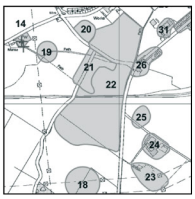
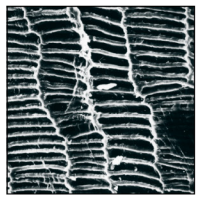
THMW19










TOTTENHAM HOUSE, MARLBOROUGH, WILTSHIRE

GEOPHYSICAL SURVEY

commissioned by BSA Heritage

August 2019

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

TOTTENHAM HOUSE, MARLBOROUGH, WILTSHIRE

GEOPHYSICAL SURVEY

commissioned by BSA Heritage

August 2019

This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **THMW19** / NGR **SU 2469 6362** / Parish **Great Bedwyn** / Local Authority **Wiltshire** / OASIS Ref. **headland5-363519**

PROJECT TEAM:

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Approved by **David Harrison** D Harrison.....

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HEADLAND ARCHAEOLOGY

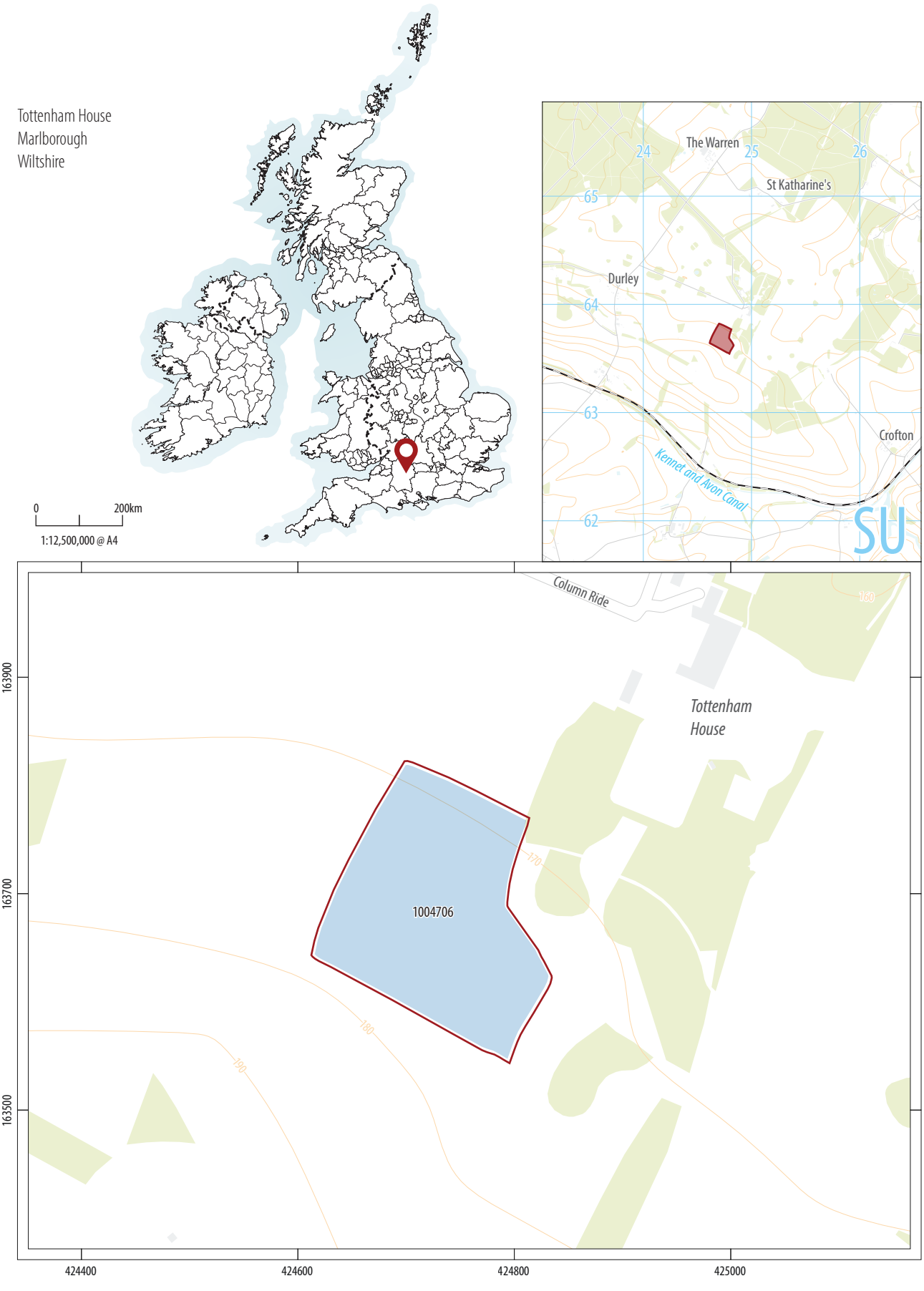
REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical survey (magnetometer and earth resistance) of a Roman pottery production site (Scheduled Monument LE 1004706) within the estate grounds of Tottenham House, Wiltshire. The survey has identified several distinct clusters of high magnitude anomalies which are suggestive of industrial activity, including nine extremely high magnitude anomalies which are interpreted as possible kilns. No anomalies of clear archaeological potential have been identified to confirm the presence of a Roman building/tessellated floor which is recorded in the north of the Scheduled area on the Wiltshire Historic Environment Record, although linear and rectilinear anomalies have been identified extending beyond the northern limit of the survey which may be archaeological in origin. Low magnitude parallel linear anomalies have been identified corresponding to broad bands of low resistance, accurately locating the surface of two post-medieval formal parkland drives which pass through the Monument.

CONTENTS

LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

TOTTENHAM HOUSE, MARLBOROUGH, WILTSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by BSA Heritage (The Client), to undertake a geophysical survey (magnetometer and earth resistance) of a Roman pottery production site at Tottenham House, Wiltshire. The survey forms part of a larger programme of archaeological investigation associated with Planning Permission (Ref. 17/12461/OUT) for the restoration of Tottenham House and its grounds.

The site is recorded by Historic England as a Scheduled Monument (List Entry 1004706) and a Section 42 licence was granted by Historic England prior to undertaking the work (see Appendix 6).

The work was undertaken in accordance with a Written Scheme of Investigation for Geophysical Survey (Harrison 2019) which was submitted to and approved by Historic England, with guidance within the National Planning Policy Framework (MHCLG 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was carried out between 11th and 13th June 2019.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Scheduled Monument, hereafter referred to as the Geophysical Survey Area (GSA), is located approximately three miles south-east of Marlborough and south of Savernake Forest, roughly 135m south-west of Tottenham House (Illus 1). It comprises a single irregularly shaped parcel of land (centred on SU 2469 6362) which is mostly under established tree cover (Illus 3–4). The northern extent of the GSA was under pasture at the time of the survey and was used for cattle grazing Illus 2).

The GSA is located on a gentle north-east facing gradient, being at 180m Above Ordnance Datum (AOD) in the south and at 170m AOD in the north.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Newhaven Chalk which is overlain in the north with Clay-with-flints Formation (clay, silt, sand and gravel). No superficial deposits are recorded over the southern half of the GSA (NERC 2019).

