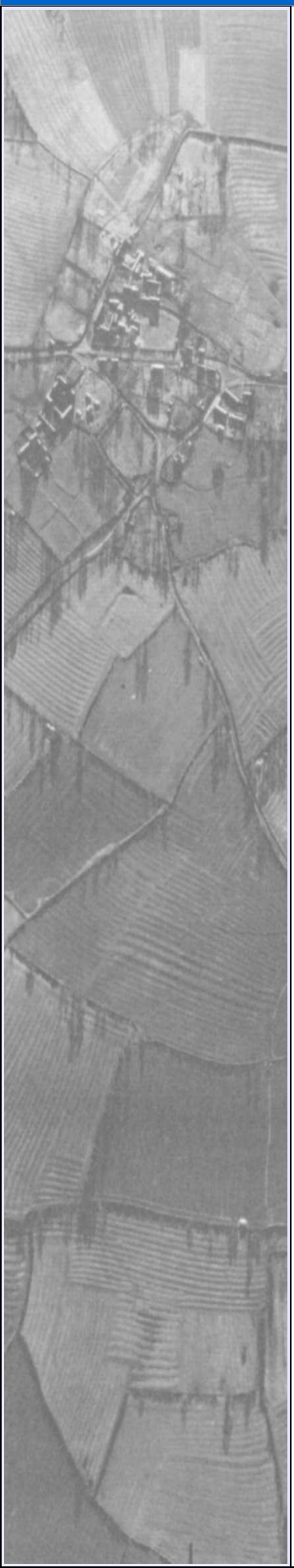

Land off The Forty
Cricklade
Wiltshire

MAGNETOMETER AND EARTH RESISTANCE SURVEY REPORT

for

Cotswold Archaeology

David Sabin and Kerry Donaldson

November 2016

Ref. no. J690

ARCHAEOLOGICAL SURVEYS LTD

Land off The Forty
Cricklade
Wiltshire

Magnetometer and Earth Resistance Survey

for

Cotswold Archaeology

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

Survey date – 20th October 2016
Ordnance Survey Grid Reference – **SU 09620 93155**

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SUMMARY

A geophysical survey was carried out by Archaeological Surveys Ltd within a small parcel of land off The Forty in Cricklade, Wiltshire. The site contained widespread dumped material, vegetation and deeply rutted ground which restricted the survey area. Magnetometry revealed that the entire site had been subject to widespread dumping of modern ferrous material with no other discernible anomalies due to the strong and widespread response. Earth resistance survey was carried out within the south eastern part of the site in a zone that was not rutted and did not contain modern debris that would prevent effective resistive measurements. An "L" shaped high resistance anomaly appears to relate to a former boundary wall or bank, with a an area of high resistance on its northern side possibly associated with a former agricultural building and yard. The features are present on 19th century Ordnance Survey mapping.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Cotswold Archaeology to undertake a geophysical of an area of land to the south of The Forty, Cricklade, Wiltshire. The site has been outlined for a proposed development and the survey forms part of an archaeological assessment of the site.

1.1.2 The site had been cleared of tall and dense vegetation immediately prior to the survey; however, as the area was small and contained clear evidence of modern ferrous contamination likely to produce magnetic disturbance, an earth resistance survey was also carried in addition to magnetometry.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry and earth resistance survey (resistivity) 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 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 Site location, description and survey conditions

1.3.1 The site is located to the south of The Forty on the western edge of Cricklade in Wiltshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 09620 93155, see Figs 01 and 02.

1.3.2 The site covers 0.2ha in total; however, due to the presence of trees, overgrown vegetation, dumped material and deeply rutted ground across the site only 0.1ha could be surveyed with magnetometry and 0.03ha with resistivity.

Plate 1: Survey area looking south east

1.3.3 Weather conditions during the survey were fine. Low precipitation prior to the earth resistance survey was considered likely to produce very suitable ground conditions for the location of anomalies.

1.4 Site history and archaeological potential

1.4.1 The site lies in an area with several archaeological sites and findspots. A number of Roman finds, including coins, pottery sherds and building debris are recorded within a 300m radius of the site. Cricklade is a Saxon walled town, one of King Alfreds burghal hidage towns with scheduled monuments listed for Cricklade Town Banks (List entry no. 1002997) and Areas of Saxon 'Burh' Within the Town Walls (List entry no. 1004679) situated 300m to the north east of the survey area. The site lies within an area known as The Forty, a settlement with medieval origins, recorded as the home of Nicholas De La Fortye in 1281 and Richard De La Fortheye in 1289. Ordnance Survey mapping from the 19th century shows that the southern part of the site

contained a farm building and possible yards which was likely to be part of the demolished 19th farmstead recorded at The Forty, with ridge and furrow recorded on land immediately to the south and south west.

1.4.2 The location of the demolished 19th century farmstead is likely to produce geophysical anomalies. There is potential for the geophysical survey to locate previously unrecorded features should they exist within the site; however, modern dumped material may obscure such features.

1.4.3 The surface conditions within the site were not suitable for the observation of cultural material during the course of the survey. A low earth bank with a north east to south west orientation was noted within the south eastern part of the site. A parallel ditch-like depression was also noted on the same orientation crossing the central part of the site. It is possible that these features are associated with the former farmstead mapped in the 19th century. A basic plan of the features was created using RTK GNSS in order to compare their position with any geophysical anomalies.

