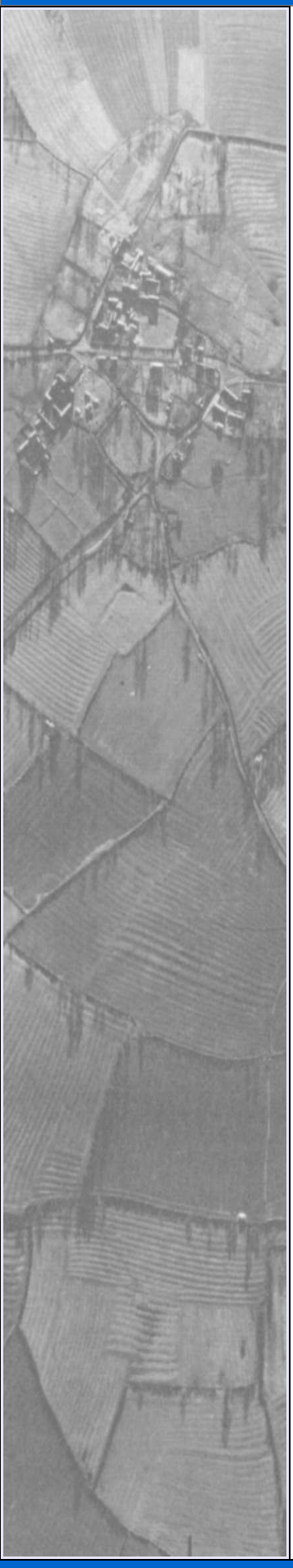

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

MAGNETOMETER AND EARTH RESISTANCE SURVEY REPORT

for

English Heritage

David Sabin and Kerry Donaldson

March 2015

Ref. no. 593

ARCHAEOLOGICAL SURVEYS LTD

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Magnetometer and Earth Resistance Survey

for

English Heritage

Report and fieldwork by David Sabin BSc (Hons) MCIfA and Kerry Donaldson BSc (Hons)

Survey dates – 16th to 24th February 2015
Ordnance Survey Grid References – **SP 32974 14637** (Blindwell Wood Barrows)**,**
SP 28991 10109 (Asthall Barrow) & **SU 33566 37675** (Waters Down Barrow)

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SUMMARY

Archaeological Surveys Ltd was commissioned by the English Heritage Geophysics Team to undertake both magnetometry and resistivity over the following three scheduled barrow sites: a pair of bowl barrows south of Blindwell Wood, Oxfordshire; Asthall Barrow, Oxfordshire and a bowl barrow near Waters Down Farm, Hampshire. The work was requested ahead of badger eviction and meshing.

Blindwell Wood Barrows
The results do not indicate the presence of a typical surrounding ditch for either barrow. There is some evidence of former quarrying immediately to the south east of the southerly barrow. An elongated amorphous feature further to the east may relate to a scrape of material, although this could be natural. The northern barrow mound is highly disturbed by badgers and has vegetation which prevented survey over it. The southerly barrow in the pair appears to have been removed by arable cultivation on its western side, although a high resistance zone may represent its remains.

Asthall Barrow
The geophysics suggests the presence of a surrounding quarry or scrape, rather amorphous in shape, with some separate quarry pits possibly also associated. Other linear ditches and pit-like features were located in the vicinity.

Waters Down Barrow
The survey has provided some weak evidence for a surrounding ditch but it appears sub-rounded or somewhat oval in shape. Two or possibly three linear ditches appear to conjoin on the north eastern side of the barrow and may well have caused disturbance to the ditch and possibly cut into the mound. Several other ditches were located to the south and south east of the barrow.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Dr Neil Linford, of the English Heritage Geophysics Team, to undertake a geophysical survey around three scheduled barrow sites that have been disturbed and damaged by badger activity. Two sites are located in Oxfordshire and a third located in Hampshire, they are; a *Pair of Bowl Barrows Immediately South of Blindwell Wood* (Monument no: 1015212), referred to in this report as Blindwell Wood Barrows, *Asthall Barrow: An Anglo-Saxon Burial Mound 100m SSW of Barrow Farm* (Monument no: 1008414), referred to as Asthall Barrow and *Bowl Barrow 400m South of Waters Down Farm* (Monument no: 1014863), referred to as Waters Down Barrow.

1.1.2 The barrows have been subject to badger disturbance, and recent tree and scrub clearance has been carried out as part of a programme of protection

and management. The geophysical survey is intended to help establish the full extent of each monument prior to badger eviction and meshing.

1.1.3 The surveys were carried out within the scheduled areas with licences from English Heritage under Section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983).

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. This is in order to establish the extent and location of the monuments and associated archaeological features prior to badger eviction and meshing to prevent recolonisation of the monuments. 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;* and 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 Blindwell Wood site is located 2.8km north west of Crawley and 4.5km north west of Witney in Oxfordshire. The scheduled area is centred on Ordnance Survey National Grid Reference (OS NGR) SP 32974 14637 with the survey area centred on SP 32980 14630, see Figures 01 and 02. The geophysical survey area covers approximately 1ha centred on the pair of barrows which are also divided into two by a boundary fence extending over them from north to south. The eastern part of the survey was within a grass field, the western part contained an emerging arable crop. The northern barrow was badger damaged and tree covered and could only be partially surveyed, see Plate 1. Immediately to the south east of the barrow pair the ground surface has been cut away and is visible as a rounded depression about 15m across.

Plate 1: Blindwell Wood northern barrow looking south west

1.3.2 The Asthall Barrow site lies 1km south of Asthall and 4.5km west of Witney in Oxfordshire. The scheduled area is centred on SP 28991 10109 and the survey area centred on SP 28980 10130, covering 0.7ha within the grassed area where the barrow is situated. Further survey to the east was restricted by the presence of piles of cut wood cleared from the barrow. The barrow is encircled by a dry stone wall, with material eroded from the barrow slumping over it. The survey was carried out over the flat area of land surrounding the barrow, but not over the monument itself due to its steep sides.

Plate 2: Asthall barrow looking east

1.3.3 The Waters Down barrow site is located 2.5km west of Longstock and 3km

north west of Stockbridge in Hampshire. The scheduled area is centred on SU 33566 37675 and the survey area on SU 33585 37680. The survey covers 0.6ha over the barrow and within arable land to the east. The barrow is located in the field margin, which is left uncultivated, and extends west into the hedge. The arable zone immediately to the east contained a short rape crop. The barrow surface was highly irregular due to badger setts, tree stumps and exposed roots.

Plate 3: Waters Down barrow looking west

1.3.4 The ground conditions within all the survey areas were generally considered to be favourable for the collection of magnetometry and earth resistance data with the exception of the small zones outlined above. Weather conditions during the survey were variable with periods of very heavy rain, which delayed the survey, and drier periods that were cold but sunny, with occasional snow showers.

1.4 Site history and archaeological potential

1.4.1 The National Heritage List for England outlines that the Blindwell Wood barrows include a pair of Bronze Age bowl barrows, aligned roughly north east - south west on a false crest, immediately south of Blindwell Wood (English Heritage 2015a). They survive as earthwork features, despite quarry damage, and there is no record of them being subject to archaeological excavation. The north eastern barrow has an irregular stony mound of 34m east-west, 20m north-south and 1.6m high. The irregular shape is due to quarrying. The south western mound has a 20m diameter and is 0.5m high, but has been reduced in height by cultivation. It is recorded as surrounded by a partly infilled 3m wide quarry ditch seen to the east and south.

1.4.2 Field observations were of a tree covered mound of rubble and earth to the north, very disturbed by badgers, with a flatter area to the south and a broad

depression further to the south east. There does not appear to be any surface expression of the southern mound in the western, arable field. The highly disturbed northern barrow appeared to be made up of limestone rubble, soil and occasional large quartzite pebbles. The latter appear similar to the Bunter Pebbles of the Midlands and are likely to relate to the Northern Drift deposits known to overlie the limestone in the vicinity. A patch of pebbles was also noted in the arable field immediately north west of the barrow.

1.4.3 Asthall Barrow is one of the best preserved examples of an Anglo-Saxon hlaew or burial mound, of which there are about ten examples within West Oxfordshire (English Heritage, 2015b). The mound was constructed within a dry stone wall, 0.5m thick and 1.5m high, which has since been repaired. The mound and wall are 17m in diameter and 2m high. The barrow was partially excavated in the 1920s by G.S. Bowles under the guidance of E.T. Leeds, and a high status cremation burial, dating to the late 6th or earth 7th centuries was discovered. The burial was associated with several items, including three pottery vessels, imported copper alloy bowls, cauldrons and drinking vessels, bone and antler gaming pieces and a Merovingian bottle jar, now all held in the Ashmolean Museum. The mound was found to have been constructed at ground level with material for its construction brought to site. There was no evidence recorded during the excavation for a quarry ditch.

1.4.4 The barrow sides appear to have slumped in places with soil partly overlying the surrounding wall around the perimeter of the monument. The surrounding area is generally flat, although a slight bank and depression were noted immediately to the south of the monument. Grass growth surrounding the barrow appeared stronger and greener.

1.4.5 The Waters Down barrow is a part of a linear group containing at least 5 Bronze Age bowl barrows (English Heritage, 2015c). It has been truncated on its western side by a road which shows that it is constructed of chalk rubble overlying a turf core. The ditch is only visible as a short section in the south east corner, where it is 3m wide. It is recorded to have been traced by a former geophysical survey and probing as a continuous feature. It was formerly classified by the Ordnance Survey as a “short” long barrow, but has since been reinterpreted as a bowl barrow.

1.4.6 The mound and area immediately surrounding it showed signs of intense badger activity, numerous voids were present on the crest of the monument. A single rim sherd was noted on the surface of the lower eastern side of the barrow and this had undoubtedly been excavated from a sett. The sherd would probably be consistent with a Late Iron Age or Roman date.

1.5 Geology and soils

1.5.1 The underlying geology at Blindwell Wood and Asthall is Forest Marble Limestone with some drift deposits from the Northern Drift Formation recorded to the east and west of Blindwell Wood Barrows (BGS, 2015). The overlying

soils across the two sites are from the Elmton 3 association which are brown rendzinas. These consist of shallow, well drained, brashy, calcareous, fine, loamy soils over limestone (Soil Survey of England and Wales, 1983).

1.5.2 The geology at Waters Down is Newhaven Chalk. The overlying soils across the site are from the Andover 2 association which are also brown rendzinas. These consist of shallow, well drained, calcareous silty soils over chalk (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry carried out on similar soils and geology have shown that there can be a good contrast between the fill of cut features and the material into which the are cut. On upstanding monuments, it can at times be more difficult to interpret as earthwork features can be magnetically enhanced. Natural features, such as solution holes and tree throw pits, can also be evident, and these can be difficult to distinguish from pit-like features of anthropogenic origin. The effectivity of resistivity is unlikely to vary considerably between the sites when considering the underlying geology and soil.

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 spaced 0.5m apart with readings recorded at 20 Hz. Each gradiometer has a fluxgate sensor separated vertically by 650mm. 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 Data are collected along a series of straight, parallel survey transects wherever possible. 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.

2.2.3 The earth resistance survey was carried out using Geoscan Research Ltd RM85 resistance meter using a mobile parallel Twin Probe array with a 0.5m electrode separation. Data were recorded at 1m intervals along traverses separated by 1m with 30m x 30m grids. The instrument was set to filter stray earth currents which can cause errors within the resistance measurements.

2.2.4 The earth resistance survey grids were set out to the Ordnance Survey OSGB36 datum using a Leica GS10 RTK GPS. The GPS 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.

2.2.5 The fixed orientation of resistivity survey grids based on the OSGB36 datum was considered appropriate given that the orientation of land boundaries was variable. A fixed grid across the site also simplifies its relocation should that be required.

2.3 Data processing, presentation and dissemination

2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. The proprietary .prm files are used to associate magnetic measurements with corresponding geographic positions based on the UTM Zone 30 (north)

projection. Track analysis and export is performed using the programme. Georeferenced data are exported in ASCII format for further analysis and display using TerraSurveyor.

2.3.2 The following processing of magnetic data using TerraSurveyor has been carried out:

- conversion of UTM to OSGB36 (via OSTN02),
- zero median traverse algorithm to remove sensor offsets,
- clipping at ±3nT (Blindwell), ±5nT (Asthall), ±3nT (Waters Down),
- data are resampled to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

Appendix C contains specific information concerning the magnetic survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on any processes, such as clipping, carried out on the data.

2.3.3 A TIFF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot.

2.3.4 Data logged by the resistance meter are downloaded and processed within TerraSurveyor software. The following processing has been carried out on data in this survey:

- clipping between 15Ω and 42Ω (Blindwell Area1) and 21Ω and 57Ω (Blindwell Area2), 32Ω and 142Ω (Asthall), 23Ω and 57Ω (Waters Down),
- data for Waters Down have been despiked.

Appendix C contains specific information concerning the resistance survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on any processes, such as clipping, carried out on the data.

2.3.5 Graphic raster images in TIFF format (.TIF) are prepared in TerraSurveyor for the earth resistance data. Regardless of survey orientation, data captured along each traverse are displayed and processed by TerraSurveyor from left to right; this corresponds to a direction of south to north in the field. Prior to displaying against base mapping, raster graphics require a rotation of 90° anticlockwise to restore north to the top of the image upon insertion into CAD/GIS mapping etc.

2.3.6 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. 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.

