from -3.00 to 3.00 nT

Area 2

Filename: J811-mag-Area2.-proc.xcp
Description: Imported as Composite from: J811-mag-Area2.asc
Northwest corner: 400236.13, 190022.69m
Southeast corner: 400607.38, 189640.49m
Source GPS Points: 1330600
Dimensions
Composite Size (readings): 2475 x 2548
Survey Size (meters): 371 m x 382 m
Grid Size: 371 m x 382 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.11
Mean: 0.05
Median: -0.01
Composite Area: 14.189 ha
Surveyed Area: 6.5624 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 3

Filename: J811-mag-Area3-proc.xcp
Description: Imported as Composite from: J811-mag-Area3.asc
Northwest corner: 400152.78, 190074.54 m
Southeast corner: 400293.63, 189971.64 m
Source GPS Points: 158200
Dimensions
Composite Size (readings): 939 x 686
Survey Size (meters): 141 m x 103 m
Grid Size: 141 m x 103 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.14
Mean: -0.01
Median: 0.02
Composite Area: 1.4493 ha
Surveyed Area: 0.77711 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: J811-mag-Area4-proc.xcp
Description: Imported as Composite from: J811-mag-Area4.asc
Northwest corner: 400345.56, 190287.15 m
Southeast corner: 400592.31, 190049.85 m
Source GPS Points: 621800
Dimensions
Composite Size (readings): 1645 x 1582
Survey Size (meters): 247 m x 237 m
Grid Size: 247 m x 237 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.93
Mean: 0.02
Median: 0.01
Composite Area: 5.8554 ha
Surveyed Area: 3.3625 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 5

Filename: J811-mag-Area5.-proc.xcp
Description: Imported as Composite from: J811-mag-Area5.asc
Northwest corner: 400258.60, 190385.86 m
Southeast corner: 400462.00, 190218.61 m
Source GPS Points: 386300
Dimensions
Composite Size (readings): 1356 x 1115
Survey Size (meters): 203 m x 167 m
Grid Size: 203 m x 167 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.37
Mean: -0.01
Median: 0.03
Composite Area: 3.4019 ha
Surveyed Area: 1.7593 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 6

Filename: J811-mag-Area6-proc.xcp
Description: Imported as Composite from: J811-mag-Area6.asc
Northwest corner: 400810.71, 189707.56 m
Southeast corner: 401138.46, 189554.11 m
Source GPS Points: 343200
Dimensions
Composite Size (readings): 2185 x 1023
Survey Size (meters): 328 m x 153 m
Grid Size: 328 m x 153 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.26
Mean: 0.05
Median: 0.02
Composite Area: 5.0293 ha
Surveyed Area: 2.2404 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 7

Filename: J811-mag-Area7-proc-hpf.xcp
Description: Imported as Composite from: J811-mag-Area7.asc
Northwest corner: 399455.29, 190393.11 m
Southeast corner: 400006.99 189948.96 m
Source GPS Points: 1829000
Dimensions
Composite Size (readings): 3678 x 2961
Survey Size (meters): 552 m x 444 m
Grid Size: 552 m x 444 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.01
Mean: 0.01
Median: 0.00
Composite Area: 24.504 ha
Surveyed Area: 11.699 ha
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Clip from -3.00 to 3.00 nT

Area 8

Filename: J811-mag-Area8-proc-hpf.xcp
Description: Imported as Composite from: J811-mag-Area8.asc
Northwest corner: 399276.18, 190061.16 m
Southeast corner: 399652.08, 189593.017 m
Source GPS Points: 1789000
Dimensions
Composite Size (readings): 2506 x 3121
Survey Size (meters): 376 m x 468 m
Grid Size: 376 m x 468 m
X Interval: 0.15 m
Y Interval: 0.15 m
Source GPS Points: 1789000
Dimensions
Composite Size (readings): 2506 x 3121
Survey Size (meters): 376 m x 468 m
Grid Size: 376 m x 468 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.85
Mean: 0.01
Median: 0.00
Composite Area: 17.598 ha
Surveyed Area: 12.057 ha
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 173
5 Clip from -3.00 to 3.00 nT

Area 9

Filename: J811-mag-Area9.xcp
Description: Imported as Composite from: J811-mag-Area9.asc
Northwest corner: 399084.52, 189899.35 m
Southeast corner: 399282.07, 189757.15 m
Source GPS Points: 229800
Dimensions
Composite Size (readings): 1317 x 948
Survey Size (meters): 198 m x 142 m
Grid Size: 198 m x 142 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.96
Mean: -0.01
Median: 0.00
Composite Area: 2.8092 ha
Surveyed Area: 1.4832 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 10
Filename: J811-mag-Area10-proc-hpf.xcp
Northwest corner: 400031.50, 190033.56 m
Southeast corner: 400141.00, 189921.51m
Source GPS Points: 87800
Dimensions
Composite Size (readings): 730 x 747
Survey Size (meters): 110 m x 112 m
Grid Size: 110 m x 112 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.50
Mean: -0.12
Median: 0.02
Composite Area: 1.2269 ha
Surveyed Area: 0.38532 ha
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Clip from -3.00 to 3.00 nT

Area 11

Filename: J811-mag-Area11-proc.xcp
Description: Imported as Composite from: J811-mag-Area11.asc
Northwest corner: 400164.81, 190254.59 m
Southeast corner: 400394.01, 190014.59 m
Source GPS Points: 665300
Dimensions
Composite Size (readings): 1528 x 1600
Survey Size (meters): 229 m x 240 m
Grid Size: 229 m x 240 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.97
Mean: 0.02
Median: 0.01
Composite Area: 5.5008 ha
Surveyed Area: 3.5055 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 12

Filename: J811-mag-Area12.-procxcp
Description: Imported as Composite from: J811-mag-Area12.asc
Northwest corner: 400797.89, 189999.31 m
Southeast corner: 401053.34, 189707.41 m
Source GPS Points: 721700
Dimensions
Composite Size (readings): 1703 x 1946
Survey Size (meters): 255 m x 292 m
Grid Size: 255 m x 292 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.04
Mean: 0.04
Median: 0.02
Composite Area: 7.4566 ha
Surveyed Area: 4.2234 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 13

Filename: J811-mag-Area13-proc.xcp
Description: Imported as Composite from: J811-mag-Area13.asc
Northwest corner: 401073.99, 189744.99m
Southeast corner: 401524.74, 189275.49 m
Source GPS Points: 1893500
Dimensions
Composite Size (readings): 3005 x 3130
Survey Size (meters): 451 m x 470 m
Grid Size: 451 m x 470 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.18
Mean: 0.04
Median: 0.00
Composite Area: 21.163 ha
Surveyed Area: 13.089 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 14

Filename: J811-mag-Area14-proc.xcp
Description: Imported as Composite from: J811-mag-Area14.asc
Northwest corner: 400919.76, 190238.20m
Southeast corner: 401199.66, 189910.15m
Source GPS Points: 792000
Dimensions
Composite Size (readings): 1866 x 2187
Survey Size (meters): 280 m x 328 m
Grid Size: 280 m x 328 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.83
Mean: 0.01
Median: 0.01
Composite Area: 9.1821 ha
Surveyed Area: 4.7295 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 15

Filename: J811-mag-Area15-proc.xcp
Description: Imported as Composite from: J811-mag-Area15.asc
Northwest corner: 400440.48, 189654.45 m
Southeast corner: 400752.78, 189266.10 m
Source GPS Points: 1147900
Dimensions
Composite Size (readings): 2082 x 2589
Survey Size (meters): 312 m x 388 m
Grid Size: 312 m x 388 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.13
Mean: 0.00
Median: 0.01
Composite Area: 12.128 ha
Surveyed Area: 7.5584 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 16