The soils within the GSA are classified in the Soilscape 8 Association, characterised as slightly acid loams and clays with impeded drainage (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

The area around Tottenham House has been subject to several previous archaeological investigations including an extensive archaeological evaluation by Wessex Archaeology in 2005. The evaluation confirmed that the Registered Park has considerable potential for prehistoric and later remains. A Roman pottery production site 135m south/south-west of the house was already Scheduled when this work was completed. (Historic England List Entry 1004706). The Historic England citation is limited, being a legacy record.

References to the site held by the Wiltshire Historic Environment Record confirm that the site was excavated in 1964 by the Reverend E. H. Steele (HER MWI 18999). Interestingly, the kiln seems to have been identified by a very early proton-magnetometer survey (Wilts

ILLUS 2 GSA (north), looking east

ANHM 1960). The remains of at least seven phases of activity were excavated from the kiln with abandoned pots within. Remains of roof fabric and evidence of fuel indicate very good preservation. Unfortunately, no plans of the area investigated were available.

Trial trench evaluation and geophysical survey completed to the east of the Scheduled area in 2005 identified further evidence of Roman pottery production within the Registered parkland area and east and north east of the Scheduled area (Smalley 2017). A study of the wider Savernake Forest in which the GSA lies indicates that the area was a centre for Roman pottery production which may have had Iron Age antecedents (Crutchley et al 2009).

The course of a Roman road ran through the area of activity discovered in 2005, well to the east of the Scheduled area. Intriguingly, just north of the Scheduled area, the Wiltshire Historic Environment Record (WHER) records the site of a Roman villa inferred from finds made in the 1850s. The Reverend W. Lukis is recorded as having located a small section of tessellated floor and recovered ivory, bronze and iron objects which led to the interpretation of a villa site. The early Ordnance Survey maps mark 'site of Roman villa', although by 1961's edition, this had become 'Roman building', However, consultation with the original references to this indicate that the finds were from a villa in Great Bedwyn (Wilts ANHM 1860), well away from the GSA. The tessellated floor is noted as being revealed to a visit by the Wiltshire Archaeological Society to Tottenham House in 1859 and as lying 'a hundred yards from the main house'. If south of the main house, it may have been related to the pottery kilns. Related research also indicates that the line of a medieval boundary bank may run east to west through the Scheduled area, although nothing is apparent above ground. The area was used for ammunition storage during the Second World War and related features may also lie within the GSA.

The routes of two post medieval parkland drives (King Harry's Ride and Octagon Ride) pass through the Scheduled area (Illus 5) and survive as low linear earthworks.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the GSA.

The specific archaeological objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any anomalies identified;
- to locate two historic parkland drives which pass through the Scheduled Monument;
- to therefore model the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

A magnetometer survey was undertaken across the Scheduled Monument, an area of 3.4ha. Specific anomalies identified in the magnetometer survey were targeted by earth resistance survey of 0.5ha (Area 1–Area 4).

ILLUS 3 King Harry's Ride, looking west

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart (Illus 5). These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.35.1 (DWConsulting) software was used to process and present the data

3.2 EARTH RESISTANCE SURVEY

The earth resistance survey was undertaken using a Geoscan RM85 and integral multiplexer set up as a twin Probe array, to take readings at 0.5m intervals on traverses 1m apart within 20m by 20m grid squares, allowing 800 readings to be recorded in each grid square. The mobile probe spacing was 0.5m with the remote probes 20m apart. This probe spacing of 0.5m gives an approximate depth penetration of 1m for most archaeological features. These readings were stored in the memory of the instrument and later downloaded for processing and interpretation. Geoplot 4 (Geoscan Research) software was used to process and present the data. Further information on soil resistance is provided in Appendix 2.

3.3 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:5,000. Illus 2–4 are site condition photographs. Illus 5 is a 1:1,000 survey location plan showing the direction of survey as GPS swaths and the projected routes of the historic drives. Fully processed (greyscale) data, minimally processed (XY trace plot) magnetometer data (presented at two scale ranges) together with an accompanying interpretative plot are presented in Illus 6 to Illus 9 inclusive at a scale of 1:1,000. The earth resistance data is presented as greyscale data in raw and processed format in Illus 10 and Illus 11 with an interpretive plot in Illus 12, also at 1:1,000. Both the magnetometer and earth resistance interpretation are shown together in Illus 13.

Technical information on the equipment used, data processing, magnetic and earth resistance survey methodology is given in Appendix 1 and Appendix 2. Appendix 3 details the survey location information and Appendix 4 describes the composition and location of the site archive. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5 with the Section 42 licence included as Appendix 6.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2019), with guidelines outlined by Europae Archaeologia Consilium (EAC 2016)

ILLUS 4 Octagon Ride, looking south-west

and by the Chartered Institute for Archaeologists (CIfA 2016). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Magnetometer Survey

Whilst the presence of mature tree cover hindered full coverage of the Scheduled Monument, ground conditions were generally good and have contributed to a high standard of magnetometer data throughout.

The survey has detected a homogeneous magnetic background throughout which is characterised by frequent, evenly-dispersed, low magnitude discrete anomalies. Against this background, numerous anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figures, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the topsoil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

Two north/south dipolar linear anomalies (SP1 and SP2; Illus 6–9) in the west and east of the GSA respectively locate buried service pipes.

An isolated large negative spike anomaly (TP1) in the east of the GSA is caused by a wooden telegraph pole with associated stay. Further south, the origin of two identical large 'spikes' is unknown. However, the anomalies are thought to be due to large buried ferrous objects.

Magnetic disturbance along the field boundaries in the north of the GSA is caused by ferrous material within the field boundaries and is of no archaeological interest.

4.2 GEOLOGICAL ANOMALIES

Numerous discrete low-magnitude anomalies have been identified throughout the survey area. The anomalies are thought to be caused by localised variation in the depth and composition of the soils. A vague low magnitude curvilinear anomaly in the south-east of the GSA is likely due to near-surface geological variation.

4.3 PARKLAND DRIVES

Faint parallel linear trends (DR1; Illus 6–9) aligned east/west within the north of the GSA correspond closely to the projected route of King Harry's Ride, a post-medieval parkland drive shown on historic mapping. The trends are spaced 11m apart and maybe caused by

infilled ditches/gullies flanking the former drive surface. DR1 was subsequently targeted by earth resistance survey (Area 2 and Area 3) for further information.

A second parkland drive, Octagon Ride, is identified aligned north-east/south-west within the south-east of the GSA, also characterised by parallel linear trend anomalies (DR2). DR2 is narrower in width – the parallel trends measuring 9m apart. DR2 was targeted by earth resistance survey (Area 4) for further information.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Fragmented linear anomalies (D1–D3; Illus 6–9) within the north of the GSA may be archaeological in origin, perhaps being due to soil-filled ditches. The anomalies are located close to the site of a putative Roman Villa/Building/tessellated floor which is recorded on the WHER and is depicted on historic OS maps, although no anomalies have been identified which are suggestive of buried structural remains, nor has any other coherent archaeological pattern been identified. It is possible that the anomalies are due to land drainage. The anomalies appear to extend beyond the limit of the GSA to the north.

