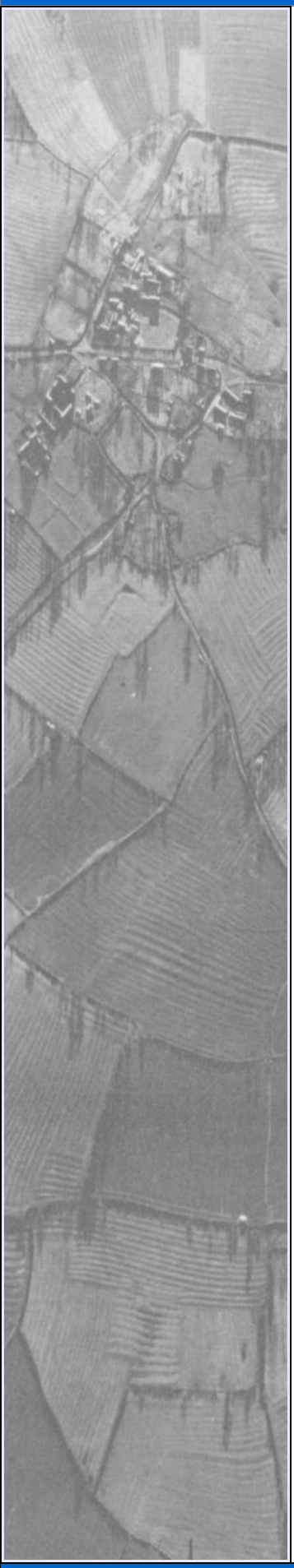

Land off the A49
Hadnall
Shropshire

MAGNETOMETER AND
EARTH RESISTANCE SURVEY REPORT

for

Archaeology Warwickshire

David Sabin and Kerry Donaldson

November 2015

Ref. no. 635

ARCHAEOLOGICAL SURVEYS LTD

Land off the A49
Hadnall
Shropshire

Magnetometer and Earth Resistance Survey

for

Archaeology Warwickshire

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Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey dates – 10th, 13th & 16th November 2015 & 17th February 2016
Ordnance Survey Grid Reference – **SJ 52110 19950**

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SUMMARY

Archaeological Surveys Ltd carried out a geophysical survey on land to the west of the A49 at Hadnall in Shropshire. The site comprises two ungrazed pasture fields and a scheduled medieval moated site and ridge and furrow. The westernmost field has been outlined for a housing development, with the easternmost field kept for public open space and the moated site to be cleared of vegetation. Both magnetometry and earth resistance surveys were carried out within all accessible parts of the site, including the scheduled moated site and ridge and furrow under a Section 42 licence from Historic England. The results of the magnetometer survey show generally very weakly magnetic anomalies the majority of which lack a coherent morphology. A pit-like response within the scheduled area has been located and an archaeological origin should be considered. Within the moated site magnetic responses were not clear due to widespread ferrous contamination. The results of the earth resistance survey show a large number of high resistance linear, rectilinear and curvilinear responses, primarily within the eastern part of the site. Although they are not well defined, an archaeological origin is possible. Within the moated site are a number of high resistance responses with a linear and rectilinear form. Given their location and morphology it is possible that they relate to possible structural remains.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Archaeology Warwickshire, to undertake a magnetometer and earth resistance survey of an area of land at Hadnall in Shropshire. The site has been outlined for a proposed residential development and public open space. An outline planning application has been approved by Shropshire County Council (14/03995 (OUT)) and the survey forms part of an archaeological assessment of the site.

1.1.2 The south eastern corner of the application area contains the Scheduled Monument of a *Moated site and associated ridge and furrow cultivation remains, 145m south of St Mary Magdalene's Church* (National Heritage List for England No: 1019650). The moated site is surrounded by trees, but recent clearance within the interior had taken place so that the survey could be conducted within it. A licence under Section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) was granted by Historic England prior to commencing the fieldwork within the scheduled area. The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2015).

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry and earth resistance

survey (resistivity) to locate geophysical anomalies that may be archaeological in origin, so that they may be assessed prior to development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* 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 site is located to the west of the A49 at Hadnall in Shropshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SJ 52110 19950, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 2.3ha within three parcels of land. Areas 1 and 2 are open fields while Area 3 is surrounded by a moat. The site is generally flat and contained grass cover of variable thickness at the time of survey. Small mounds of cut vegetation were present across some parts of the site and attest the very overgrown conditions cleared to allow the survey to go ahead.

1.3.3 The moated area was extremely overgrown with young trees, briar, nettles etc. and a programme of clearance was undertaken to allow survey to be carried out. The conditions were adequate but the area was somewhat restricted by a band of trees and bushes around the periphery of the moat island. In addition, the site contained modern debris in the form of tyres, corrugated iron, etc.

1.3.4 An exposed pipeline encased in concrete crosses the southern part of Area 1 from west to east and leads to a low brick built structure that contains inspection chambers within the southern part of Area 2. Several other inspection chambers and a shallow, wide depression were noted adjacent to the brick structure. The system appears redundant and may relate to a former drain or sewer. The depression appears to correlate with a pond mapped in the late 19th century.

1.3.5 The ground conditions across the site were generally considered to be favourable for the collection of magnetometer and earth resistance data. However, localised zones of tall and rough vegetation around the perimeter of the survey areas restricted some coverage as did the presence of a partly exposed concrete encased pipe and brick drainage structure. Weather conditions during the survey were mainly fine.

Plate 1: Area 2 looking north

Plate 2: Moat island (Area 3)

1.4 Site history and archaeological potential

1.4.1 The archaeological and historic background has been prepared by Archaeology Warwickshire. All Historic Environment information is outlined within Appendix E.

1.4.2 The village of *Hadenhale* belonged to Godwin prior to the Norman conquest and the name is of Saxon origin (Morriss, 2014). The Church of Saint Mary Magdalene in Hadnall dates to *c.*1190 with later alterations. It was built using ashlared Grinshill stone. Once a chapel of ease, the church now serves as the parish church (Shropshire Historic Environment Record MSA 6987, National Heritage List for England No: 1177680). A watching brief in the churchyard recorded some finds but no features (ESA 5974).

1.4.3 The south eastern corner of the site contains the Scheduled Monument of a *Moated site and associated ridge and furrow cultivation remains, 145m south of St Mary Magdalene's Church* (National Heritage List for England No: 1019650). It has a well preserved rectangular moat, with waterfilled ditches between 3m and 6m wide (HER MSA 163). There are now no visible traces of building foundations within the central 44m x 55m area. Historic sources reference a house in 1327 and further records attest to Thomas Banaster and his family occupying the site for many years from 1429. A large timber-framed house on the moat island fell into disrepair in the 18th century and was demolished. To the north of the moat there is ridge and furrow which is included in the scheduling in order to preserve the relationship. Field observations took place in 1967, 1979 and 1982 by English Heritage (ESA 4306, ESA 4307 and ESA 4308) and in 1977 by Shropshire County Council (ESA 4304) and a further visit in 1981 (ESA 4305). An archaeological evaluation was carried out to the south-west of the moat in 2012 (ESA 6913). It showed that there had been some modern disturbance of the area due to a housing development nearby.