Filename: J811-mag-Area16-proc.xcp
Description: Imported as Composite from: J811-mag-Area16.asc
Northwest corner: 400455.34, 190118.08 m
Southeast corner: 400694.44, 189930.13 m
Source GPS Points: 447300
Dimensions
Composite Size (readings): 1594 x 1253
Survey Size (meters): 239 m x 188 m
Grid Size: 239 m x 188 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.94
Mean: 0.02
Median: 0.01
Composite Area: 4.4939 ha
Surveyed Area: 2.5544 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 17

Filename: J811-mag-Area17-proc.xcp
Description: Imported as Composite from: J811-mag-Area17.asc
Northwest corner: 399320.17, 189627.46 m
Southeast corner: 399562.27, 189287.86 m
Source GPS Points: 599800
Dimensions
Composite Size (readings): 1614 x 2264
Survey Size (meters): 242 m x 340 m
Grid Size: 242 m x 340 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 0.84
Mean: 0.00
Median: 0.00
Composite Area: 8.2217 ha
Surveyed Area: 3.9211 ha
GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Lo pass Uniform (median) filter: Window dia: 10
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 printed copies on request. The greyscale images can also be made available to the HER along with the abstraction CAD layers on request. 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	J811-mag-**[area number/name]**.asc J811-mag-**[area number/name]**.xcp J811-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J811-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J811-**[version 2]**.dwg	CAD file in 2010 dwg format
Report	J811 report.odt	Report text in Open Office odt format

Table 3: 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)
AS-ABST MAG LAND DRAIN		Cyan 0,255,255	Line or polyline
Anomalies with an agricultural origin			
AS-ABST MAG AGRICULTURAL		Green 0,255,0	Line or polyline
AS-ABST MAG RIDGE AND FURROW		0,127,63	Line, polyline or polygon (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 4: CAD layering

Appendix F – copyright and intellectual property

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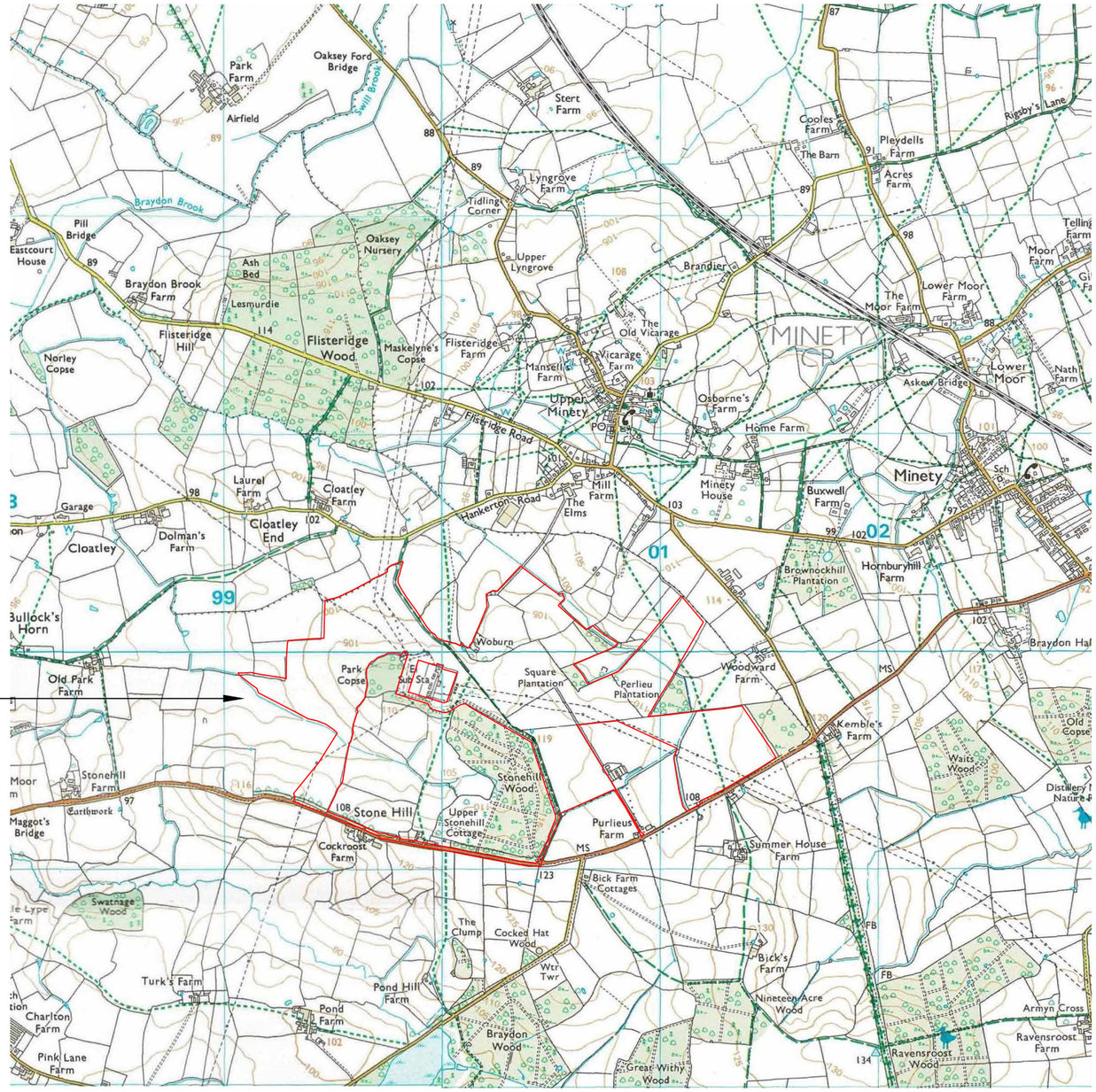
info@archaeological-surveys.co.uk
Tel: 01249 814 231



Survey location

Survey location

Site centred on OS NGR
SU 0039 8974

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

Archaeological Surveys
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Geophysical Survey
Land adjacent to
Minety Substation
Charlton/Hankerton
Wiltshire

Map of survey area

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

399200 399400 399600 399800 400000 400200 400400 400600 400800 401000 401200 401400

190800 190600 190400 190200 190000 189800 189600 189400 189200 189000 188800

N

Area 7 Figs 11 & 12

Areas 3, 4, 5, 10 & 11 Figs 07 & 08

Area 5

Area 4

Area 11

Areas 12 & 14 Figs 17 & 18

Area 3 Figs 09 & 10

Areas 8 & 9 Figs 13 & 14

Area 16

Area 8 north Figs 15 & 16

Area 7

Area 3

Area 14

Area 10

Area 9

Area previously surveyed for battery storage

Area 1

Area 12

Area 2

Areas 1, 2 & 16 Figs 05 & 06

Area 8

Area 17 Figs 21 & 22

Area 6

Area 17

Area 15

Area 13

Area 15 Figs 19 & 20

Areas 6 & 13 Figs 09 & 10

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Geophysical Survey
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Charlton/Hankerton
Wiltshire

Referencing information

Referencing grid to OSGB36 datum at 200m intervals

- 399200 189400
- Survey tracks
- Survey track start
- Survey track stop
- Development boundary
- Scaled view of figures

SCALE 1:8000

0m 80 160 240 320 400m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

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Wiltshire

Greyscale plot of processed magnetometer data

+3nT

-3nT

SCALE 1:8000

0m 80 160 240 320 400m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

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Abstraction and interpretation of magnetic anomalies

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Linear anomaly - ridge and furrow
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear anomaly - associated with former outfarm
- Positive linear anomaly - of natural origin / former water channel
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - of natural origin
- 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 1:8000

0m 80 160 240 320 400m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

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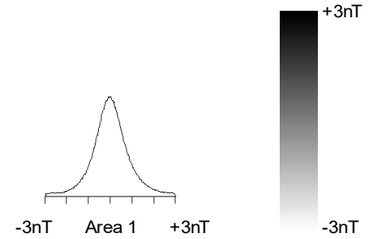
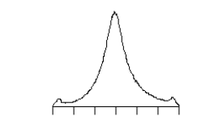
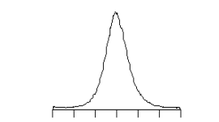
Charlton/Hankerton
Wiltshire