2.3.7 The main form of data display prepared for this report is the greyscale plot accompanied by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.8 The raster images are combined with base mapping using ProgeCAD Professional 2014, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.

2.3.9 During collection of the magnetometer data, height data are recorded by the GPS. A shaded relief plot and a contour plot have been derived from the height data and have been displayed for Blindwell Wood barrows (Fig 06) and Waters Down barrow (Fig 13). A basic hachure plan has been added also. This additional information assists interpretation of the geophysical anomalies where there are upstanding monuments.

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.

2.3.11 The English Heritage Geophysics Team will be supplied with a copy of the raw geophysical data as an ASCII file for the magnetometry from DLMGPS, together with the raw and processed composite files from TerraSurveyor. The resistivity data will be supplied as raw and processed TerraSurveyor composite files and grids. The report text and figures as a PDF and CAD dwg will also be issued.

3 RESULTS

3.1 General assessment of survey results - magnetometry

3.1.1 The detailed magnetic survey was carried out over three separate sites at Blindwell Wood Barrows (1ha), Asthall Barrow (0.7ha) and Waters Down Barrow (0.6ha).

3.1.2 Magnetic anomalies located can be generally classified as positive linear and discrete positive responses of archaeological potential, positive and negative anomalies of an uncertain origin, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects.

3.1.3 Anomalies located within each survey area have been numbered and are

described below with subsequent discussion in Section 4.

3.2 Statement of data quality - magnetometry

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the datasets. Localised magnetic disturbance and debris are unlikely to obscure weak anomalies of archaeological potential.

3.2.2 The limestone geology at Blindwell and Asthall is associated with soils that can support moderately high levels of magnetic susceptibility relating to both anthropogenic activity and natural processes. Magnetic contrast is notably stronger than at the Waters Down barrow located on chalk.

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 for each survey area.

Report sub-heading CAD layer names and plot colour	**Description and origin of anomalies**
Anomalies with archaeological potential AS-ABST MAG POS LINEAR ARCHAEOLOGY AS-ABST MAG POS DISCRETE ARCHAEOLOGY AS-ABST MAG POS ARCHAEOLOGY AS-ABST MAG NEG ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc..
Anomalies associated with ground disturbance/quarrying AS-ABST MAG QUARRYING/ GROUND DISTURBANCE AS-ABST MAG ROCK	Magnetically variable anomalies, which may be negative, indicating a response to geology/drift deposits and/or positive indicating an increased depth of topsoil. Very strongly magnetic anomalies are a response to highly magnetic material which can be used to infill a depression. A negative response may be a response to a band of rock near the surface, or at the edge of a depression.
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS AREA UNCERTAIN AS-ABST MAG NEG AREA UNCERTAIN	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. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL	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.
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. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE	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 such 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 and with hysteresis adjacent to strong magnetic sources.

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 a total of three survey areas, at Blindwell Wood Barrows (1ha), Asthall Barrow (0.7ha) and Waters Down Barrow (0.6ha).

3.4.2 Resistive anomalies located can be generally classified as high and low resistance anomalies of an archaeological origin, high and low resistance of uncertain origin, high resistance linear anomalies of an agricultural origin and low resistance anomalies with a natural origin. Anomalies located within each survey area have been numbered and will be outlined below with subsequent discussion in Section 4.

3.5 Statement of data quality - resistivity

3.5.1 Data are considered representative of the resistive anomalies present within the site. There are no significant defects within the dataset.

3.5.2 The resistance surveys were carried out in dry conditions but immediately after periods of heavy rain; however, resistive contrast appears good as the winter period prior to the work was not excessively wet and water tables generally appeared to be low. The Blindwell and Asthall surveys contain variability probably relating to the underlying geology, the former revealing 'crack-like' anomalies.

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 for each survey area.

Report sub-heading CAD layer names and plot colour	Description and origin of anomalies
Anomalies with archaeological potential AS-ABST RES LOW LINEAR ARCHAEOLOGY AS-ABST RES LOW ARCHAEOLOGY AS-ABST RES HIGH ARCHAEOLOGY AS-ABST RES LOW DISCRETE ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as enclosures, structures, ring ditches, etc.. High resistance may indicate structural material (e.g. stone); low resistance may relate to the moisture retentive fill of cut features.
Anomalies associated with ground disturbance/ quarrying AS-ABST RES QUARRY AS-ABST RES ROCK	The anomaly may be a low resistance response to the fill of a depression or possible quarry. It may also have associated high resistance anomalies, possibly indicating bands of rock near the surface.
Anomalies with an uncertain origin AS-ABST RES LOW LINEAR UNCERTAIN AS-ABST RES HIGH DISCRETE UNCERTAIN AS-ABST RES HIGH AREA UNCERTAIN AS-ABST RES LOW AREA UNCERTAIN	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. High resistance anomalies are indicative of comparatively low moisture and may indicate stone, compacted soil, changes in drainage, etc. Low resistance anomalies are indicative of comparatively high moisture and may relate to the fill of cut features, organic material within the soil, damp areas etc..
Anomalies with an agricultural origin AS-ABST RES AGRICULTURAL	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.
Anomalies with a natural origin AS-ABST RES NATURAL FEATURES	The anomalies may be high, low or variable. They may indicate widespread and numerous pit-like, linear or amorphous responses.

Table 2: List and description of resistivity interpretation categories

3.7 List of anomalies – Magnetometry Blindwell Wood Barrows

Area centred on OS NGR 432980 214630, see Figure 04.

Anomalies of archaeological potential

(1) – A negative anomaly, lacking in definition, corresponds to a low mound in the eastern half of the site.

Anomalies associated with ground disturbance/quarrying

(2) – A positive anomaly corresponds to a partly infilled depression within the field.

The depression is 15-20m wide and appears to relate to a quarry pit, adjacent to the mound (1). Along the eastern and southern edges is a negative response which is situated within the side of the depression. There have corresponding responses in the resistivity results (12). Although the site is listed to contain two bowl barrows, there is no evidence for a ring ditch, but a quarry pit. Whether this quarry pit is associated with a round barrow, or just to a former quarry with the mound associated with spoil is uncertain.

Anomalies with an uncertain origin

(3) – An elongated weakly positive response is located in the eastern part of the survey area. This type of response often indicates former quarrying; however, there is no corresponding surface expression. It appears to extend northwards, possibly beneath the northern barrow. It is possible that this relates to shallow quarry or scrape of material, perhaps associated with the barrows.

(4) – Located in the south western part of the survey area is a positive response. This is also indicative of quarrying.

(5) – The survey area contains a number of discrete positive responses. There are a large number of them, but only the strongest and most well defined have been abstracted. It is likely that they relate to naturally formed pit-like features, although an anthropogenic origin for some should be considered.

(6) – A number of short, positive linear responses have been recorded. Some may relate to agricultural activity, but many do not have a coherent pattern or morphology and it is possible that they relate to natural features, such as cracks within the underlying geology.

Anomalies with an agricultural origin

(7) – A number of linear anomalies can be seen in the western half of the survey area which was under arable cultivation. These relate to agricultural activity.

Anomalies with a modern origin

(8) – Magnetic disturbance along the centre of the survey area is a response to ferrous material within extant and former fencing.

(9) – A negative anomaly at the south western corner of the site appears to relate to a substantial buried ferrous object which is situated immediately adjacent to the south west corner. No object was visible on the surface.

3.8 List of anomalies – Resistivity Blindwell Wood Barrows

Area centred on OS NGR 432980 214630, see Figure 05.

Anomalies of archaeological potential

(10) – An area of high resistance to the east of the centre of the site partly corresponds to negative anomaly (1) in the magnetometer data.

(11) – A small high resistance response to the north west of the centre of the site corresponds to the northern barrow mound.

Anomalies associated with ground disturbance/quarrying

(12) – An area of low resistance corresponds to positive anomaly (2) in the magnetometer data and the depression within the ground surface. On its southern and eastern edge is a high resistance response corresponding to the negative response in the magnetic data.

Anomalies with an uncertain origin

(13) – A low resistance response can be seen in the eastern half of the survey area, where it is amorphous in the south and then appears to extend as three linear bands. This partly corresponds to the positive response (3) seen in the magnetic data and may indicate former quarrying, although there is no corresponding surface expression.

(14) – An area of high resistance can be seen to the west of the central part of the site. There is no corresponding mound within this arable field; however, it is possible that it relates to the former southern barrow mound and an association with (10) is possible.

Anomalies with a natural origin

(15) – A series of low resistance sinuous responses are located primarily within the western part of the site. It is likely that the sinuous responses relate to natural variations within the underlying geology.

3.9 List of anomalies – Magnetometry Asthall Barrow

Area centred on OS NGR 428980 210130, see Figure 08.

Anomalies of archaeological potential

(16) – An amorphous positive anomaly with some associated negative responses surrounds Asthall Barrow. It is likely to be indicative of quarrying, and it would appear that this is a former quarry pit or shallow scrape associated with the barrow. It corresponds to a zone of low resistance (23).

(17) – An isolated amorphous anomaly is located 9m to the west of anomaly (1) and has a similar response. This would also appear to be related to quarrying, and

although isolated from the barrow, an association should be considered.

(18) – A number of discrete positive responses surround the barrow. They are 10-16nT, and some are sub-circular while others have an elongated oval appearance. They vary in size, the smallest being 4m by 2m, the largest 8m by 5m. These also correspond to the area of low resistance (23) that surrounds the barrow and appear to relate to substantial pits.

(19) – A positive linear anomaly extends across the eastern part of the survey area. It corresponds to a low resistance linear anomaly (25) and appears to relate to a linear ditch. It is not possible to determine if it is directly associated with the barrow.

Anomalies with an uncertain origin

(20) – A number of discrete positive responses can be seen within the survey area and only the strongest (6-27nT) and most well defined have been abstracted. It is possible that these relate to naturally formed pit-like features; however, an anthropogenic origin cannot be ruled out.

(21) – The survey area contains a number of weakly positive and negative linear anomalies. They are generally short or fragmented and their origin cannot be confidently interpreted.

Anomalies associated with magnetic debris

(22) – A small patch of magnetic debris is located to the south east of the barrow mound. The response indicates that ferrous and other magnetically thermoremnant material is present; however, it is not possible to determine if it relates to modern or earlier burning.

3.10 List of anomalies – Resistivity Asthall Barrow

Area centred on OS NGR 428980 210130, see Figure 09.

Anomalies of archaeological potential

(23) – An amorphous low resistance zone surrounds the barrow and generally corresponds to magnetic anomalies (16) and (18). This would indicate former quarrying or a scrape of material and therefore an association with the barrow seems likely.

(24) – A number of discrete low resistance responses can be seen beyond anomaly (23). Many relate to pit-like responses (18) and amorphous responses (17) and they are also likely to relate to small quarry pits.

(25) – A low resistance linear anomaly extends along the eastern part of the survey area and corresponds to positive linear anomaly (19) seen in the magnetometer

results. A second linear anomaly extends north westwards from close to the centre of it, which is not clearly evident in the magnetic data. These anomalies relate to linear ditches.

(26) - The northern part of the survey area contains a number of narrow low resistance linear anomalies. It is possible that some may relate to cut features, while others may relate to former agricultural activity, or possible cracks within the solid geology.

3.11 List of anomalies – Magnetometry Waters Down Barrow

Area centred on OS NGR 433585 137680, see Figure 11.

Anomalies of archaeological potential

(27) – A broadly curvilinear positive response can be seen surrounding the barrow mound. This would appear to relate to the barrow ditch, although it does not appear to be classically circular in shape, rather more like a flattened oval shape. It appears to be partly crossed or joined by linear anomaly (28) from the south and (29) from the south east. There are a number of slightly more enhanced zones within the anomaly.

(28) – A positive linear anomaly representing a former ditch extends north eastwards from the south western corner of the survey area. It appears to partly cut or join anomaly (27) and then extend north eastwards beyond it. There also appears to be an association with anomaly (29).

(29) – A positive linear anomaly representing a ditch-like feature extends north westwards from the eastern field boundary towards the north eastern corner of the barrow and anomaly (27). It is not clear if it continues around the barrow to the north.

(30) – Two positive linear anomalies extend across the southern part of the survey area. It is not clear if they truncate or are truncated by other linear features (28) and (30). These anomalies are approximately 7.5m apart and probably relate to a pair of parallel linear ditches.

(31) – Two further positive linear anomalies representing ditch-like features can be seen in the south eastern part of the survey area.

(32) – Extending south eastwards from the north western corner of the survey area, then extending southwards towards the barrow is a positive linear anomaly. This also appears to relate to a former ditch.

Anomalies with an uncertain origin

(33) – There are a small number of weakly positive anomalies, which are short and

lack a coherent morphology preventing confident interpretation.

(34) – The survey area contains a number of discrete positive responses. Although some may relate to archaeological features, a natural origin cannot be ruled out.

Anomalies with an agricultural origin

(35) – A number of negative linear anomalies relate to cultivation marks within the field, at the field margin and surrounding the barrow.

Anomalies associated with magnetic debris

(36) – Widespread and strongly magnetic debris is located predominantly on the barrow. These are likely to relate to modern ferrous material and debris. There are some positive responses within these dipolars that may indicate magnetically enhanced material associated with the barrow mound.

3.12 List of anomalies – Resistivity Waters Down Barrow

Area centred on OS NGR 433585 137680, see Figure 12.

