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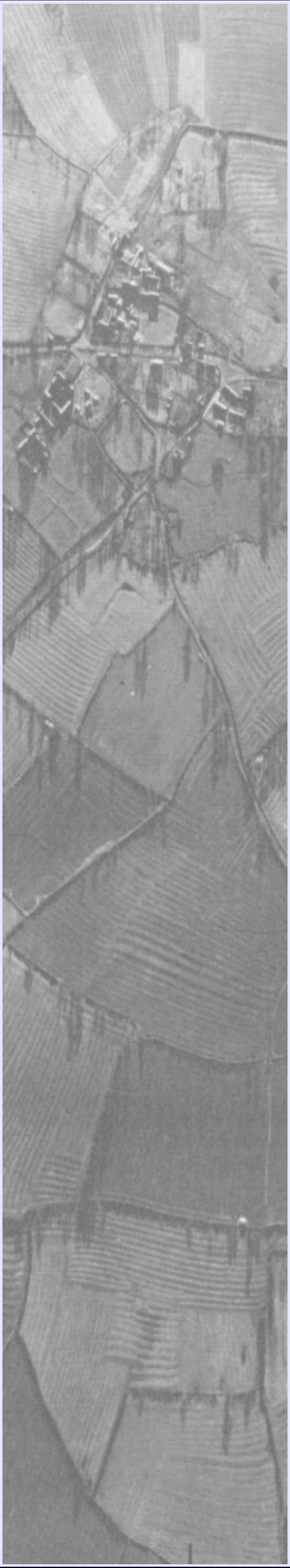

Land at The Old Priory
North Woodchester
Gloucestershire

EARTH RESISTANCE & MAGNETOMETER SURVEY REPORT

for

Mr & Mrs Hill

David Sabin & Kerry Donaldson

April 2019

Ref. no. J780

ARCHAEOLOGICAL SURVEYS LTD

Land at The Old Priory North Woodchester Gloucestershire

Earth Resistance & Magnetometer Survey Report

for

Mr & Mrs Hill

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Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

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SUMMARY

Magnetometry and resistivity surveys were carried out by Archaeological Surveys Ltd, on behalf of the landowner, over land at The Old Priory, North Woodchester in Gloucestershire. The work was carried out in order to provide an archaeological assessment of a narrow strip of land ahead of a proposed tree planting scheme designed to provide additional screening along the eastern edge of the scheduled monument of Woodchester Roman Villa. The area of planting was targeted with magnetometry and resistivity, with magnetometry over a wider area and the interpretation of the results was support by LiDAR analysis. The results indicate the presence of several former field boundaries with two former ditches extending into the area of proposed planting. The orientation of these boundary ditches appears similar to extant post medieval enclosure boundaries. Geophysical and LiDAR evidence for medieval ridge and furrow, and an associated headland, appears to demonstrate an early field layout with a different orientation. Through the majority of the proposed tree planting zone LiDAR data have revealed the presence of a low, broad bank that coincides with anomalies present in the resistivity data. The feature may be associated with material deposited during the construction of a railway immediately to the east of the site. The wider area of magnetometry revealed numerous other anomalies of uncertain origin.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Caroline Hill to undertake an earth resistance (resistivity) and magnetometer survey of an area of land to the south east of the Old Priory, North Woodchester in Gloucestershire. A small area of land has been outlined for a proposed tree screening scheme, and the survey aims to assess the archaeological potential of the site which lies within the scheduled monument of Woodchester Roman Villa.

1.1.2 A Written Scheme of Investigation (WSI) and Section 42 Licence Application document was produced by Archaeological Surveys (2019) and submitted to Historic England South West Casework Team. The WSI considers the requirements of a Brief for geophysical survey issued by the Client.

1.1.3 Survey techniques included magnetometry and resistivity with LiDAR (Light Detection and Ranging) data analysis supporting the abstraction and interpretation. Resistivity targeted the area of tree planting while magnetometry cover a much wider area in order to assess the archaeological potential of the adjacent zone.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use earth resistance survey (resistivity) and magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed ahead of ground disturbance by tree planting. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 With the survey area located within the scheduled monument of Woodchester Roman Villa, it is considered possible that both structural remains and former cut features, such as ditches and pits, may be present. Resistivity can be a more effective technique at locating structural remains when compared to magnetometry; however, data collection is significantly slower particularly when data is collected at high resolution, and results can be influenced by weather conditions and vegetation. Magnetometry may be more effective at locating former cut features and can also locate magnetic material associated with industrial activity. It is comparatively rapid particularly when collecting high resolution data. The wider area surveyed by magnetometry assists in assessing the nature and context of anomalies located in the area of proposed tree planting.

1.2.3 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.

1.4 Site location, description and survey conditions

1.4.1 The site is located to the south east of the Old Priory, North Woodchester, Gloucestershire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SO 84121 03075 (tree planting area), see Figs 01 and 02.

1.4.2 The magnetometry survey covers approximately 1.7ha and the targeted resistivity approximately 0.27ha. The surveys are located within a single field used for grazing, at the time of carrying out the work the ground cover was mainly short grass; however, the northern part of the targeted area contains several large pine trees and rough vegetation including nettles and briars.

1.4.3 The land tends to slope down towards the east with a moderately steep slope in the western part of the field grading to an almost flat or bowl shaped profile towards the eastern boundary. Beyond the eastern boundary the land slopes down very steeply to the disused Stonehouse and Nailsworth Railway line and Nailsworth Stream. The south western corner of the field contains a small barn and terraced area that was not surveyed.

Plate 1: Looking north east towards the proposed tree planting area

Plate 2: Looking south east along the southern part of the tree planting zone

1.4.4 The ground conditions across the site were generally considered to be favourable for the collection of geophysical data, with damp topsoil particularly suitable for resistivity. Some small areas of tall vegetation and briars prevented survey within the northern part of the target zone, and topsoil disturbance caused by badgers was noted in the southern part of the zone. Weather conditions during the survey were fine.

1.5 Site history and archaeological potential

1.5.1 The location of the proposed tree planting lies on the eastern edge of the scheduled monument of Woodchester Roman Villa (List entry no. 1004839). The villa was originally discovered in 1693, partially exposed in 1712 and 1722 and excavated by Samuel Lysons in 1793. The villa contains at least 64 rooms grouped around an inner and outer courtyard and dating from the 2nd to the 4th centuries. The villa is known for the "Orpheus Mosaic", lying within part of the graveyard of the former Church of St Mary, Woodchester (abandoned 1863). The villa building is recorded as having dimensions of 550 feet by 300 feet (167m by 91m) and is situated 300m west of the proposed tree planting scheme.

1.5.2 Immediately to the east lies the former line of the Stonehouse and Nailsworth Railway (later Midland Railway), in use between 1867 and 1969. The Gloucestershire Historic Environment Record lists that "many skeletons" were found during the construction of the railway, just to the north east of the survey area (GHER no. 7548).

1.5.3 The surface conditions within the site were generally unsuitable for the observation of cultural material during the course of the survey due to grass cover. However, small areas of exposed soil associated with former animal burrowing to the west of the planting scheme, and disturbance by animals within it, failed to reveal any cultural material. Approximately 90m west of the scheme a steep bank, adjacent to the western limit of the area of magnetometry, appears to contain numerous fragments of sandstone Roman roof tile with some terracotta tile and stone also visible. There are no Historic Environment Records indicative of finds in this location (OS NGR 384039 203022).

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is limestone, argillaceous rocks and subordinate sandstone from the Lias Group and Inferior Oolite Group. On the eastern edge of the site it is ferruginous limestone from the Marlstone Rock Formation (BGS, 2017).

1.6.2 The overlying soil across the site is from the Curtisden association and is a stagnogleyic, argillic brown earth. It consists of a silty soil over siltstone and a slowly permeable subsoil (Soil Survey of England and Wales, 1983). A broad, low bank running along the eastern side of the site, and through the area of proposed planting, may indicate soil dumping in this area possibly associated with the adjacent railway.

1.6.3 Magnetometry carried out over similar geology and soil has produced very good results. The site is, therefore, considered suitable for magnetic survey. Anomalies of natural origin may be present, and it may not be possible to separate these from anomalies of anthropogenic origin. The underlying geology and naturally formed features may also produce anomalies within the resistivity data.

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. Additional details are set out below and within Appendix B.

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. The cart is pushed at walking speed and not towed. Each sensor is not balanced 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 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 is manifest as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <100s.

2.2.5 The earth resistance survey was initially 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 and beta 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 grids 30m x 30m in size.

2.2.6 In addition to the resistivity data collected using the MSP25, at the same time magnetometry data were collected with the RM85 using the FAB1 (Fluxgate Adapter Box) with a single Sensys FGM650 gradiometer. Data were collected at the same resolution as the alpha and beta resistance datasets (1m x 0.25m within 30m x 30m grids). This additional magnetometry is useful for filling in areas where no RTK GNSS is available, e.g. under trees, and where survey traverses contain rough ground conditions as distance measurement and logging is achieved from an odometer.

2.2.7 The alpha and beta resistance 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.

2.2.8 Due to the presence of anomalies of uncertain origin within the tree planting area, an additional earth resistance survey was carried out using a Geoscan Research Ltd RM85 resistance meter and a mobile parallel twin probe array collecting data with 0.5m and 1m electrode separation. Data were recorded in zig-zag fashion at 1m intervals along traverses separated by 1m for the 1m electrode separation and 1m intervals along traverses separated by 0.5m with the 0.5m electrode separation. The different datasets were recorded simultaneously using a multiplexed system. A survey grid size of 30m by 30m was chosen.

2.2.9 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 ±3nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 Appendix D contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix C 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 The additional magnetometry dataset captured with the RM85 with FAB1 on the MSP25 cart is downloaded and processed using Geoplot 4. Gradiometer offset values are removed using a zero median traverse algorithm. A low pass filter is used to smooth the data with clipping for display at ±3nT.

2.3.7 Data logged by the RM85 resistance meter are downloaded and processed within TerraSurveyor and Geoplot 4 software. Raw data are analysed and displayed within the report as well as processed data. Appendix C outlines the processing sequence with further information on processing set out within Appendix B. TIF files are prepared in TerraSurveyor for the earth resistance data. Resistivity data are displayed as raw, despiked, high pass filtered and low pass filtered images. The processing applied within each survey area is outlined in Appendix D.

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 GPS, resection method, etc.

2.3.9 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.

2.3.10 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 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model derived from the Environment Agency's LiDAR data. Shaded relief plots are created using Surfer 15 (Fig 09).

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

3 RESULTS

3.1 Data interpretation

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

Interpretation category	Description and origin of anomalies
Anomalies with an uncertain origin	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information.
Anomalies relating to land management	Anomalies are mainly linear and may be associated with the 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 or as parallel linear anomalies.
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. Resistivity anomalies may be high or low and are clearly associated with extant modern features.
Anomalies with a natural origin	Naturally formed features can produce variable anomalies that relate to the properties of the soil, subsoil and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial'or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to magnetic anomalies within more solid geology.