Greyscale plot of processed magnetometer data - Areas 1, 2 & 16







SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

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Wiltshire

Abstraction and interpretation of magnetic anomalies - Areas 1, 2 & 16

Area 16

Area 1

Area 2

Woodland unsurveyable

Woodland unsurveyable

Area previously surveyed for battery storage

Heavily rutted - unsurveyable

Pylons

Pylon

Pylon

Pylon

N

8

10

5

2

1

29

- Positive linear anomaly - of uncertain origin
- Weak multiple dipolar linear anomaly - land drain
- Positive anomaly - area of magnetic enhancement
- Variable magnetic response - of natural origin
- 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 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 06

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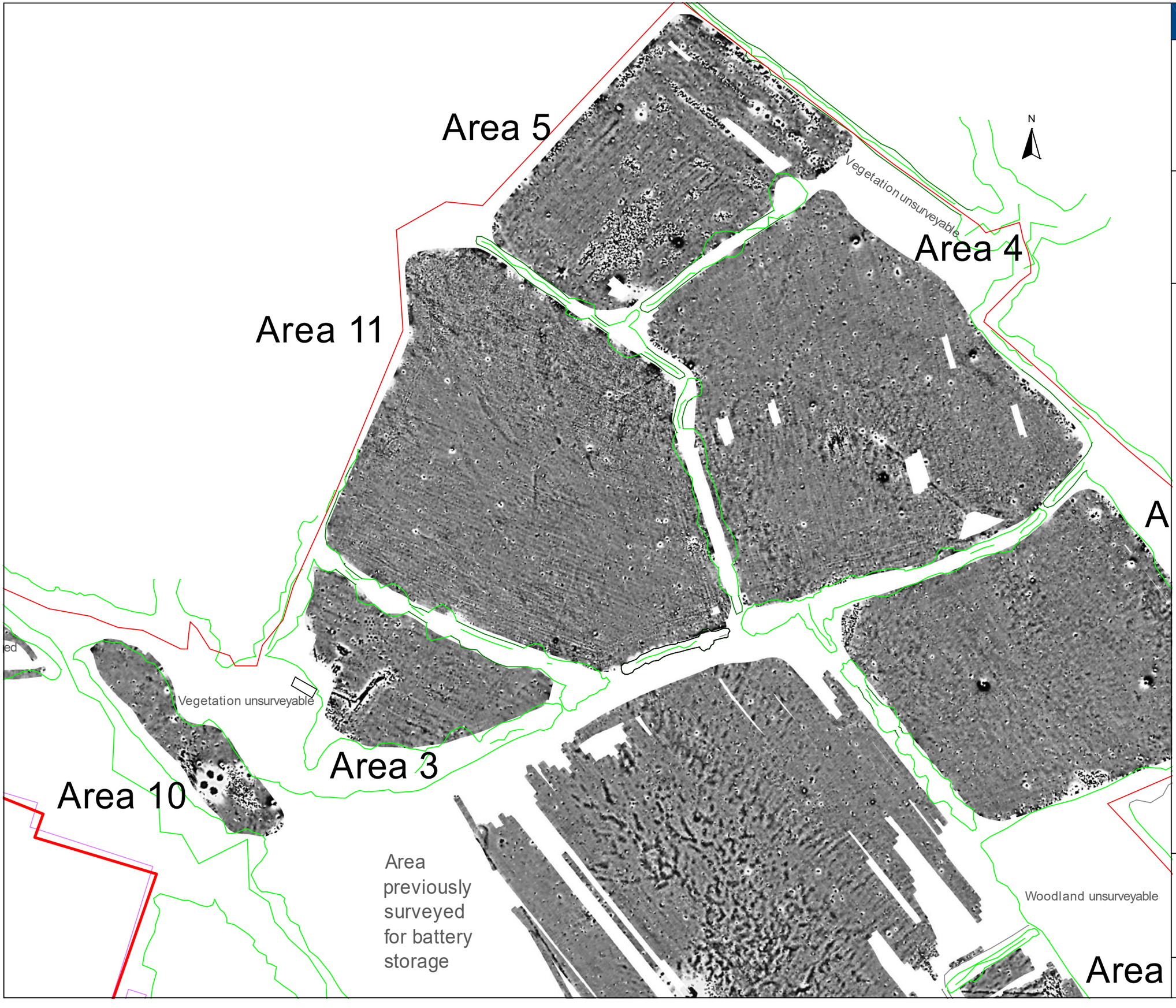
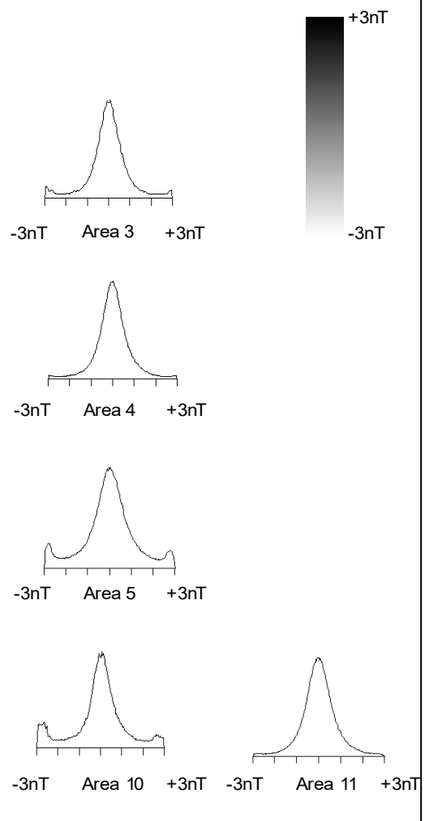
Wiltshire

Greyscale plot of processed magnetometer data - Areas 3, 4 ,5 10 & 11





SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 07

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Land adjacent to
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Charlton/Hankerton
Wiltshire

Abstraction and interpretation of magnetic anomalies - Areas 3, 4, 5 10 & 11

Area 5

Area 4

Area 11

Area 3

Area 10

Area

Vegetation unsurveyable

Vegetation unsurveyable

Woodland unsurveyable

Area previously surveyed for battery storage

N

11
9
8
10
4
6
3
5
7
2

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear anomaly - associated with former outfarm
- Positive linear anomaly - former field boundary
- Linear anomaly - ridge and furrow
- Linear anomaly - of agricultural origin
- 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 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08