1.5 Geology and soils

1.5.1 The underlying geology is mudstone from the Oxford Clay Formation (BGS, 2016).

1.5.2 The overlying soil across the site is from the Wickham 2 association and is a typical stagnogley soil. It consists of a slowly permeable, seasonally waterlogged, fine loamy over clayey soil (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry carried out over similar geology and soil has produced good results. The site is, therefore, considered suitable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

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

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.1.5 The electrical resistance or resistivity of the soil depends upon the moisture content and distribution within the soil. Buried features such as walls can affect the moisture distribution and are usually more moisture resistant than other features such as the infill of a ditch. A stone wall will generally give a high resistance response and the moisture retentive content of a ditch can give a low resistance response. Localised variations in resistance are measured in ohms (Ω) which is the SI unit for electrical impedance or resistance.

2.1.6 The Twin Probe configuration used in this survey is favoured for archaeological prospection and can give a response to features up to 1m in depth with a mobile probe separation of 0.5m.

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 <10s.

2.2.5 The earth resistance survey was carried out with a Geoscan Research RM85 mounted on a MSP25 Mobile Sensor Platform. The platform comprises a wheeled resistance array with four spiked wheels that act as the four probes of a square array which are set 0.75m apart on an aluminium frame. It is configured as a multiplexed 0.75m square array recording alpha, beta and gamma measurements every 0.25m along traverses separated by 1m. Readings are triggered by distance encoder pulses from an MSP25 wheel after an initial calibration. The survey was carried out in a zig-zag fashion over a grid 30m x 30m.

2.2.6 The alpha and beta measurements are represented by changes in the configuration of the current and potential probes achieved by rapid switching with the multiplexer. There is often little difference between the two; however, some directional effects may be apparent. The gamma measurement is effectively the difference between the alpha and beta measurements and may not contain useful data.

2.2.7 The earth resistance survey grids were set out to the Ordnance Survey OSGB36 datum using a Leica GS10 RTK GNSS. The GNSS is used in conjunction with Leica's SmartNet service where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

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 ±30nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

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

2.3.5 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. With regard to the Sensys MXPDA, minimally processed data is considered by the manufacturer to be data that is 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 very high density of data collection.

2.3.6 Data logged by the resistance meter are downloaded and processed within Geoplot 4 and then exported for further processing and display in TerraSurveyor software. Raw data are analysed and displayed within the report and no processing, other than clipping between +30Ω and -10Ω has been carried out.

2.3.7 The raster images are combined with base mapping using ProgeCAD Professional 2014 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 also drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for

paper printing.

2.3.9 A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features.

2.3.10 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 - magnetometry

3.1.1 The detailed magnetic survey was carried out over 0.1ha within a single plot of land. The area contained widespread disturbance due to the presence of waste ferrous material that included vehicle parts, wheels, a gate, Heras fencing, etc.

3.1.2 Magnetic anomalies located can be classified as areas of magnetic debris and strong discrete dipolar anomalies relating to ferrous objects.

3.2 Statement of data quality - magnetometry

3.2.1 Data are considered representative of the magnetic anomalies present within the site. The widespread modern ferrous contamination may have completely obscured features of archaeological potential.

3.3 Data interpretation - magnetometry

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, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics.

Report sub-heading CAD layer names and plot colour	**Description and origin of anomalies**
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is 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, or hearths and may therefore be archaeologically significant. However where the site can be seen to have been contaminated by modern material or subject to

	modern use, the response is also likely to be modern. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.

Table 1: List and description of magnetometry interpretation categories

3.4 General assessment of survey results - resistivity

3.4.1 The earth resistance survey was carried out over approximately 0.03ha.

3.4.2 Resistive anomalies located can be generally classified as a linear high resistance anomaly associated with a low bank and an area of high resistance that may relate to a surface and structural remains associated with a former agricultural building.

3.5 Statement of data quality - resistivity

3.5.1 Data are considered representative of the resistive anomalies present within the site. Survey was constrained by modern dumped material and deeply rutted ground in the northern part of the site.

3.6 Data interpretation - resistivity

3.6.1 The listing of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the earth resistance survey. A basic explanation of the characteristics of the anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross reference to the abstraction and interpretation plot. Sub-headings are then used to group anomalies with similar characteristics.

Report sub-heading CAD layer names and plot colour	**Description and origin of anomalies**
Anomalies associated with land management AS-ABST RES BOUNDARY AS-ABST RES HIGH STRUCTURAL ARCHAEOLOGY	High resistance anomalies are indicative of comparatively low moisture and may indicate stone, compacted soil, changes in drainage, etc. Such anomalies relate to mapped or visible earthwork features relating to land boundaries/banks/walls. A widespread zone of high resistance, possibly surrounded by walling may indicate a surface.

Table 2: List and description of resistivity interpretation categories

3.7 List of anomalies – magnetometry

Area centred on OS NGR 409620 193155, see Fig 03

3.7.1 The magnetometry data demonstrate widespread strongly magnetic debris relating

to modern ferrous material within the site. Due to the strength and widespread distribution of the material, it is not possible to determine if there are any weaker anomalies present.

3.8 List of anomalies – resistivity

Area centred on OS NGR 409630 193144 see Fig 04.