Table 1: List and description of interpretation categories

3.2 General assessment of survey results – magnetometry

3.2.1 The magnetometry survey was carried out over approximately 1.7ha.

3.2.2 Magnetic anomalies located can be generally classified as those associated with land management, anomalies of uncertain origin, anomalies with an agricultural origin, anomalies associated with magnetic debris and disturbance. Anomalies located within each survey area have been numbered and will be outlined in 3.4 below with subsequent discussion in Section 4.

3.3 Statement of data quality and other factors influencing the results - magnetometry

3.3.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the datasets. Strongly contrasting magnetic anomalies are typical of Cotswold soils and geologies due to high levels of magnetic susceptibility within the topsoil and very low levels associated with the underlying solid geology. The high level of natural magnetic contrast can readily produce magnetic anomalies associated with natural features e.g. tree throw pits, animal burrows, faults and cracks due to cambering, solution features, soil creep and other colluvial features.

3.3.2 Magnetic debris is widespread and in places quite dense although it is unlikely to obscure weaker anomalies of archaeological potential. The origin of the debris probably mainly relates to the use of ferrous waste materials for the consolidation of paths and tracks. The are numerous industrial sites within the vicinity including the former Dudbridge Iron Works just over 1km to the north.

3.4 List of anomalies – magnetometry

Area centred on OS NGR 384066 203109, see Figs 06 & 07.

Anomalies relating to land management

(1) - The southern part of the survey area contains parallel positive linear anomalies indicative of former ditch-like features that cross through the proposed area of planting. LiDAR data has not revealed any surface features associated with these ditches; however, they appear similarly orientated to extant boundary features and may cut through former ridge and furrow which appears to have a different orientation. The anomalies appear to fade towards the western end possibly due to an overlying soil bank. It is considered that the ditches may relate to former field boundaries associated with post medieval land enclosure.

(2) - Short ditch-like anomaly relating to a former field boundary.

(3) - Linear anomalies associated with low banks indicative of removed field boundaries. They appear parallel to anomalies (1).

Anomalies with an uncertain origin

(4) - A weakly positive zone within the area of proposed planting. The zone correlates with an area of high resistance and may represent an infilled erosion scar caused by water overflow from the adjacent ditch-like anomaly (1).

(5) - Short linear and/or pit-like anomalies within and immediately adjacent to the proposed planting area. The anomalies are uncertain in origin, similar discrete anomalies are located further to the south west (6).

(6) - The southern part of the survey area contains several discrete elongated positive anomalies of uncertain origin. They may represent pit-like or short linear features.

(7) - A cluster of discrete positive anomalies to the west of anomalies (6) appear to be associated with recently disturbed ground. It is possible that they represent collapsed animal burrows and chambers.

(8) - A positive linear anomaly adjacent to the northern end of the proposed area of planting. The anomaly lies immediately north and parallel with the edge of a broad earth bank and is likely to represent a former ditch-like feature.

(9) - A broad and weakly positive anomaly appears to be associated with an earth bank.

(10) - Positive linear anomalies within the central part of the survey area may be associated with agricultural or natural features.

(11) - Weak, positive linear anomalies in the northern part of the survey area are of uncertain origin but may represent former land boundary ditches.

(12) - A 'D' shaped positive anomaly of uncertain origin may represent a former cut feature. It may be of archaeological potential.

(13) - In the northern part of the survey area there are two broad positive linear anomalies and a discrete positive response nearby. The anomalies moderately high in magnitude which may indicate the presence of magnetically thermoremnant or burnt material. They are generally parallel with and a short distance to the west of a footpath that has been surfaced with highly magnetic material, anomaly (15).

Anomalies with an agricultural origin

(14) - The survey area is crossed by a series of weak, parallel positive and negative linear anomalies indicative of ridge and furrow cultivation. The north east to south west orientation of these differs from the orientation of extant field boundaries; however, LiDAR analysis has revealed a former boundary bank (29) running perpendicular to the ridge and furrow, presumably a former headland, but this lies to the west of the surveyed area.

Anomalies associated with magnetic debris

(15) - A linear band of magnetic debris in the northern part of the site has been caused by material used to consolidate a footpath. The material may be associated with iron slag originating from industry based in the nearby valley.

(16) - Magnetic debris along the western edge of the survey area may relate to ferrous material used in ground consolidation, trackways, etc. With ferruginous geology nearby, the possibility of early iron working sites immediately to the west should also be considered.

(17) - A discrete area of magnetic debris in the southern part of the site may relate to the removal of a large tree and associated ground make-up and levelling with magnetic material.

(18) - Widespread strong dipolar anomalies relate to ferrous objects or iron working slag mainly within the topsoil.

Anomalies with a modern origin

(19) - Zones of magnetic disturbance caused by fencing, services and steel cable used to support electricity poles.

3.5 General assessment of survey results - resistivity

3.5.1 The detailed magnetic survey was carried out over approximately 0.27ha. The survey was targeted in order to cover the area of proposed tree planting using a line four 30m x 30m grids that partly overlap the eastern field boundary but extend to the west well beyond the limit of planting. The initial survey using the Geoscan MSP25 cart system was supplemented with two grids of twin probe survey, with data collected simultaneously using 0.5m and 1m probe spacing in order to provide and assessment of anomaly depth.

3.5.2 Resistivity anomalies located can be generally classified as high and low resistance anomalies of uncertain origin and anomalies with a natural origin. Anomalies located within the survey area have been numbered and are described in 3.7 below with subsequent discussion in Section 4.

3.6 Statement of data quality and other factors influencing the results - resistivity

3.6.1 Data are considered representative of the anomalies present within the site. Generally useful contrast was present across the survey area. Raw data collected with the MSP25 cart revealed a very noisy dataset for the alpha configuration, probably due to soil contamination on the electrode plate within one of the wheel housings. However, the beta readings appeared smooth, with the exception of a small number of spikes, and typical of a representative dataset. As a consequence only the beta dataset was used within the report, and a subsequent survey was carried out, using twin probe configuration, in order to provide a comparative dataset and assess the relative depth of high resistance anomalies of uncertain origin located near the southern end of the survey with the MSP25.

3.7 List of anomalies – resistivity

Area centred on OS NGR 384108 203098, see Figs 03 - 05 & 08.

Anomalies with an uncertain origin

(20) - A zone of moderately high resistance appears to correlate with magnetic anomaly (4) and may also relate to a nearby ditch-like feature (1). The zone appears as a possible disturbance or cut through anomaly (27), which is likely to be natural in origin, suggesting a possible infilled erosion scar. The eastern side of the anomaly may be obscured by the overlying earth bank (25).

(21) - A small zone of high resistance to the south of (20) is only present within data collected with the MSP25 cart and 0.5m twin probe surveys. The wider 1m twin probe data does not convincingly contain the anomaly suggesting that it is quite a shallow feature and unlikely to be archaeologically significant.

(23) - A small zone of high resistance at the northern end of the survey area cannot be interpreted as its full extent has not been covered. It may relate to adjacent bank and ditch features.

(24) - A low resistance linear anomaly that correlates with positive linear anomaly (8). The response is indicative of an infilled ditch-like feature and may be associated with the adjacent earth bank.

(25) - Mainly high resistance, with a small zone of low resistance, correlating with a broad earth bank (28) identified within the LiDAR data. The bank may be associated with the railway immediately to the east, possibly to assist in the prevention of erosion to the steep slope by preventing water run off from the fields.

Anomalies with a natural origin

(26) - A zone of high resistance caused by moisture uptake and sheltering beneath a large tree.

(27) - A linear zone of high resistance along the western edge of the survey area does not appear to correlate with magnetic anomalies or feature visible on LiDAR. The orientation of the anomaly is parallel with the steep sided valley immediately east of the survey area, and it is likely that the response is to the underlying geology or abrupt changes to the soil. The 1m twin probe separation produced a strong anomaly suggesting the feature has some depth.

3.8 General assessment of LiDAR data

3.8.1 The LiDAR data were used to create a shaded relief greyscale plot that encompasses an area of 2km by 2km although only the larger area of survey with some additional land to the east and west have been plotted.

3.8.2 The plot clearly highlights numerous earthworks including extant and former field boundaries, agricultural features (ridge and furrow earthworks and a headland) and a low bank covering much of the tree planting area. Features located within the survey area have been numbered and are described in 3.9 below with subsequent discussion in Section 4.

3.9 List of anomalies – LiDAR

Area centred on OS NGR SO 384066 203109, see Figs 09 & 10.

Features of uncertain origin

(28) - A broad earth bank covering a significant proportion of the area of proposed tree planting. Although the origin of the feature is uncertain, it appears to partly overlie or disturb a former field boundary (31) at its northern end and is partly covered by mature pine trees suggesting it is at least a century old. The presence of the railway immediately to the east may indicate that the feature is relate, perhaps as a convenient dump for soil or for preventing water running off the fields and eroding the steep western slope above the line.

Features of agricultural origin

(29) - To the west of the area of magnetometry survey, a low bank extends from close to the site of the Roman villa towards the south south east for a distance of approximately 300m. The bank is partly truncated by the western field boundary of the survey area. It is clear that the feature has been used as a field boundary or headland as ridge and furrow earthworks and magnetic anomalies run perpendicular to it, extending across the survey area to the east (30). It is possible that the feature relates to an earlier landscape based more on the orientation of the Roman site.

(30) - A series of parallel linear earthworks typical of former ridge and furrow cultivation. It is possible that earth bank (28) overlies an eastern headland to the ridge and furrow.

(31) - Low linear banks indicative of former field boundaries possibly built as drystone walls.

(32) - Possible land boundary features.

(33) - Area of terracing associated with a stone barn.

4 DISCUSSION

4.1.1 Two former ditches (1), identified in the magnetometry results, can be seen in the southern part of the site and extend possibly as far as the edge of the valley to the east. It could be considered that these may be early features as they have no surface expression and the magnetic signature is typical of ancient ditches filled with soil of enhanced magnetic susceptibility. However, the ditches do appear on a similar orientation to extant land boundaries which differ from an earlier layout based on geophysical evidence of ridge and furrow (14) and LiDAR evidence of a long headland (29) to the west of the surveyed area. There is also no evidence for truncation or characteristic modification to the edges of the ditches by the ridge and furrow also suggesting they post date it. The ditches may, therefore, date to the post medieval period of enclosure.

4.1.2 LiDAR analysis, supported by the geophysical data, indicates the presence of a low earth bank (28) extending across the tree planting area. Towards the southern end of this area the bank appears to extend up to 10m into the field from the eastern boundary, increasing to around 20m near the northern end of the area before curving towards the north west. The northern end of the bank appears to disturb or overlie a former field boundary (31) but several mature pine trees are growing on it suggesting it must be at least a century or so old. The origin of the bank may relate to the construction of the adjacent railway in the 1860s. It may be formed of soil and other material dumped along the field edge or possibly placed deliberately to prevent water running off the fields and eroding the steep valley side above the line.