West of the linear anomalies a broad, high magnitude sub-square anomaly (ST1), which appears on the same north/south alignment, is tentatively ascribed as possibly being structural in origin. ST1 was targeted by earth resistance survey (Area 1) for further information.

D4 locates a fragmented linear anomaly aligned north/south from DR1 terminating at a modern field boundary. The anomaly may relate to post-medieval or modern drainage activity although an archaeological origin cannot be completely dismissed.

4.5 POSSIBLE KILNS AND ASSOCIATED ANOMALIES

Several distinct clusters of high magnitude anomalies have been identified within the centre of the GSA which are characteristic of thermoremanent activity. The clusters comprise numerous high magnitude discrete anomalies within which nine broad and extremely high magnitude (in excess of 100nT) anomalies (K1–K9; Illus 6–9) are interpreted as possible kilns. The possible kiln anomalies are mostly irregular in shape although K4 and K7 are both rectangular in appearance, aligned north-east/south-west, whereas K6 and K9 are more elongated. Whilst the clusters of anomalies form no coherent pattern, any of the surrounding high magnitude discrete anomalies could be associated with the pottery production industry, perhaps being due to smaller kilns, kiln debris, pottery wasters, slag etc.

Earth Resistance Survey

The earth resistance survey complements the results of the magnetometer survey, successfully identifying the routes of the two parkland drives as broad linear bands of low resistance across Area 2–4 (D1 and D2; Illus 10–13). The low resistance is probably caused by an increased accumulation of water within or over the buried drive surface in contrast to the surrounding soils. This is perhaps exacerbated by a period of prolonged rainfall in the days prior to the survey.

A clear low-resistance linear anomaly (D5; Illus 10–13) aligned east/west in the south of Area 2 and Area 3 is caused by an infilled ditch which was not detected in the magnetometer data. The anomaly is orientated parallel with King Harry's Ride (DR1) 16m to the north and may locate a drainage or boundary ditch associated with the formal layout of the parkland.

Within the northern corner of Area 4 an area of high resistance corresponds with a high magnitude magnetic anomaly of possible archaeological origin. The anomaly may be due to a kiln or to compacted material/debris associated with pottery production.

Parallel linear high resistance anomalies within Area 1 correspond with high magnitude linear anomalies (D1 and D2; Illus 13) in the magnetometer data. The high resistance may be due to a resistive ditch-fill (relative to the surrounding soils) and may be due to a field drain. No anomalies have been identified in the earth resistance survey to suggest the presence of a structure corresponding to the square high magnitude magnetic anomaly (ST1).

5 CONCLUSION

The survey has successfully evaluated the survey area and has identified several distinct clusters of high magnitude anomalies which are suggestive of industrial activity, including nine extremely high magnitude anomalies which are interpreted as possible kilns. No anomalies of clear archaeological potential have been identified to confirm the presence of a Roman building/ tessellated floor which is recorded on the Wiltshire Historic Environment Record in the north of the Scheduled Monument, although linear anomalies have been identified extending beyond the northern limit of the survey which may be archaeological in origin. Low magnitude parallel linear anomalies have been identified locating the routes of two parkland drives which pass through the Monument.

6 REFERENCES

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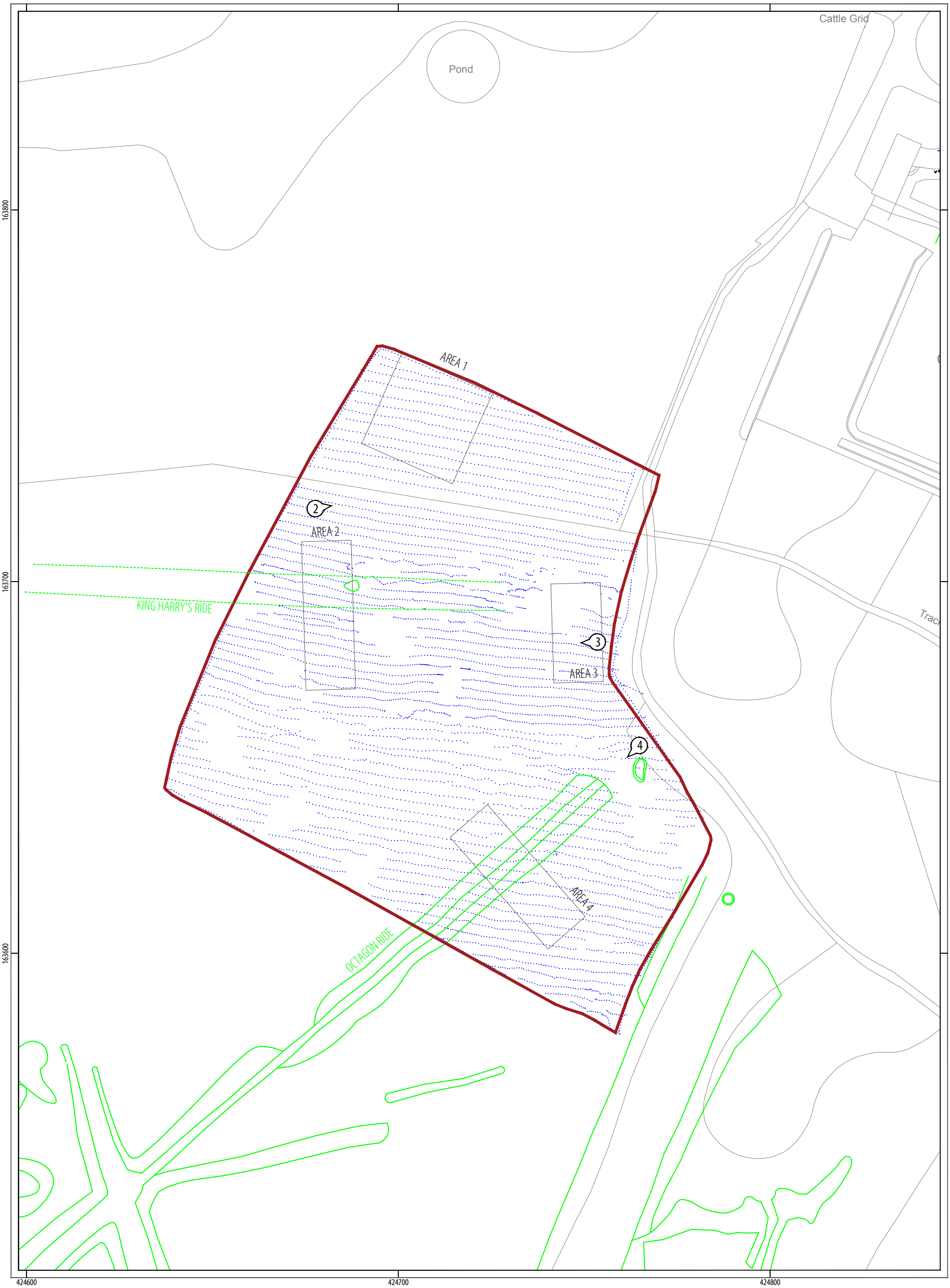

Scheduled Monument
GPS swaths
area of earth resistance survey
earthworks
location and direction of ILLUS 2-4