3.8.1 The earth resistance survey has located an "L" shaped high resistance linear anomaly in the south eastern part of the site (30-60Ω). The north east to south west section of the anomaly correlates with a low bank noted during the survey. To the north of the bank the response is generally higher, at 10-20Ω, than to the south, at generally 3Ω, possibly indicating an internal surface or yard and/or structural remains. Ordnance Survey mapping from the 19th century indicates the presence of a former building and land plots and these are considered likely to be the origin of the anomalies.

4 CONCLUSION

4.1.1 The magnetometer survey indicates that there is widespread magnetic contamination of modern origin across much of the site, and it is possible that this may have obscured weaker magnetic anomalies. However, 19th century Ordnance Survey mapping indicates that the south eastern part of the site contained a small building and yards or small land parcels, and the earth resistance survey has located an "L" shaped high resistance linear anomaly that may correspond with a former mapped boundary. Part of the anomaly is associated with a low extant bank orientated north east to south west. To the north of this feature the response is generally much higher than to the south, possibly indicating a former surface and/or relating to the former structure.

5 REFERENCES

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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 gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm 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 field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

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 ±15nT and ±10nT 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 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 slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks and modern agricultural features.

Appendix C – survey and data information

Magnetometer data

COMPOSITE
Filename: J690-mag-proc.xcp
Description: Imported as Composite from: J690-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 409594.441120437, 193175.582938677 m
Southeast corner: 409642.591120437, 193129.682938677 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 48100

Dimensions
Composite Size (readings): 321 x 306
Survey Size (meters): 48.2 m x 45.9 m
Grid Size: 48.2 m x 45.9 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 33.15
Min: -33.00
Std Dev: 18.89
Mean: -0.93
Median: -0.17
Composite Area: 0.22101 ha
Surveyed Area: 0.098876 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 -30.00 to 30.00 nT

Earth resistance data - alpha

Filename: J690-res-alpha-proc.xcp
Description: Imported as Composite from GeoPlot : J690-res-alpha
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 24/10/2016 15:10:52

Direction of 1st Traverse: -22.5 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 120 x 30
Survey Size (meters): 30 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 30.00
Min: -10.00
Std Dev: 7.39
Mean: 7.07
Median: 5.80
Composite Area: 0.09 ha
Surveyed Area: 0.031975 ha

Processes: 2
1 Base Layer
2 Clip from -10.00 to 30.00 ohm

Earth resistance data - beta

Filename: J690-res-beta-proc.xcp
Description: Imported as Composite from GeoPlot : J690-res-beta
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm

Direction of 1st Traverse: -22.5 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 120 x 30
Survey Size (meters): 30 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 30.00
Min: -10.00
Std Dev: 7.55
Mean: 7.33
Median: 6.20
Composite Area: 0.09 ha
Surveyed Area: 0.031975 ha

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 printed copy of the report and a PDF copy will be supplied to the Wiltshire Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Magnetometer data path: J690 Cricklade\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
cricklade1\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	20/10/16	D.J.Sabin
cricklade1\MX\J690-mag.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	24/10/16	K.T.Donaldson
Mag\comps\J690-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	24/10/16	K.T.Donaldson
Mag\comps\J690-mag.-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±30nT).	24/10/16	K.T.Donaldson
Resistance data - path: J690 Cricklade\Data				
Geoplot\Grid 1a.grd and 1b.grd., .dat., .grs	Geoplot 4	Produced on download of Geoscan RM85 cart for resistivity (alpha and beta)	20/10/16	D.J.Sabin
Geoplot\Grid J690-res-alpha.cmp, .cmd,. dms, .txt Geoplot\Grid J690-res-beta.cmp, .cmd,. dms, .txt	Geoplot 4	Composite data file produced from .grd resistance survey grids.	24/10/16	D.J.Sabin
Res\comps J690-res-alpha.xcp J690-res-alpha-proc.xcp J690-res-beta.xcp J690-res-beta-proc.xcp	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	24/10/16	D.J.Sabin
Graphic data - path: Jxxx xxxxxx\Data				
Mag\graphics\ J690-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±30nT.	24/10/16	K.T.Donaldson
Mag\graphics\ J690-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	24/10/16	K.T.Donaldson
Res\graphics\ J690-res-alpha-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a greyscale plot clipped to -10Ω and +30Ω.	24/10/16	K.T.Donaldson
Res\graphics\ J690-res-alpha-proc..tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	24/10/16	K.T.Donaldson
Res\graphics\ J690-res-beta-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a greyscale plot clipped to -10Ω and +30Ω	24/10/16	K.T.Donaldson
Res\graphics\ J690-res-beta-proc..tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	24/10/16	K.T.Donaldson
CAD data - path: J690 Cricklade CAD				
J690 version 1.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	20/10/16	K.T.Donaldson
Text data - path: J690 Cricklade\Documentation				
J690 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	03/11/16	K.T.Donaldson

Appendix E – copyright and intellectual property

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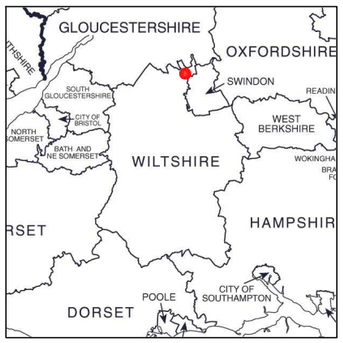
Cricklade
Wiltshire