5 CONCLUSION

5.1.1 The geophysical survey has provided useful datasets for magnetometry and resistivity with LiDAR data supporting the abstraction and interpretation of anomalies. The wider area of magnetometry has also proved beneficial to the assessment of anomalies located in the limited area covered by the proposed tree planting scheme. Within this wider area no anomalies were confidently categorised as of archaeological potential, although numerous anomalies of uncertain origin were located and some may well relate to archaeological features. Within the area of tree planting no anomalies could be confidently categorised as archaeological in origin although again some anomalies of uncertain origin were located.

5.1.2 Within the tree planting area and the southern part of the more extensive magnetometry survey, two positive linear anomalies indicate the presence of former ditches. The interpretation of these anomalies as post medieval boundary features is based on their orientation being parallel with and perpendicular to the extant field boundaries. Evidence for former ridge and furrow demonstrates that it has a different orientation to the layout of extant field boundaries and is therefore likely to pre-date them. The presence of a low linear bank representing a headland or boundary to the west of the surveyed area also implies that early field boundaries would have a different orientation to those constructed presumably as part of post medieval enclosure.

5.1.3 Analysis of LiDAR data reveals a wide but low bank running through and covering much of the area of proposed tree planting. Given the age of mature trees growing within this bank, and the fact that it appears to overlie or disturb a former field boundary at its northern end, it would seem reasonable to suggest that its construction is related to the railway immediately to the east. Whether the feature represents a convenient area for dumping earth or whether it was deliberately formed to assist in slope stabilisation or to prevent run off from the fields is unclear. It may partly overlie a medieval headland that must run along the eastern field boundary, and it may also account for the weak magnetic anomalies associated with the two underlying ditches within this area. The bank also seems to have produced geophysical anomalies, mainly in the resistance data, and there appears to be a short ditch-like feature at its northern end.

6 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 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 – basic principles of earth resistance survey (resistivity)

Earth resistance survey, commonly known as resistivity, relies on the variability of conduction of current through soil and the subsurface matrix. The variability relates to the distribution of moisture within different materials so that non-porous features, such as foundations, produce a relatively high resistance response and more moisture retentive soil, such as found within the fill of a former ditch, produces a low resistance measurement. The technique is, therefore, influenced by climatic factors although the success of a survey can be difficult to predict based on these alone. Soil type, ground use, vegetative cover and the nature of buried features and subsoil are all factors that will influence the outcome of a survey.

The technique involves inputting a small electrical current into the ground and measuring subtle variations to the current at regular intervals across an area. The current input and measurement requires a series of probes to be inserted into the ground and the configuration of these can influence the resolution of resistive anomalies and the depth of response. Research has demonstrated that the twin electrode configuration is one of the most useful for archaeological prospection. It requires a mobile frame with two electrodes separated usually by 0.5m and a pair of remote probes linked to the logging instrument using a long cable.

Cart-based systems are also regularly used in archaeological prospection, and generally these require four spiked wheels to inject current into the ground and take measurements. The four wheels act as a square array which can be electronically switched to change the orientation of measurement and current input. Two or three readings are rapidly logged at each recording station and these are referred to as alpha, beta and gamma. The gamma is often not recorded as this represents the difference between the alpha and beta configurations and can be derived during data processing. The alpha and beta datasets often demonstrate subtle differences that relate to the orientation of subsurface features and both are analysed as part of the abstraction and interpretation process. Advantages of cart systems are speed and resolution and they do not require a trailing cable; however, ground conditions are more critical and problems can be encountered with ground cover and in areas that are excessively damp or dry.

When using the twin probe configuration a useful reading interval for archaeological prospection across an area is 1m. Data are logged at 1m centres along traverses separated by 1m. Where areas contain known archaeological features 0.5m x 0.5m or 1m x 0.5 readings are considered more informative. Data collected by cart-based systems are typically at 0.25m centres along traverses separated by 1m.

Appendix C – 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.

Edge Match

Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. It then subtracts the difference between the means from all datapoints in the selected area.

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.

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.

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

Appendix D – survey and data information

Unprocessed magnetometry Area 1

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Mag\TS Area 1\comps\
Filename: Mag-b.xcp
Description: Imported as Composite from GeoPlot : Mag-b
Instrument Type: Gradiom. (RM85)
Units: nT
Comments: Source Timestamp: 27/03/2019 18:20:52
Sensors: 1
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 480 x 30
Survey Size (meters): 120 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 124.61
Min: -1302.70
Std Dev: 39.84
Mean: -61.29
Median: -57.58
Composite Area: 0.36 ha
Surveyed Area: 0.25348 ha

Processed magnetometry Area 1

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Mag\TS Area 1\comps\
Filename: J780-mag-Area1-a-proc-lpf.xcp

Processes: 3
1 Base Layer
2 DeStripe Median Traverse: Grids: All
3 Low pass Uniform (mean) filter: Window: 3 x 3

Unprocessed magnetometry Area 2

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Mag\Sensys cart\TS Area 2\comps\
Filename: J780-mag-Area2.xcp

Description: Imported as Composite from: J780-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 383967.768445599, 203241.408000419 m
Southeast corner: 384140.768445599, 203009.408000419 m
Comments: Source Timestamp: 27/03/2019 18:20:08
Sensors: 5
Dummy Value: 32702
Source GPS Points: 501100
Dimensions
Composite Size (readings): 173 x 232
Survey Size (meters): 173 m x 232 m
Grid Size: 173 m x 232 m
Stats
Max: 2090.31
Min: -1379.59
Std Dev: 26.41
Mean: -33.16
Median: -33.03
Composite Area: 4.0136 ha
Surveyed Area: 1.7006 ha

Minimally processed magnetometry Area 2

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Mag\Sensys cart\TS Area 2\comps\
Filename: J780-mag-Area2-proc.xcp
Processes: 1
1 Base Layer

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

Unprocessed resistivity (MSP25)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: J780-res-b.xcp
Description: Imported as Composite from GeoPlot : Res-b
Instrument Type: Resist. (RM85)
Units: ohm
Comments: Source Timestamp: 27/03/2019 18:05:48
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 480 x 30
Survey Size (meters): 120 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 20.47
Min: -10.93
Std Dev: 1.62
Mean: 5.66
Median: 5.47
Composite Area: 0.36 ha
Surveyed Area: 0.25348 ha

Processed resistivity (MSP25)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: J780-res-b-proc.xcp (despiked)
Filename: J780-res-b-proc-hpf.xcp (despiked + high pass filter)
Filename: J780-res-b-proc-lpf.xcp (despiked + low pass filter)

Unprocessed resistivity (0.5m twin probe)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: J780-res-probe-0-5merge.xcp
Description: Imported as Composite from GeoPlot : Res-probe-0-5merge
Instrument Type: Resist. (RM85)
Units: ohm
Comments: Source Timestamp: 28/03/2019 19:26:13 Merge Composites (Rotation Angle 0) : C:\Business\Jobs\J780 Woodchester\Data\Res\Res-probe-0-5a.cmp C:\Business\Jobs\J780 Woodchester\Data\Res\Res-probe-0-5b.cmp
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 60 x 60
Survey Size (meters): 60 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 0.5 m
Stats
Max: 53.35
Min: 9.65
Std Dev: 3.36
Mean: 16.13
Median: 16.00
Composite Area: 0.18 ha
Surveyed Area: 0.1087 ha

Processed resistivity (0.5m twin probe)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: J780-res-probe-0-5merge-proc.xcp (despiked)
Filename: J780-res-probe-0-5merge-proc-hpf.xcp (despiked + high pass filter)
Filename: J780-res-probe-0-5merge-lpf.xcp (despiked + low pass filter)

Unprocessed resistivity (1m twin probe)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: Res-probe-1m.xcp
Description: Imported as Composite from GeoPlot : Res-probe-1m
Instrument Type: Resist. (RM85)
Units: ohm
Comments: Source Timestamp: 28/03/2019 19:21:27
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 60 x 30
Survey Size (meters): 60 m x 30 m
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m
Stats
Max: 21.65
Min: -2.00
Std Dev: 1.62
Mean: 7.30
Median: 7.15
Composite Area: 0.18 ha
Surveyed Area: 0.1087 ha

Processed resistivity (1m twin probe)

COMPOSITE
Path: C:\Business\Jobs\J780 Woodchester\Data\Res\TS comps\comps\
Filename: J780-res-probe-1m-proc.xcp (despiked)
Filename: J780-res-probe-1m-proc-hpf.xcp (despiked + high pass filter)
Filename: J780-res-probe-1m-lpf.xcp (despiked + low pass filter)

Appendix E – 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 will be sent to Stephen Miles at the Historic England South West office and a PDF copy will be emailed to Melanie Barge (Historic England Inspector of Ancient Monuments) and copied to Paul Linford (Historic England Geophysics Team).

A copy of the report in PDF/A format will also be supplied to the Gloucestershire Historic Environment Record, together with a DXF of the survey boundary. The report will uploaded to Online AccesS to the Index of archaeological investigationS (OASIS).

Appendix F – copyright and intellectual property

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Historic England Geophysical Survey Database Questionnaire

Survey Details

Name of Site: Land at The Old Priory, North Woodchester,
County: Gloucestershire

NGR Grid Reference (Centre of survey to nearest 100m):**SO 84121 03075**

Start Date: 27th March 2019 **End Date:** 28th March 2019

Geology at site (Drift and Solid): Lias Group and Inferior Oolite Group

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)
Woodchester Roman Villa. List entry number 1004839

Archaeological Sites/Monument types detected by survey
Ditches - post medieval?
Ridge and furrow - medieval?
Pits - uncertain

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):David Sabin, Archaeological Surveys Ltd

Name of Client, if any: Mr & Hill (landowners)

Purpose of Survey: To establish the presence of any archaeological features prior to planting of tree screening along the edge of the property.