Anomalies of archaeological potential

(37) – A low resistance response is associated with the barrow. There are some higher resistance responses towards the centre of the barrow mound. The surface of the mound is very uneven, containing badger holes and tree roots, and these would have affected the results. However, it appears that the mound is of lower resistance than the immediate surroundings, suggesting that it may be comprised of more moisture retentive material. There is some correlation with positive anomaly (27) which may indicate that the outer edge of the low resistance response relates to a surrounding ditch.

(38) – A low resistance linear anomaly corresponds to anomaly (28) seen in the magnetometer data. It relates to a linear ditch that extends towards and beyond the north eastern corner of the barrow.

(39) – A low resistance linear anomaly extends towards the north eastern corner of the barrow from the south east. It corresponds to anomaly (29) in the magnetic data, and again it is not clear if it extends beyond the barrow to the north west as a high resistance response (45).

(40) – Two low resistance linear anomalies correspond to the pair of parallel positive linear anomalies (30) in the southern part of the survey area.

(41) - A number of further low resistance linear anomalies are located in the south eastern part of the survey area. There is some corresponding magnetic response, although there are some differences.

(42) – An L shaped low resistance linear anomaly extends from the north west corner, and then extends southwards towards the barrow. It corresponds to positive linear anomaly (32).

Anomalies with an uncertain origin

(43) – A low resistance response extends south westwards from the southern edge of the barrow. It is not clear if it is associated with the barrow ditch.

(44) – To the south and east of the barrow mound are high resistance responses. It is not clear if they are associated with the barrow directly or if they are due to compacted ground surrounding the barrow.

(45) – A high resistance response is located to the north of the barrow mound. It is not clear if it is an extension of linear response (39) or if it is associated with a the barrow ditch. The response indicates that this is material with a lower moisture content and more dense matrix than the barrow mound.

(46) – A low resistance anomaly appears to curve around the barrow mound, approximately 24m away. While it is possible that it has some association with the barrow, it has no corresponding magnetic anomaly, and it generally follows the cultivation trend indicating that it too may be agricultural in origin.

Anomalies with an agricultural origin

(47) – A number of high resistance linear anomalies are associated with agricultural activity and correspond to negative magnetic anomalies (35).

4 DISCUSSION

4.1.1 The Blindwell Wood Barrows are listed as two bowl barrows, aligned north east to south west, with evidence of quarrying of the north east barrow, and a 3m wide partly infilled ditch surrounding the south west barrow on the southern and eastern sides. However, within the field, the northern mound is very disturbed, the southern has no mound in the western field, but is defined as a low mound in the eastern field due to a wide quarry depression around its southern and eastern edges. It is much more than 3m wide, nearer a 15-20m wide depression in the ground surface, indicative of quarrying. There is no clear evidence for a ring ditch surrounding either barrow; however, to the east there is an elongated amorphous anomaly that may be indicative of a former scrape. However, there is no depression within the ground surface and it is possible that it may be a natural feature.

4.1.2 At Asthall Barrow, excavation in the 1920s indicated that there was no corresponding barrow ditch and that material had been brought to site for its

construction. However, there are a number of magnetic and resistance anomalies that relate to an amorphous area and pits surrounding the barrow mound which appear to relate to quarrying and possibly a scraped area which would indicate an association with construction of the barrow. The survey area also located linear ditches to the north east, although it is not possible to ascertain if they are associated with the barrow. The majority of the magnetic anomalies correspond to earth resistance responses, although more detail is shown in the resistance data.

4.1.3 Waters Down Barrow also does not have a clearly defined ring ditch, although there are magnetic and resistance anomalies that do appear to relate to surrounding ditch-like features. There is evidence for a number of linear ditches that converge at the north eastern corner of the barrow, with a pair of parallel linear ditches to the south. Both the magnetometry and resistivity correspond very well, with again, perhaps a little more detail seen in the resistivity data.

5 CONCLUSION

5.1.1 The geophysical survey was undertaken at the sites of the three badger damaged barrows in order to determine any associated archaeological features prior to meshing to deter badgers. At each one of the sites, magnetometry and resistivity were undertaken and both display a very good correlation between the results of the two techniques. None of the sites appear to contain a classic ring ditch surrounding the barrows, but rather a range of responses.

5.1.2 At Blindwell Wood, where a pair of bowl barrows are listed, there is a visible wide depression in the field which is recorded as relating to the infilled ditch of the southern barrow. The results indicate that this probably relates to a quarry, with a second possible quarry or scrape of material further east with no surface expression. There is also a high resistance response in the western part of the site which does not relate to any mound, but may be associated.

5.1.3 The results at Asthall Barrow demonstrate evidence for an amorphous quarry and other possible quarry pits surrounding the barrow mound. It appears likely that these are associated with the barrow. Other linear ditches have also been found, and a further number of pit-like responses, but it is not clear if they are associated.

5.1.4 Waters Down barrow is predominantly a low resistance response but has been highly damaged by badgers and trees and, therefore, has a poorly compacted matrix. There is some evidence of a surrounding ditch, but this appears more oval than round. A number of linear ditches conjoin and appear to partially cut the barrow ditch, meeting at its north eastern corner. Other linear ditches, including a parallel pair, have also been located to the south

and south east of the barrow.

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 gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 0.65m apart. The instrument is carried about 15cm 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. 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 different offsets associated with the gradiometer sensors.

Appendix C – TerraSurveyor metadata

Blindwell Woods Barrows - magnetometry

COMPOSITE
Filename: J593-Blindwell-mag.xcp
Description: Imported as Composite from: J593-Blindwell-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (OSGB36):
Northwest corner: 432928.036534723, 214682.326565862 m
Southeast corner: 433032.316534723, 214578.046565862 m

Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 356100

Dimensions
Composite Size (readings): 869 x 869
Survey Size (meters): 104 m x 104 m

X Interval: 0.12 m
Y Interval: 0.12 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.26
Mean: 0.05
Median: 0.00
Composite Area: 1.0874 ha
Surveyed Area: 0.97614 ha

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

Blindwell Woods - resistivity Area 1

COMPOSITE

Filename: J593-Blindwell-res-Area1-proc.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702

Dimensions
Composite Size (readings): 120 x 90
Survey Size (meters): 120 m x 90 m
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m

Stats
Max: 42.00
Min: 15.00
Std Dev: 6.21
Mean: 27.60
Median: 26.30
Composite Area: 1.08 ha
Surveyed Area: 0.4574 ha

Processes: 3
1 Base Layer
2 Clip from 15.00 to 42.00 Ohm
3 Despike Threshold: 1 Window size: 3x3

Blindwell Woods - resistivity Area 2

COMPOSITE
Path: C:\Business\Jobs\J593 Three barrows\Data\Blindwell\Res\Session 2\comps\
Filename: J593-res-Blindwell-Area2-proc.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702

Dimensions
Composite Size (readings): 120 x 60
Survey Size (meters): 120 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m

Stats
Max: 67.00
Min: 21.00
Std Dev: 8.72
Mean: 36.81
Median: 35.30
Composite Area: 0.72 ha
Surveyed Area: 0.4704 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Processes: 2
1 Base Layer
2 Clip from 21.00 to 67.00 Ohm

Asthall Barrow - magnetometry

COMPOSITE
Filename: J593-Asthall-mag.xcp
Description: Imported as Composite from: J593-Asthall-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT

UTM Zone: 30U
Survey corner coordinates (OSGB36):
Northwest corner: 428921.406131189, 210168.800712958 m
Southeast corner: 429032.406131189, 210077.600712958 m

Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 241900

Dimensions
Composite Size (readings): 925 x 760
Survey Size (meters): 111 m x 91.2 m

X Interval: 0.12 m
Y Interval: 0.12 m

Stats
Max: 5.53
Min: -5.50
Std Dev: 2.07
Mean: 0.14
Median: -0.02
Composite Area: 1.0123 ha
Surveyed Area: 0.65589 ha

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 -5.00 to 5.00 nT

Asthall Barrow - resistivity

COMPOSITE
Filename: J593-Asthall-res.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702

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

Stats
Max: 142.00
Min: 32.00
Std Dev: 21.88
Mean: 96.39
Median: 98.75
Composite Area: 1.44 ha
Surveyed Area: 0.6834 ha

Processes: 2
1 Base Layer
2 Clip from 32.00 to 142.00 Ohm

Waters Down Barrow - magnetometry

Filename: J593-WatersDown-mag-proc.xcp

Description: Imported as Composite from: J593-Waters-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (OSGB36):
Northwest corner: 433555.284476353, 137734.237238419 m
Southeast corner: 433617.684476353, 137626.337238419 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 257700

Dimensions
Composite Size (readings): 624 x 1079
Survey Size (meters): 62.4 m x 108 m
Grid Size: 62.4 m x 108 m
X Interval: 0.1 m
Y Interval: 0.1 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.07
Mean: 0.02
Median: -0.01
Composite Area: 0.6733 ha
Surveyed Area: 0.63176 ha

Processes: 1
1 Base Layer

GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 10.00 nT
5 Clip from -5.00 to 5.00 nT
6 Clip from -3.00 to 3.00 nT

Waters Down Barrow - resistivity

COMPOSITE
Filename: J593-Watersdown-res.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702

Dimensions
Composite Size (readings): 120 x 60
Survey Size (meters): 120 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m

Stats
Max: 57.00
Min: 23.00
Std Dev: 6.55
Mean: 39.15
Median: 38.60
Composite Area: 0.72 ha
Surveyed Area: 0.5815 ha

Processes: 3
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Clip from 23.00 to 57.00 Ohm

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.

Archive contents:

Geophysical data - path: J593 Three barrows\Data\Blindwell				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
****Mag\blindwell1\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA at Blindwell barrows.	19/02/15	D.J.Sabin
****Mag\blindwell1\MX\ J593-Blindwell-mag.asc	Sensys DLMGPS	ASCII CSV (tab) file representing Blindwell survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	20/02/15	D.J.Sabin
\Mag\Blindwell\comps\J593-Blindwell-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	20/02/15	D.J.Sabin
\Mag\Blindwell\comps\J593-Blindwell-mag-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	20/02/15	D.J.Sabin
****Res\Session 1\grids\ 01-11.xgd	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity over Blindwell Area 1.	18/02/15	D.J.Sabin
\Res\Session 1\comps\J593-Blindwell-res-Area1-raw	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	20/02/15	D.J.Sabin
\Res\Session 1\comps\J593-Blindwell-res-Area1-proc	TerraSurveyor 3.0.23.0	Processed composite data file (despiked and clipped 15 to 42Ω).	20/02/15	D.J.Sabin
****Res\Session 2\grids\ 01-07.xgd	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity over Blindwell Area 2.	20/02/15	D.J.Sabin
\Res\Session 2\comps\J593-Blindwell-res-Area2-raw	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	20/02/15	D.J.Sabin
\Res\Session 2\comps\J593-Blindwell-res-Area2-proc	TerraSurveyor 3.0.23.0	Processed composite data file (clipped 21 to 67Ω).	20/02/15	D.J.Sabin
Geophysical data - path: J593 Three barrows\Data\Asthall				
\Mag\asthall1\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA at Asthall barrow.	23/02/15	D.J.Sabin
****Mag\asthall1\MX\ J593-Asthall-mag.asc	Sensys DLMGPS	ASCII CSV (tab) file representing Asthall survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	23/02/15	D.J.Sabin
\Mag\Asthall\comps \J593-Asthall-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	03/03/15	D.J.Sabin
\Mag\Asthall\comps \J593-Asthall-mag-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping ±5nT).	03/02/15	D.J.Sabin
\Res\Session 1\grids\ 01-14.xgd	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity over Asthall.	21/02/15	D.J.Sabin
\Res\Session1\comps\ J593-Asthall-res	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	21/02/15	D.J.Sabin
\Res\Session1\comps\ J593-Asthall-res-proc	TerraSurveyor 3.0.23.0	Processed composite data file (clipped 32 to 142Ω).	21/02/15	D.J.Sabin
Geophysical data - path: J593 Three barrows\Data\Waters Down				

\Mag\watersdown1\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA at Waters Down barrow.	23/02/15	D.J.Sabin
\Mag\watersdown1\MX\ J593-Waters-mag.asc	Sensys DLMGPS	ASCII CSV (tab) file representing Waters Down survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	23/02/15	D.J.Sabin
\Mag\Watersdown\comps\ J593-Waters-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	23/02/15	D.J.Sabin
\Mag\Watersdown\comps\ J593-Waters-mag-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping ±3nT).	23/02/15	D.J.Sabin
\Res\Session1\grids\ 01-08.xgd	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity over Asthall.	24/02/15	D.J.Sabin
\Res\Session1\comps\ J593-Watersdown-res	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	24/02/15	D.J.Sabin
\Res\Session1\comps\ J593-Watersdown-res-proc	TerraSurveyor 3.0.23.0	Processed composite data file (clipped 23 to 57Ω).	24/02/15	D.J.Sabin
Graphic data - path: J593 Three barrows\Data\Blindwell				
\Mag\Blindwell\graphics\ J593-Blindwell-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	20/02/15	K.T.Donaldson
\Mag\Blindwell\graphics\ J593-Blindwell-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
\Mag\Blindwell\graphics\ J593-Blindwell-tracks.tif	TerraSurveyor 3.0.23.0	TIF file showing survey tracks.	20/02/15	K.T.Donaldson
\Mag\Blindwell\graphics\ J593-Blindwell-tracks.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
Graphic data - path: J593 Three barrows\Data\Asthall				
\Mag\Asthall\graphics\ J593-Asthall-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±5nT.	20/02/15	K.T.Donaldson
\Mag\Asthall\graphics\ J593-Asthall-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
\Mag\Asthall\graphics\ J593-Asthall-tracks.tif	TerraSurveyor 3.0.23.0	TIF file showing survey tracks.	20/02/15	K.T.Donaldson
\Mag\Asthall\graphics\ J593-Asthall-tracks.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
Graphic data - path: J593 Three barrows\Data\Waters Down				
\Mag\Watersdown\graphics\ J593-Waters-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	20/02/15	K.T.Donaldson
\Mag\Watersdown\graphics\ J593-Waters-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
\Mag\Watersdown\graphics\ J593-Waters l-tracks.tif	TerraSurveyor 3.0.23.0	TIF file showing survey tracks.	20/02/15	K.T.Donaldson
\Mag\Watersdown\graphics\ J593-Waters-tracks.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	20/02/15	K.T.Donaldson
CAD data - path: J593 Three barrows\CAD\				
J593 version 3.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	13/02/15	K.T.Donaldson
Text data - path: J593 Three barrows\Documentation\				
J593 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	06/03/15	K.T.Donaldson

Table 3: Data archive description

Appendix E – copyright and intellectual property

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ENGLISH HERITAGE

English Heritage Geophysical Survey Database Questionnaire

Survey Details

Name of Site: Pair of Bowl Barrows immediately South of Blindwell Wood

County: Oxfordshire

NGR Grid Reference (Centre of survey to nearest 100m):

SP 329 146

Start Date: 18th February 2015 End Date: 20th February 2015

Geology at site (Drift and Solid):

Forest Marble Limestone

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)

Monument No: 1015212

Archaeological Sites/Monument types detected by survey
(Type and Period if known. "?" where any doubt).