Archaeological Surveys
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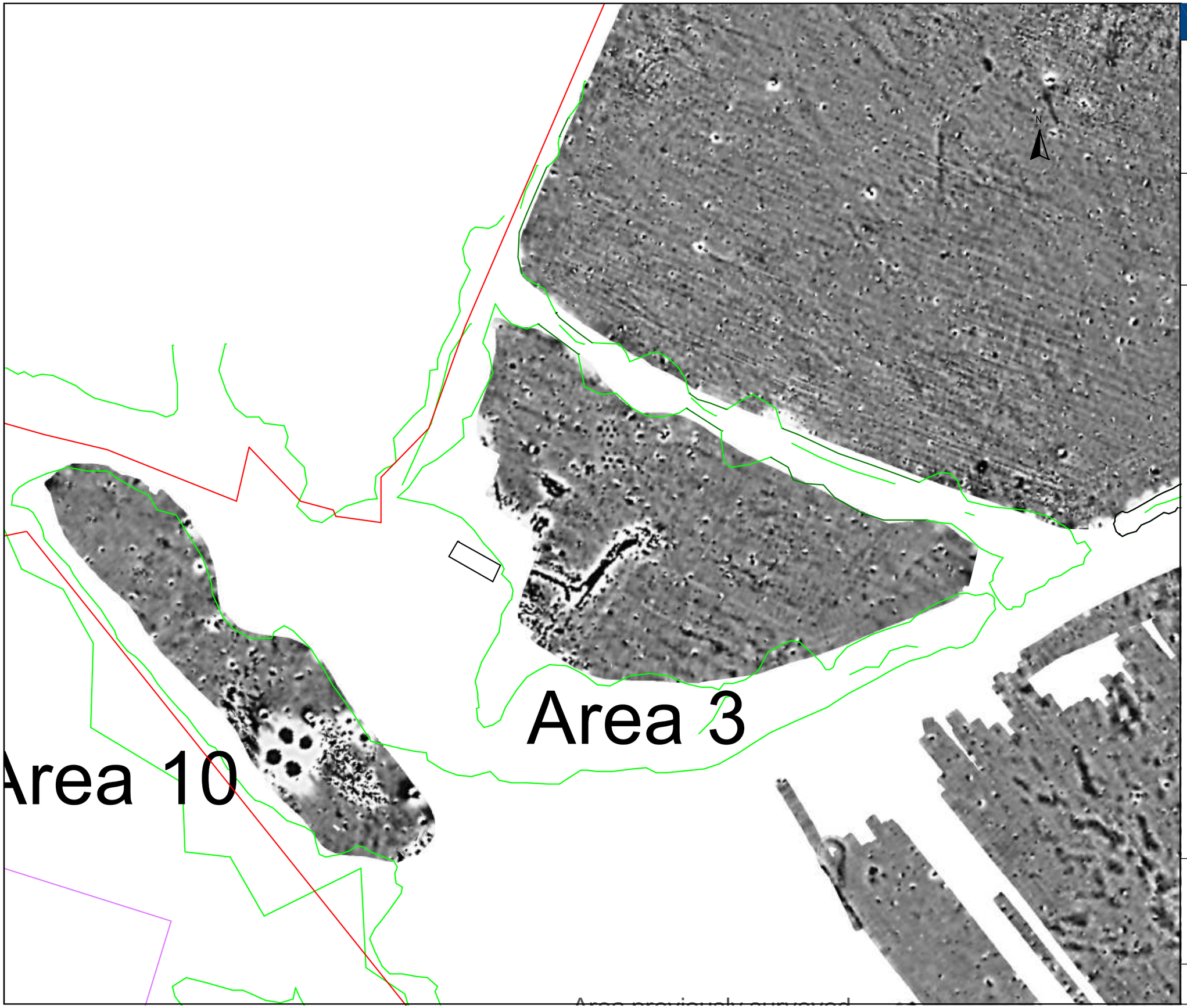
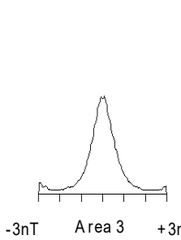
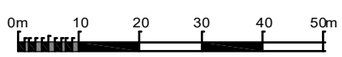
Wiltshire

Greyscale plot of processed magnetometer data - Area 3





SCALE 1:1000



KTD	DJS	FIG 09

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Land adjacent to
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Charlton/Hankerton
Wiltshire

Abstraction and interpretation of magnetic anomalies - Area 3

N

4
6
3
5
7

Area 3

Area 10

Area previously surveyed

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear anomaly - associated with former outfarm
- Positive linear anomaly - former field boundary
- Linear anomaly - ridge and furrow
- Linear anomaly - of agricultural origin
- 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 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 10

Area 12

Area 6

Area 13

Pylon

Pylon

N

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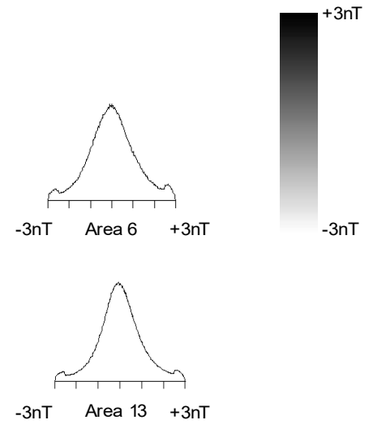
Wiltshire

Greyscale plot of processed magnetometer data - Areas 6 & 13



SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 11

Area 12

Area 6

Area 13

Pylon

Pylon

13

12

33

31

32

N

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Charlton/Hankerton
Wiltshire

Abstraction and interpretation of magnetic anomalies - Areas 6 & 13

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Positive linear anomaly - possible land drain
- Positive linear anomaly - former water channel
- Variable magnetic response - of natural origin
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 12

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Wiltshire

Greyscale plot of processed magnetometer data - Area 7

+3nT
-3nT
-3nT Area 7 +3nT

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 13

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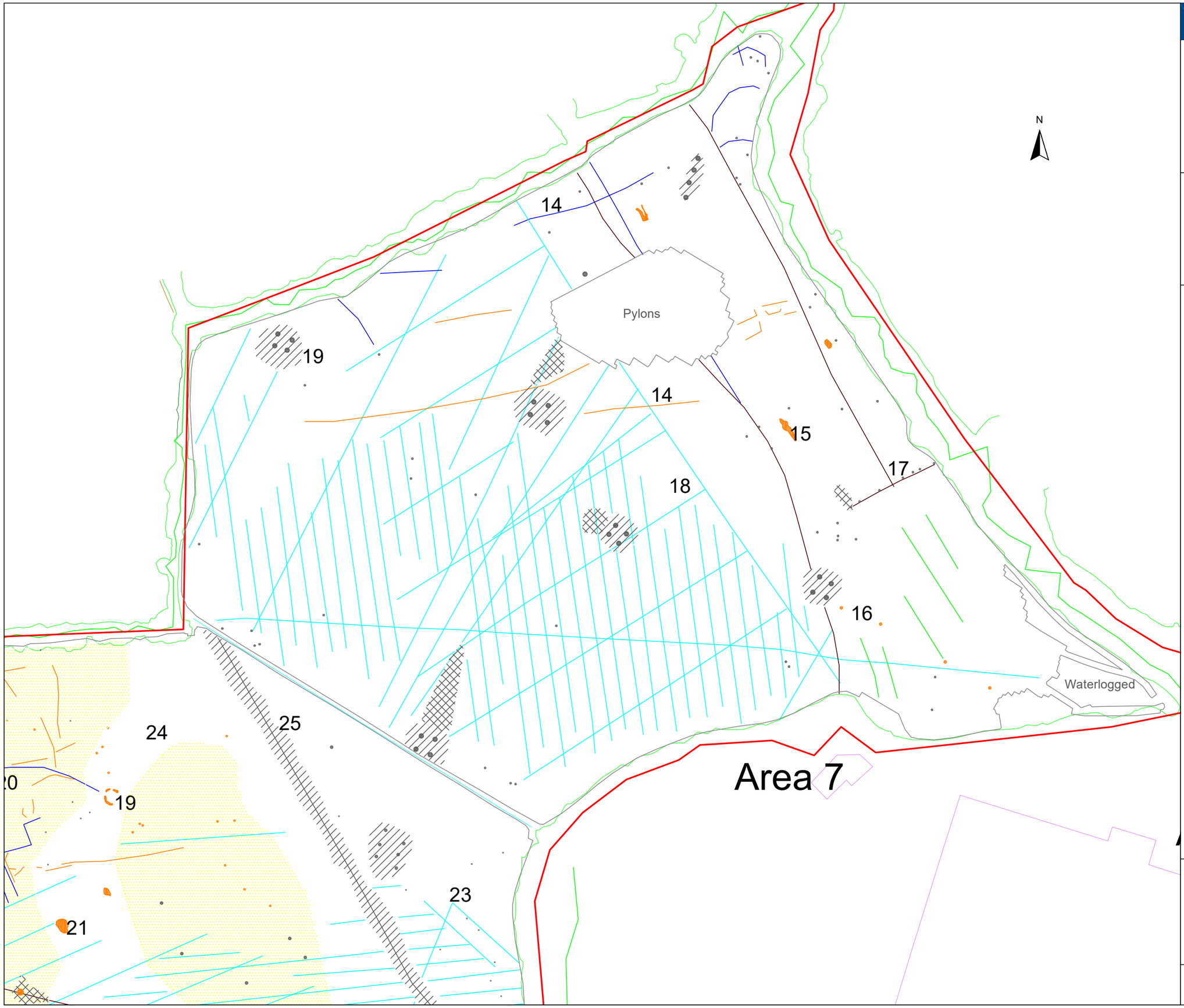
Wiltshire