1.4.4 Listed Buildings within the village include the early to mid-17th century Hermitage Farmhouse (MSA 6988 NHLE 1055393) and 16th century Hall Farmhouse MSA 10505, NHLE 1366798). There is also a record of a post-medieval watermill at Hadnall Mill (MSA 17036). Richard Morriss identified that until the early 19th century the main focus of the village was around the cross-roads next to the church (Morriss, 2014).

1.4.5 A number of 19th century and later monuments are recorded on the Shropshire HER: Brick works are noted on Ordnance survey maps from 1891 to the south-east of the site (MSA 3356) in the neighbouring parish of Astley, Shrewsbury and Atcham. Other records include the site of a non-conformist chapel of 19th century date, now demolished (MSA 8615), the 19th century Saracens Head (MSA 6989, NHLE 1055394), a 19th century stable block and coach house (MSA 16144) and the site of a Methodist chapel from 1832, now demolished (MSA 16856).

1.4.6 The 19th century Crewe and Shrewsbury Branch of the London and North Western Railway is located to the west of the site (MSA 12843). An early 20th century building incorporated into the churchyard wall has been interpreted as a charnel house, or possibly a storage building or mortuary (MSA 10504, NHLE 1366797). Several farms are recorded on the HER in the vicinity, 19th century farmstead of Church farm (MSA 29721), C. 1900 Hall Farm (MSA 29722), Hermitage Farm (MSA 29723), Pool Farm (MSA 29724), 8&9 Wood

Road (MSA 29743), Littlewood Farm at 43 & 44 Shrewsbury Road (MSA 29744), Astley lane Farm (MSA 29745) and Sunnyside Farm (MSA 29746).

1.4.7 The presence of the moated site and ridge and furrow indicates that there is the potential for the geophysical survey to locate anomalies associated with these features. There is always potential for the survey to locate geophysical anomalies that relate to previously unrecorded features should they be present within the site.

1.4.8 A number of features likely to be 19th - 20th century date exist within the site and are considered worth noting due to their potential impact on the survival of archaeological remains immediately west of the moated site, adjacent to its western entrance. The features consist of a pipeline, wide depression and brick built structure, see 1.3.4. Several inspection chambers are visible in the vicinity with one close to the edge of the moated site near the entrance. The depression is shown as a pond on late 19th century mapping but has disappeared by the early 20th century. The ground in this area appeared waterlogged and several pieces of modern debris, including plastic piping, indicate relatively modern infill. The features are likely to have disturbed or removed any surviving trackway leading to the western entrance.

Plate 3: Area 2 - brick built drainage structure and infilled pond west of the moated site

1.5 Geology and soils

1.5.1 The underlying solid geology across the site is Triassic sandstone from the Kinnerton Sandstone Formation with overlying deposits of Devensian Diamicton Till (BGS 2015).

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

1.5.3 Magnetometry survey carried out across similar soils has produced variable results, with the potential for low magnetic susceptibility. Earth resistance can be hindered by waterlogged or very dry conditions and also impeded by dense ground cover.

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.

2.2 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 20Hz. The gradiometers have a range of recording data between 0.1nT and 10,000nT. The system is linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged computer.

2.2.2 Magnetic data are collected along a series of parallel survey tracks wherever possible. The length of each track is variable and relates to the size of the survey area and other factors including ground conditions. A visual display aids accurate placing of tracks and their separation. 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).

2.2.3 The earth resistance survey was carried out within Areas 1 & 2 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 in size.

2.2.4 The alpha and beta measurements are represented by changes in the configuration of the current and potential probes achieved by rapid switching with the multiplexer. The alpha and beta measurements are generally the most useful and there is often little difference between the two; however, some directional effects may be apparent.

2.2.5 Within Area 3, the moat island, due to the presence of overlying cut scrub debris, the 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 0.5m intervals along traverses separated by 0.5m. The instrument was set to filter stray earth currents which can cause errors within the resistance measurements.

2.2.6 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. 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. Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display using TerraSurveyor.

2.3.2 The magnetometer data are collected between limits of ±10000nT and clipped for display. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track. A zero median traverse function is required in order to remove fixed offset values present within the sensors which do not undergo a zeroing procedure in the field. The approach ensures that the gradiometer sensors are very accurately aligned and fixed to the vertical magnetic field and are not influenced by localised magnetic fields or disturbed by vibration. 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 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on any processes, such as clipping, carried out on the magnetic data.

2.3.4 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 magnetic data display used in the report is the minimally processed greyscale plot.

2.3.5 Data logged by the resistance meter are downloaded and processed within TerraSurveyor 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 Geoplot 4 for the earth resistance data.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2014 creating DWG (2010) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GPS, resection method, etc.

2.3.7 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.

2.3.8 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.

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

3 RESULTS

3.1 General assessment of survey results - magnetometry

3.1.1 The detailed magnetic survey was carried out over a total of three survey areas covering approximately 2.3ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines.

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

3.2 Statement of data quality - magnetometry

3.2.1 Data are considered representative of the magnetic anomalies present within the site. Zones of magnetic disturbance and debris are widespread and have the potential to obscure weak anomalies.

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 an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE 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 relating to land management AS-ABST MAG DRAIN 	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches) or a multiple dipolar response indicates a ceramic drain. They may relate to buried drains or extant ones
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. 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 AS-ABST MAG DISTURBANCE  AS-ABST MAG SERVICE	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. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

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 the same area as the magnetometry.

3.4.2 Resistive anomalies located can be generally classified as high resistance anomalies of archaeological potential, high and low resistance anomalies of uncertain origin, low resistance areas associated with extant depressions and high resistance anomalies associated with ridge and furrow. Anomalies located within each survey area have been numbered and will be outlined below.

3.5 Statement of data quality - resistivity

3.5.1 Data are considered representative of the resistive anomalies present within the site. Additional noise encountered within Areas 1 and 2 relates to small clumps of dead vegetation on the ground surface and the associated effect this has on surface contact and moisture distribution.

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 HIGH LINEAR ARCHAEOLOGY AS-ABST RES HIGH 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).
Anomalies with an uncertain origin AS-ABST RES HIGH LINEAR UNCERTAIN 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 RIDGE & FURROW	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 land drainage often form distinctive patterns.
Anomalies associated with extant depressions AS-ABST RES LOW DEPRESSION	The anomaly may be a low resistance response to the fill of an extant depression or ditch.

Table 2: List and description of resistivity interpretation categories

3.7 List of anomalies – magnetometry Area 1

Area 1 centred on OS NGR 352060 319955, see Figs 03 & 04.

Anomalies with an uncertain origin

(1) - The survey area contains a small number of short, weakly positive, linear responses. They do not have a coherent morphology or pattern and they cannot be confidently interpreted as cut features.

(2) - A negative linear anomaly appears to extend westwards in the northern part of Area 1. A similar response can be seen to the east in Area 2 (12) and an association is possible.

Anomalies associated with land management

(3) - A number of positive and dipolar linear responses relate to extant gullies and drainage ditches within the southern parts of Areas 1 and 2.

Anomalies associated with magnetic debris

(4) - Magnetic debris can be seen in patches within the survey area. It is likely to relate to dumped material used for ground make up.

(5) - Strong, discrete, dipolar anomalies can be seen within all of the survey areas and relate to ferrous and other magnetically thermoremnant objects within the topsoil.