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:
Archaeological Surveys Ltd, 1 West Nolands, Nolands Road, Yatesbury, Calne, SN11 8YD

b) Full Report: As above with copy to OASIS and HER

<u>Technical Details</u>

<u>(Please fill out a separate sheet for each survey technique used)</u>

Type of Survey (Use term from attached list or specify other):
Magnetometry

Area Surveyed, if applicable (In hectares to one decimal place): 1.7ha

Traverse Separation, if regular: 0.5m

Reading/Sample Interval:20Hz

Type, Make and model of Instrumentation:

Sensys Magneto MXPDA (multiple fluxgate gradiometers)

Land use <u>at the time of the survey</u> (Use term/terms from the attached list or specify other):
Grassland

Historic England

<u>Technical Details</u>

<u>(Please fill out a separate sheet for each survey technique used)</u>

Type of Survey (Use term from attached list or specify other):
Earth resistance

Area Surveyed, if applicable (In hectares to one decimal place): 0.26ha

Traverse Separation, (for Mobile Sensor Platform): 0.75m **Reading/Sample Interval:**0.25

Traverse Separation, for twin probe array 1m electrode separation: 1m
Reading/Sample Interval:1m

Traverse Separation, for twin probe array 0.5m electrode separation: 1m
Reading/Sample Interval:0.5m

Type, Make and model of Instrumentation:

Geoscan RM85 resistance meter mounted on a MSP25 Mobile Sensor Platform

Geoscan RM85 resistance meter with mobile twin probe array configuration

Land use <u>at the time of the survey</u> (Use term/terms from the attached list or specify other):

Grassland

Archaeological Surveys Ltd

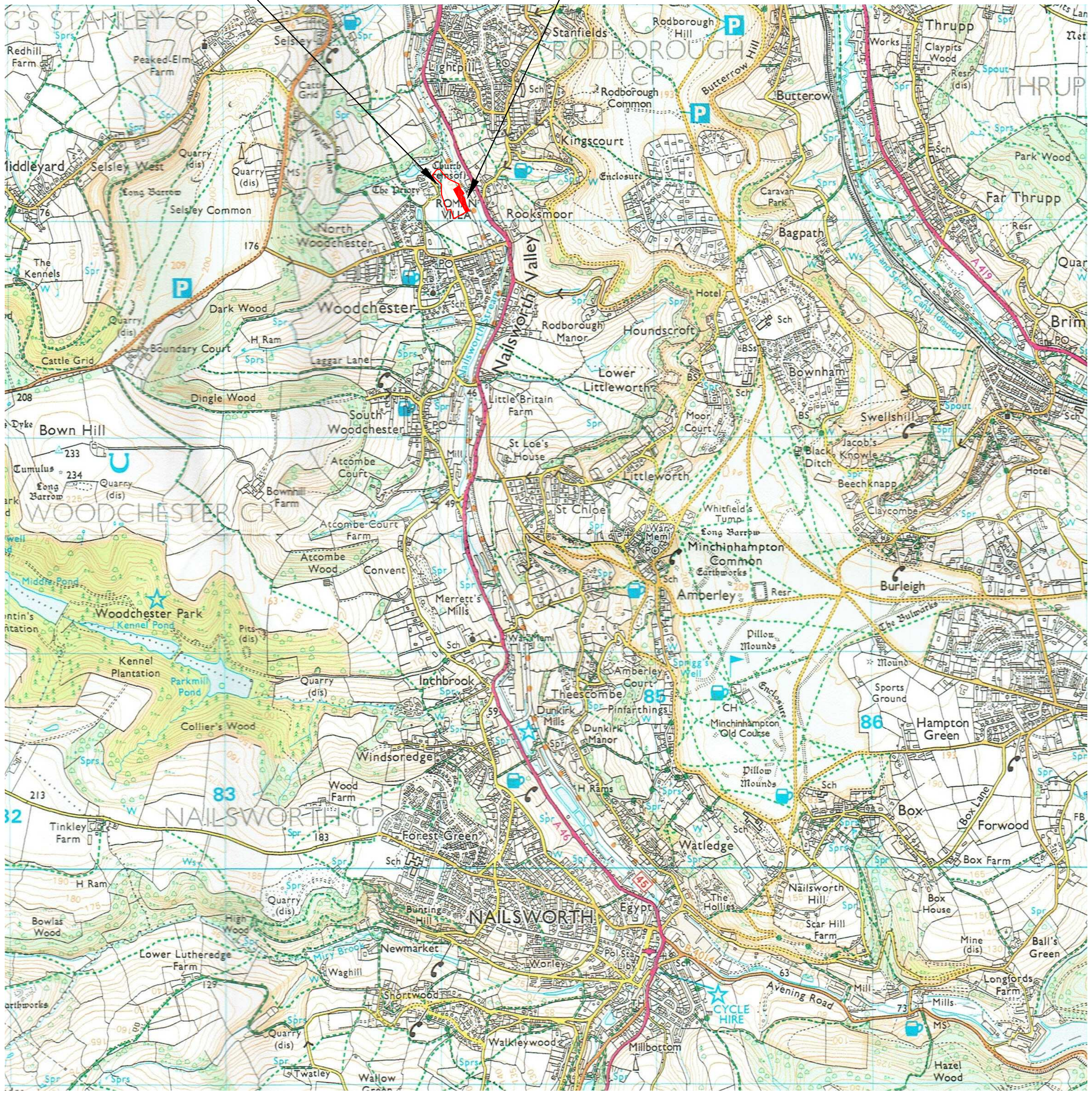
Geophysical Survey
Land at The Old Priory
North Woodchester
Gloucestershire

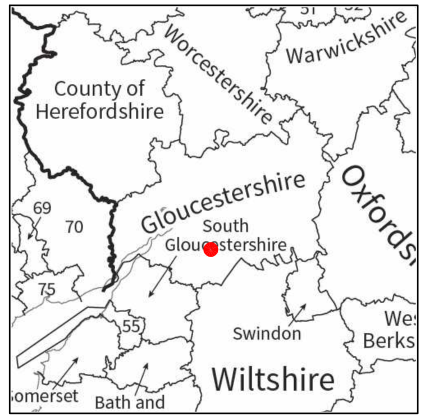
Map of survey area

Magnetometry survey area

Resistivity survey area

N





Survey location

Site centred on OS NGR
SO 84121 03075

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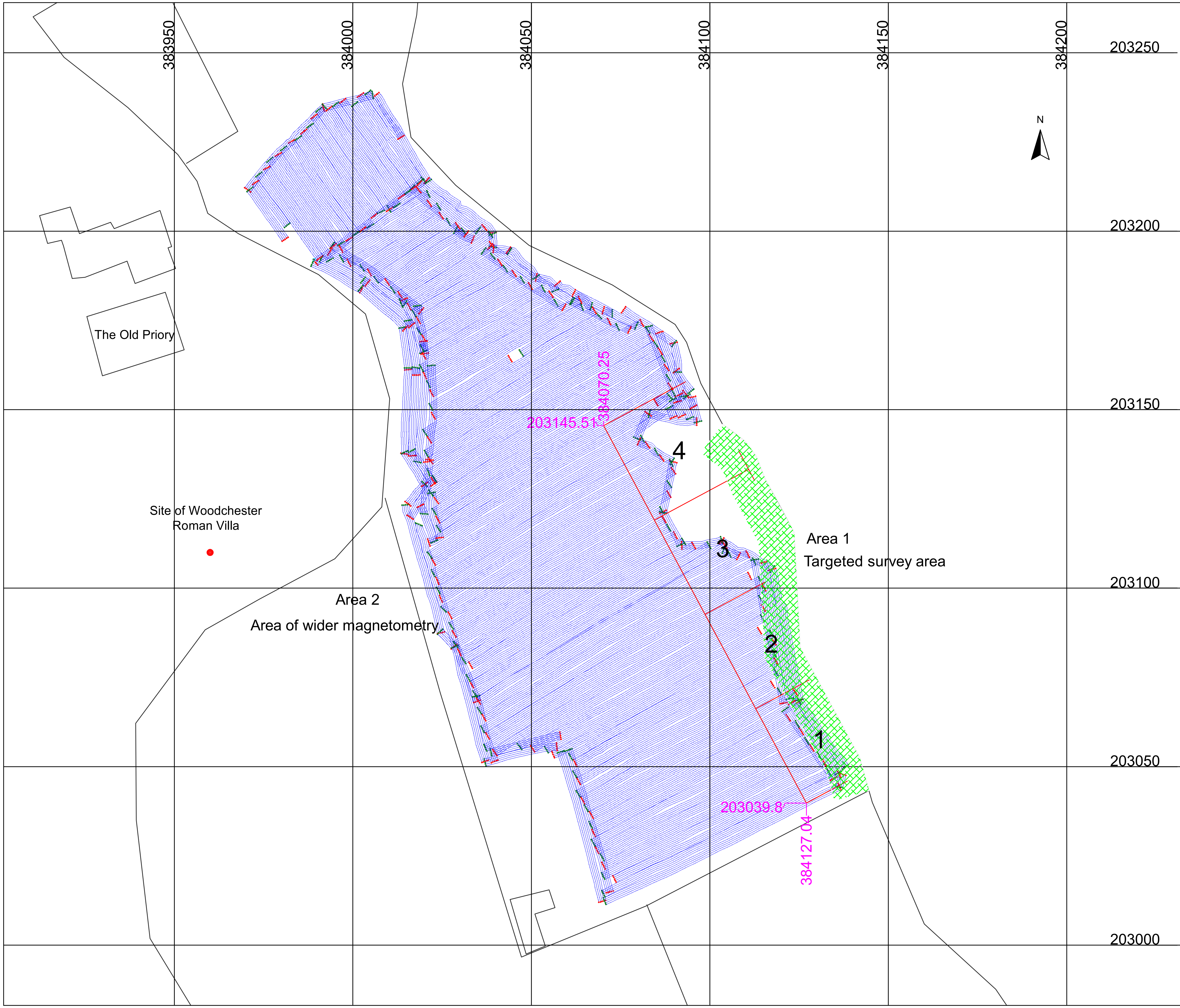
DRAWN BY	CHECKED BY	
DJS	KTD	FIG 01



Archaeological Surveys Ltd

Geophysical Survey
Land at The Old Priory
North Woodchester
Gloucestershire

Referencing information

Approximate area of tree proposed tree planting

Survey tracks

Survey track start

Survey track stop

Targeted survey 30m grid

Referencing grid to OSGB36 datum at 50m intervals

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SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 02