Bronze Age round barrow

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Archaeological Surveys Ltd (David Sabin and Kerry Donaldson)

Name of Client, if any:

English Heritage

ENGLISH HERITAGE

Purpose of Survey:

To establish the extent and location of the monuments and associated archaeological features prior to badger eviction and meshing to prevent recolonisation of the monuments.

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

Archaeological Surveys Ltd, 1 West Nolands, Nolands Road, Yatesbury, Calne, SN11 8YD

Data also sent to English Heritage Geophysics Team

b) Full Report:

As above and also sent to English Heritage Geophysics Team

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Magnetometer

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

1ha

Traverse Separation, if regular: **Reading/Sample Interval:**

0.5m 20Hz

Type, Make and model of Instrumentation:

Sensys Magneto MXPDA – (5 fluxgate gradiometers)

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

Arable and Grassland - Pasture

ENGLISH HERITAGE

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Resistivity

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

1ha

Traverse Separation, if regular: **Reading/Sample Interval:**

1m 1m

Type, Make and model of Instrumentation:

Geoscan Research Ltd RM85

For Resistivity Survey:

Probe configuration: Twin probe

Probe Spacing: 0.5m

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

Arable and Grassland – Pasture

ENGLISH HERITAGE

English Heritage Geophysical Survey Database Questionnaire

Survey Details

Name of Site: Asthall Barrow: An Anglo-Saxon Burial Mound 100m SSW of Barrow Farm

County: Oxfordshire

NGR Grid Reference (Centre of survey to nearest 100m):

SP 289 101

Start Date: 21st February 2015 End Date: 23rd February 2015

Geology at site (Drift and Solid):

Forest Marble Limestone

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)

Monument No: 1008414

Archaeological Sites/Monument types detected by survey
(Type and Period if known. "?" where any doubt).

Anglo-Saxon Barrow

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Archaeological Surveys Ltd (David Sabin and Kerry Donaldson)

Name of Client, if any:

English Heritage

ENGLISH HERITAGE

Purpose of Survey:

To establish the extent and location of the monuments and associated archaeological features prior to badger eviction and meshing to prevent recolonisation of the monuments.

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

Archaeological Surveys Ltd, 1 West Nolands, Nolands Road, Yatesbury, Calne, SN11 8YD

Data also sent to English Heritage Geophysics Team

b) Full Report:

As above and also sent to English Heritage Geophysics Team

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Magnetometer

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

0.7ha

Traverse Separation, if regular: **Reading/Sample Interval**

0.5m 20Hz

Type, Make and model of Instrumentation:

Sensys Magneto MXPDA – (5 fluxgate gradiometers)

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

Grassland - Pasture

ENGLISH HERITAGE

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Resistivity

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

0.7ha

Traverse Separation, if regular: **Reading/Sample Interval:**

1m 1m

Type, Make and model of Instrumentation:

Geoscan Research Ltd RM85

For Resistivity Survey:

Probe configuration: Twin probe

Probe Spacing: 0.5m

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

Grassland - Pasture

ENGLISH HERITAGE

English Heritage Geophysical Survey Database Questionnaire

Survey Details

Name of Site: Bowl Barrow 400m South of Waters Down Farm

County: Hampshire

NGR Grid Reference (Centre of survey to nearest 100m):

SU 335 376

Start Date: 23rd February 2015 End Date: 24th February 2015

Geology at site (Drift and Solid):

Newhaven Chalk

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)

Monument No: 1014863

Archaeological Sites/Monument types detected by survey
(Type and Period if known. "?" where any doubt).

Bronze Age Bowl Barrow

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Archaeological Surveys Ltd (David Sabin and Kerry Donaldson)

Name of Client, if any:

English Heritage

ENGLISH HERITAGE

Purpose of Survey:

To establish the extent and location of the monuments and associated archaeological features prior to badger eviction and meshing to prevent recolonisation of the monuments.

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

Archaeological Surveys Ltd, 1 West Nolands, Nolands Road, Yatesbury, Calne, SN11 8YD

Data also sent to English Heritage Geophysics Team

b) Full Report:

As above and also sent to English Heritage Geophysics Team

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Magnetometer

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

0.6ha

Traverse Separation, if regular: **Reading/Sample Interval:**

0.5m 20Hz

Type, Make and model of Instrumentation:

Sensys Magneto MXPDA – (5 fluxgate gradiometers)

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

Arable

ENGLISH HERITAGE

Technical Details

(Please fill out a separate sheet for each survey technique used)

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

Resistivity

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

0.6ha

Traverse Separation, if regular: **Reading/Sample Interval:**

1m 1m

Type, Make and model of Instrumentation:

Geoscan Research Ltd RM85

For Resistivity Survey:

Probe configuration: Twin probe

Probe Spacing: 0.5m

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

Grassland - Arable

Additional Remarks (Please mention any other technical aspects of the survey that have not been covered by the above questions such as sampling strategy, non standard technique, problems with equipment etc.):

List of terms for Survey Type

Magnetometer (includes gradiometer)

Resistivity

Resistivity Profile

Magnetic Susceptibility

Electro-Magnetic Survey

Ground Penetrating Radar

Other (please specify)

ENGLISH HERITAGE

List of terms for Land Use:

Arable
Grassland - Pasture
Grassland - Undifferentiated
Heathland
Moorland
Coastland - Inter-Tidal
Coastland - Above High Water
Allotment
Archaeological Excavation
Garden
Lawn
Orchard
Park
Playing Field
Built-Over
Churchyard
Waste Ground
Woodland
Other (please specify)

Blindwell Barrows

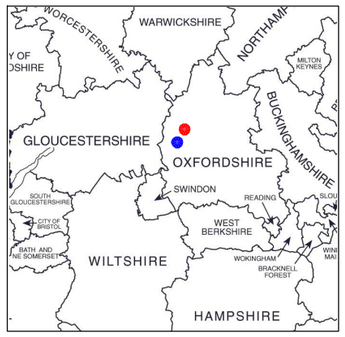
Asthall Barrow

N

Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Location map for Blindwell Wood Barrows and Asthall Barrow



- Blindwell Wood Barrows location
- Asthall Barrow location

Blindwell Wood Barrows survey area centred on OS NGR SP 32980 14630

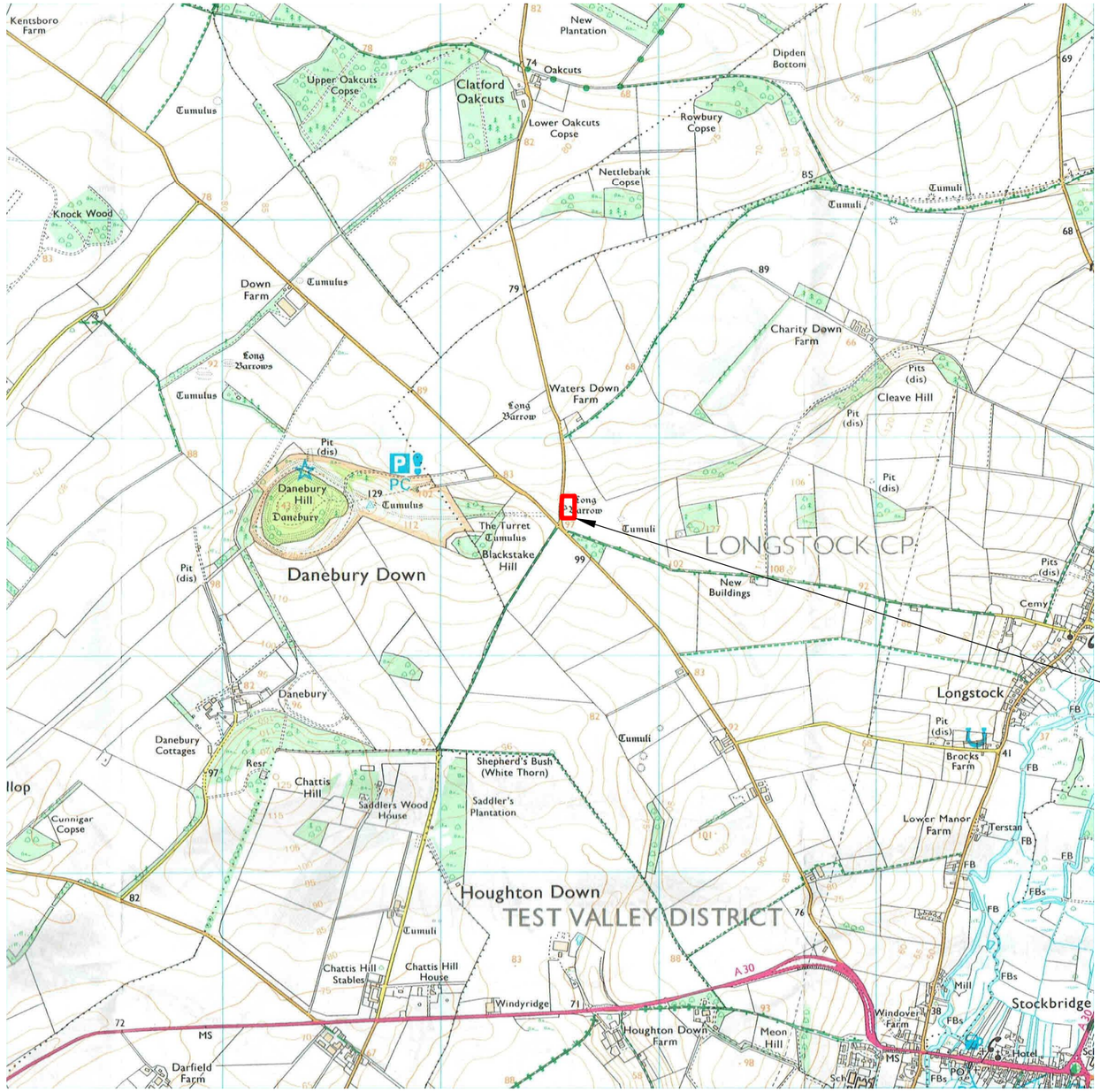
Asthall Barrow survey area centred on OS NGR SP 28980 10130

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01



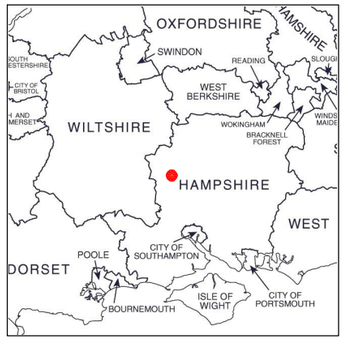
N

Survey location

Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Location map for Waters Down Barrow