Anomalies with a modern origin

(6) - Two services can be seen extending parallel to the eastern and northern field boundaries.

3.8 List of anomalies – magnetometry Area 2

Area 2 centred on OS NGR 352145 319945, see Figs 03 & 04.

Anomalies with an uncertain origin

(7) - A very weakly positive linear anomaly is located within the centre of the site. Although it is within the area of an extant ridge and an association seems likely, the shape of the response is slightly curving, different to the ridge and furrow, which is oriented almost north south.

(8) - A discrete positive response lies to the east of anomaly (7) within an extant furrow. It has a response of up to 10nT and a diameter of 3.2m which may indicate that it relates to a pit or burnt material.

(9) - A weakly positive linear anomaly may be associated with the ridge and furrow, although it does appear to have a slightly different orientation.

(10) - The survey area contains a number of weakly positive linear anomalies. Although several of these are grouped together, it is not possible to determine if they relate to cut features.

(11) - A possible negative rectilinear anomaly is located close to the western edge of the survey area. The southern part of this appears to relate to high resistance linear anomaly (22) which extends further to the east, and also a linear bank that appears to define the ridge and furrow within this part of the field.

Anomalies associated with magnetic debris

(12) - A linear zone of magnetic debris may relate to ground consolidation along the line of a footpath.

(13) - Widespread magnetic debris is located within the area of the extant drains and depressions in the southern part of the survey area.

3.9 List of anomalies – magnetometry Area 3

Area centred on OS NGR 352163 319887, see Figs 03 & 04.

Anomalies with an uncertain origin

(14) - The survey area contains a number of discrete positive responses and short positive linear anomalies. However, due to the widespread and very highly magnetic debris (15) within the moated site interior, it is not possible to determine the age or origin of these anomalies.

Anomalies associated with magnetic debris

(15) - The majority of the moated site interior contains widespread magnetic debris, strong dipolar anomalies and magnetic disturbance from ferrous objects.

3.10 List of anomalies – resistivity Area 1

Area centred on OS NGR 352060 319955, see Figs 06 - 08.

Anomalies of uncertain origin

(16) - A high resistance zone can be seen within the central part of the survey area and just extending into Area 2 to the east with a response of generally 20Ω. It does not appear to have any surface expression and it is not possible to determine if it relates to the underlying geology or if it has an anthropogenic origin.

(17) - Broad linear bands of high resistance responses can be seen extending within anomaly (16) and to the north of it. The response is generally over 20Ω and their origin is uncertain.

(18) - In the northern part of the survey area is a high resistance linear and a low resistance linear anomaly. There origin cannot be determined.

Anomalies associated with extant depressions

(19) - An L shaped low resistance anomaly is associated with extant linear drains.

3.11 List of anomalies – resistivity Area 2

Area centred on OS NGR 352145 319945, see Figs 06 - 08.

Anomalies of uncertain origin

(20) - A high resistance band extends along the edge of the series of ridge and furrow, and it may be associated with positive linear anomaly (7) seen within the magnetic data.

(21) - The survey area contains a number of high resistance linear and curvilinear responses. They lack a coherent morphology and appear fragmented; however, an archaeological origin should be considered.

(22) - A high resistance linear anomaly, with an adjacent low resistance linear anomaly to the north, extends across much of the survey area. The western part of the high resistance linear corresponds to negative linear anomaly (11) and also to a linear bank within the field. The response, however, appears to extend eastwards across the ridge and furrow to the east.

Anomalies with an agricultural origin

(23) - A number of broad bands of high resistance can be seen in the north western part of the survey area. They correspond to the ridges of a series of ridge and furrow in this part of the field.

Anomalies associated with extant depressions

(24) - A low resistance anomaly is associated with a depression within the field. A former pond is recorded on Ordnance Survey mapping in 1881.

3.12 List of anomalies – resistivity Area 3 moated site

Area centred on OS NGR 352163 319887, see Figs 06 - 08.

Anomalies of archaeological potential

(25) - A number of high resistance responses have been located within the interior of the moated site. The most well defined area in the north western part of the site, with linear, rectilinear and possible curvilinear elements recorded. One high resistance linear appears to extend from the western entrance towards the centre of the area. As these responses lie within the scheduled site, they have a high archaeological potential and may relate to features such as a causeway leading to the western entrance and former structural remains.

Anomalies of uncertain origin

(26) - In the southern part of the survey area are amorphous zones of relatively high resistance, with others seen to the north. Due to the widespread tree cover within the site it is not possible to determine if these relate to tree roots or archaeological features.

(27) - An amorphous zone of low resistance is located in the centre of the survey area. This part of the site was much wetter that the rest of the interior, although there was no apparent depression. The origin of the response is uncertain.

4 CONCLUSION

4.1.1 The results of the geophysical survey reveal a number of anomalies across the site. To the north of the moated site is a weakly positive linear anomaly. It may be associated with the scheduled ridge and furrow, although it has a slightly curvilinear form and so may relate to a ditch-like feature with an uncertain origin. To the east of this is a pit-like feature, which appears to be situated within a furrow; however, an archaeological origin should be considered. Within the moated site there are a number of positive responses, but the widespread magnetic debris and disturbance prevent confident interpretation.

4.1.2 The earth resistance results show that there are a number of high resistance linear and possible rectilinear or curvilinear features mainly within the eastern part of the site. They lack a coherent morphology, but an archaeological origin should be considered. In the western part of the site there is a zone of high resistance that does not appear to relate to any topographic feature, and it is not possible to determine if it is natural or anthropogenic in origin. Within the moated site are a number of high resistance linear and possible rectilinear and curvilinear responses. Their morphology may suggest that these have a high archaeological potential although the effects of variable tree and scrub cover should be considered even though they had been removed prior to the survey. Further high resistance and low resistance anomalies have been located within the moated site, but it is not possible to determine their origin.

5 REFERENCES

Archaeological Surveys, 2015. *Land off the A49, Hadnall, Shropshire, Geophysical Survey Written Scheme of Investigation.* Unpublished typescript document.

Aspinall, A., Gaffney, C. and Schmidt, A., 2009. *Magnetometry for Archaeologists*. Lanham (US), AltaMira Press.

British Geological Survey, 2015. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed 16/10/2015.].

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for archaeological geophysical survey*. IfA, University of Reading.

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.* 2nd ed. Swindon: English Heritage.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IfA Paper No. 6. IfA, University of Reading.