0 25m
1:1,000 @ A3

PROJECT THMW19
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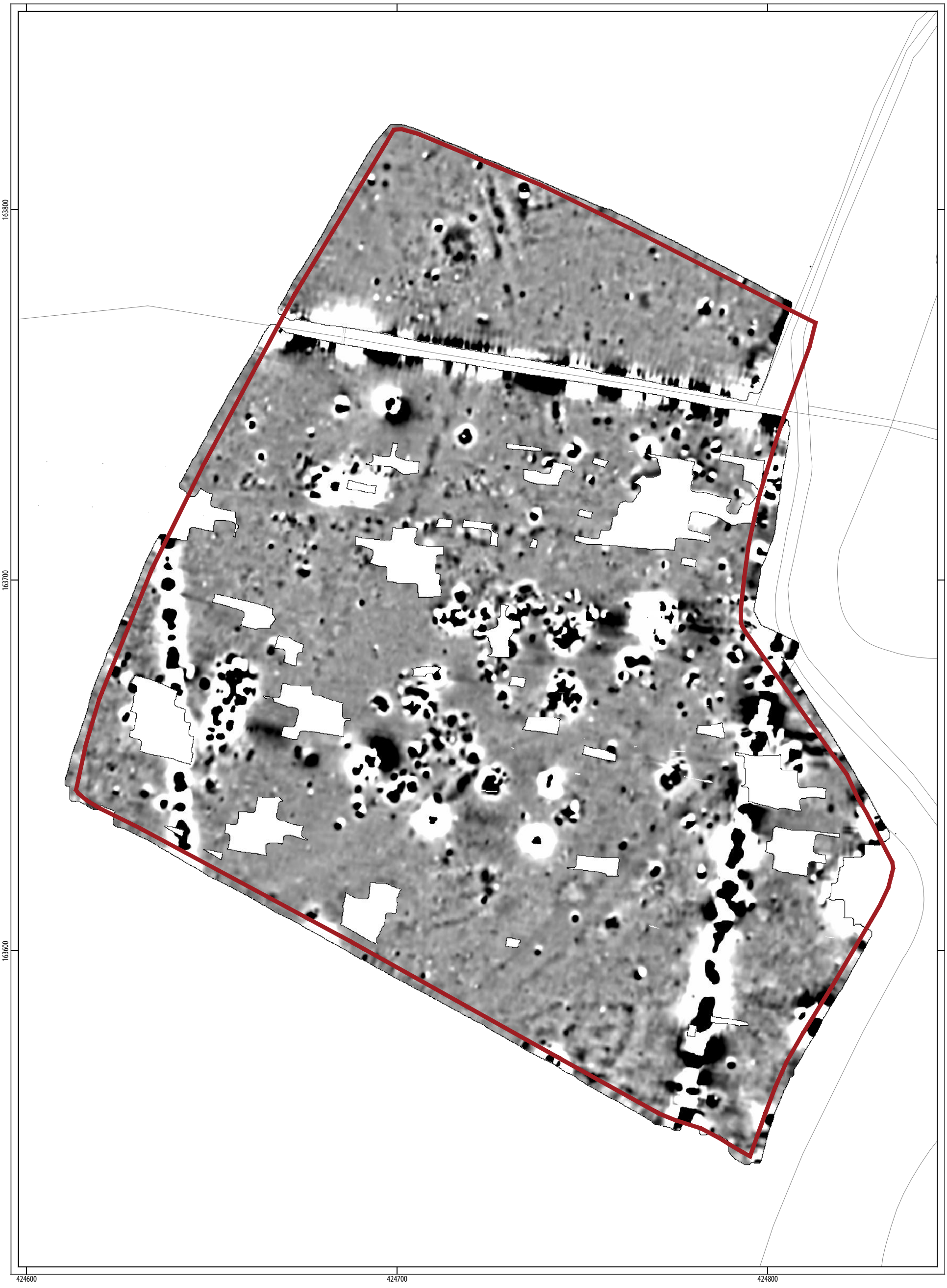
ILLUS 5 Survey location showing GPS swaths and parkland drives



Scheduled Monument

nT
-2.0
3.0

0
25m
1:1,000 @ A3

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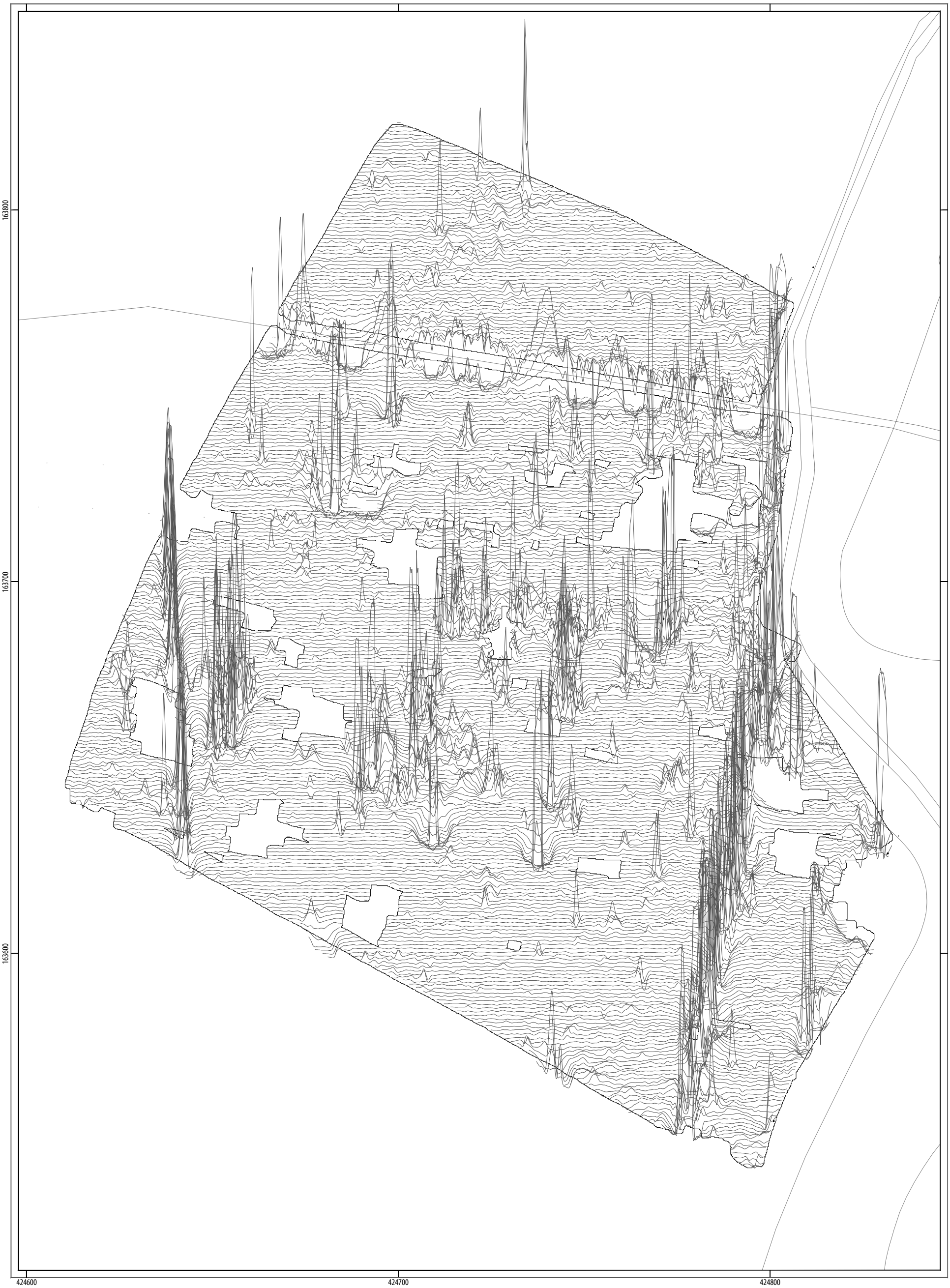
ILLUS 6 Processed greyscale magnetometer data