Map of survey area

Survey location



● Survey location

Site centred on OS NGR
SU 09620 93155

SCALE 1:25 000

0m 500m 1000m

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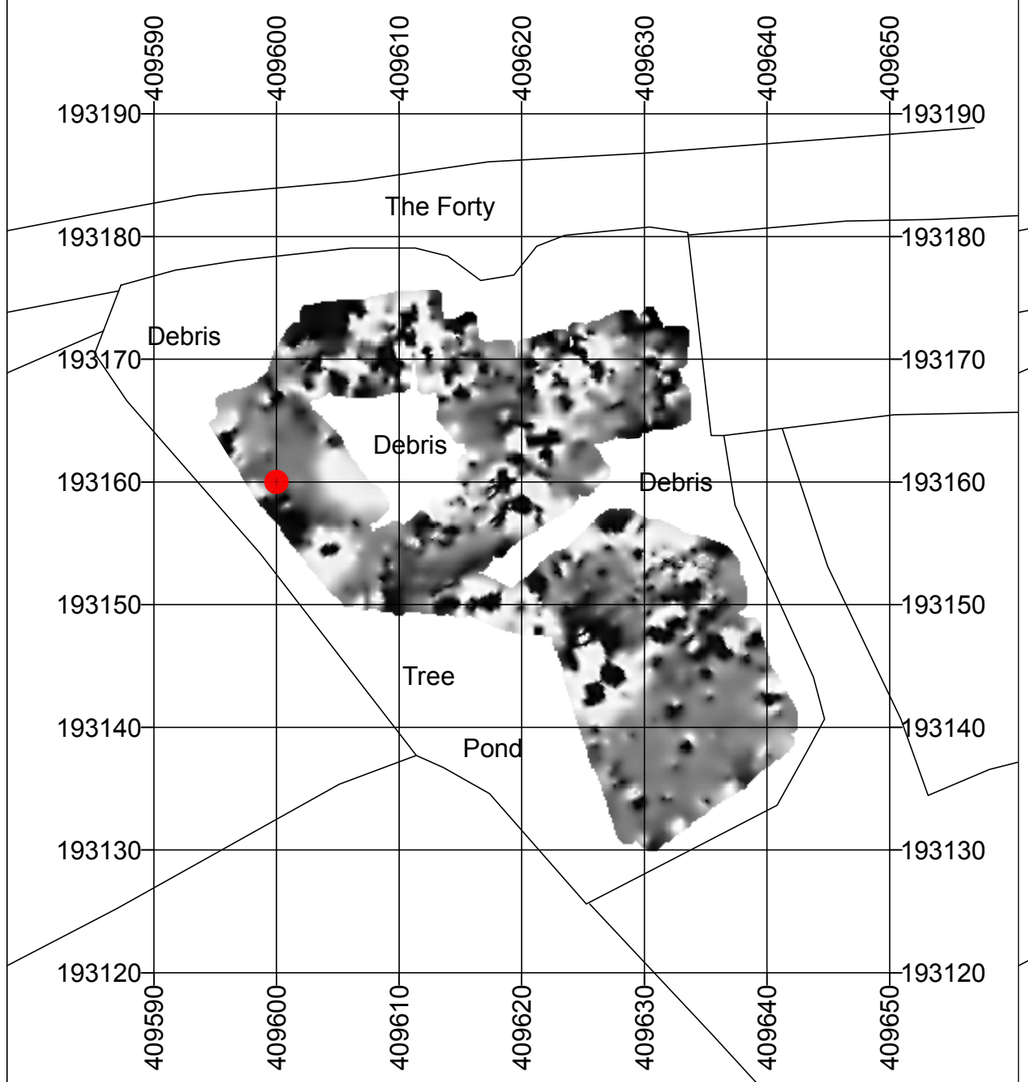
FIG 01