Morriss, R. K., 2014. *Land off Shrewsbury Road, Hadnall, Shropshire; A Heritage Impact Statement.* Mercian Heritage Series No 742.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 3 Midland and Western England*

Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±15nT and ±10nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

High Pass Filtering

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

Appendix C – survey and data information

Area 1 & 2 processed magnetometer data

COMPOSITE
Path: C:\Business\Jobs\J635 Hadnall\Data\Mag\comps\
Filename: J635-mag-proc.xcp
Description: Imported as Composite from: J635-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 352020.539528646, 320058.015506807 m
Southeast corner: 352212.389528646, 319849.065506807 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 669500
Dimensions
Composite Size (readings): 1279 x 1393
Survey Size (meters): 192 m x 209 m
Grid Size: 192 m x 209 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.64
Mean: 0.01
Median: 0.01
Composite Area: 4.0087 ha
Surveyed Area: 2.0927 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Processes: 1
1 Base Layer

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

Area 3 processed magnetometer data

COMPOSITE
Filename: J635-mag-moat-proc.xcp
Description: Imported as Composite from: J635-mag-Area3.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 352144.555852019, 319909.157641957 m
Southeast corner: 352181.755852019, 319865.957641957 m
Comments: Source Timestamp: 16/11/2015 20:54:58
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 44700
Dimensions
Composite Size (readings): 248 x 288
Survey Size (meters): 37.2 m x 43.2 m
Grid Size: 37.2 m x 43.2 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 11.05
Min: -11.00
Std Dev: 5.18
Mean: 0.05
Median: -0.11
Composite Area: 0.1607 ha
Surveyed Area: 0.099252 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 -10.00 to 10.00 nT

Area 1 raw resistance data

COMPOSITE
Filename: J635-res-Area1-raw.xcp
Description: Imported as Composite from GeoPlot : test
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 13/11/2015 22:25:24
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 960 x 60
Survey Size (meters): 240 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 38.97
Min: -13.02
Std Dev: 7.38
Mean: 12.82
Median: 13.75
Composite Area: 1.44 ha
Surveyed Area: 0.8645 ha
Processes: 3
1 Base Layer
2 Search & Replace From: -100 To: 100 With: Dummy (Area: Top 0, Left 0, Bottom 29, Right 119)
3 Clip at 3.00 SD

Area 1 raw resistance data - beta

COMPOSITE
Filename: J635-res-beta-Area1-raw.xcp
Description: Imported as Composite from GeoPlot : J635-res-beta-Area1
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 18/11/2015 08:14:11
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 960 x 60
Survey Size (meters): 240 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 34.44
Min: -9.36
Std Dev: 7.09
Mean: 12.52
Median: 13.25
Composite Area: 1.44 ha
Surveyed Area: 0.8645 ha
Processes: 3
1 Base Layer
2 Search & Replace From: -100 To: 100 With: Dummy (Area: Top 0, Left 0, Bottom 29, Right 119)
3 Clip at 3.00 SD

Area 1 processed resistance data - alpha

COMPOSITE
Filename: J635-res-Area1-proc.xcp
Description: Imported as Composite from GeoPlot : test
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 13/11/2015 22:25:24

Collection Method: zig zag
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 960 x 60
Survey Size (meters): 240 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 26.00
Min: 0.00
Std Dev: 6.36
Mean: 12.45
Median: 13.93
Composite Area: 1.44 ha
Surveyed Area: 0.8645 ha
Processes: 4
1 Base Layer
2 Search & Replace From: -100 To: 100 With: Dummy (Area: Top 0, Left 0, Bottom 29, Right 119)
3 Despike Threshold: 1 Window size: 3x3
4 Clip from 0.00 to 26.00 ohm

Area 1 processed resistance - beta

COMPOSITE
Filename: J635-res-beta-Area1-proc.xcp
Description: Imported as Composite from GeoPlot : J635-res-beta-Area1
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 18/11/2015 08:14:11
Collection Method: zig zag
Dummy Value: 2047.5
Dimensions

Composite Size (readings): 960 x 60
Survey Size (meters): 240 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 26.00
Min: 0.00
Std Dev: 6.31
Mean: 12.43
Median: 13.50
Composite Area: 1.44 ha
Surveyed Area: 0.8645 ha
Processes: 4
1 Base Layer
2 Search & Replace From: -100 To: 100 With: Dummy (Area: Top 0, Left 0, Bottom 29, Right 119)
3 Despike Threshold: 1 Window size: 3x3
4 Clip from 0.00 to 26.00 ohm

Area 2 raw resistance data - alpha

COMPOSITE
Filename: J635-res-Area2-raw.xcp
Description: Imported as Composite from GeoPlot : J635-res-Area2
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 16/11/2015 20:54:58
Collection Method: zig zag
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 720 x 120
Survey Size (meters): 180 m x 120 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 32.20
Min: -11.16
Std Dev: 4.70
Mean: 10.50
Median: 10.60
Composite Area: 2.16 ha
Surveyed Area: 1.0818 ha
Processes: 2
1 Base Layer
2 Clip at 3.00 SD

Area 2 raw resistance data - beta

COMPOSITE
Filename: J635-res-beta-Area2-raw.xcp
Description: Imported as Composite from GeoPlot : J635-res-beta-Area2
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 16/11/2015 21:36:44
Collection Method: zig zag
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 720 x 120
Survey Size (meters): 180 m x 120 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 36.59
Min: -12.91
Std Dev: 5.73
Mean: 11.87
Median: 11.90
Composite Area: 2.16 ha
Surveyed Area: 1.0818 ha
Processes: 2
1 Base Layer
2 Clip at 3.00 SD

Area 2 processed resistance data - alpha

COMPOSITE
Filename: J635-res-Area2-proc.xcp
Description: Imported as Composite from GeoPlot : J635-res-Area2
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 16/11/2015 20:54:58
Collection Method: zig zag
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 720 x 120
Survey Size (meters): 180 m x 120 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 20.00
Min: 0.00
Std Dev: 3.64
Mean: 10.45
Median: 10.70
Composite Area: 2.16 ha
Surveyed Area: 1.0818 ha
Processes: 4
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Clip from 0.00 to 26.00 ohm
4 Clip from 0.00 to 20.00 ohm

Area 2 processed resistance - beta

COMPOSITE
Path: C:\Business\Jobs\J635 Hadnall\Data\Res\comps\
Filename: J635-res-beta-Area2-proc.xcp
Description: Imported as Composite from GeoPlot : J635-res-beta-Area2
Instrument Type: Resist. (RM85Wheel25M)
Units: ohm
Comments: Source Timestamp: 16/11/2015 21:36:44
Collection Method: zig zag
Dummy Value: 2047.5
Dimensions
Composite Size (readings): 720 x 120
Survey Size (meters): 180 m x 120 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 26.00
Min: 0.00
Std Dev: 4.25
Mean: 11.82
Median: 12.02
Composite Area: 2.16 ha
Surveyed Area: 1.0818 ha
Processes: 3
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Clip from 0.00 to 26.00 ohm

Area 3 raw resistance data - parallel twin

COMPOSITE
Filename: J635-res-Area3-raw.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Comments: Source Timestamp: 16/11/2015 20:54:58
Collection Method: ZigZag
Dummy Value: 32702
Dimensions
Composite Size (readings): 120 x 120
Survey Size (meters): 60 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m
Stats
Max: 39.89
Min: 5.82
Std Dev: 4.90
Mean: 22.80
Median: 22.25
Composite Area: 0.36 ha
Surveyed Area: 0.1128 ha
Processes: 3
1 Base Layer
2 Search & Replace From: 0 To: 100 With: Dummy (Area: Top 59, Left 0, Bottom 62, Right 2)
3 Clip at 3.00 SD

Area 3 processed resistance data - parallel twin

COMPOSITE
Filename: J635-res-Area3-proc.xcp
Instrument Type: GeoScan (Resistance)
Units: Ohm
Comments: Source Timestamp: 16/11/2015 20:54:58
Collection Method: ZigZag
Dummy Value: 32702
Dimensions
Composite Size (readings): 120 x 120
Survey Size (meters): 60 m x 60 m
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m
Stats
Max: 34.21
Min: 11.50
Std Dev: 4.74
Mean: 22.75
Median: 22.25
Composite Area: 0.36 ha
Surveyed Area: 0.1128 ha
Processes: 3
1 Base Layer
2 Search & Replace From: 0 To: 100 With: Dummy (Area: Top 59, Left 0, Bottom 62, Right 2)
3 Clip at 2.00 SD

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

A PDF copy of the report will be supplied to the Shropshire Historic Environment Record with printed copies available on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS). A printed copy of the report will also be sent to Susan Smith and a PDF to Bill Klemperer of Historic England West Midlands Office and a PDF copy sent to Paul Linford, Historic England Geophysics Team Leader.