Scheduled Monument

26.0nT/cm

0 25m

1:1,000 @ A3

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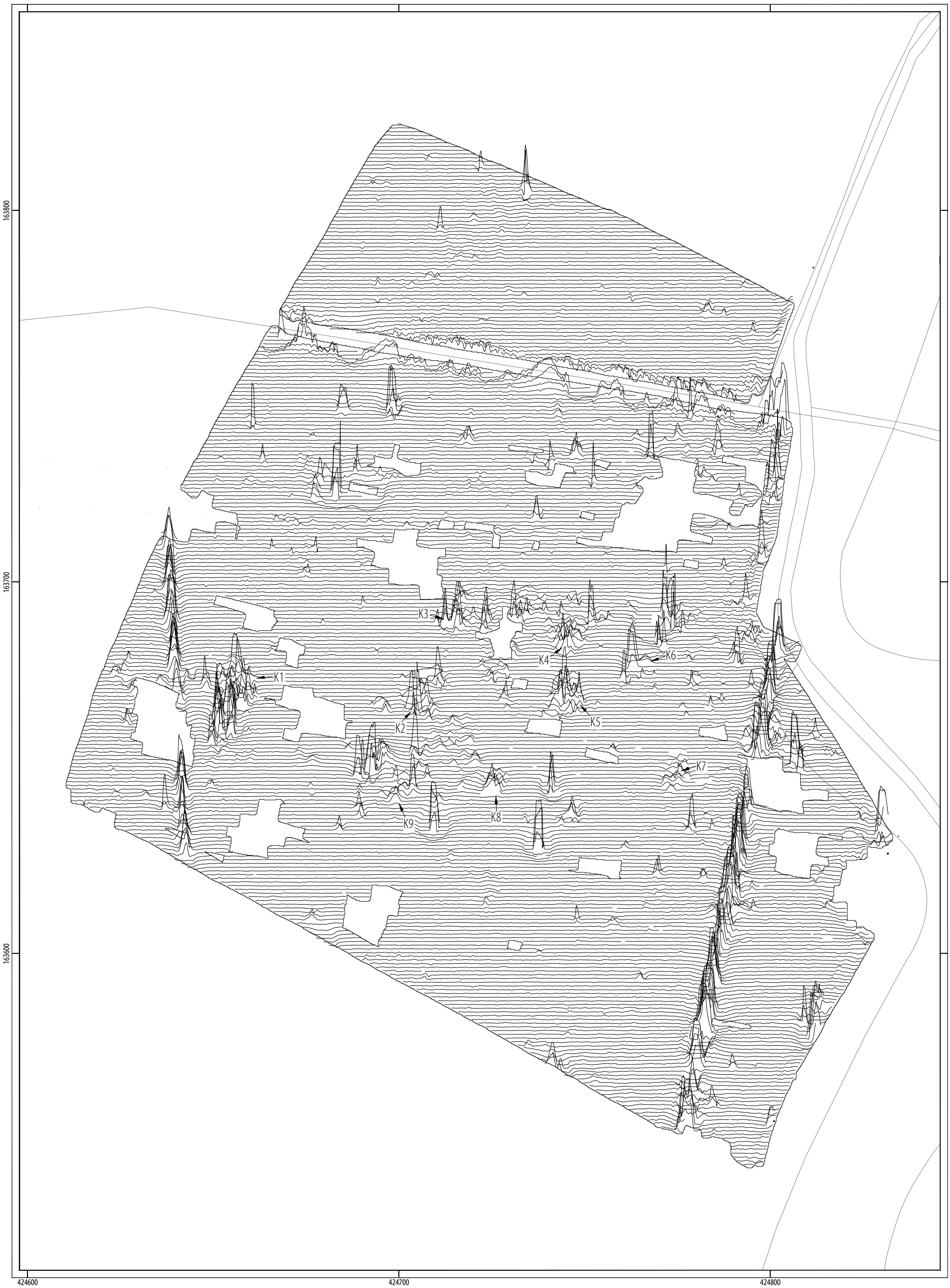
ILLUS 7 XY trace plot of minimally processed magnetometer data



Scheduled Monument

106.0nT/cm

0 25m

1:1,000 @ A3

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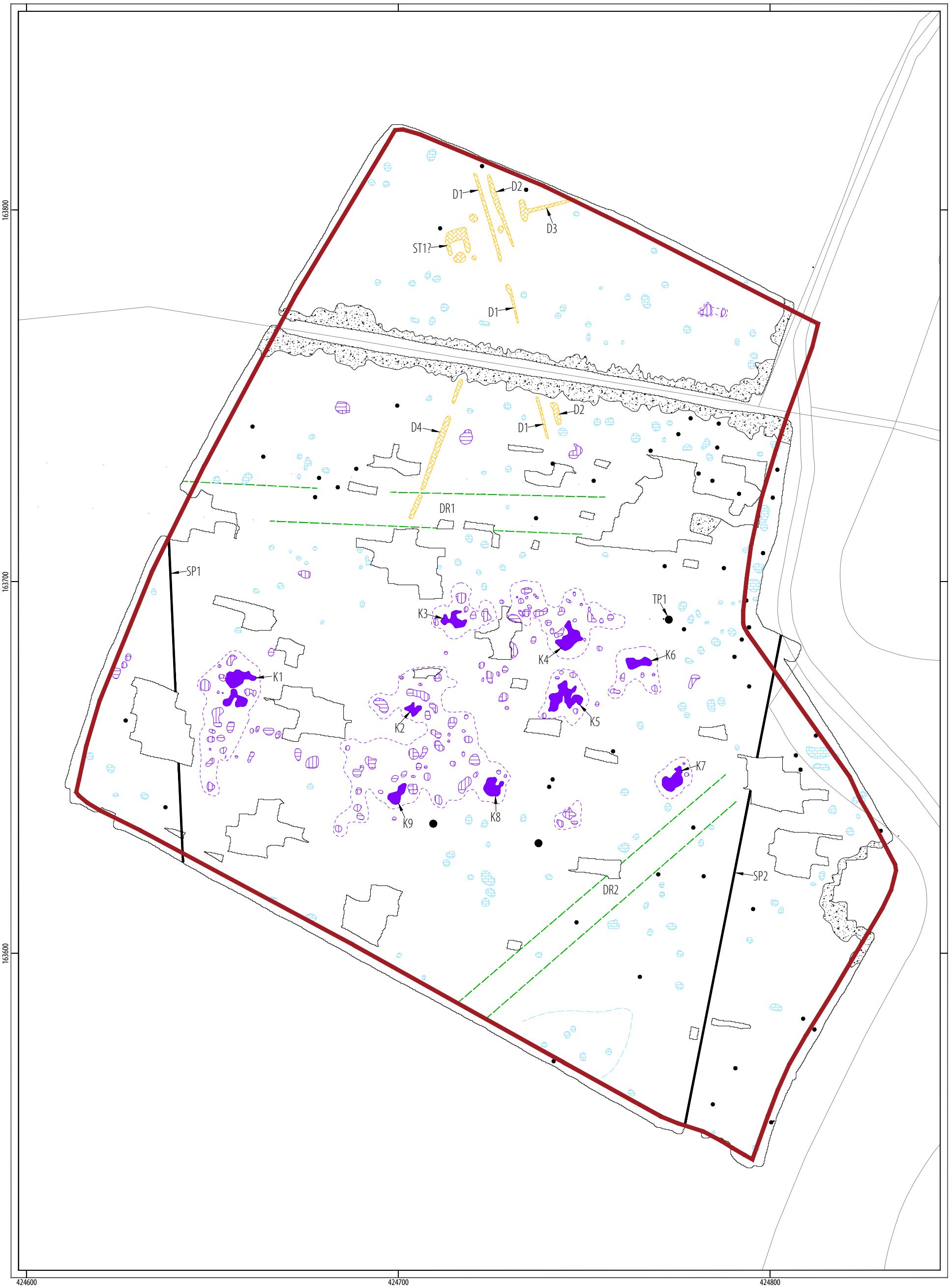
ILLUS 8 XY traceplot of minimally processed magnetometer data, showing possible kilns