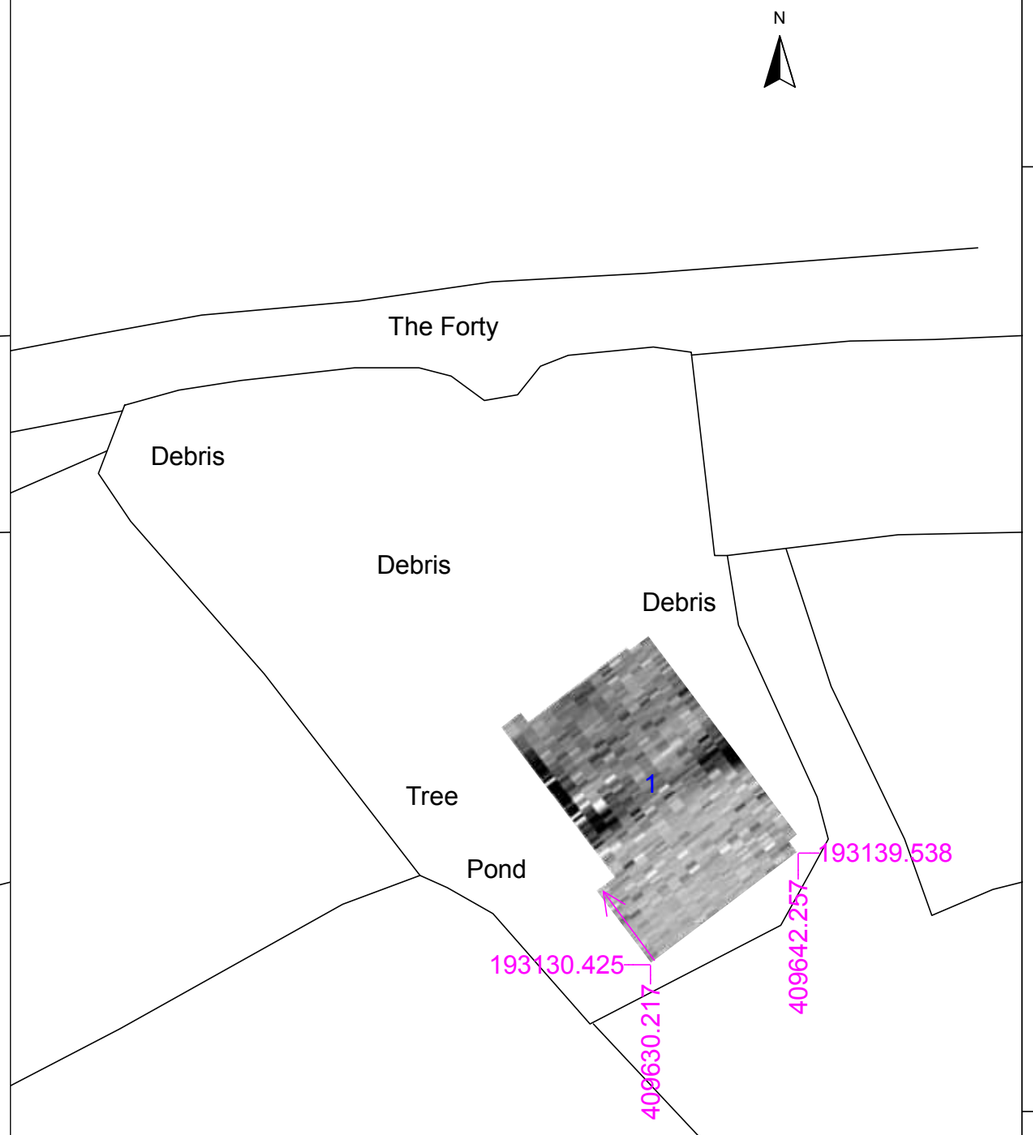
Magnetometry referencing



Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02
Referencing grid to OSGB36 datum at 10m intervals

● 409600 193160

Resistivity referencing



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Referencing information

Resistivity grid coordinates based on Ordnance Survey OSGB36 datum

Grids set out using RTK GPS with Leica SmartNet correction data RTCMv2 format OSTN02 transformation