Magnetometer data - path: J635 Hadnall\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
hadnall1\MX\ and hadnall3\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	10/11/15	D.J.Sabin
hadnall1\MX\J635-mag-Area1.asc hadnall3\MX\J635-mag-Area3.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	11/11/15	D.J.Sabin
Mag\comps\J635-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	11/11/15	D.J.Sabin
Mag\comps\J635-mag-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	11/11/15	D.J.Sabin
Mag\comps\J635-mag-moat.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	18/02/16	D.J.Sabin
Mag\comps\J635-mag-moat-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±20nT).	18/02/16	D.J.Sabin
Resistance data - path: J635 Hadnall\Data\Res				
\Hadnall\ J6351a-17a.grd and J6351b-17b.grd., .dat., .grs	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 cart for resistivity for Area 1 (alpha and beta)	13/11/15	D.J.Sabin
\Hadnall2\ 1a-18a.xgd and 1b-18b.xgd., .dta., .grs.	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity for Area 2 (alpha and beta)	16/11/15	D.J.Sabin
\grids\ 01-04.grd	TerraSurveyor 3.0.23.0	Produced on download of Geoscan RM85 for resistivity for Area 3 (moat)	15/11/15	D.J.Sabin
\comps\ J635-res-Area1.cmp,. xcp \comps\ J635-res-beta-Area1.cmp,. xcp \comps\ J635-res-Area2.cmp,. xcp	TerraSurveyor 3.0.23.0	Composite data file produced from .xgd resistance survey grids.	1611/15	D.J.Sabin
\comps\ J635-res-Area3.cmp,. xcp	TerraSurveyor 3.0.23.0	Processed composite data file .	18/02/15	D.J.Sabin
Graphic data - path: J635\Hadnall\Data				
Mag\graphics\ J635-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	11/11/15	K.T.Donaldson
Mag\graphics\ J635-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	11/11/15	K.T.Donaldson
Mag\graphics\ J635-mag--moat-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	18/02/16	K.T.Donaldson
Mag\graphics\ J635-mag--moat-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	18/02/16	K.T.Donaldson
Res\graphics\J635-res-Area1-raw.tif	TerraSurveyor 3.0.23.0	TIF file showing a raw greyscale plot clipped at 3SD	17/11/15	K.T.Donaldson
Res\graphics\J635-res-Area1-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a processed greyscale plot	15/11/15	K.T.Donaldson
Res\graphics\J635-res-Area2-raw.tif	TerraSurveyor 3.0.23.0	TIF file showing a raw greyscale plot clipped at 3SD	17/11/15	K.T.Donaldson

Res\graphics\J635-res-Area2-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a processed greyscale plot	16/11/15	K.T.Donaldson
Res\graphics\J635-res-Area3-raw.tif	TerraSurveyor 3.0.23.0	TIF file showing a raw greyscale plot clipped at 3SD	18/02/16	K.T.Donaldson
Res\graphics\J635-res-Area3-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a processed greyscale plot	18/02/16	K.T.Donaldson
CAD data - path: J635\Hadnall\CAD				
J635 version 1.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	06/11/15	K.T.Donaldson
Text data - path: J635\Hadnall\Documentation				
Jxxx report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	30/11/15	K.T.Donaldson

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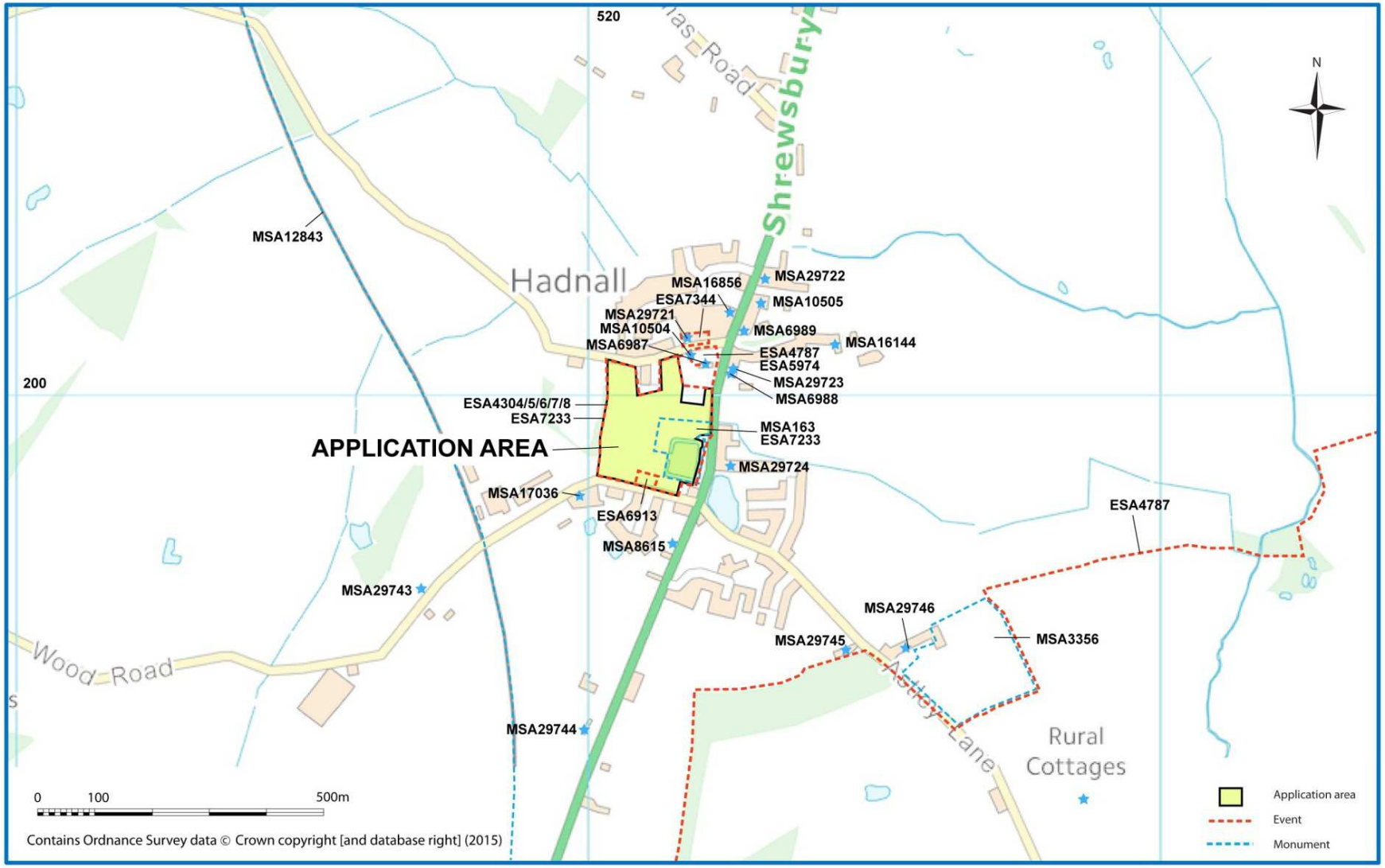
Appendix F – Historic Environment information