Abstraction and interpretation of magnetic anomalies - Area 7



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

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 14

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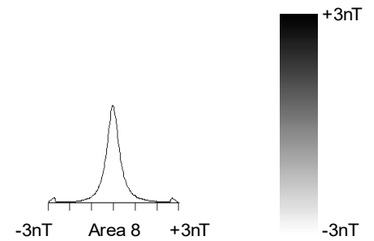
Wiltshire

Greyscale plot of processed magnetometer data - Areas 8 & 9



SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 15

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Geophysical Survey
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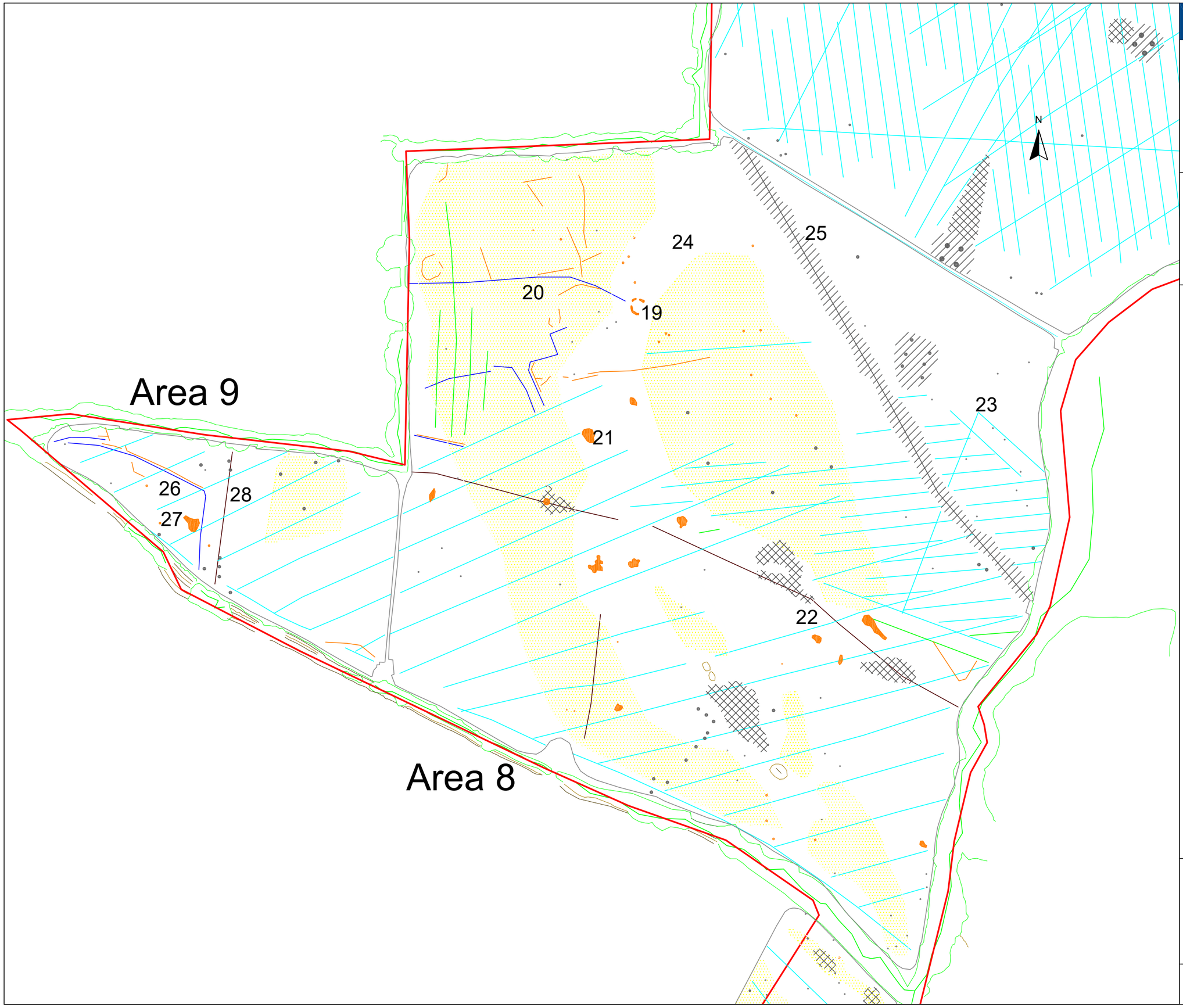
Charlton/Hankerton
Wiltshire

Abstraction and interpretation of magnetic anomalies - Areas 8 & 9



- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - of agricultural origin
- Positive linear anomaly - land drain
- Positive linear anomaly - former field boundary
- 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 multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 16

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Geophysical Survey
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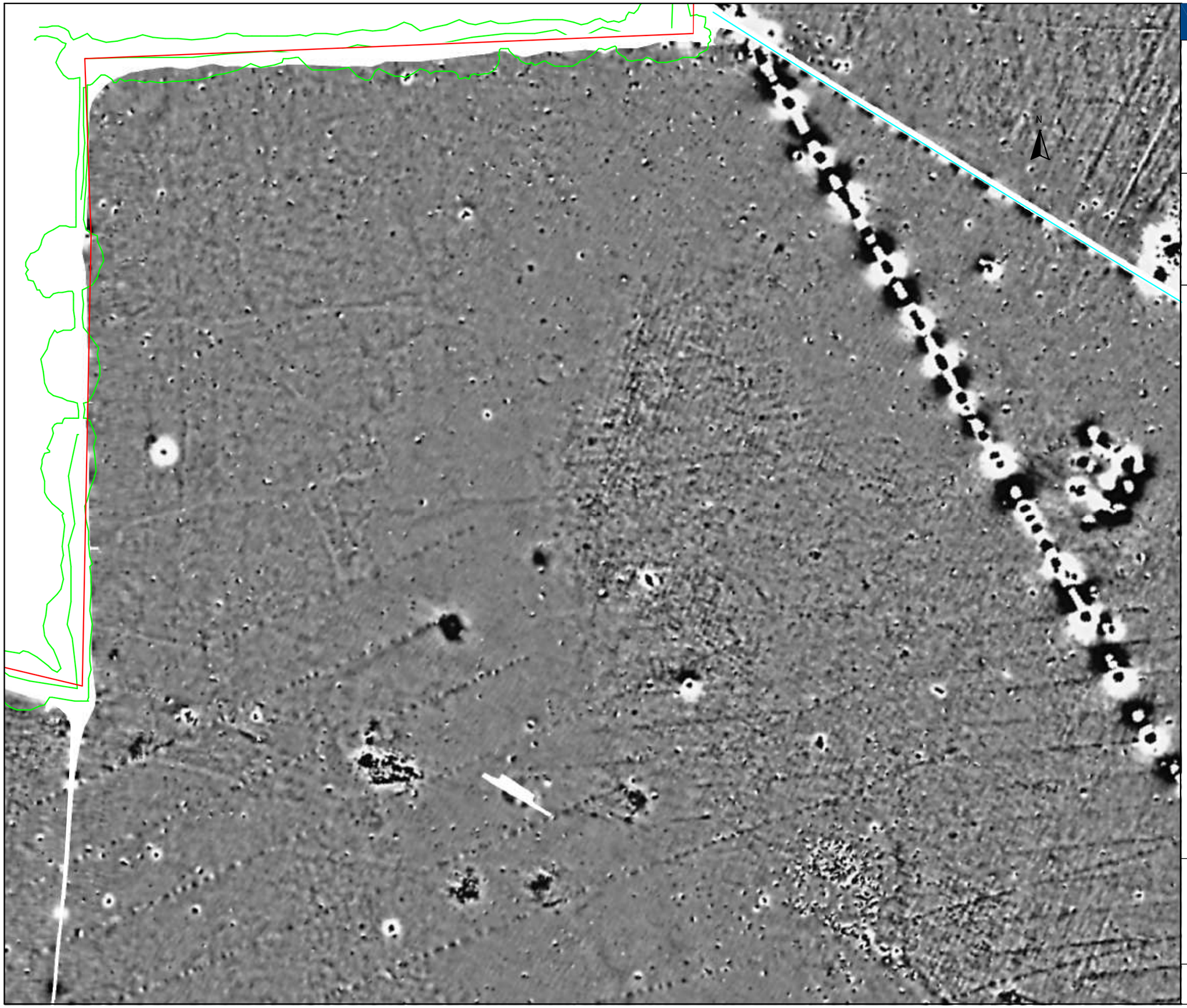
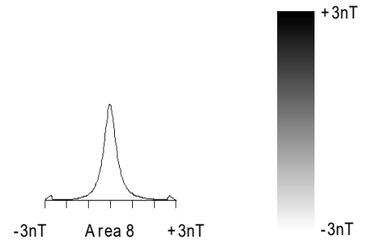
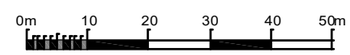
Charlton/Hankerton
Wiltshire