Referencing grid to OSGB36 datum at 50m intervals

Survey grid size = 30m

→ Survey start and traverse direction

1 Grid reference number and filename

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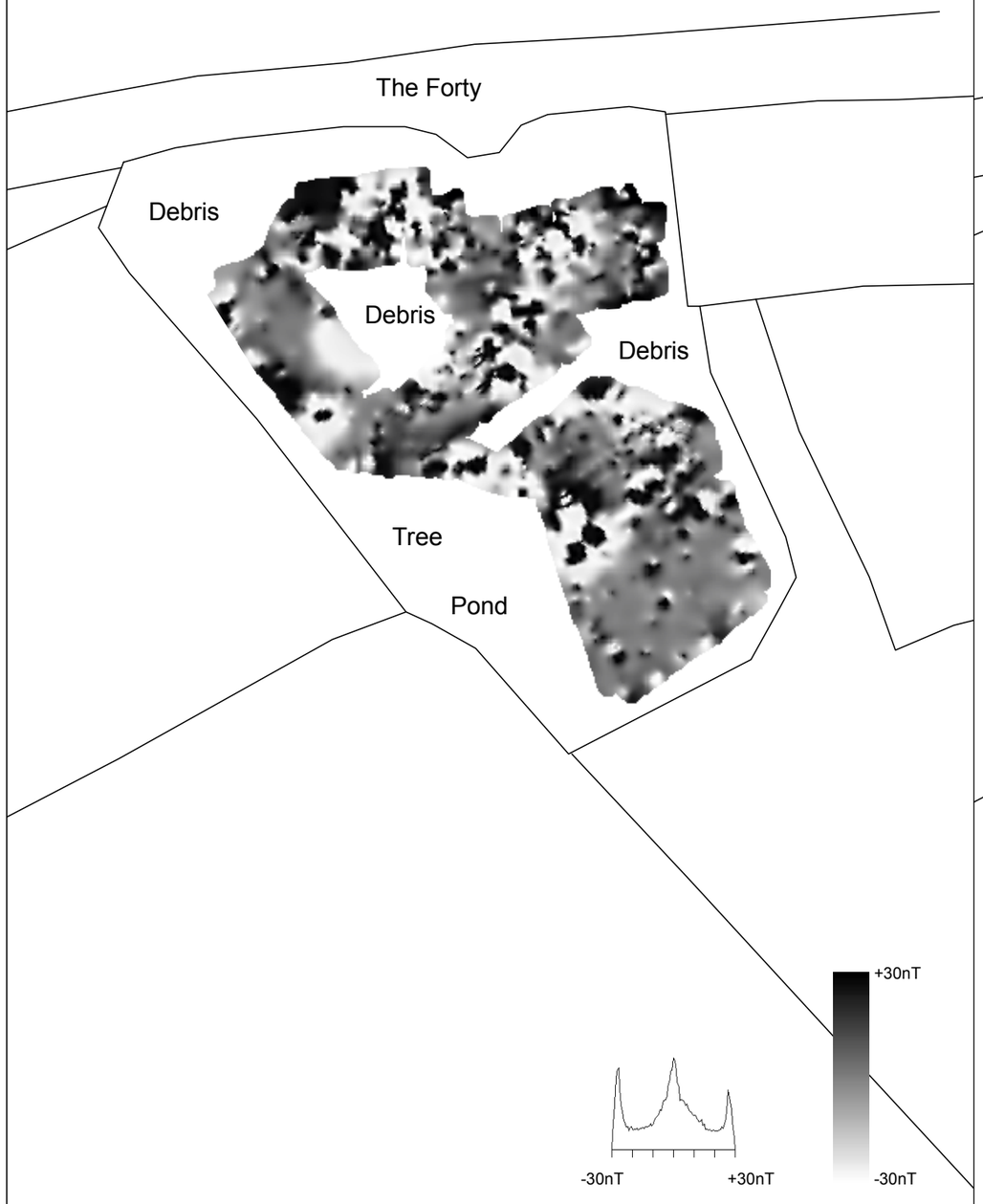
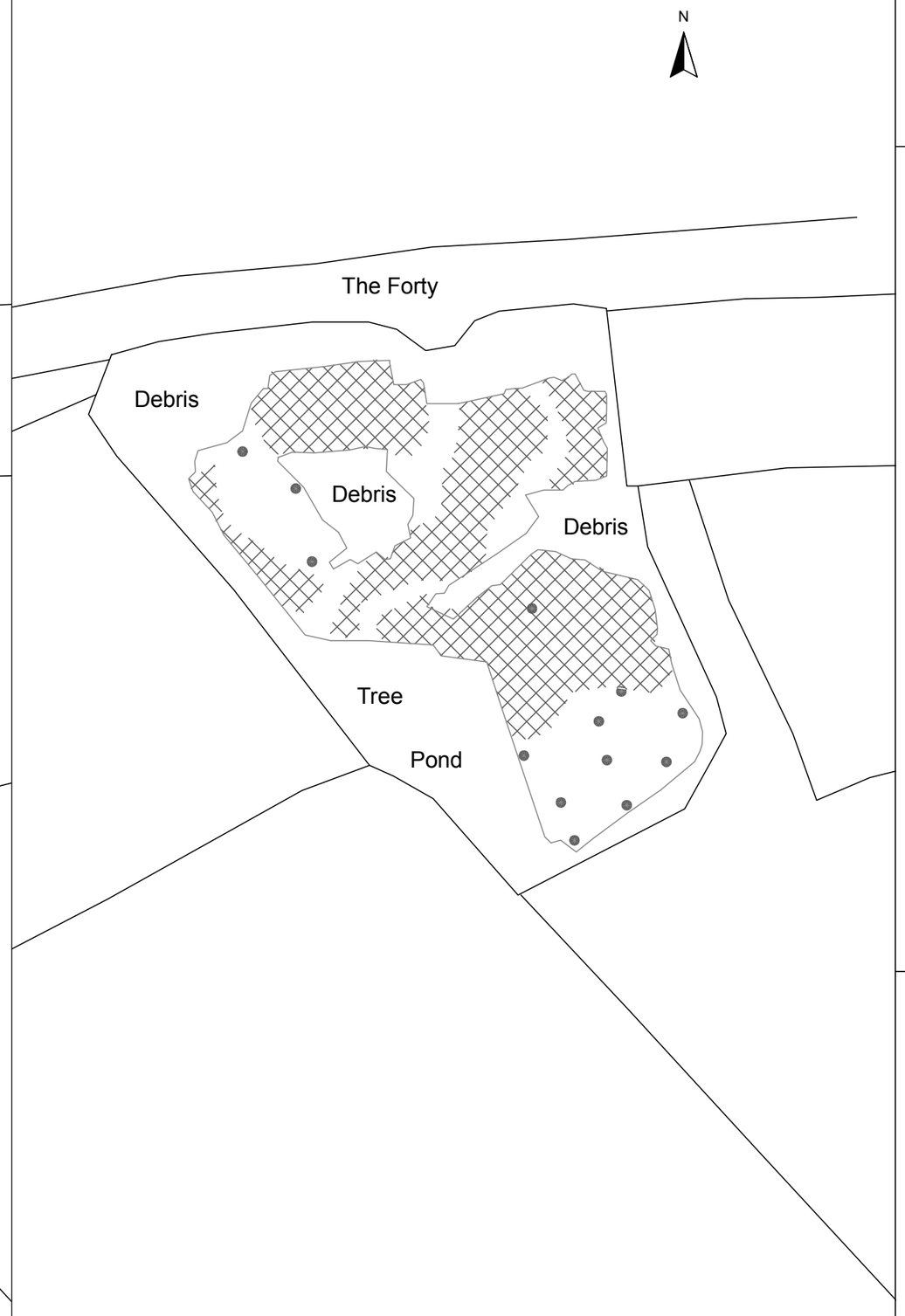
FIG 02

Greyscale plot of processed magnetometer data





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Abstraction and interpretation of magnetometer anomalies