Historic England

WEST MIDLANDS OFFICE

Historic England Geophysical Survey Database Questionnaire

Survey Details

Name of Site: MOATED SITE AND ASSOCIATED RIDGE AND FURROW CULTIVATION REMAINS 145M SOUTH OF ST MARY MAGDALENE'S CHURCH

County: Shropshire

NGR Grid Reference (Centre of survey to nearest 100m): SJ 5211 1995

Start Date: 10/11/2015 **End Date:** 17/02/2016

Geology at site (Drift and Solid): Triassic Sandstone and Till

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

Scheduled Monument of a *Moated site and associated ridge and furrow cultivation remains, 145m south of St Mary Magdalene's Church* (National Heritage List for England No: 1019650).

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

Ditch?
Pit?
Structure?

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

Name of Client, if any: Archaeology Warwickshire

THE AXIS 10 HOLLIDAY STREET BIRMINGHAM B1 1TG

Telephone 0121 625 6870
HistoricEngland.org.uk

Purpose of Survey:

To assess the archaeological potential of the site within the moated site and within 2 fields, prior to a housing development in one field, and restoration/conservation of the moated site.

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 and PDF copy on OASIS.

Historic England

WEST MIDLANDS OFFICE

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):
2.2ha

Traverse Separation, if regular: 0.5m
Reading/Sample Interval: 20Hz (displayed at 0.15m)

Type, Make and model of Instrumentation:
Sensys Magneto MXPDA (multiple fluxgate gradiometers)

For Resistivity Survey: Geoscan RM85

Probe configuration: (MSP25 Mobile Sensor Platform) Square array (Areas 1 & 2)
Parallel twin - Area 3 moated site

Probe Spacing: (MSP25 Mobile Sensor Platform) Areas 1 & 2 - 0.75m
Area 3 (parallel twin) - 0.5m

Traverse separation: Areas 1 & 2 - 1m, Area 3 - 0.5m

Reading interval: Areas 1 & 2: 0.25m, Area 3 0.5m

Land use at the time of the survey (Use term/terms from the attached list or specify other): Grassland (Areas 1 & 2), recently cleared scrub (Area 3)