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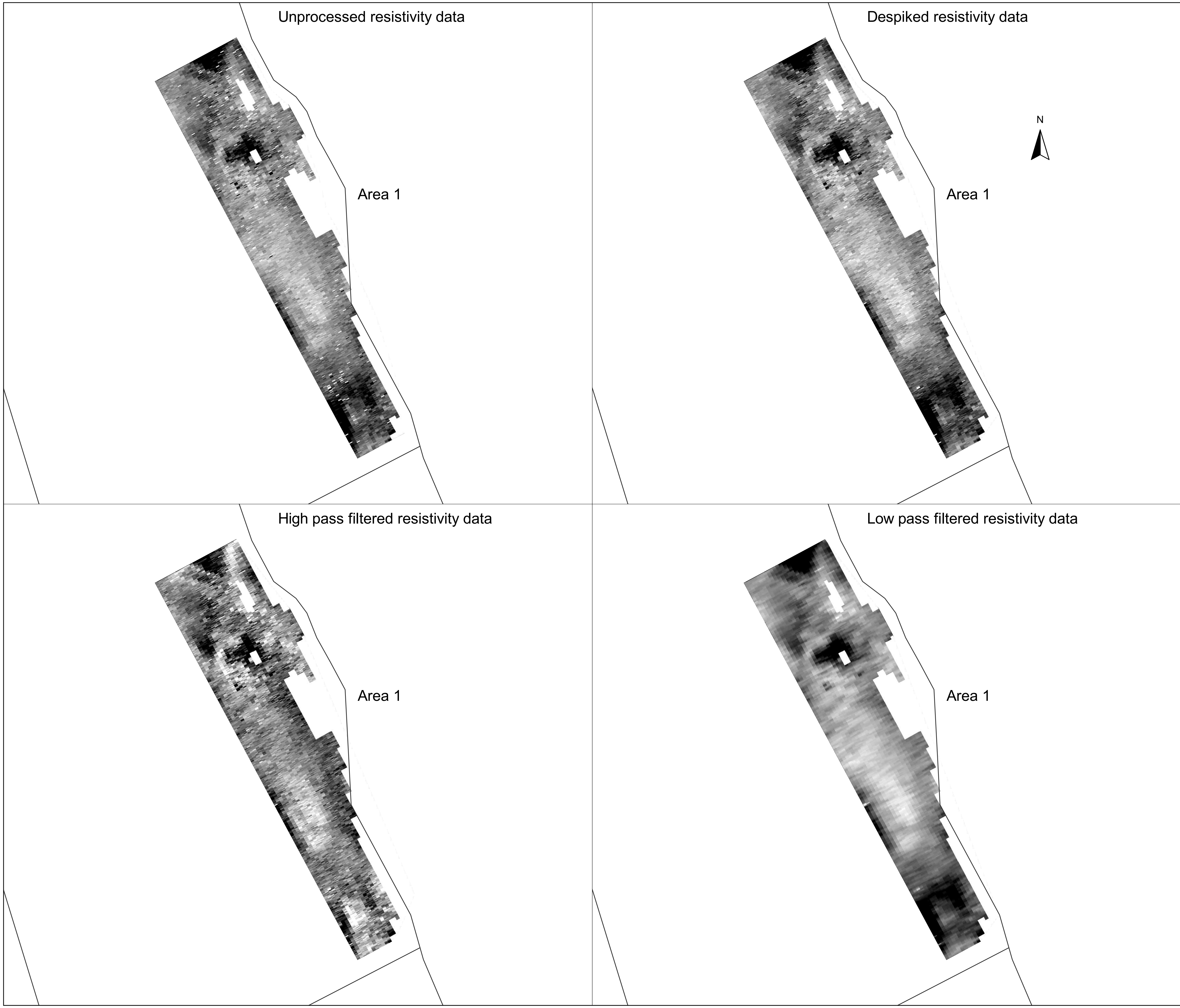
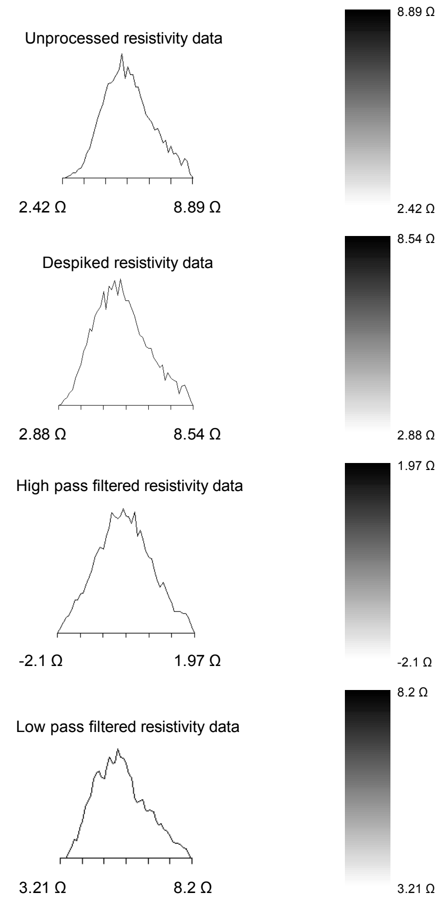
Geophysical Survey
Land at The Old Priory
North Woodchester
Gloucestershire

Greyscale plots of resistance data recorded using Geoscan RM85 with MSP25 cart-based system





SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 03

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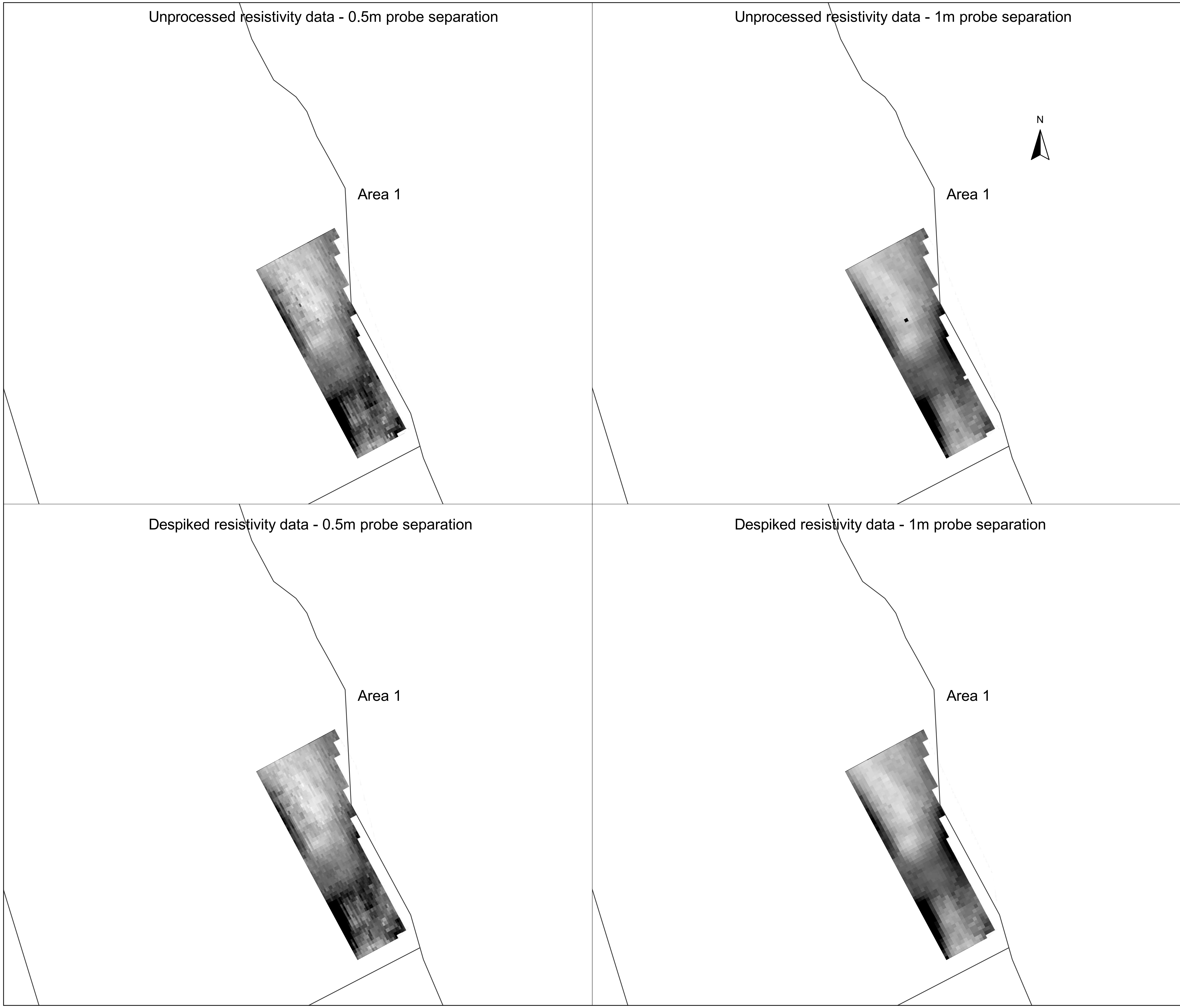
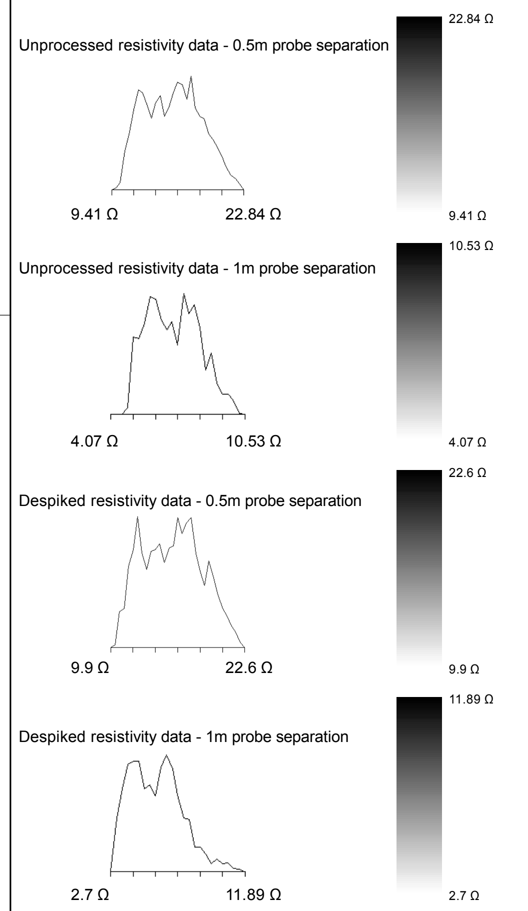
Geophysical Survey
Land at The Old Priory
North Woodchester
Gloucestershire

Greyscale plots of resistance data recorded using Geoscan RM85 with twin probe separations of 0.5m and 1m





SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

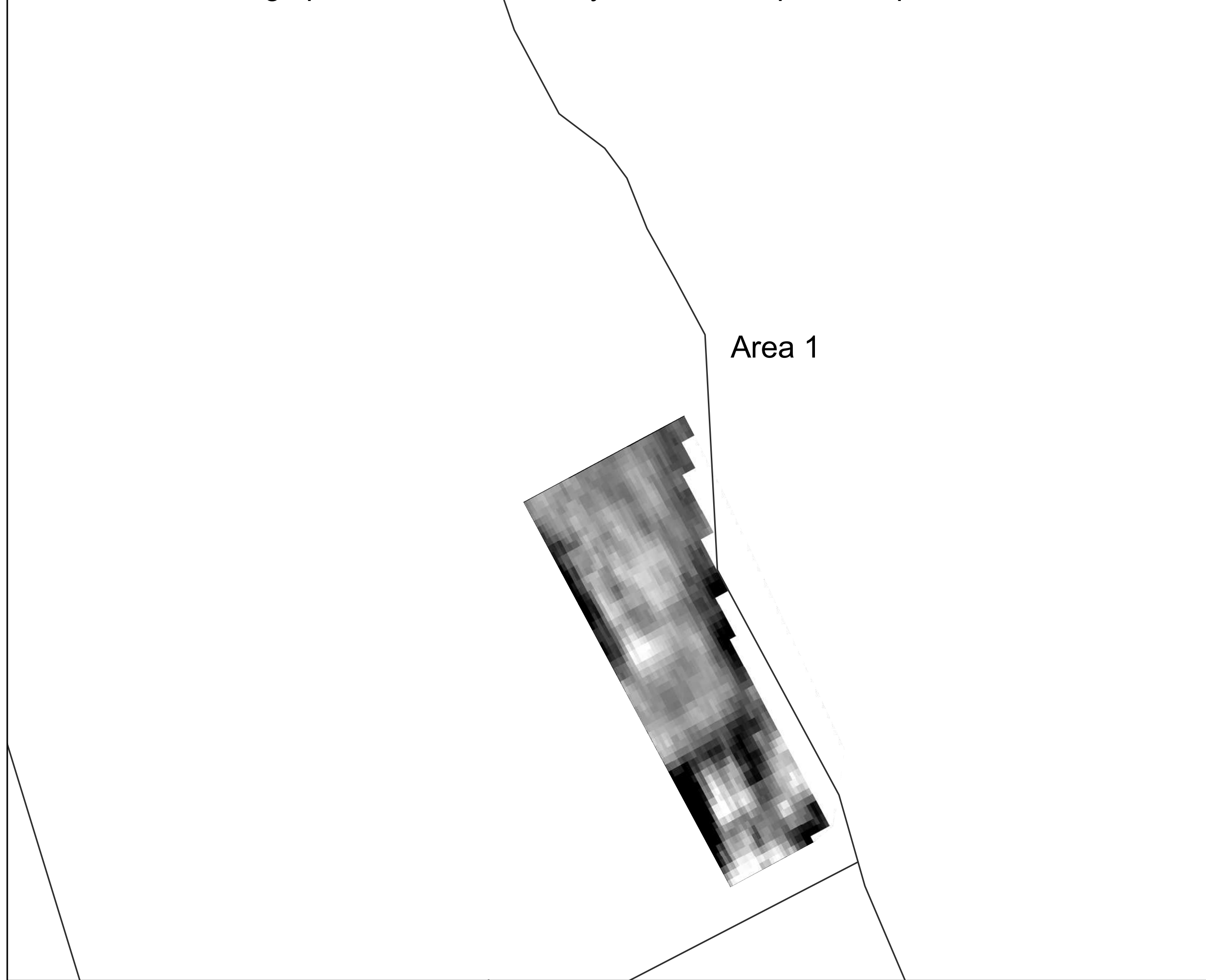
DRAWN BY	CHECKED BY	
DJS	KTD	FIG 04

Archaeological Surveys Ltd

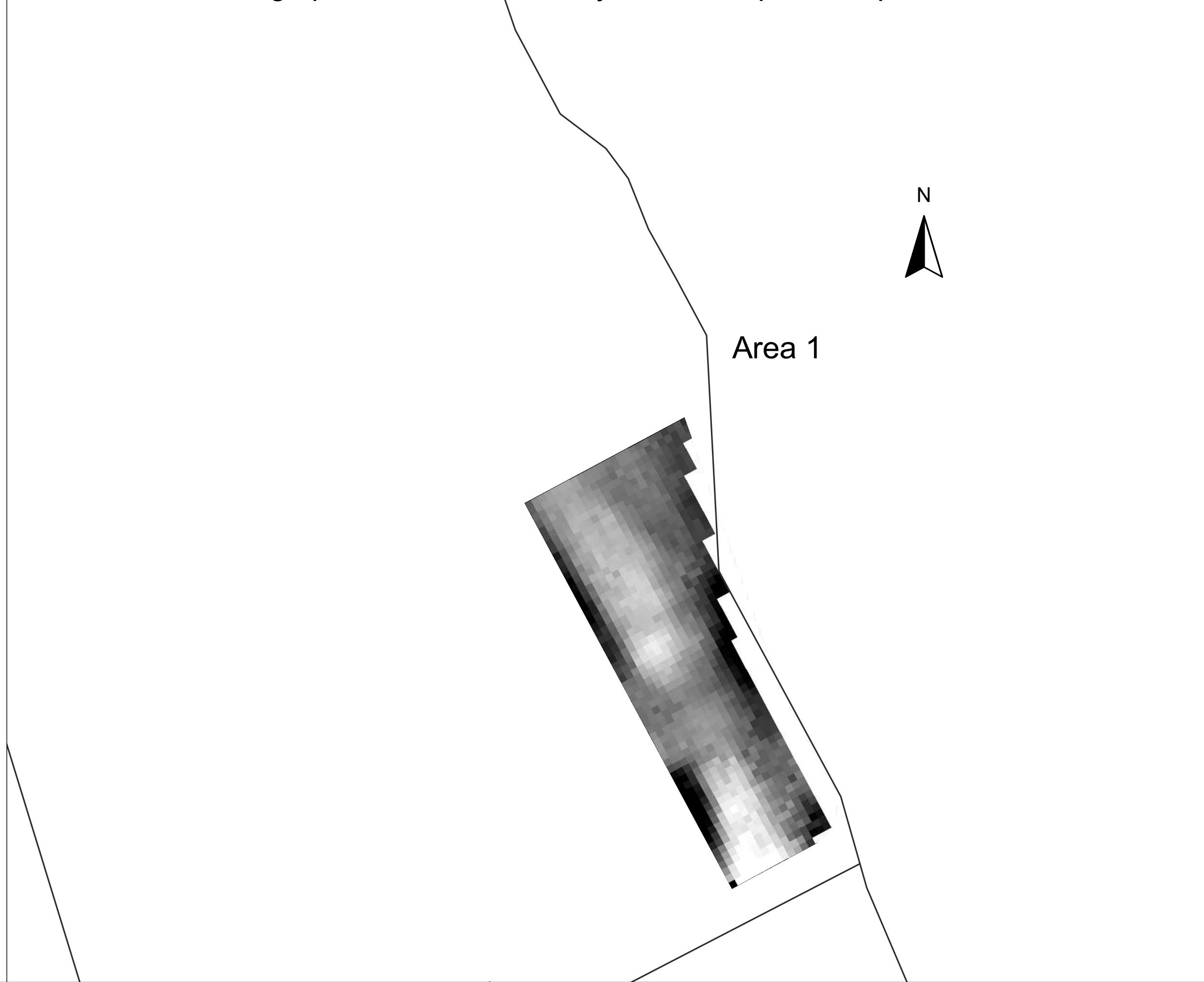
Geophysical Survey
Land at The Old Priory
North Woodchester
Gloucestershire

Greyscale plots of resistance data recorded using Geoscan RM85 with twin probe separations of 0.5m and 1m

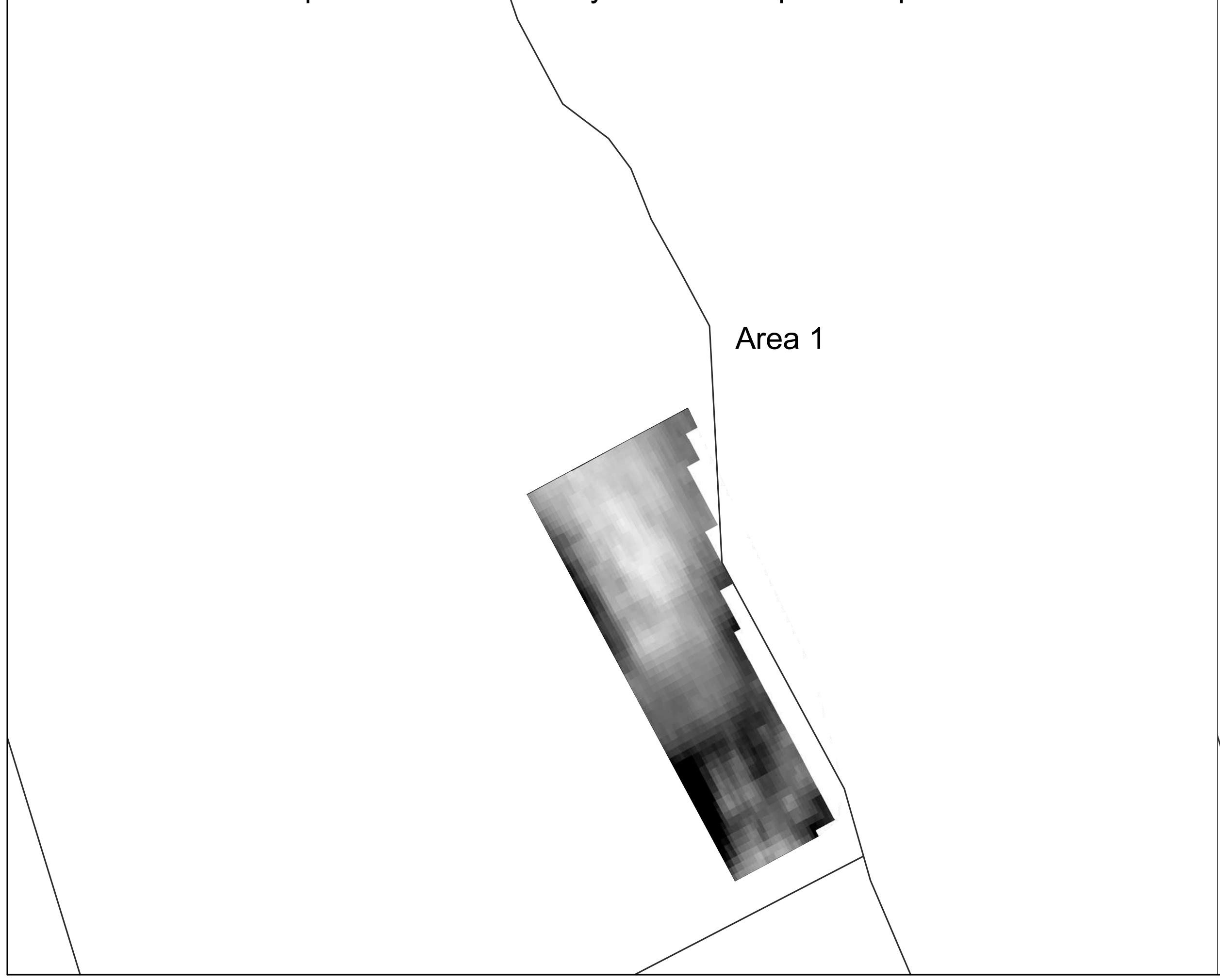
High pass filtered resistivity data - 0.5m probe separation