Scheduled Monument

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	geological variation

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	geology
linear trend	parkland drive
magnetic enhancement	archaeology?
magnetic enhancement	industrial/fired material
magnetic enhancement	possible kiln

ABBREVIATIONS	
D	ditch
DR	drive
K	possible kiln
ST?	structure
SP	service pipe
TP	telegraph pole

0 25m
1:1,000 @ A3

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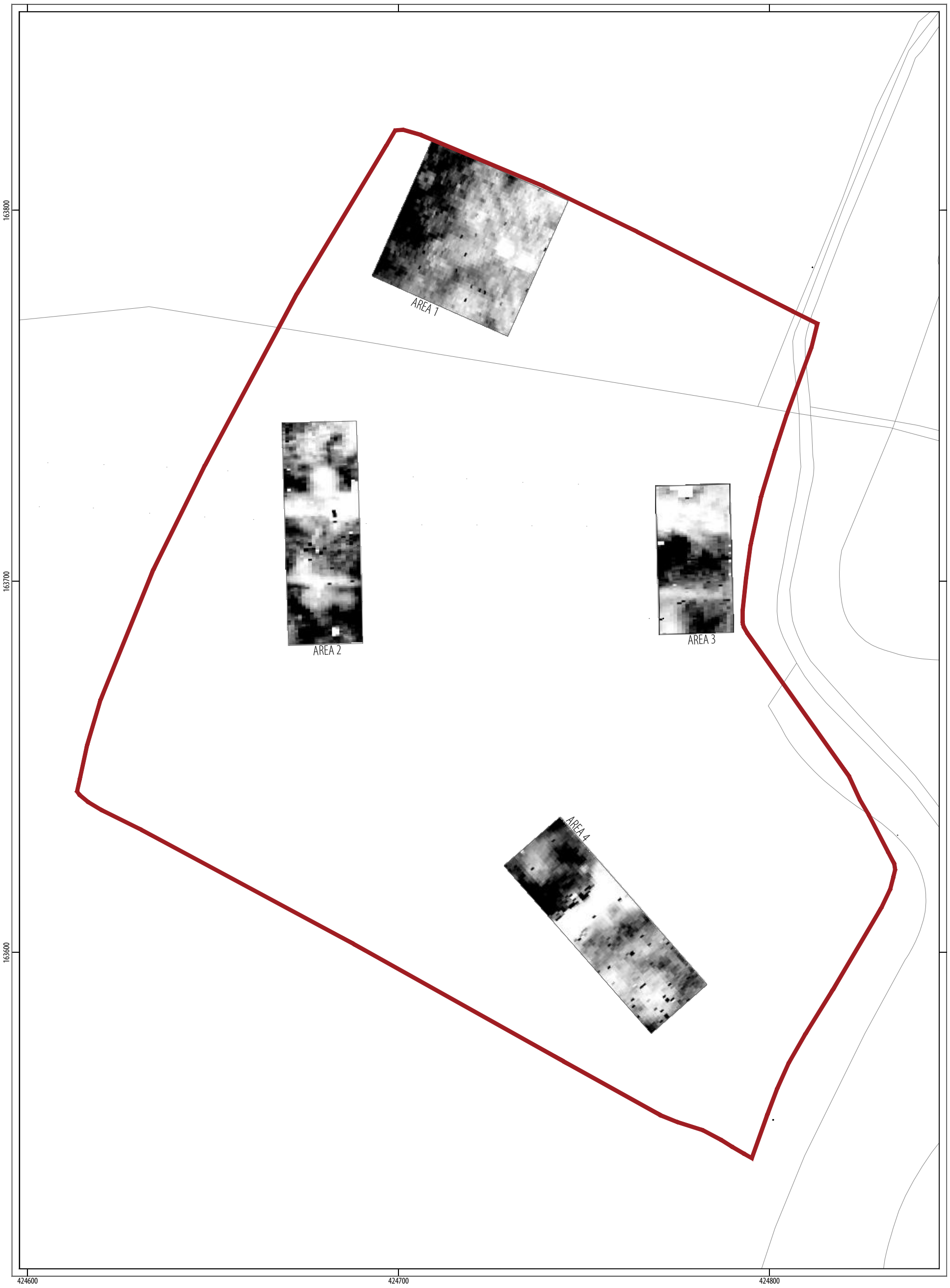
ILLUS 9 Interpretation of magnetometer data