THE AXIS 10 HOLLIDAY STREET BIRMINGHAM B1 1TG

Telephone 0121 625 6870
HistoricEngland.org.uk

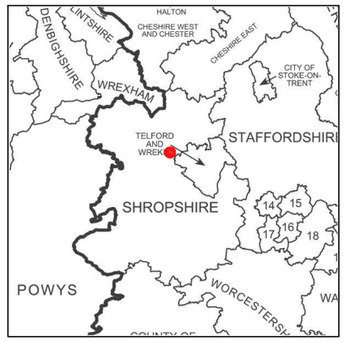
N

Survey location

Archaeological Surveys Ltd

Geophysical Survey
Land off the A49
Hadnall
Shropshire

Map of survey area



Survey location

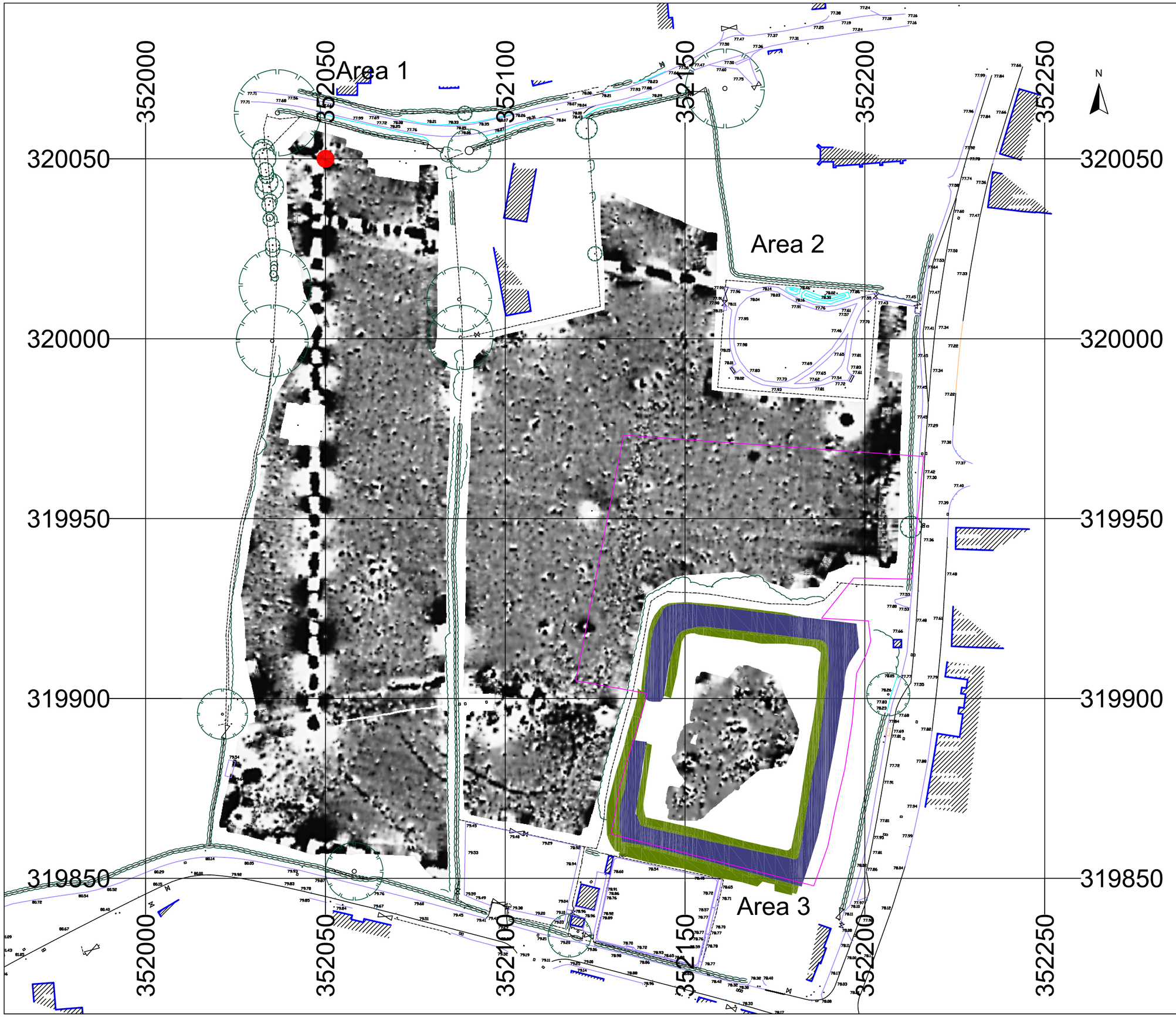
Site centred on OS NGR
SJ 52110 19950

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01



Archaeological Surveys Ltd

Geophysical Survey
Land off the A49
Hadnall
Shropshire

Magnetometry referencing information

Referencing grid to OSGB36 datum at 50m intervals

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

352050 320050

Scheduled area of moated site and associated ridge and furrow

SCALE 1:1000

0m 20 40 60 80 100m

SCALE TRUE AT A3

FIG 02

Area 1

Area 2

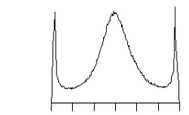
Area 3

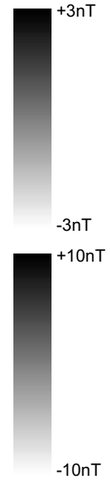
N

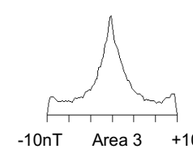
Archaeological Surveys Ltd

Geophysical Survey
Land off the A49
Hadnall
Shropshire

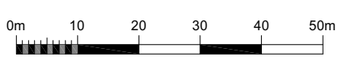
Greyscale plot of minimally processed magnetometer data







SCALE 1:1000



SCALE TRUE AT A3

FIG 03

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Land off the A49
Hadnall
Shropshire

Abstraction and interpretation of magnetometer anomalies

Area 1

Area 2

Area 3

N

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear anomaly - drain
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 04