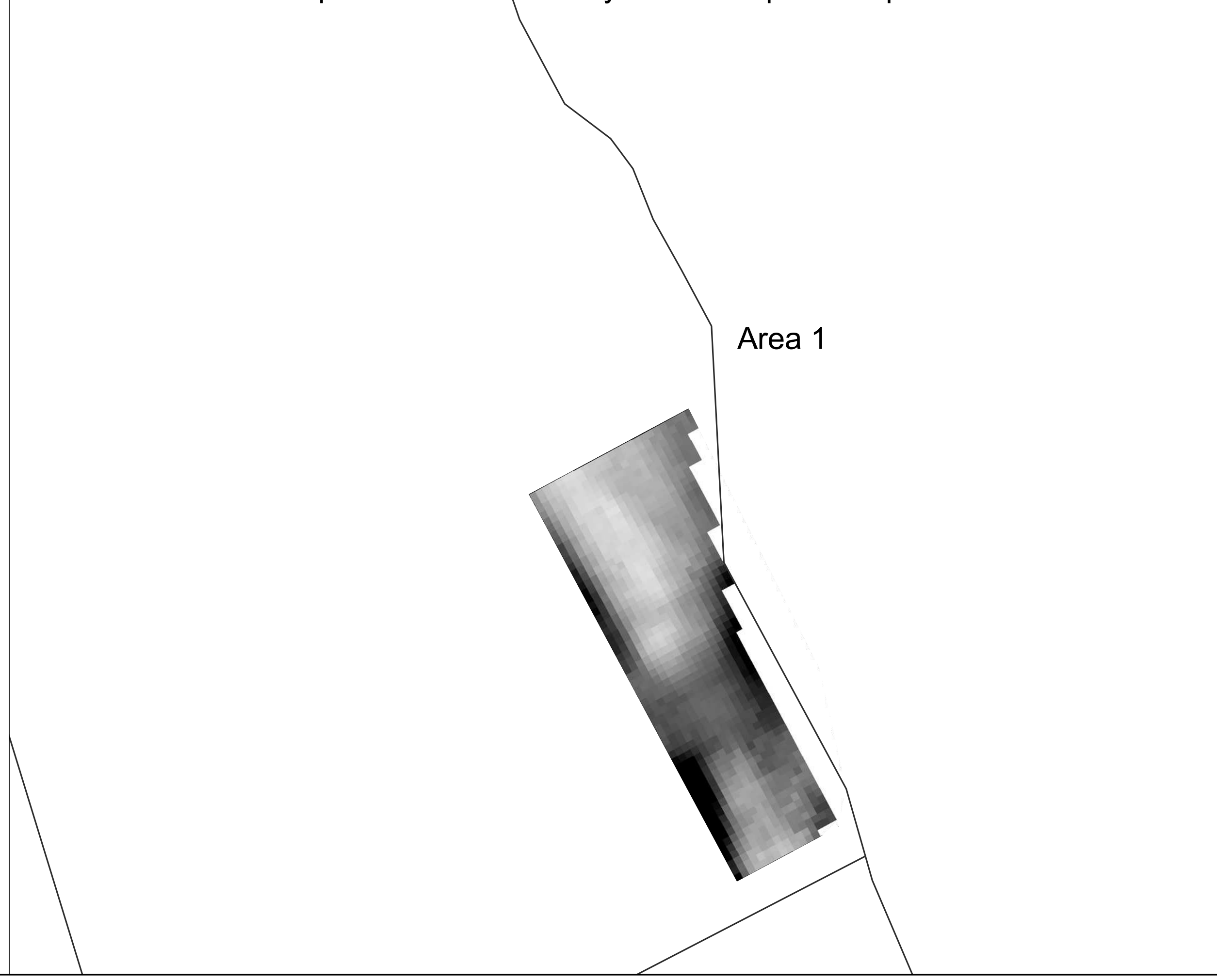
High pass filtered resistivity data - 1m probe separation

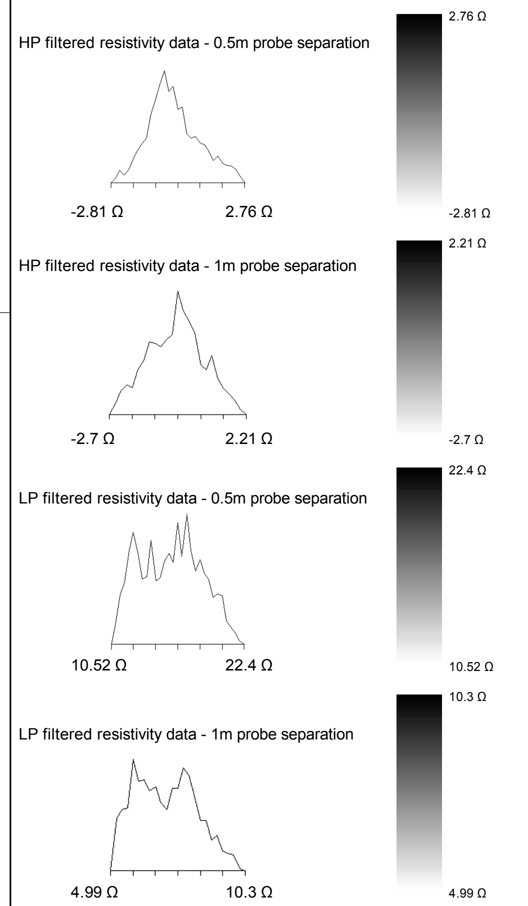


Low pass filtered resistivity data - 0.5m probe separation



Low pass filtered resistivity data - 1m probe separation





SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 05

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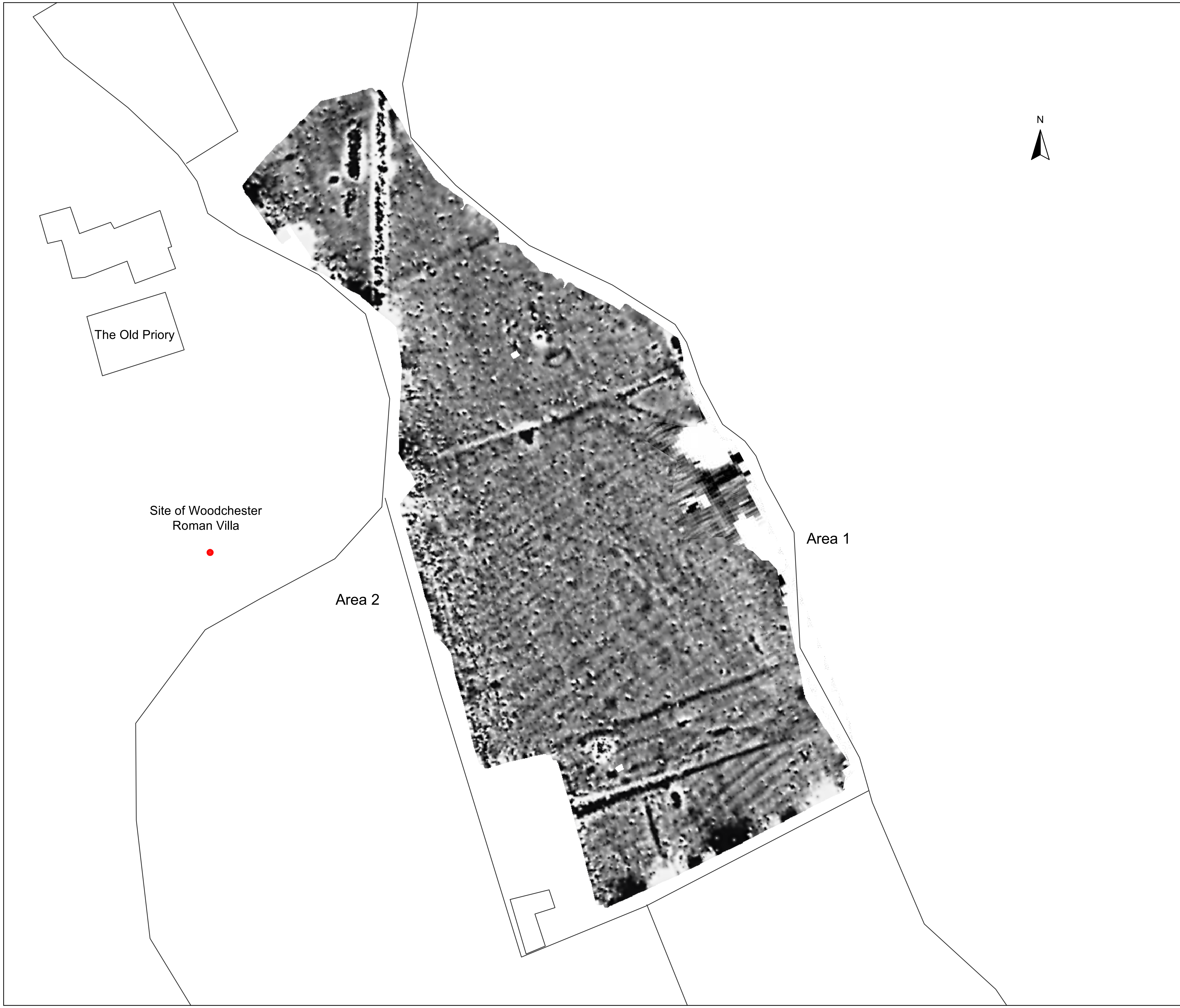
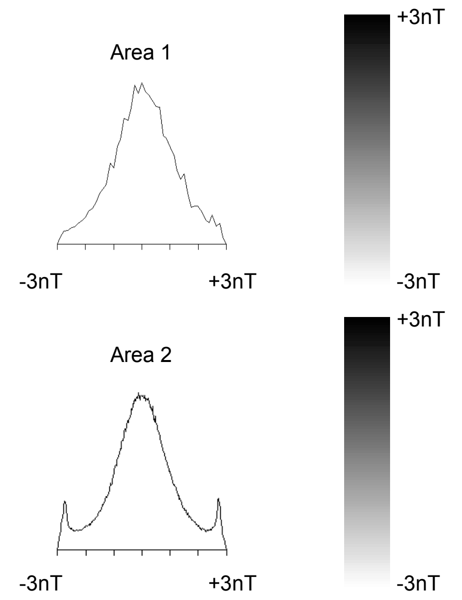
Land at The Old Priory
North Woodchester
Gloucestershire



Greyscale plot of minimally processed magnetometer data - Areas 1 and 2



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 06

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Abstraction and interpretation of magnetic anomalies