Survey location

Waters Down Barrow survey area centred on OS NGR SU 33585 37680

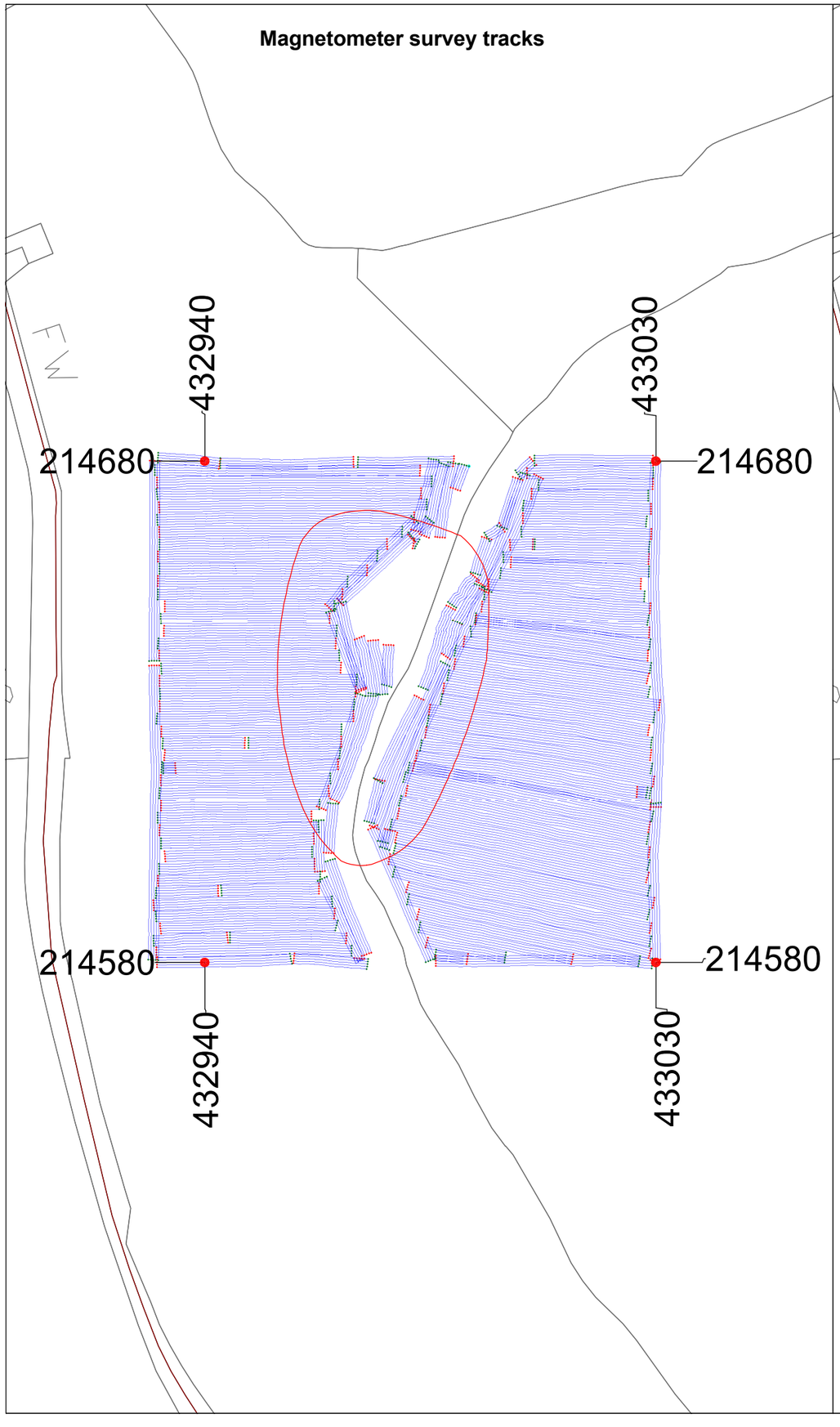
SCALE 1:25 000

0m 500m 1000m

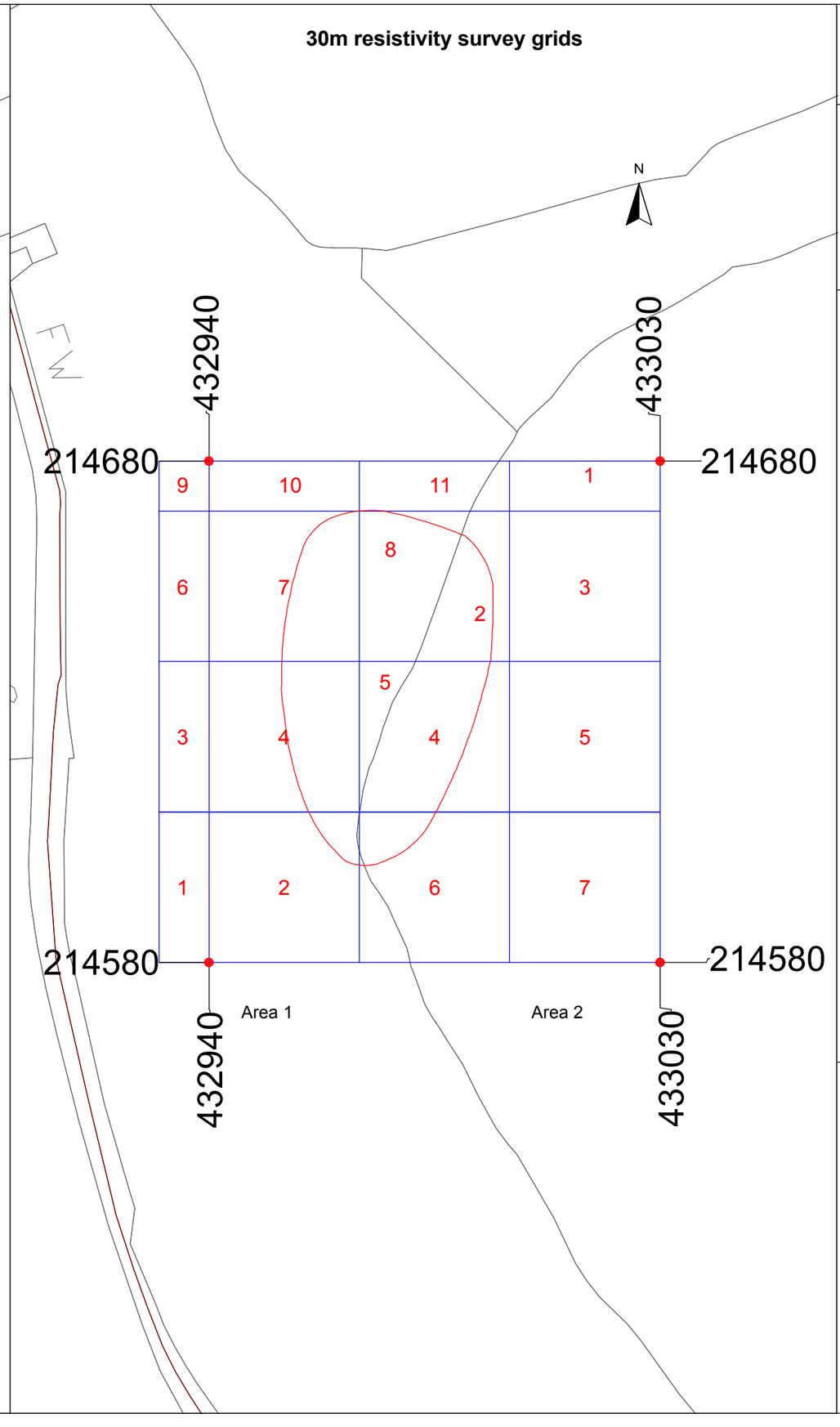
SCALE TRUE AT A3

FIG 02

Magnetometer survey tracks



30m resistivity survey grids



Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Referencing information - Blindwell Wood Barrows

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

- Survey tracks
- Survey track start
- Survey track stop
- 1 Resistivity grid number
- Scheduled area

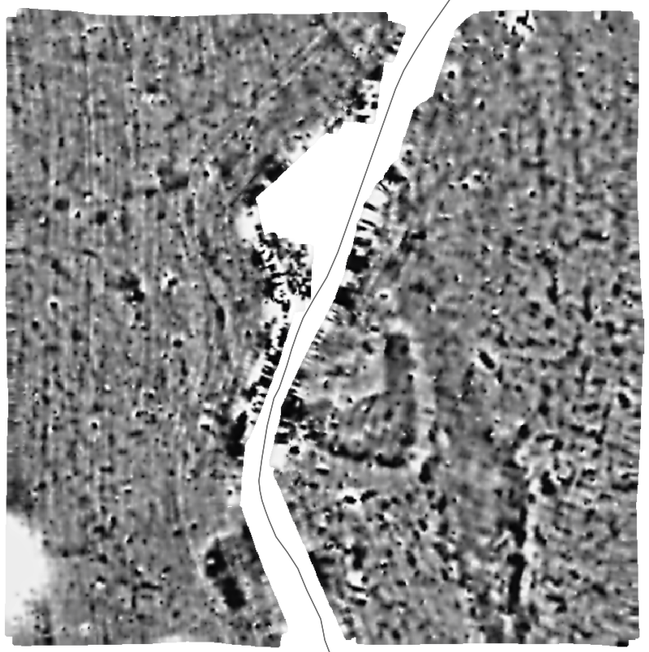
SCALE 1:1000

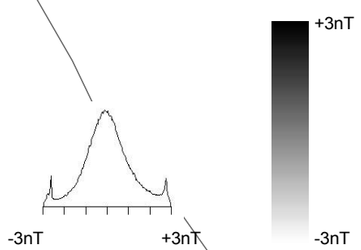
0m 10 20 30 40 50m

SCALE TRUE AT A3

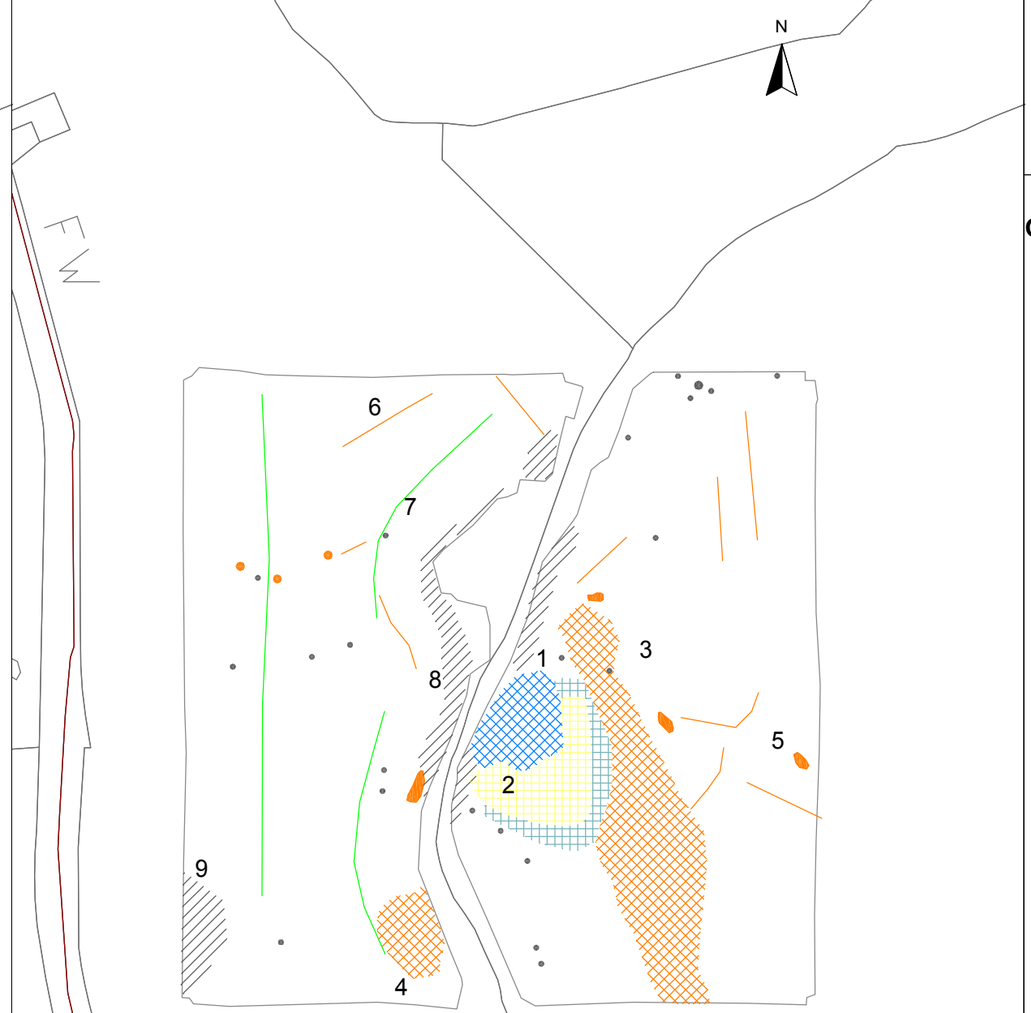
FIG 03

Greyscale plot of minimally processed magnetometer data





Abstraction and interpretation of magnetometer anomalies



Archaeological Surveys Ltd

Geophysical Survey

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Greyscale plot and abstraction and interpretation of magnetic anomalies - Blindwell Wood Barrows

- Negative anomaly - low mound
- Positive anomaly - quarry pit / depression
- Negative anomaly - possible band of rock in side of depression
- Positive anomaly - magnetically enhanced material
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

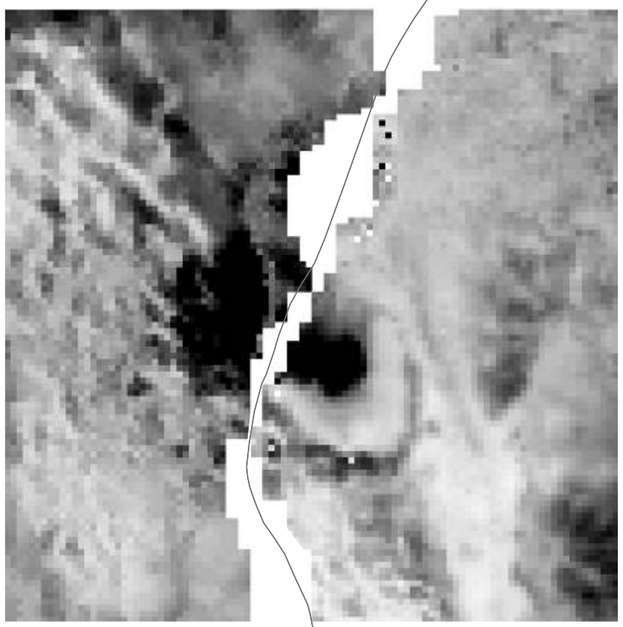
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