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Hadnall
Shropshire

Referencing information

Grid coordinates based on Ordnance Survey OSGB36 datum

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

Referencing grid to OSGB36 datum at 50m intervals

Survey grid size = 30m

Survey start and traverse direction

1 Grid reference number and filename

Scheduled area of moated site and associated ridge and furrow

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Area 1

Area 2

Area 3

N

352050,05

320040,27

352122,85

319982,08

352052,77

319860,29

352119,7

319862,06

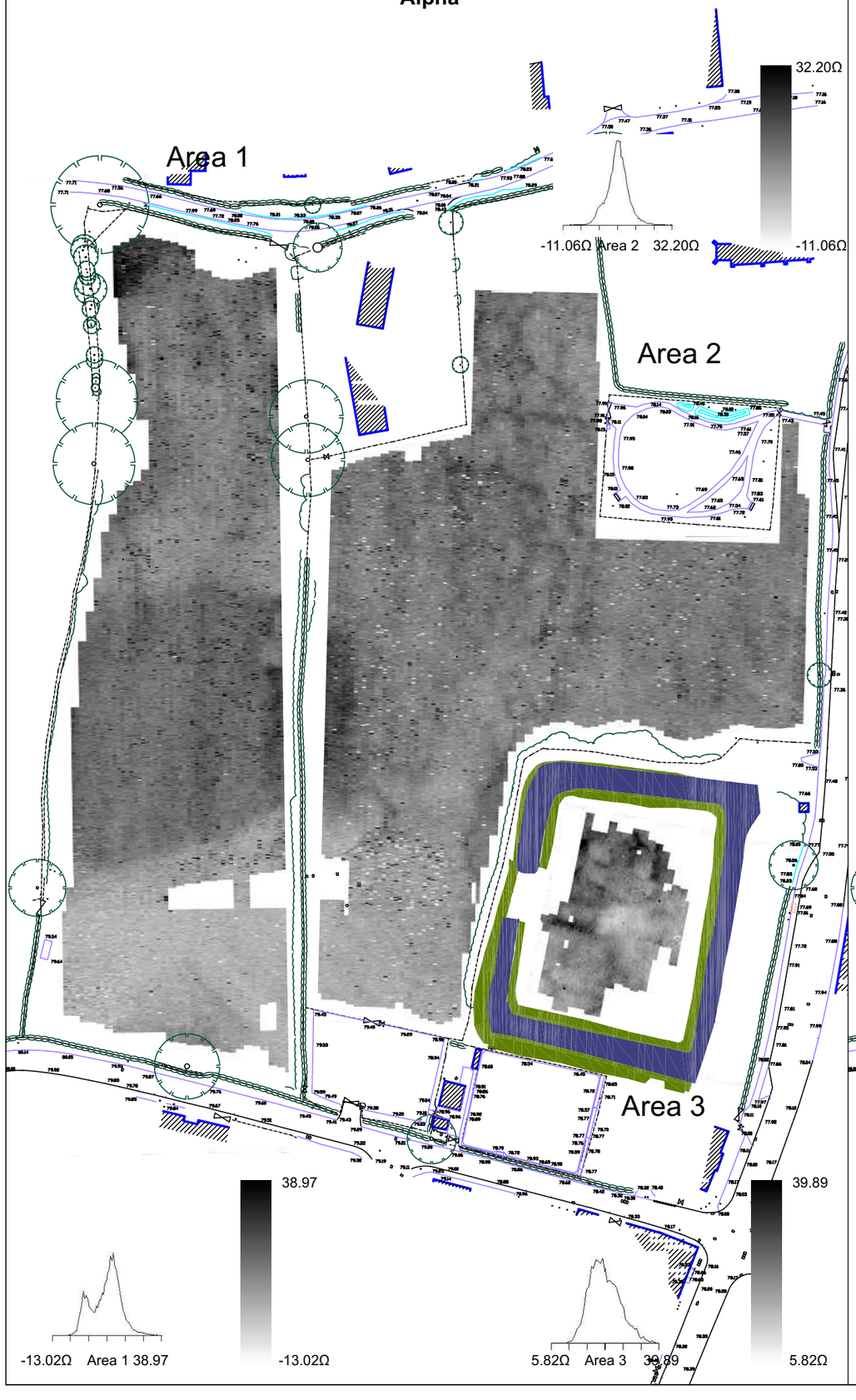
319887,36

352173,68

319831,46

352144,27

Alpha



Beta

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Hadnall
Shropshire

Greyscale plot of raw resistance data

Raw data clipped at 3SD

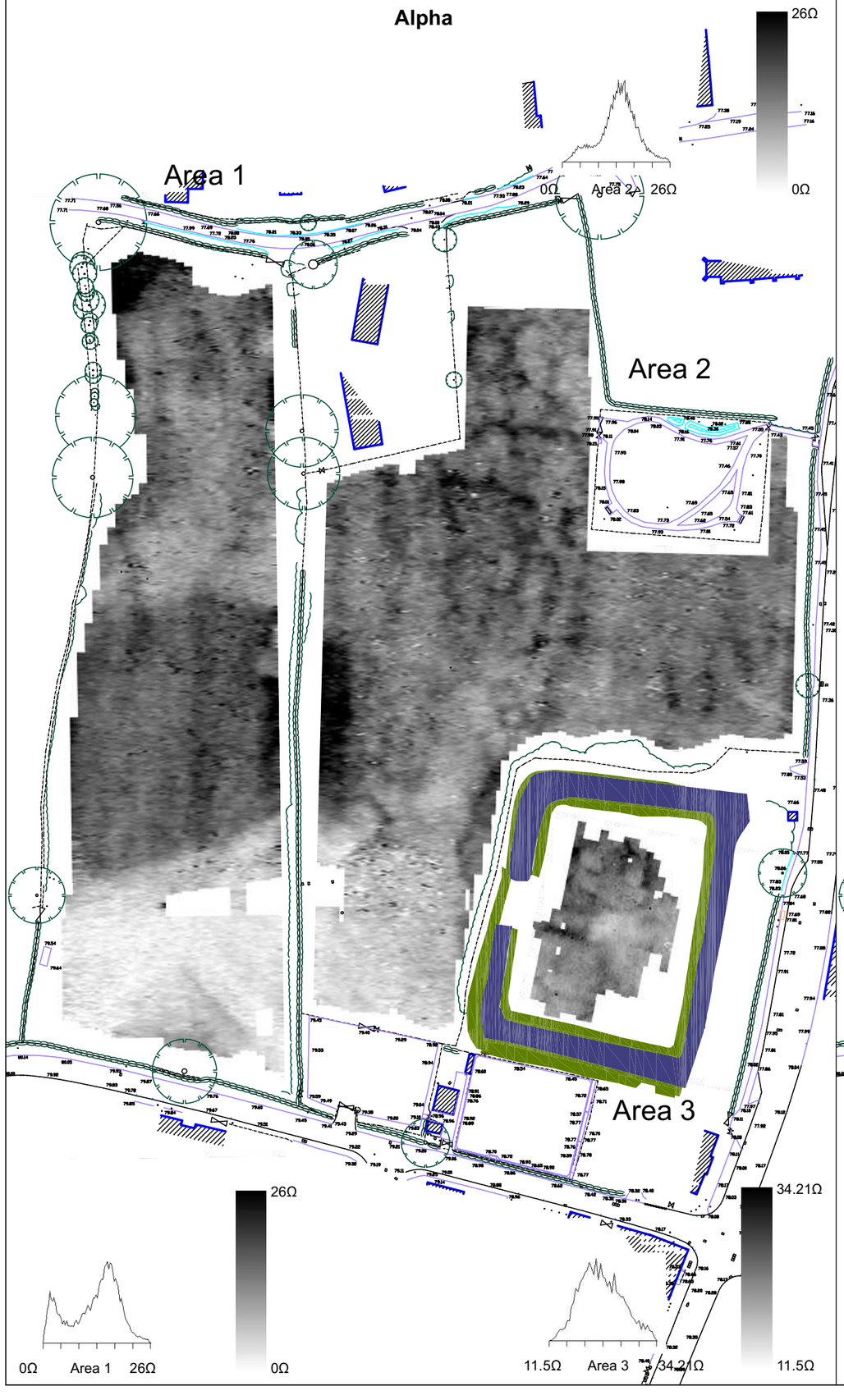
SCALE 1:1250

0m 10 20 30 40 50m

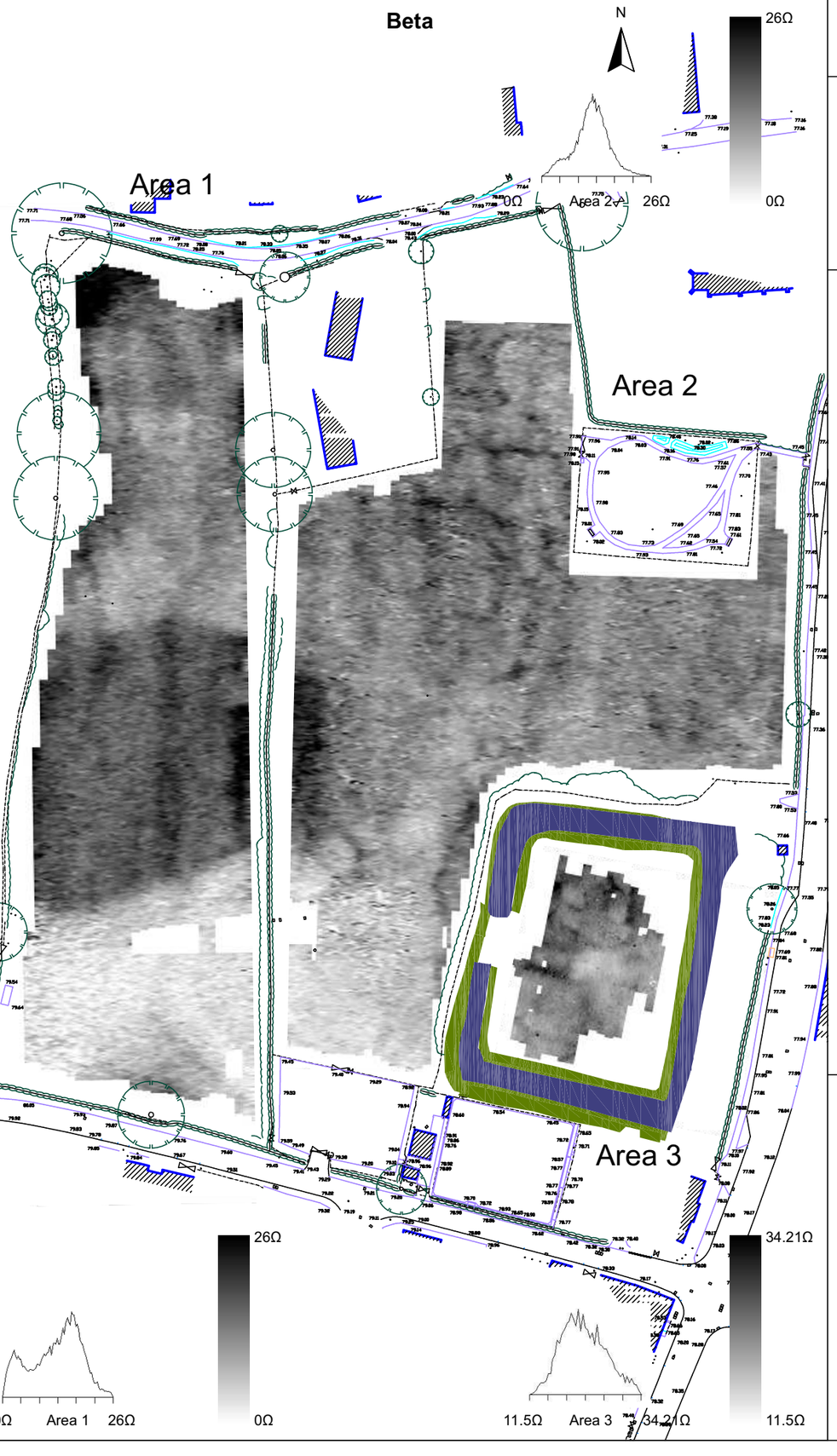
SCALE TRUE AT A3

FIG 05

Alpha



Beta



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Greyscale plot of processed resistance data

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 07

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Hadnall
Shropshire

Abstraction and interpretation of resistance anomalies

- High resistance linear anomaly - of archaeological potential
- High resistance linear anomaly - of uncertain origin
- Low resistance linear anomaly - of uncertain origin
- High resistance linear anomaly - ridge and furrow (ridge)
- Area of high resistance - of archaeological potential
- Area of high resistance - of uncertain origin
- Area of low resistance - of uncertain origin
- Area of low resistance - extant ditch/depression

Area 1

Area 2

Area 3

16

17

18

19

20

21

22

23

24

25

26

27

N

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 08