Greyscale plot of processed magnetometer data - Area 8





SCALE 1:1000



KTD	DJS	FIG 17

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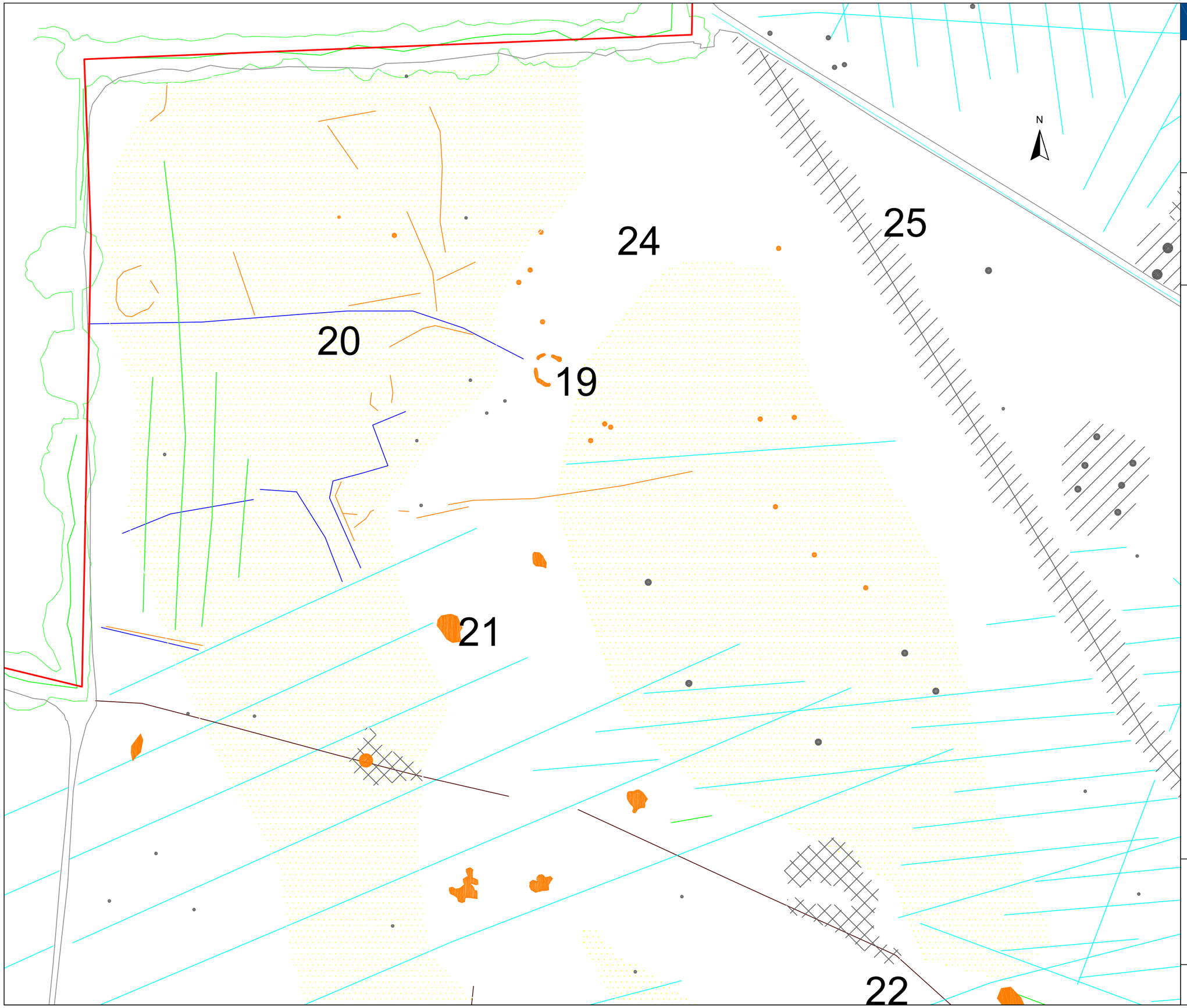
Abstraction and interpretation of magnetic anomalies - Area 8



- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - of agricultural origin
- Positive linear anomaly - land drain
- Positive linear anomaly - former field boundary
- 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 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