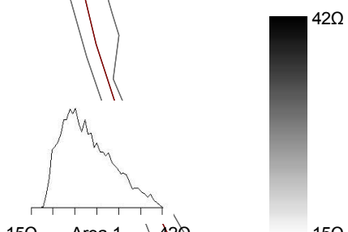
FIG 04

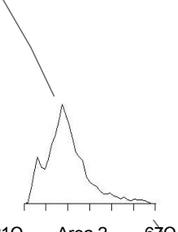
Greyscale plot of minimally processed resistance data



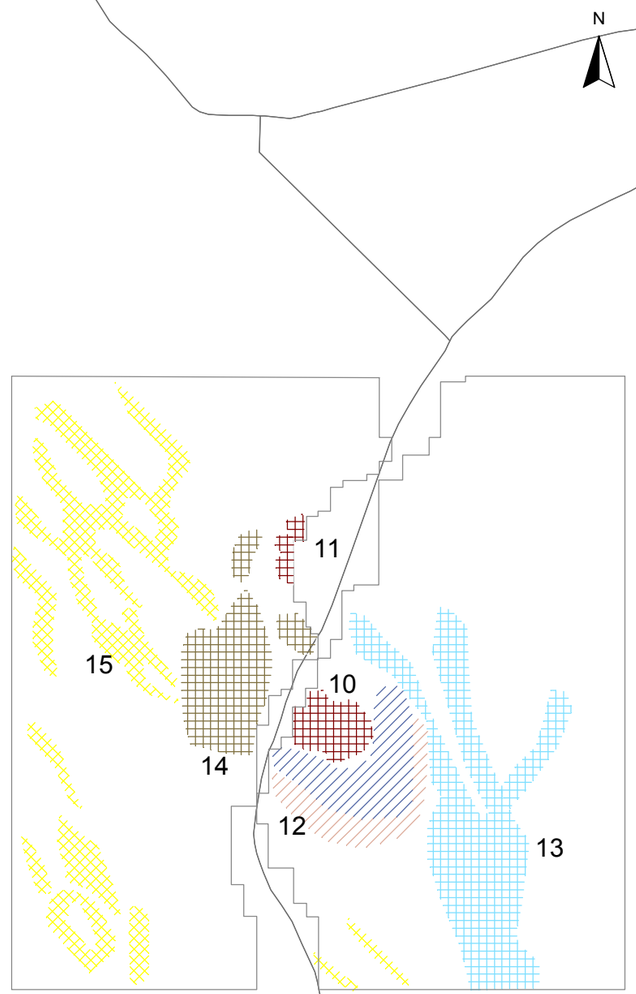
Area 1

Area 2





Abstraction and interpretation of resistance anomalies



Archaeological Surveys Ltd

Geophysical Survey

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Greyscale plot and abstraction and interpretation of resistance anomalies - Blindwell Wood Barrows

- Area of high resistance - low mound
- Area of high resistance - possible band of rock in side of depression
- Area of low resistance - quarry pit / depression
- Area of high resistance - of uncertain origin
- Area of low resistance - of uncertain origin
- Negative anomaly - of natural origin

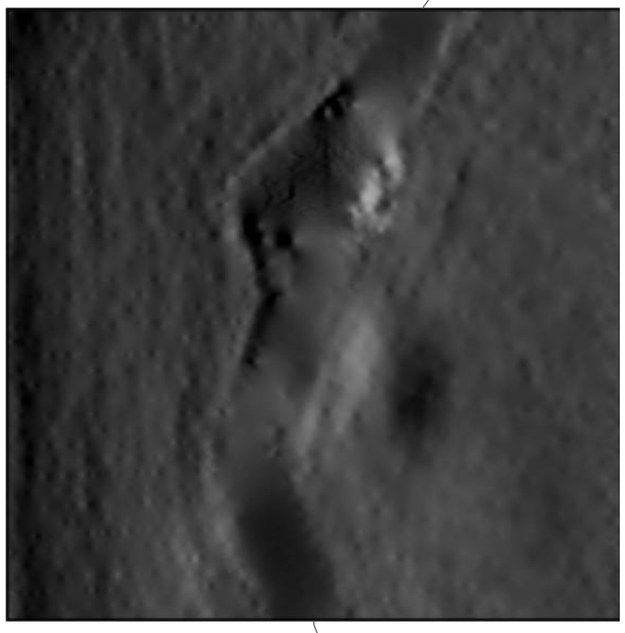
SCALE 1:1000

0m 10 20 30 40 50m

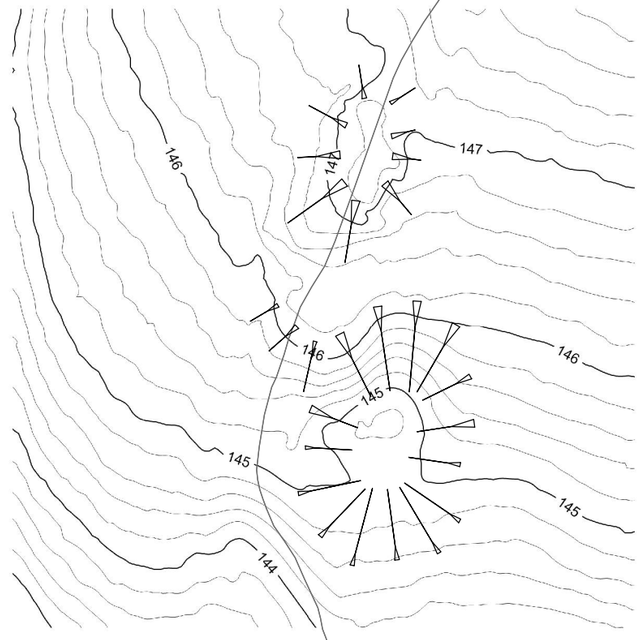
SCALE TRUE AT A3

FIG 05

Shaded relief model derived from height data collected using RTK GPS during magnetometer survey



Contour plot derivied from height data collected using RTK GPS during magnetometer survey



Archaeological Surveys Ltd

Geophysical Survey

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Shaded relief and contour plots of Blindwell Wood Barrows

Height data converted from WGS84 to ODN plus antenna height of 1.5m using OSGM02

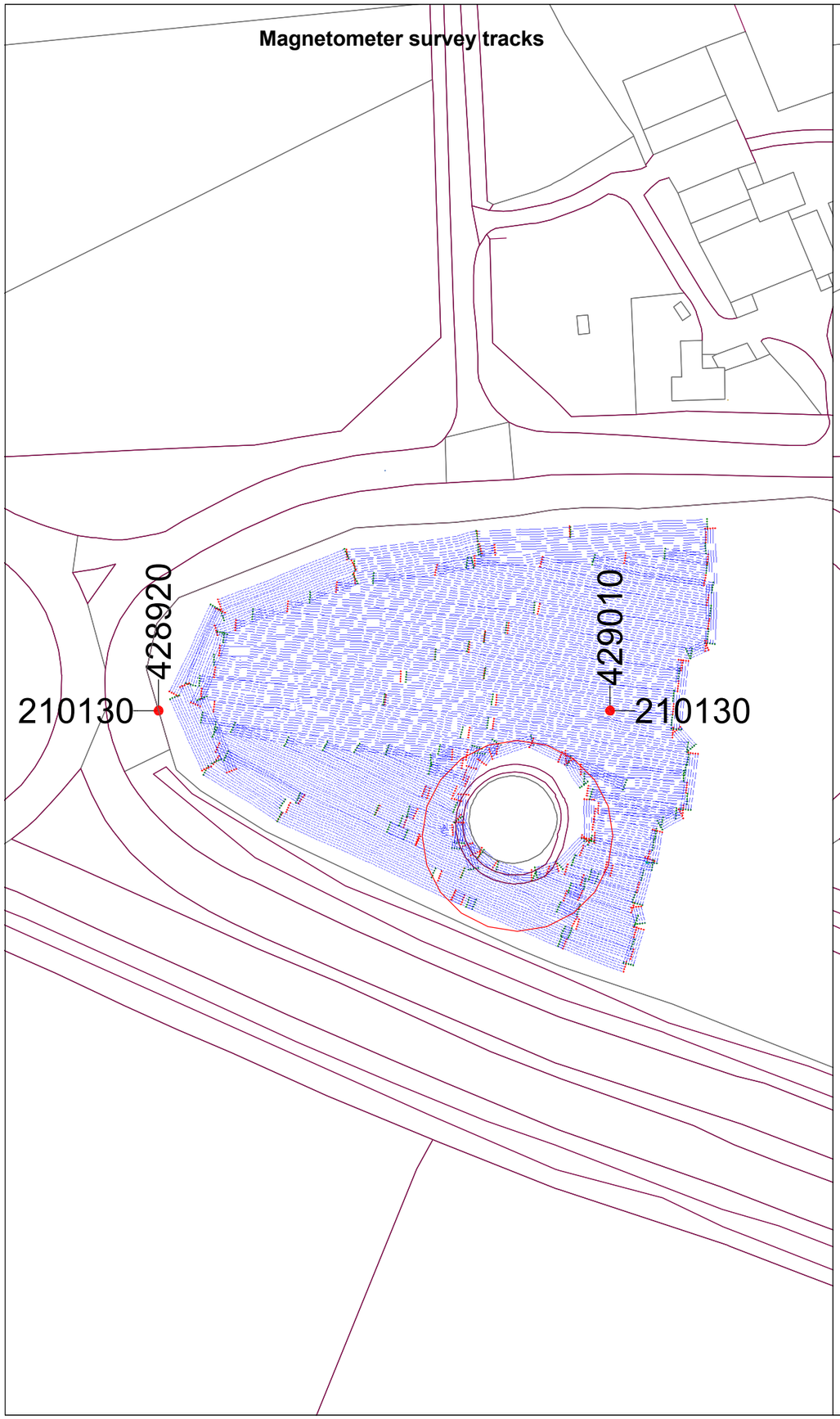
SCALE 1:1000

0m 10 20 30 40 50m

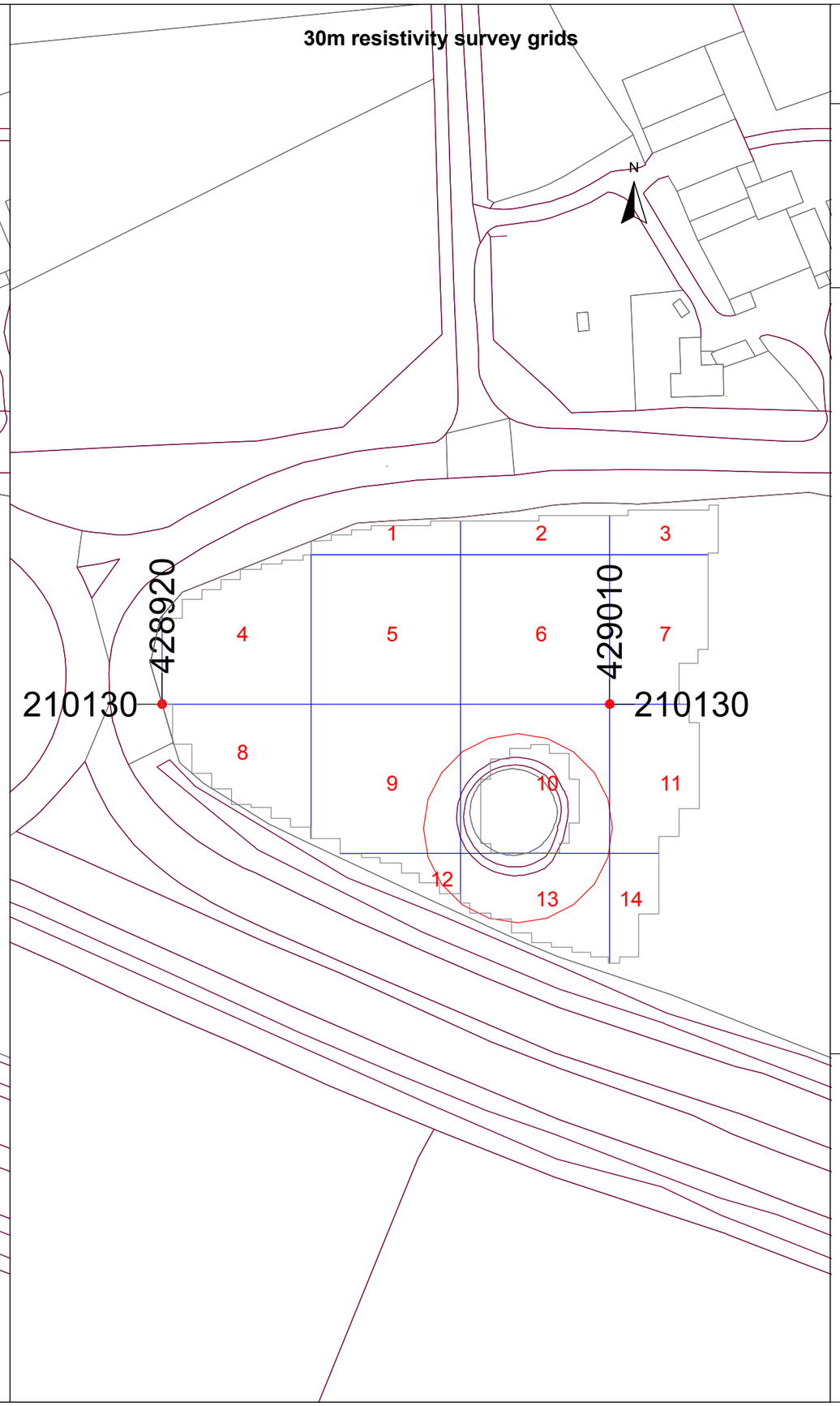
SCALE TRUE AT A3

FIG 06

Magnetometer survey tracks



30m resistivity survey grids



Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Referencing information - Asthall Barrow