Scheduled Monument

SD
-1.0
1.0

0
25m
1:1,000 @ A3

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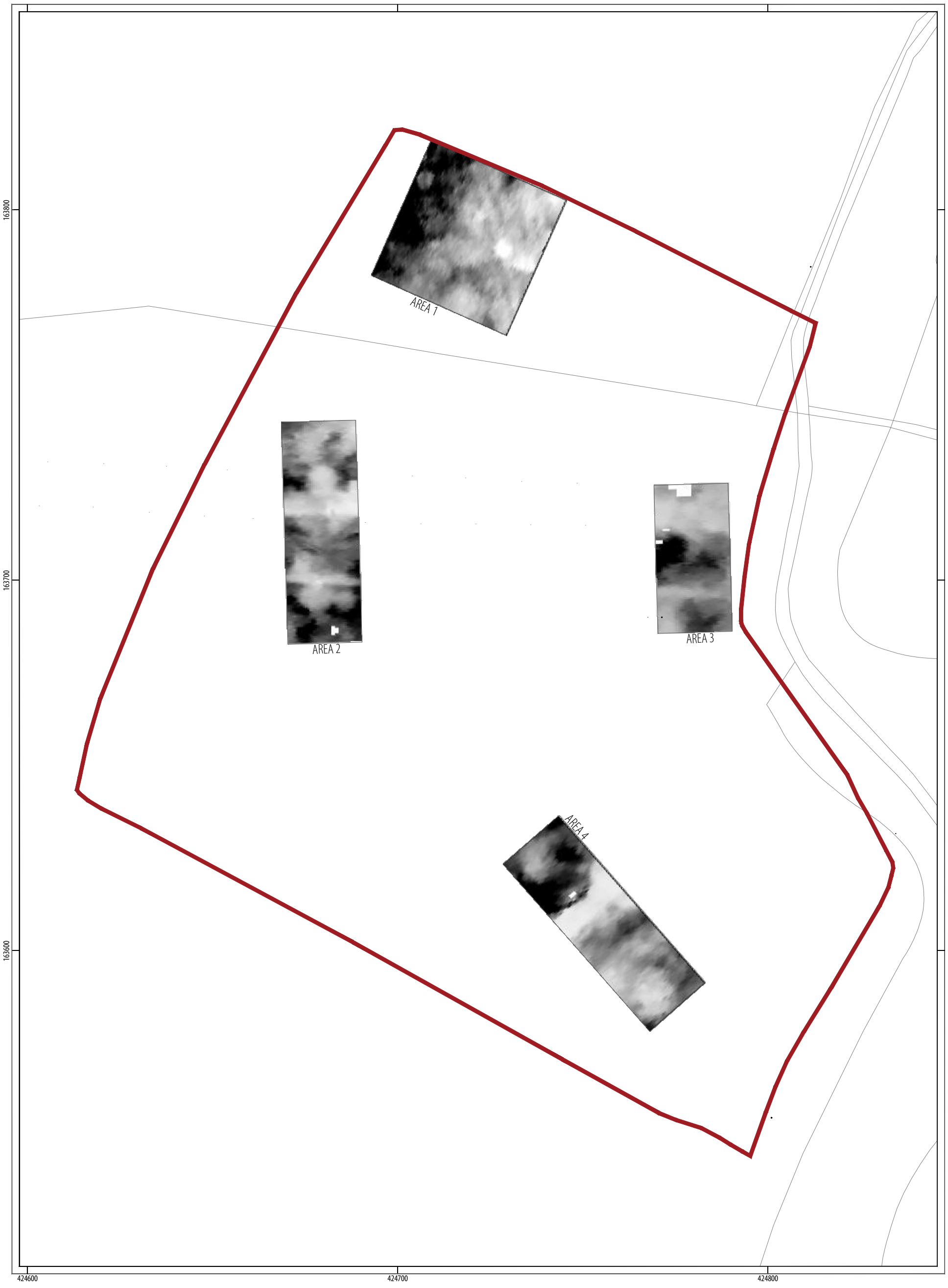
ILLUS 10 Unprocessed earth resistance data



Scheduled Monument

SD
-2.0
2.0

0
25m
1:1,000 @ A3

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ILLUS 11 Processed earth resistance data

Scheduled Monument

TYPE OF ANOMALY	INTERPRETATION
high resistance	archaeology?
high resistance linear	ditch
high resistance	natural?
low resistance linear	ditch
low resistance	drive surface
low resistance	natural?

ABBREVIATIONS	
D	ditch
DR	drive

0 25m
1:1,000 @ A3

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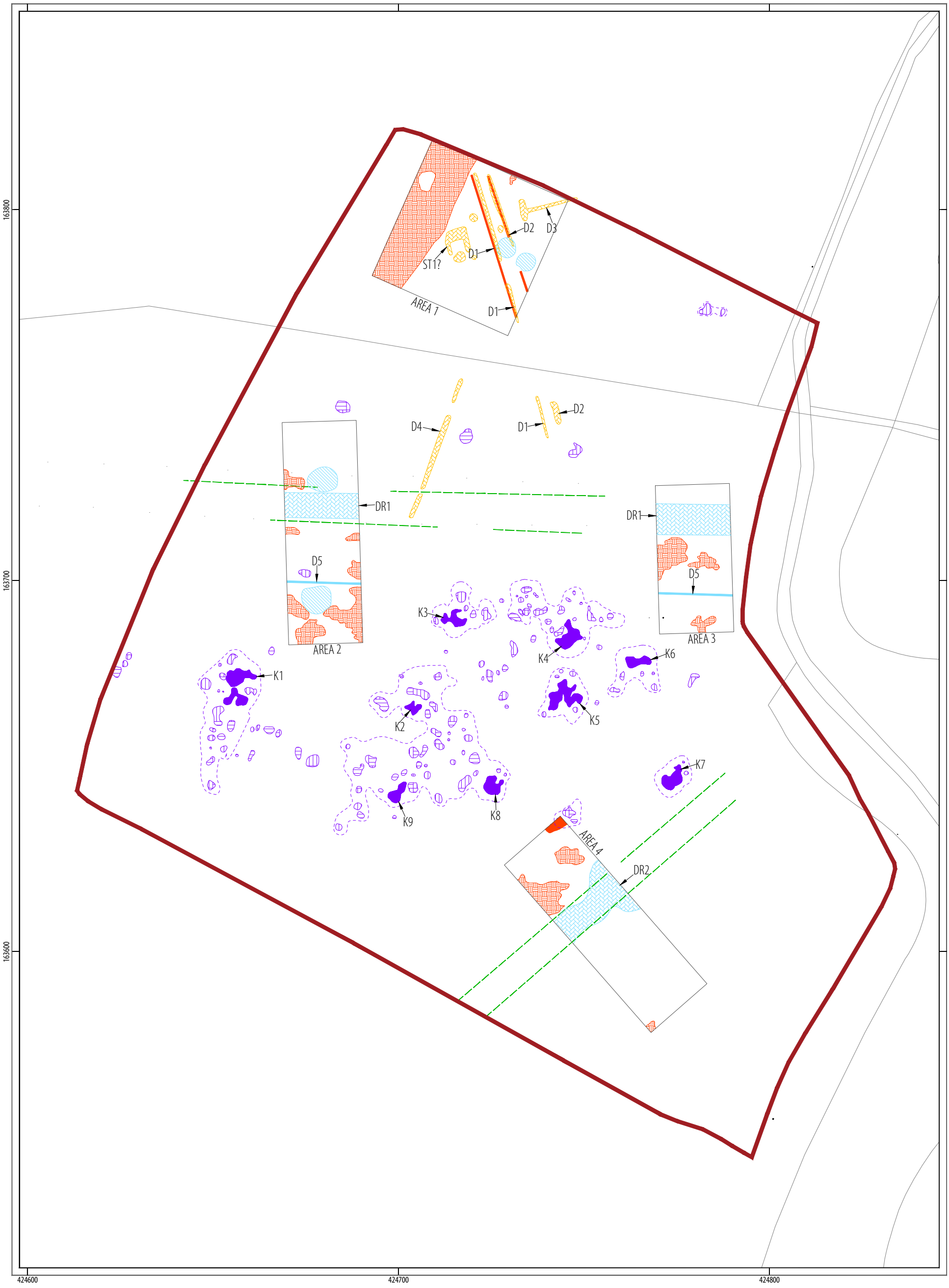
ILLUS 12 Interpretation of earth resistance data