Magnetic debris - spread of magnetically thermoremnant/ferrous material

Strong dipolar anomaly - ferrous object

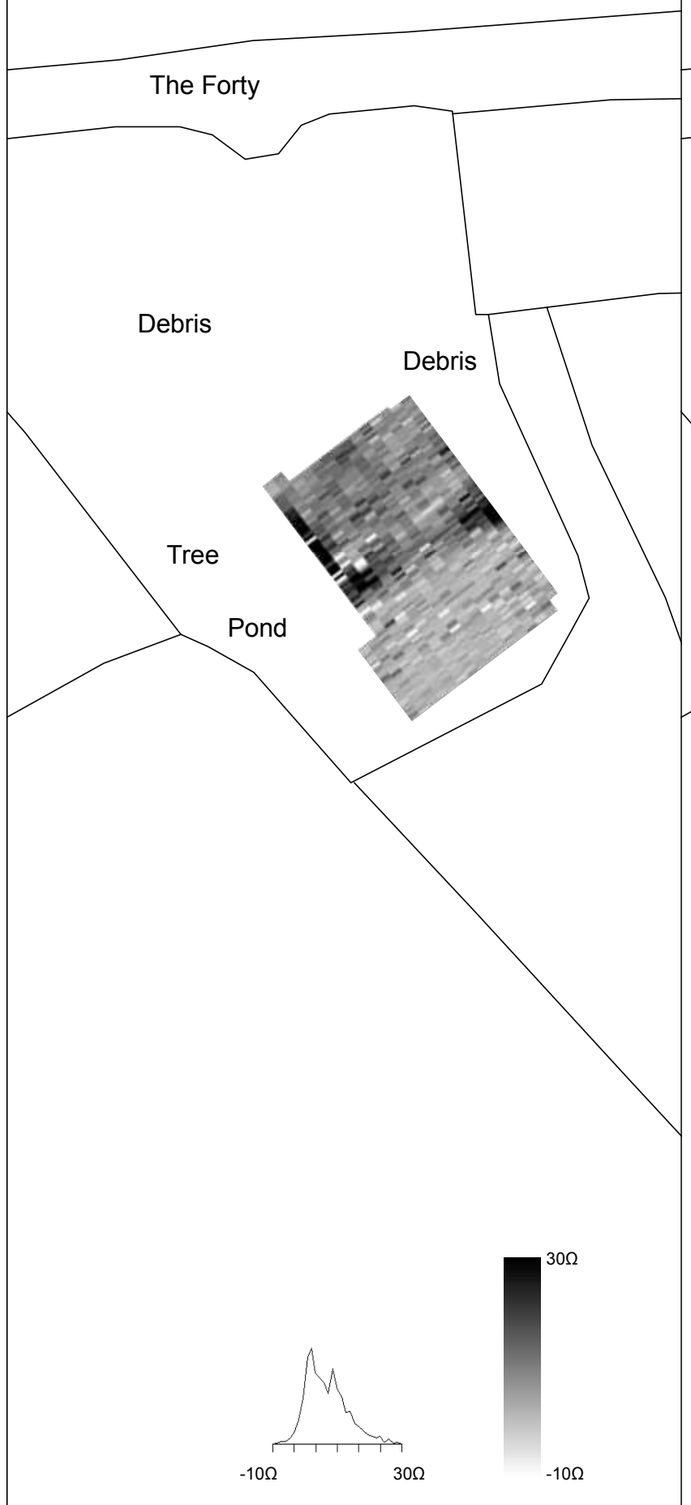
SCALE 1:500

0m 5 10 15 20 25m

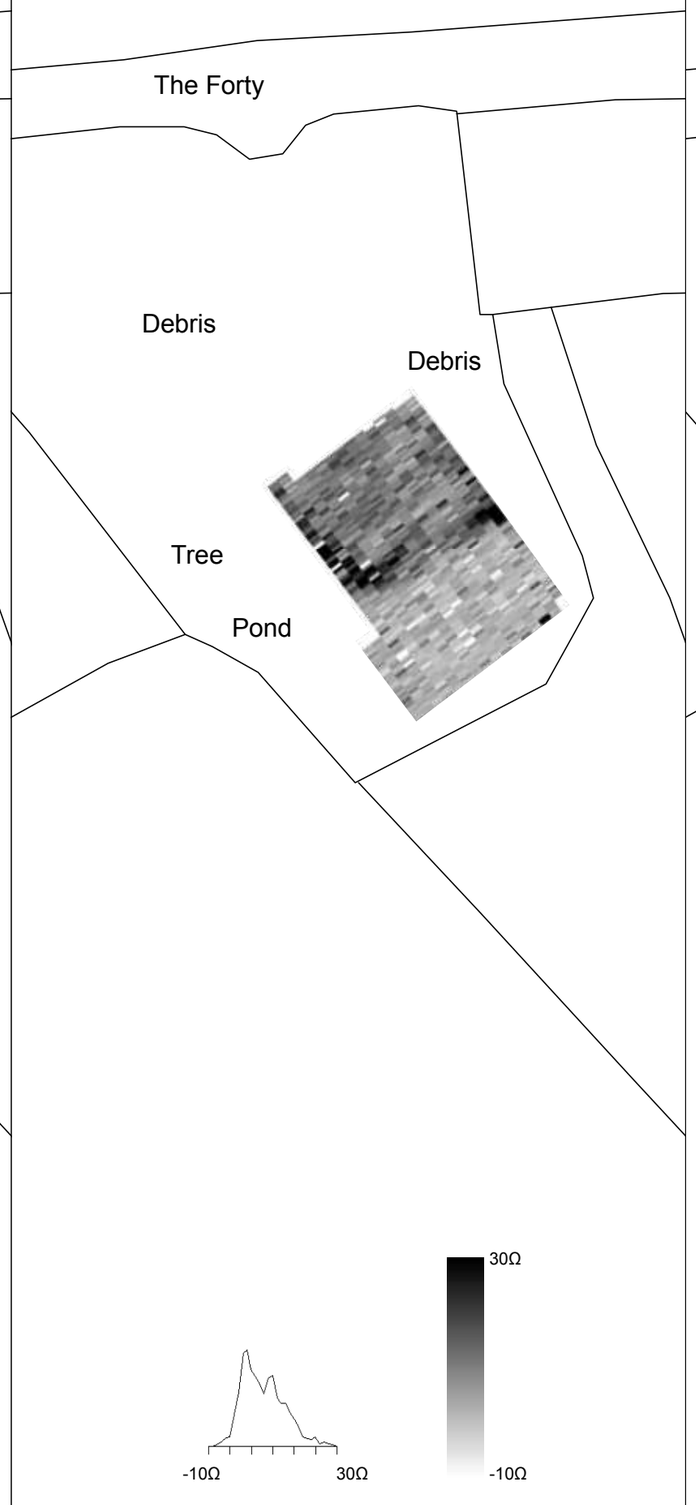
SCALE TRUE AT A3

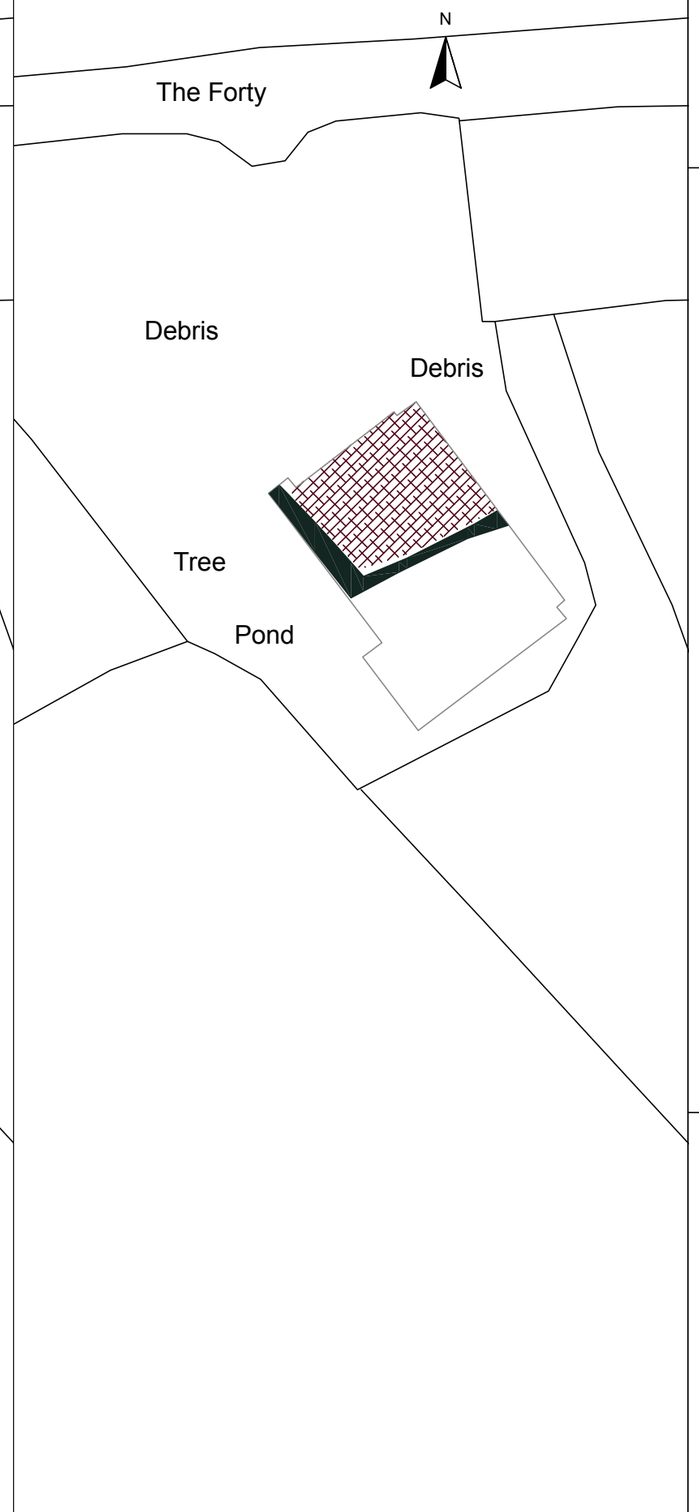
FIG 03

Greyscale plot of alpha resistance data



Greyscale plot of beta resistance data





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Abstraction and interpretation of resistance anomalies

- Linear zone of high resistance - former boundary that correlates with extant bank
- Area of high resistance - possible surface/remains of former farm building

SCALE 1:500

0m 5 10 15 20 25m

SCALE TRUE AT A3

FIG 04