Magnetometer data collected at 20Hz and georeferenced to ETRS89/UTM zone 30 N with conversion to OSGB36 using OSTN02

- Survey tracks
- Survey track start
- Survey track stop
- 1 Resistivity grid number
- Scheduled area

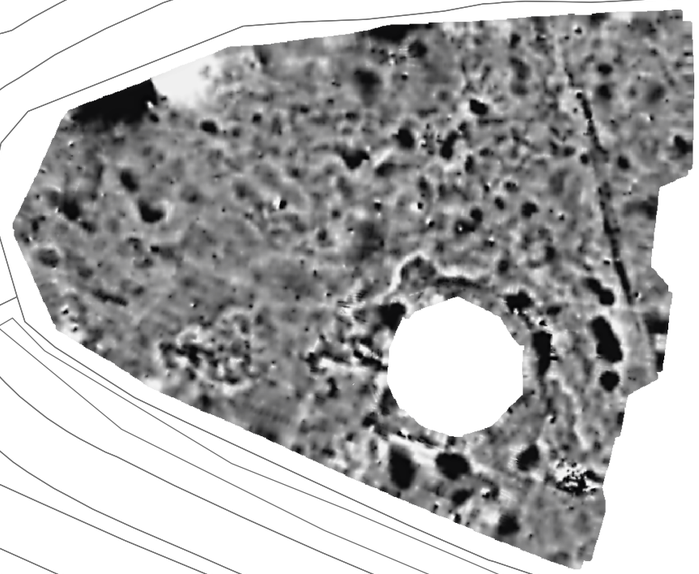
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 07

Greyscale plot of minimally processed magnetometer data



+5nT

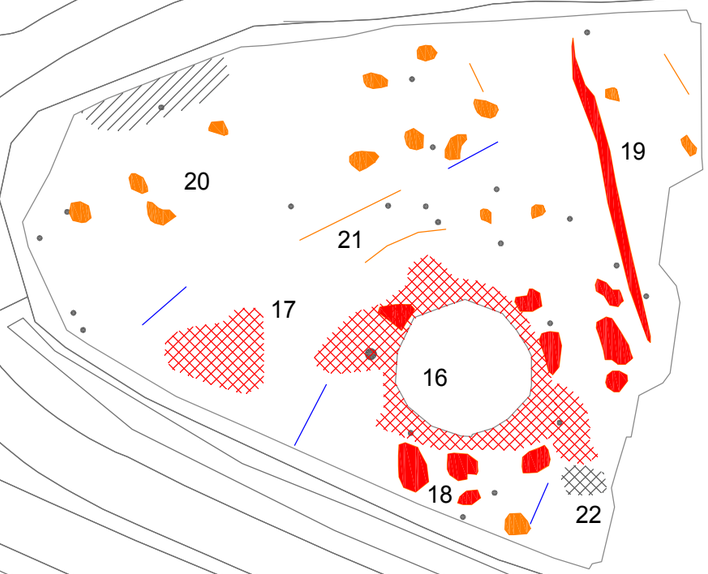
-5nT

+5nT

-5nT

Abstraction and interpretation of magnetometer anomalies

N



Archaeological Surveys Ltd

Geophysical Survey

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Greyscale plot and abstraction and interpretation of magnetic anomalies - Asthall Barrow

- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - cut feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

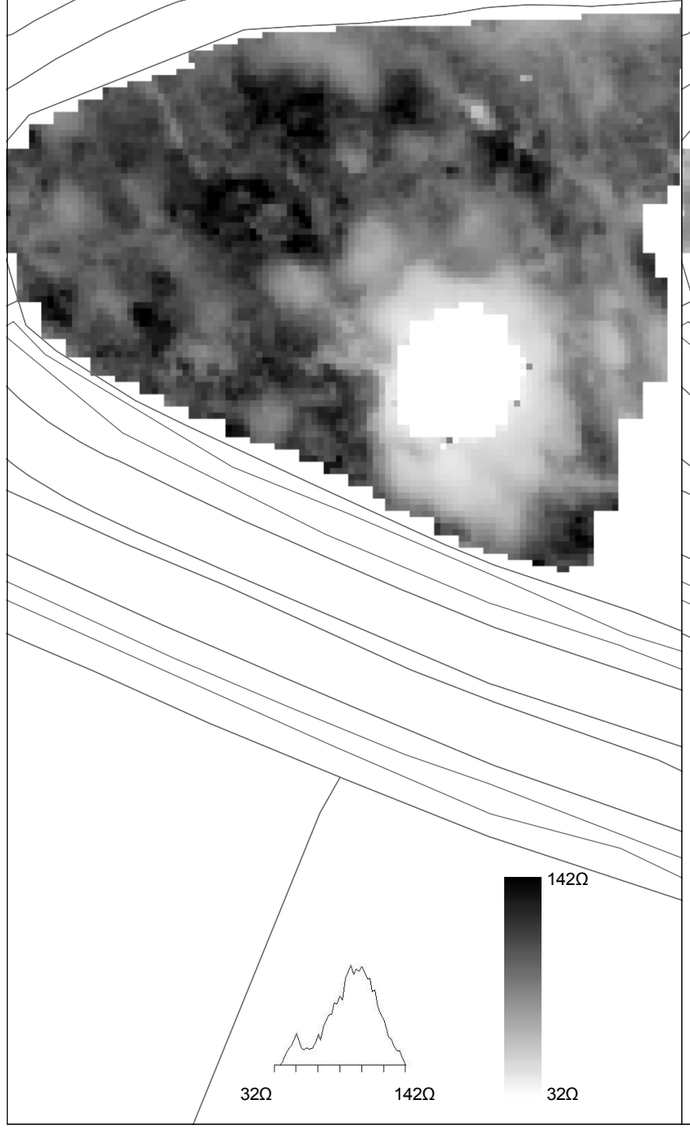
SCALE 1:1000

0m 10 20 30 40 50m

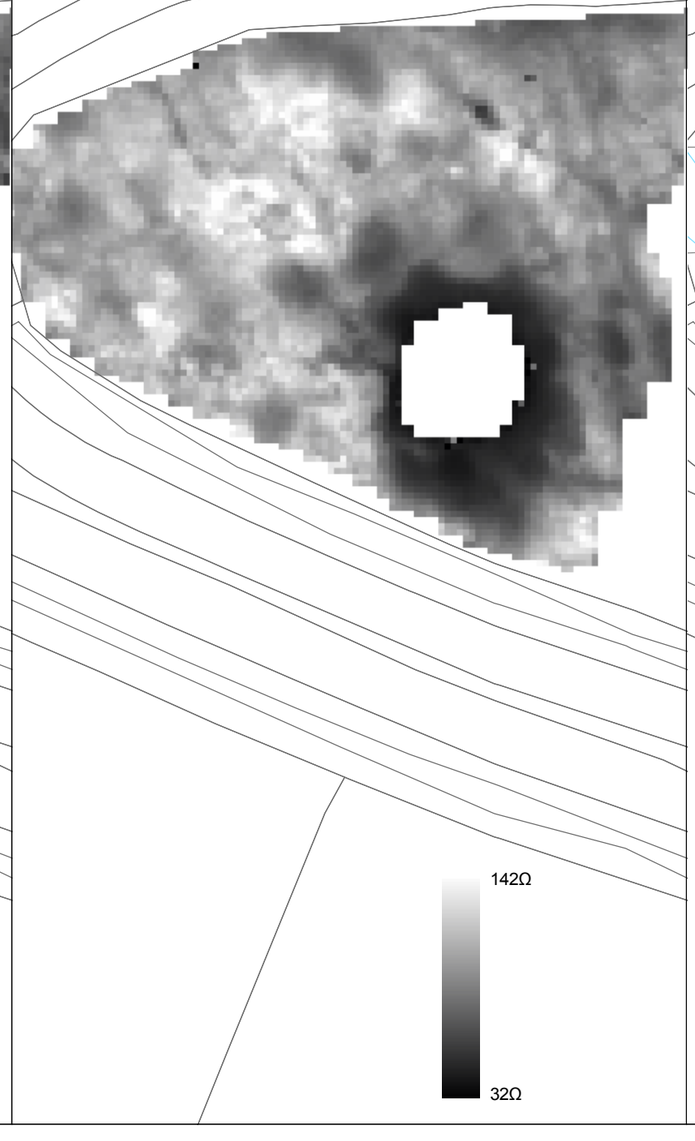
SCALE TRUE AT A3

FIG 08

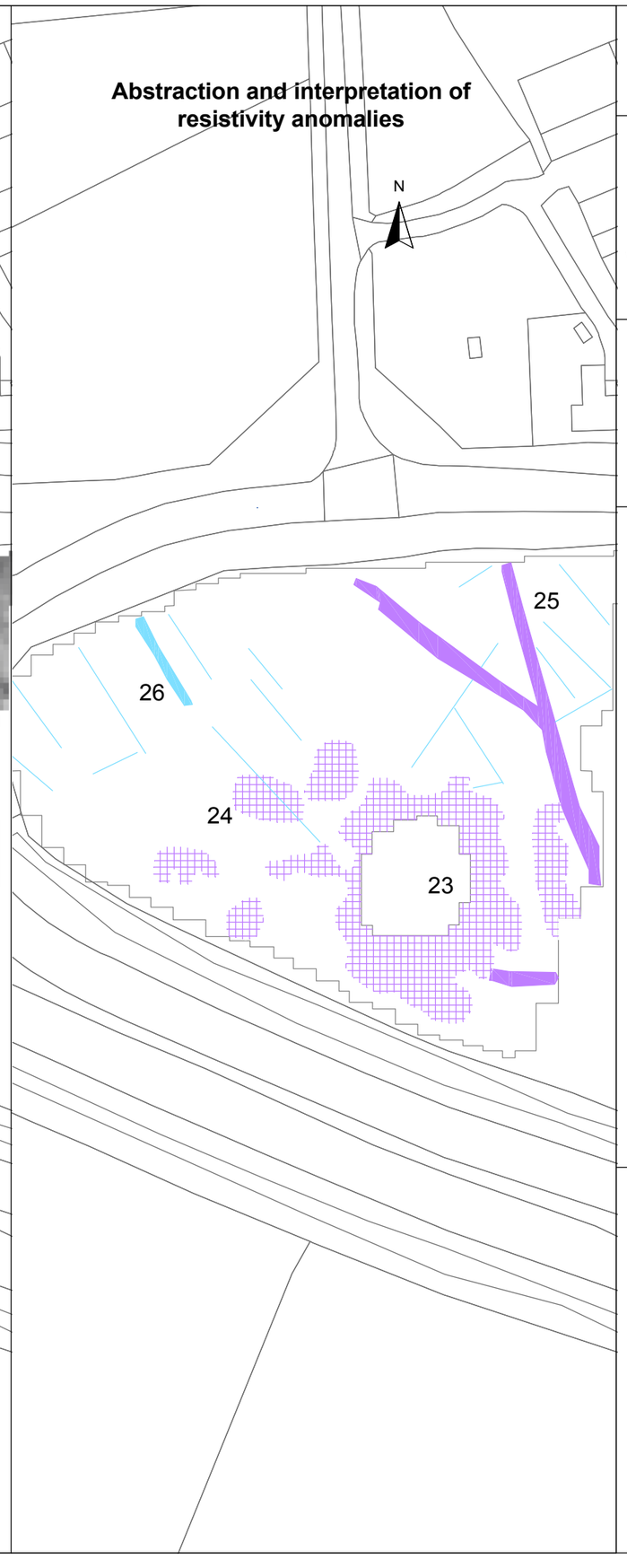
Greyscale plot of minimally processed resistivity data



Greyscale plot of minimally processed resistivity data - reversed pallate



Abstraction and interpretation of resistivity anomalies



Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Greyscale plot and abstraction and interpretation of resistance anomalies - Asthall Barrow

Abstraction and interpretation of resistance anomalies

- Low resistance linear anomaly - cut feature of archaeological potential
- Low resistance linear anomaly - of uncertain origin
- Area of low resistance - pit or quarry of archaeological potential