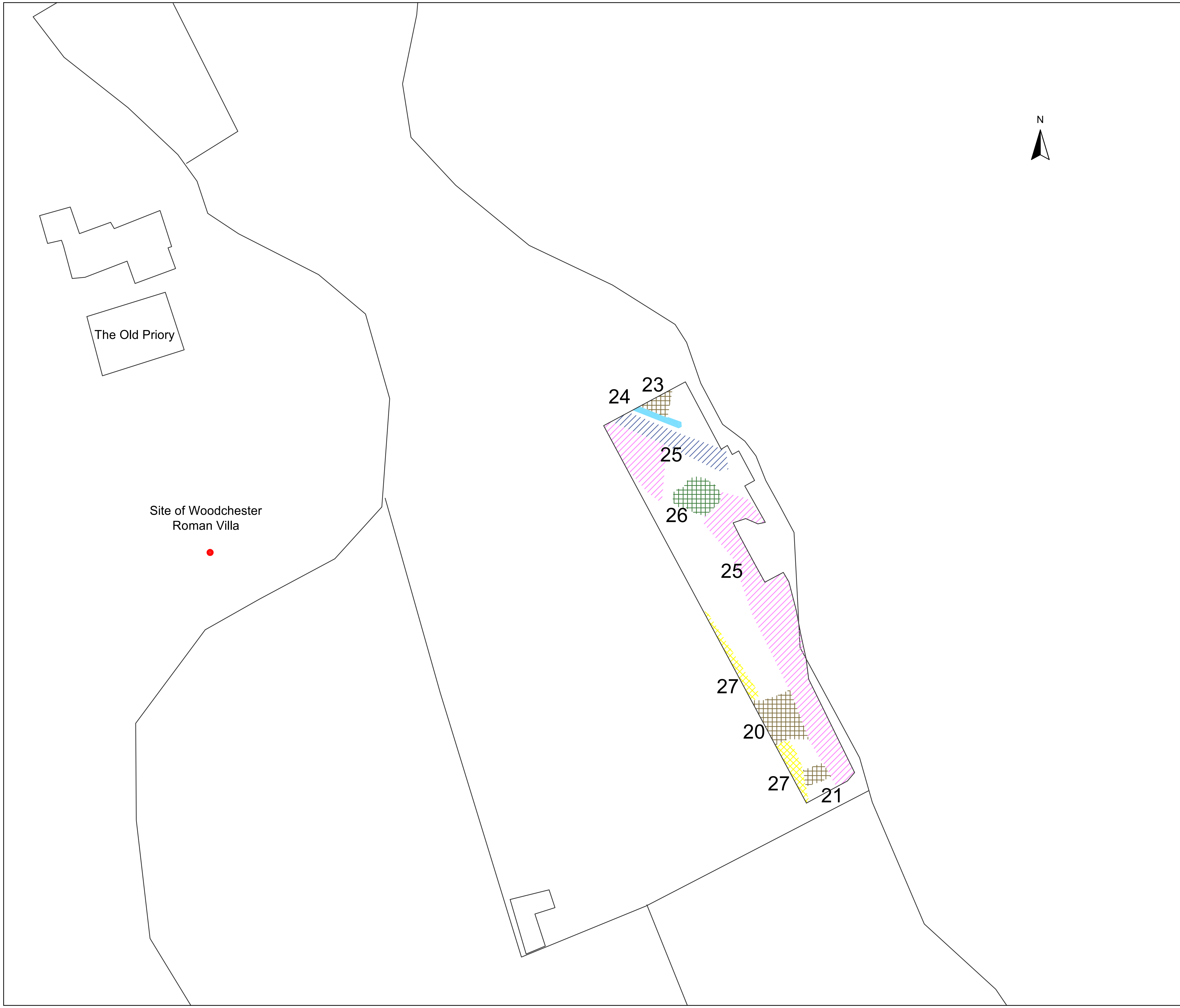
- Linear anomalies relating to former boundary walls/banks/ditches
- Linear anomalies of uncertain origin - ditch-like features
- Linear anomalies indicative of ridge and furrow cultivation
- Positive anomalies of uncertain origin
- Areas of magnetic debris
- Areas of magnetic disturbance
- Discrete postive anomaly - pit-like feature/burnt area
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 07



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Abstraction and interpretation of resistivity anomalies

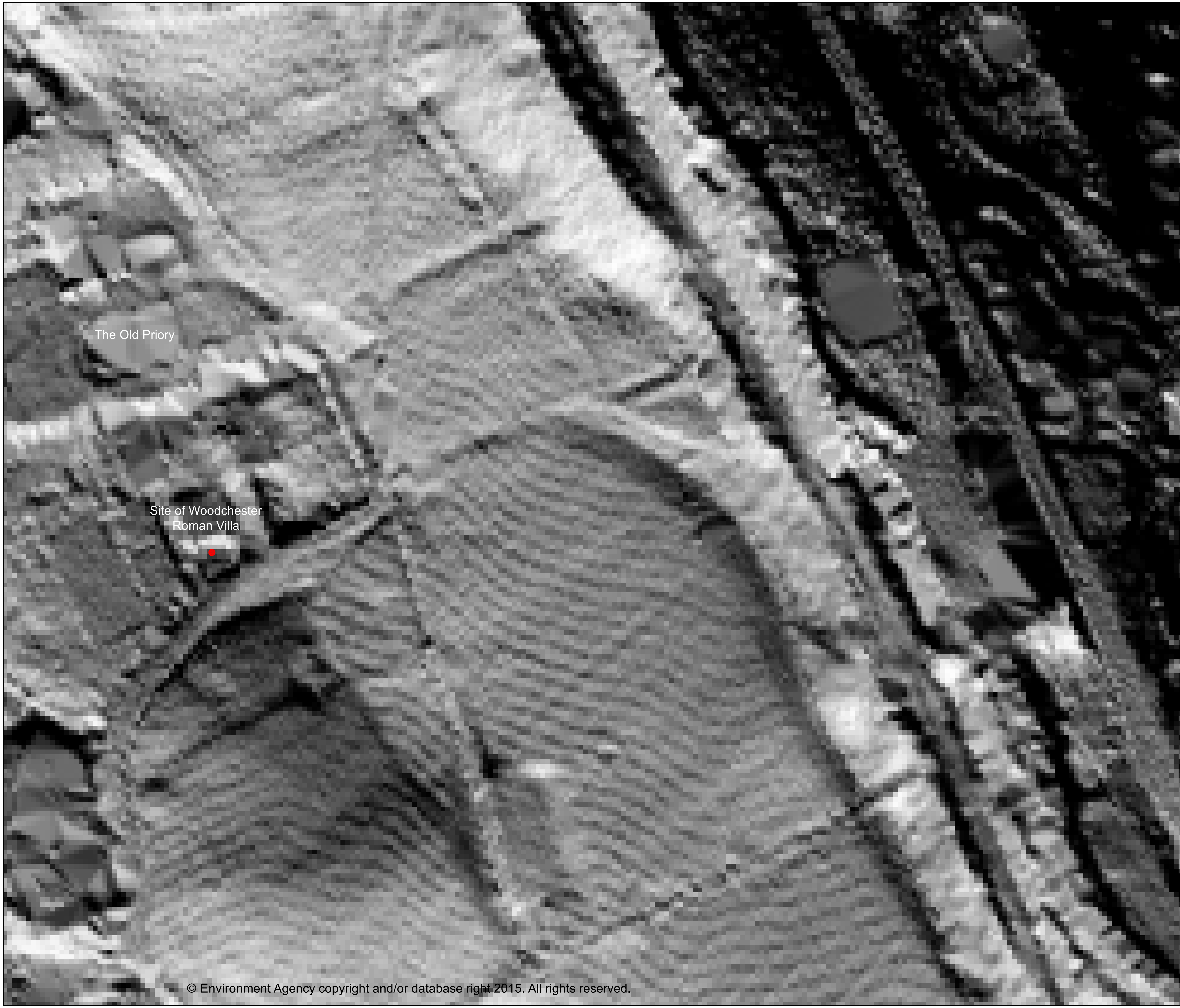
- Ditch-like feature of uncertain origin
- Areas of high resistance of uncertain origin
- High resistance associated with low earth bank
- Low resistance associated with low earth bank
- Areas of high resistance caused by trees/vegetation
- High resistance associated with natural feature

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 08



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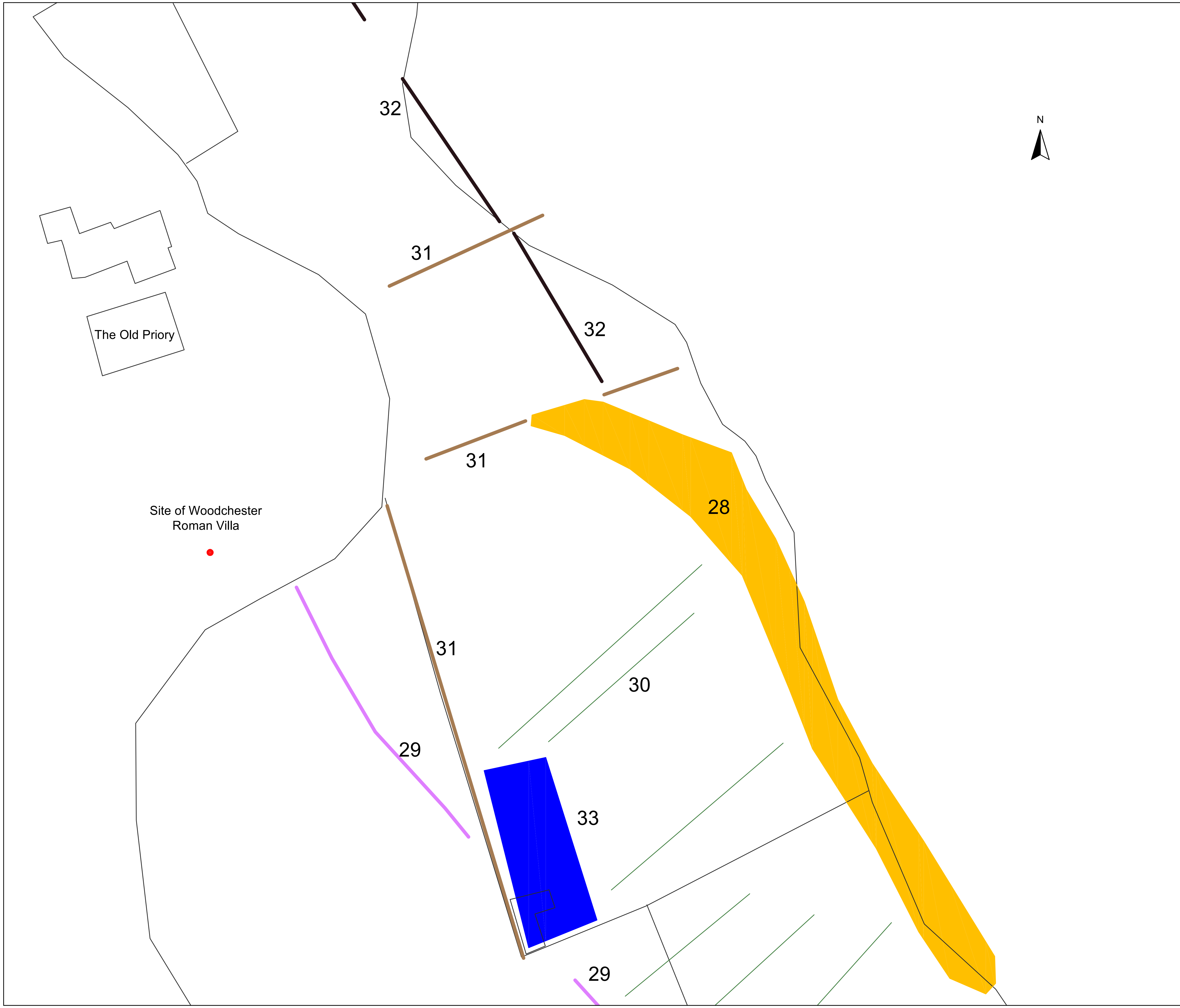
Shaded relief model derived from Environment Agency's LiDAR data - 1m resolution

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
DJS	KTD	FIG 09



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Abstraction and interpretation of LiDAR data

- Linear bank relating to early land boundary or headland
- Broad bank of uncertain origin - possible spoil from adjacent railway cutting
- Linear banks related to former field boundaries
- Bank and ditch feature - possible former boundary
- Low earthworks associated with ridge and furrow cultivation
- Area of terracing

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

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DJS	KTD	FIG 10