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 18

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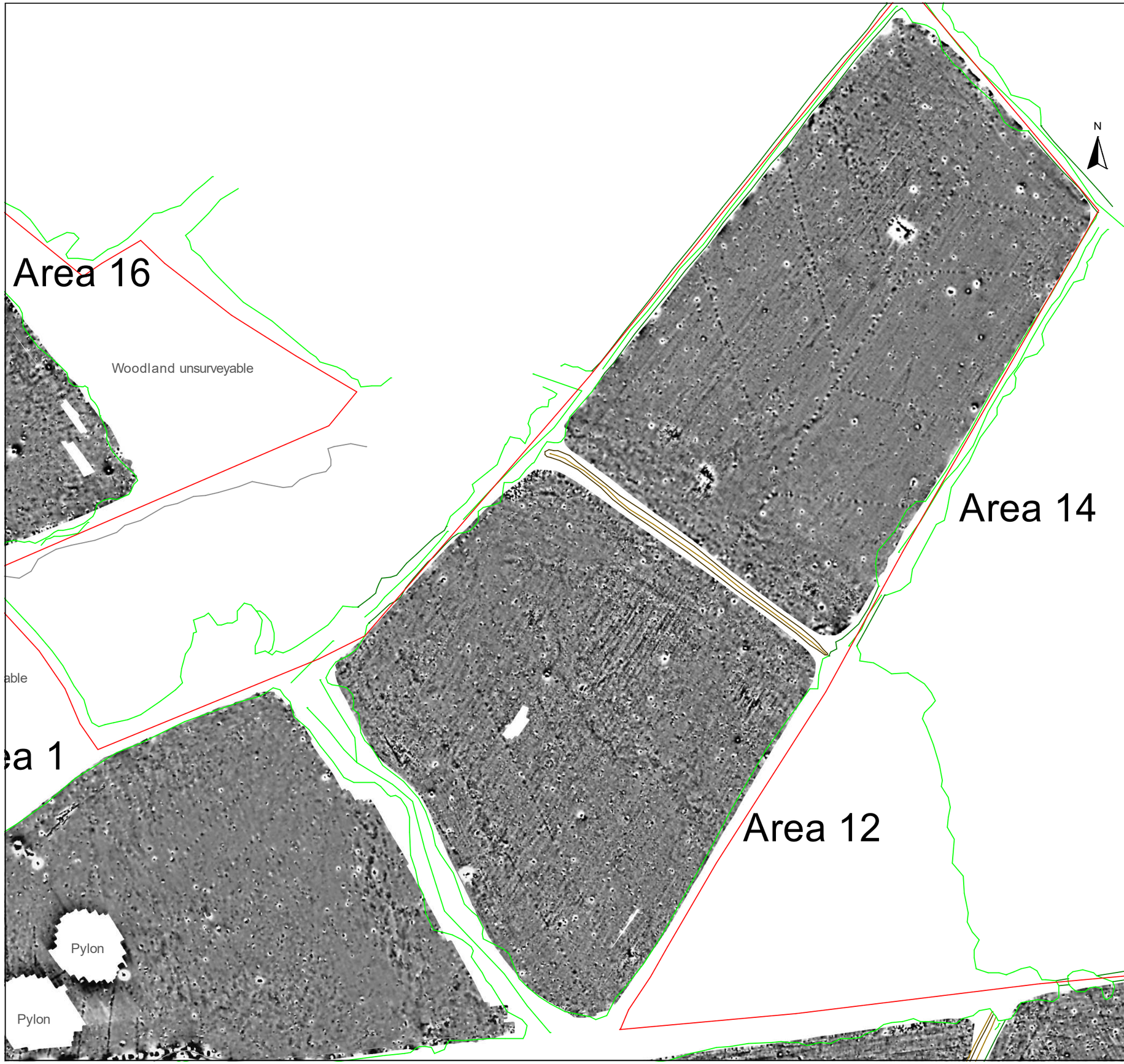
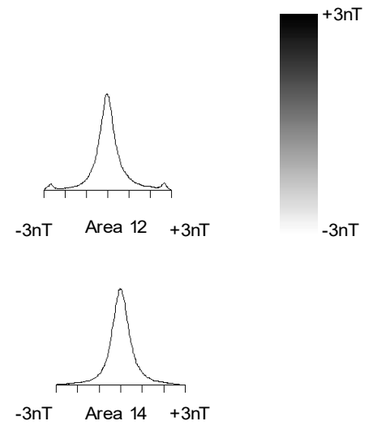
Wiltshire

Greyscale plot of processed magnetometer data - Areas 12 & 14





SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 19

Archaeological Surveys
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Charlton/Hankerton
Wiltshire

Abstraction and interpretation of magnetic anomalies - Areas 12 & 14

Area 16

Woodland unsurveyable

Area 14

Area 12

35

34

36

30

29

1

Pylon

Pylon

N

- Positive linear anomaly - of uncertain origin
- Positive linear anomaly - land drain
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 20

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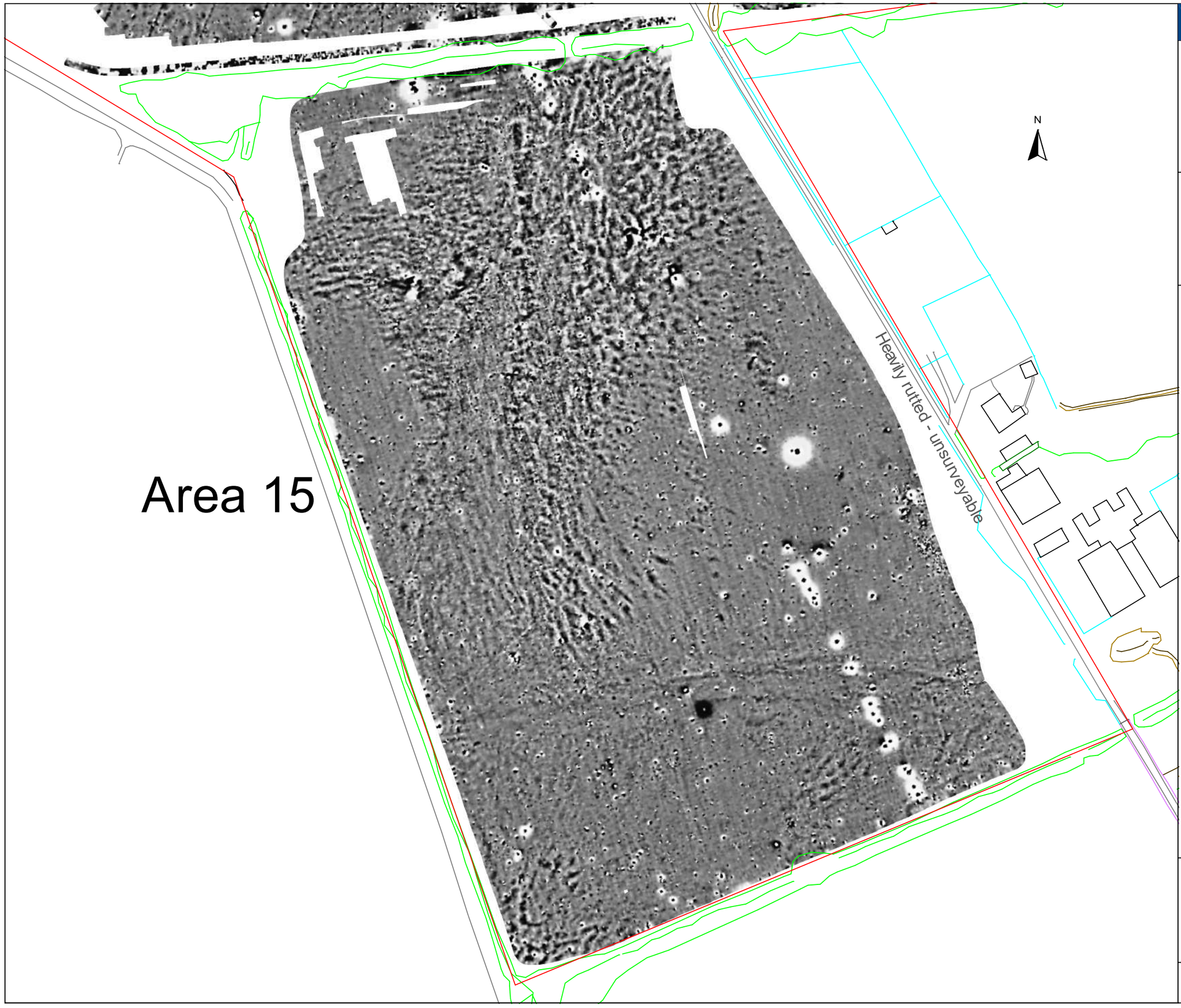
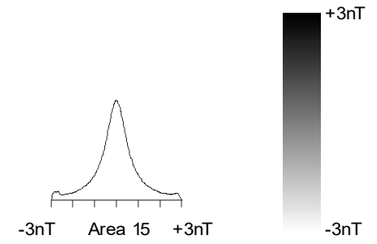
Wiltshire