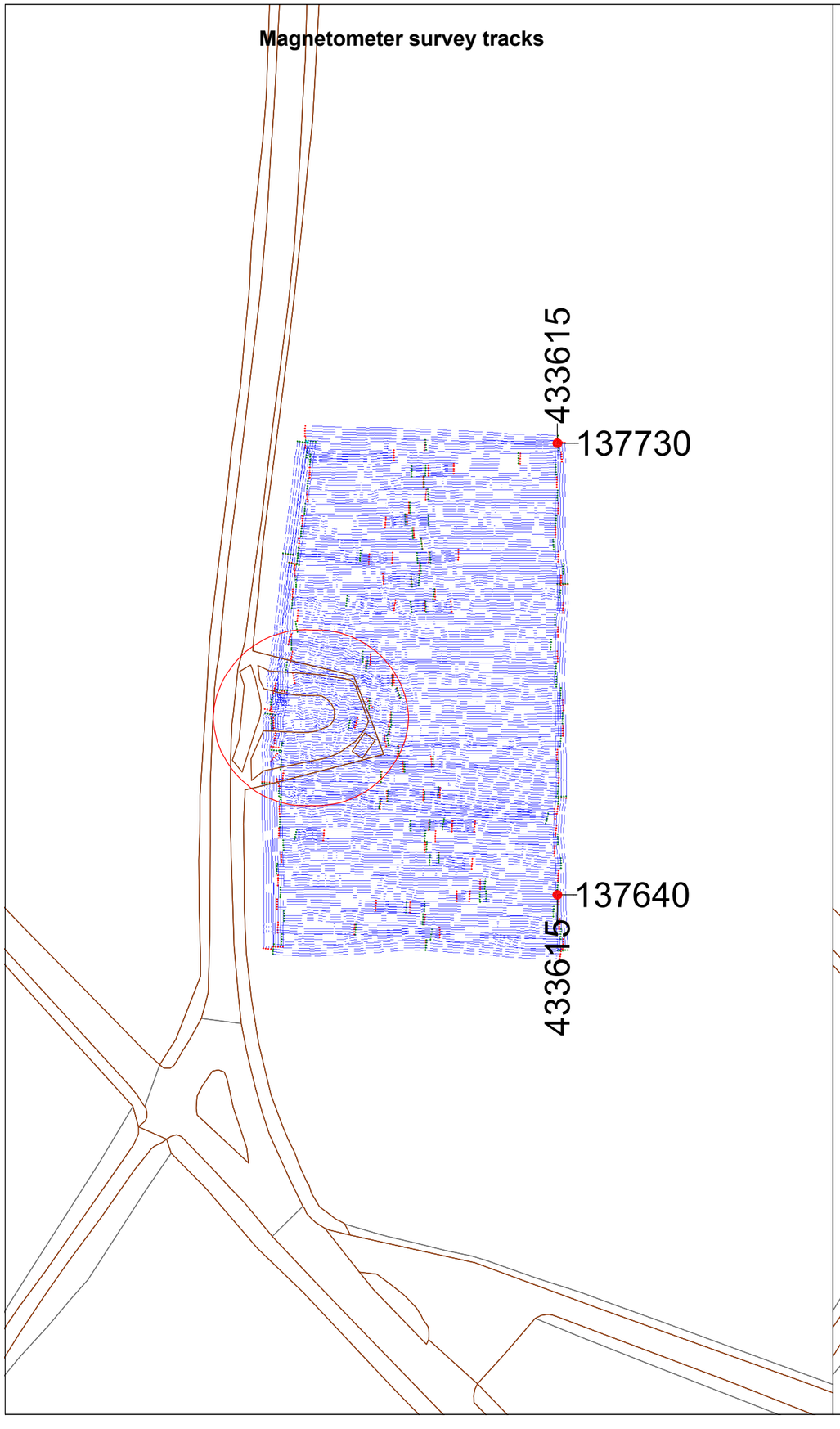
SCALE 1:1000

0m 10 20 30 40 50m

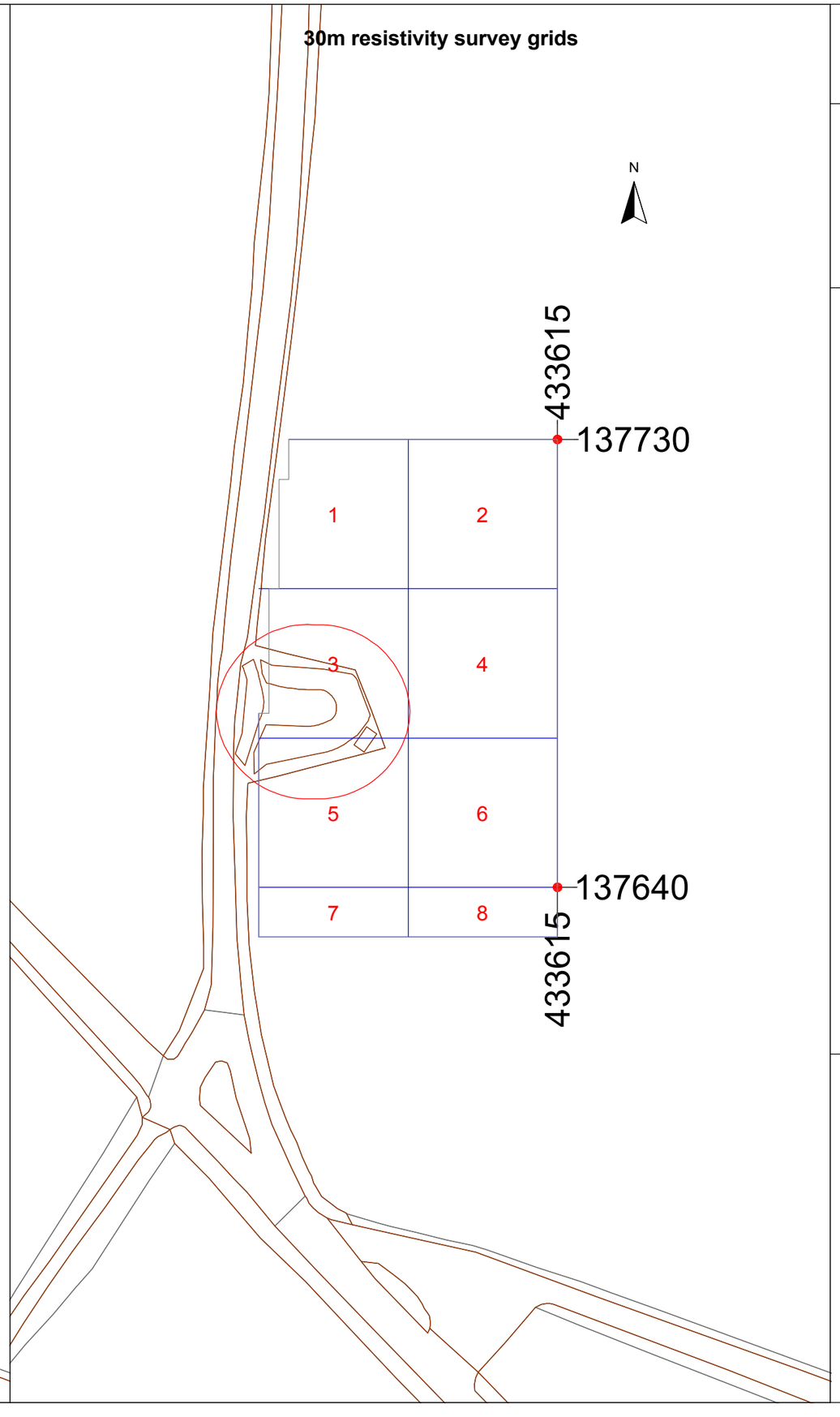
SCALE TRUE AT A3

FIG 09

Magnetometer survey tracks



30m resistivity survey grids



Archaeological Surveys Ltd

Geophysical Survey
Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Referencing information - Waters Down Barrow

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

- Survey tracks
- Survey track start
- Survey track stop
- 1 Resistivity grid number
- Scheduled area

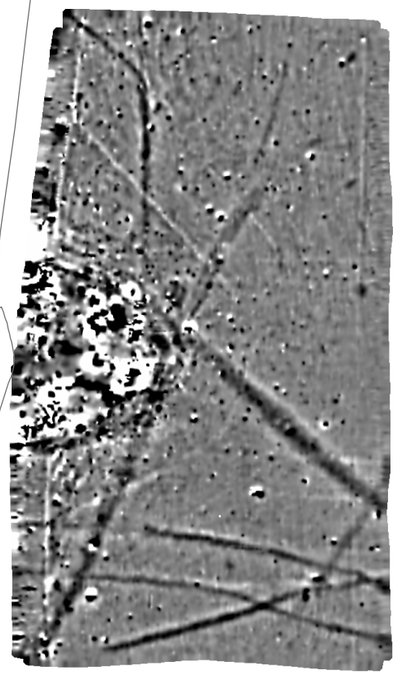
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 10

Greyscale plot of minimally processed magnetometer data



+3nT

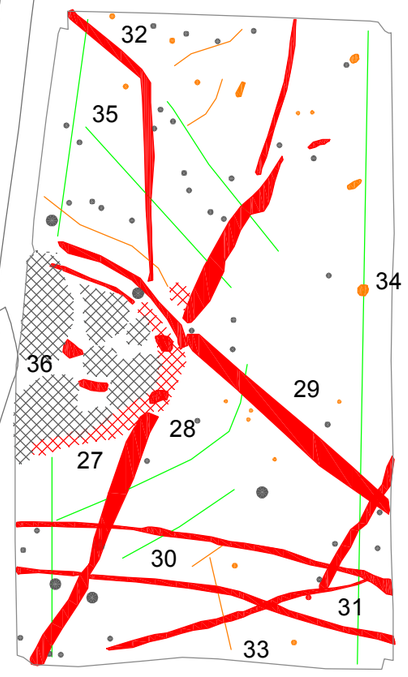
-3nT

+3nT

-3nT

Abstraction and interpretation of magnetometer anomalies

N



Archaeological Surveys Ltd

Geophysical Survey

Blindwell Wood Barrows & Asthall Barrow, Oxfordshire & Waters Down Barrow, Hampshire

Magnetometry greyscale plot and abstraction and interpretation - Waters Down Barrow

- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

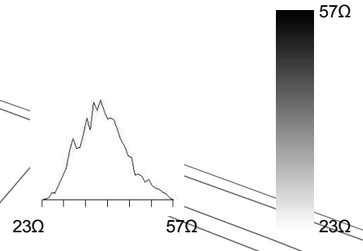
SCALE 1:1000

0m 10 20 30 40 50m

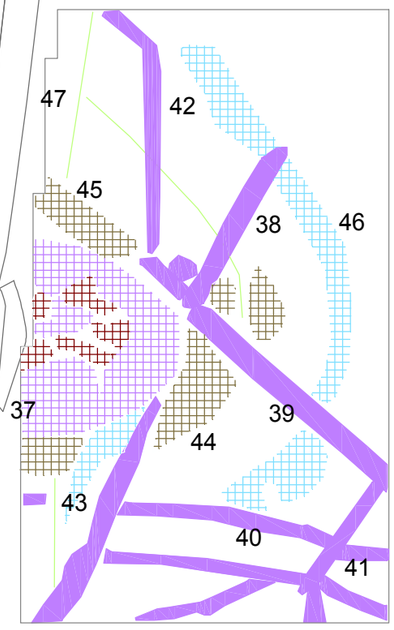
SCALE TRUE AT A3

FIG 11

Greyscale plot of minimally processed resistivity data



Abstraction and interpretation of resistivity anomalies



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Greyscale plot and abstraction and interpretation of resistance anomalies - Waters Down Barrow

Abstraction and interpretation of resistance anomalies

- Linear anomaly - of agricultural origin
- Low resistance linear anomaly - cut feature of archaeological origin
- Discrete low resistance anomaly - cut feature of archaeological origin
- Area of high resistance - associated with barrow mound
- Area of low resistance - associated with barrow mound
- Area of high resistance - of uncertain origin
- Area of low resistance - of uncertain origin

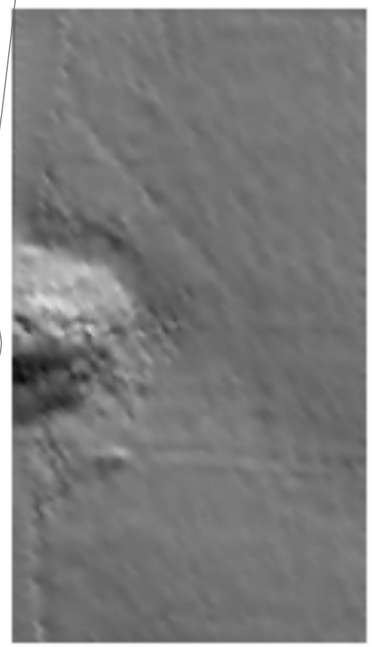
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 12

Shaded relief model derived from height data collected using RTK GPS during magnetometer survey



Contour plot derivied from height data collected using RTK GPS during magnetometer survey

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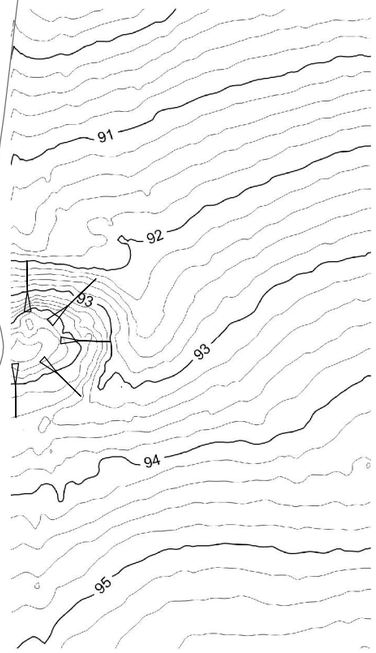

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Shaded relief and contour plots of Waters Down Barrow

Height data converted from WGS84 to ODN plus antenna height of 1.5m using OSGM02

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 13