Greyscale plot of processed magnetometer data - Area 15





SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 21

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Geophysical Survey
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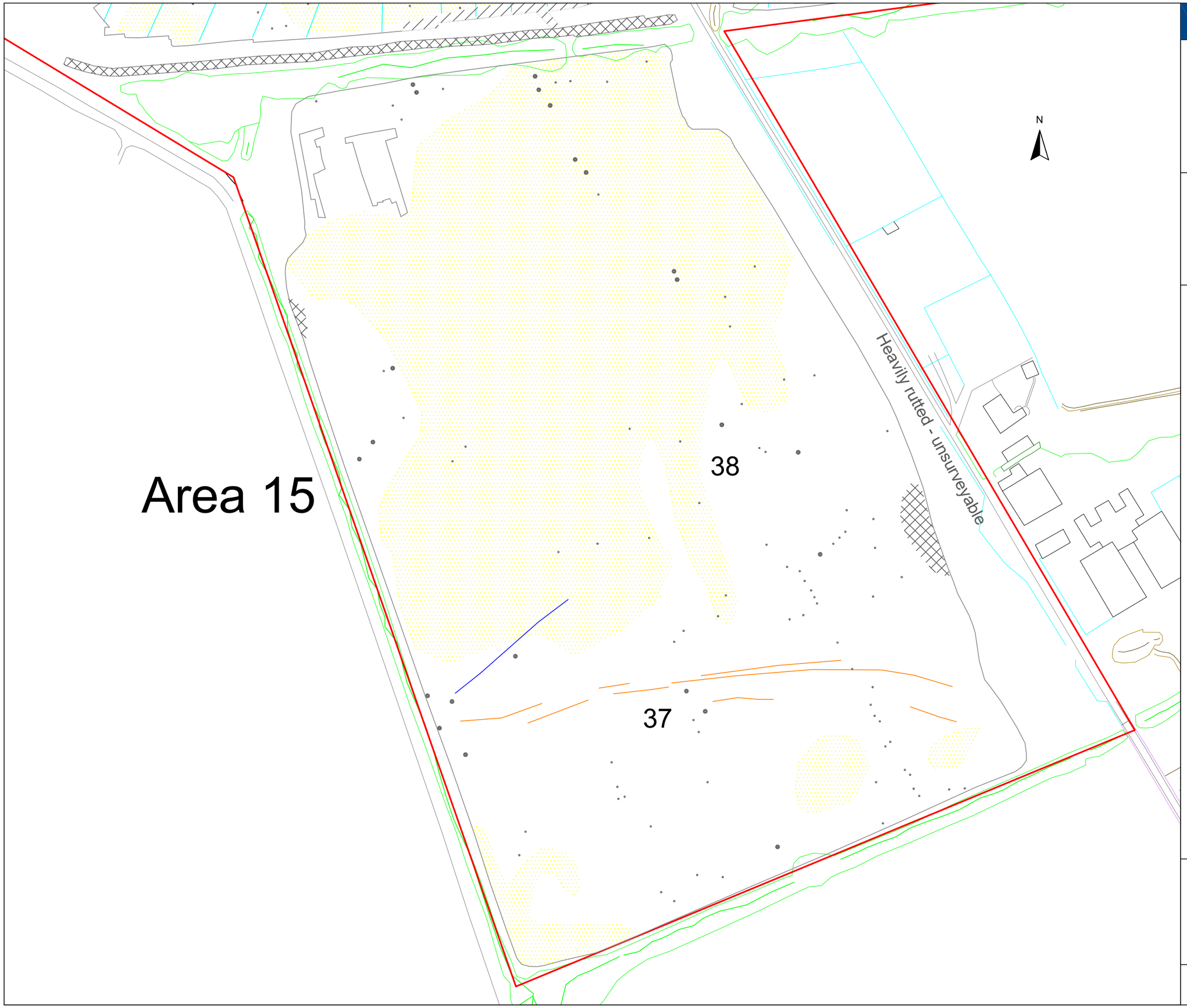
Wiltshire

Abstraction and interpretation of magnetic anomalies - Area 15



- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 22

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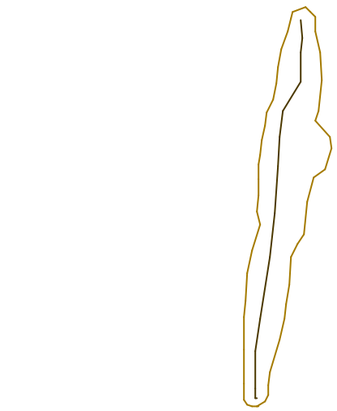
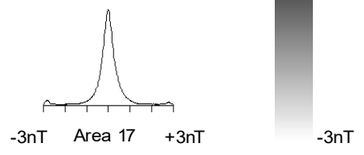
Wiltshire

Greyscale plot of processed magnetometer data - Area 17

Area 17

N





SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 23

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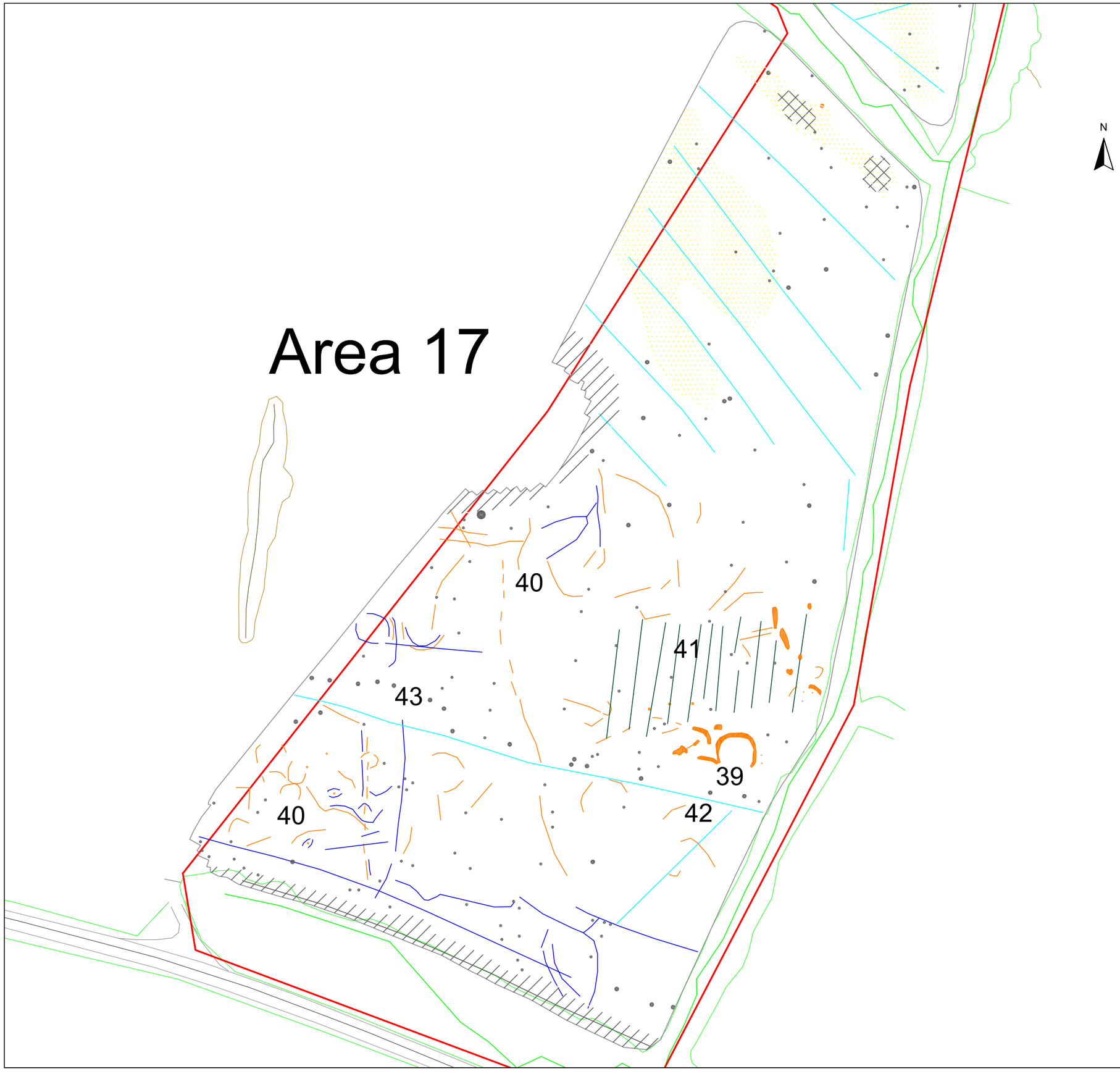
Abstraction and interpretation of magnetic anomalies - Area 17



- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - ridge and furrow
- Weak multiple dipolar linear anomaly - 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 multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

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KTD	DJS	FIG 24