Scheduled Monument

TYPE OF ANOMALY	INTERPRETATION
high resistance	archaeology?
high resistance linear	ditch
high resistance	natural?
low resistance linear	ditch

TYPE OF ANOMALY	INTERPRETATION
low resistance	drive surface
low resistance	natural?
linear trend	parkland drive
magnetic enhancement	archaeology?
magnetic enhancement	industrial/fired material
magnetic enhancement	possible kiln

ABBREVIATIONS	
D	ditch
DR	drive
K	possible kiln
ST?	structure

0 25m
1:1,000 @ A3

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ILLUS 13 Interpretation of magnetometer and earth resistance data

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Data processing and presentation

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 2 EARTH RESISTANCE SURVEY

Soil resistance

The electrical resistance of the upper soil horizons is predominantly dependant on the amount and distribution of water within the soil matrix. Buried archaeological features, such as walls or infilled ditches, by their differing capacity to retain moisture, will impact on the distribution of sub-surface moisture and hence affect electrical resistance. In this way there may be a measurable contrast between the resistance of archaeological features and that of the surrounding deposits. This contrast is needed in order for sub-surface features to be detected by a resistance survey.

The most striking contrast will usually occur between a solid structure, such as a wall, and water-retentive subsoil. This shows as a resistive high. A weak contrast can often be measured between the infill of a ditch feature and the subsoil. If the infill material is soil it is

likely to be less compact and hence more water retentive than the subsoil and so the feature will show as a resistive low. If the infill is stone the feature may retain less water than the subsoil and so will show as a resistive high.

The method of measuring variations in ground resistance involves passing a small electric current (1mA) into the ground via a pair of electrodes (current electrodes) and then measuring changes in current flow (the potential gradient) using a second pair of electrodes (potential electrodes). In this way, if a structural feature, such as a wall, lies buried in a soil of

uniform resistance much of the current will flow around the feature following the path of least resistance. This reduces the current density in the vicinity of the feature, which in turn increases the potential gradient. It is this potential gradient that is measured to determine the resistance. In this case, the gradient would be increased around the wall giving a positive or high resistance anomaly. In contrast a feature such as an infilled ditch may have a moisture retentive fill that is comparatively less resistive to current flow. This will increase the current density and decrease the potential gradient over the feature giving a negative or low resistance anomaly.

Survey methodology

The most widely used archaeological technique for earth resistance surveys uses a twin probe configuration. One current and one potential electrode (the remote or static probes) are fixed firmly in the ground a set distance away from the area being surveyed. The other current and potential electrodes (the mobile probes) are mounted on a frame and are moved from one survey point to the next. Each time the mobile probes make contact with the ground an electrical circuit is formed between the current electrodes and the potential gradient between the mobile and remote probes is measured and stored in the memory of the instrument.

A Geoscan RM85 resistance meter was used during this survey, with the instrument logging each reading automatically at 0.5m intervals on traverses 1m apart. The mobile probe spacing was 0.5m with the remote probes 20m apart and at least 20m away from the grid under survey. This mobile probe spacing of 0.5m gives an approximate depth of penetration of 1m for most archaeological features. Consequently a soil cover in excess of 1m may mask, or significantly attenuate, a geophysical response.

Data processing and presentation

All of the illustrations incorporating a digital map base were produced in AutoCAD LT 2018 (Autodesk).

The resistance data is presented in this report in greyscale format with a linear gradation of values and was obtained by exporting a bitmap from the processing software (Geoplot v4.0; Geoscan Research) into AutoCAD LT 2018. The data has been processed and has also been interpolated by a value of 0.5 in both the X and Y axes using a sine wave (x)/x function to give a smoother, better defined plot.

APPENDIX 3 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 4 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-363519

PROJECT DETAILS	
Project name	Tottenham House, Marlborough, Wiltshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical survey (magnetometer and earth resistance) of a Roman pottery production site (Scheduled Monument LE 1004706) within the estate grounds of Tottenham House, Wiltshire. The survey has identified several distinct clusters of high magnitude anomalies which are suggestive of industrial activity, including nine extremely high magnitude anomalies which are interpreted as possible kilns. No anomalies of clear archaeological potential have been identified to confirm the presence of a Roman building/tessellated floor which is recorded in the north of the Scheduled area on the Wiltshire Historic Environment Record, although linear and rectilinear anomalies have been identified extending beyond the northern limit of the survey which may be archaeological in origin. Low magnitude parallel linear anomalies have been identified corresponding to broad bands of low resistance, accurately locating the surface of two post-medieval formal parkland drives which pass through the Monument.
Project dates	Start: 11-06-2019 End: 13-06-2019
Previous/future work	Yes / Yes
Any associated project reference codes	THMW19 - Contracting Unit No.
Any associated project reference codes	17/12461/OUT - Planning Application No.
Any associated project reference codes	1004706 - NHLE No.
Type of project	Field evaluation
Site status	Scheduled Monument (SM)
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	POTTERY KILN Roman
Monument type	N/A
Significant Finds	N/A
Significant Finds	N/A
Methods & techniques	"Geophysical Survey"
Development type	Estate management (i.e. maintenance of existing structures and landscape by capital works and on-going maintenance)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	After outline determination (eg. As a reserved matter)
Solid geology	Chalk (including red chalk)
Drift geology	Clay with flints
Techniques	Magnetometry
Techniques	Resistivity - area

PROJECT LOCATION	
Country	England
Site location	Wiltshire Kennet Great Bedwyn Tottenham House, Wiltshire
Study area	3.6 Hectares
Site coordinates	SU 2469 6362 51.370603383285 -1.645270577888 51 22 14 N 001 38 42 W Point

PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	BSA Heritage

Project design originator	Headland Archaeology
Project director/manager	Harrison, D
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer
PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics","Survey","Text"
Paper Archive Exists?	No
PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Tottenham House, Marlborough, Wiltshire; Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Date	2019
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	PDF[A]
Entered by	David Harrison (david.harrison@headlandarchaeology.com)
Entered on	13 August 2019

APPENDIX 6 SECTION 42 LICENCE TO CARRY OUT A GEOPHYSICAL SURVEY

Historic England

Mr David Harrison
Headland Archaeology
North Unit 16
Hillside
Beeston Road
Leeds
LS11 8ND

Direct Dial: 0117 975 0726

Our ref: AA/075217/5

28 May 2019

Dear Mr Harrison

Ancient Monuments and Archaeological Areas Act 1979 (as amended) section 42 - licence to carry out a geophysical survey

ROMANO-BRITISH KILNS 150YDS (135M) SSW OF TOTTENHAM HOUSE
Case No:SL00213939
Monument no: 1004706

I refer to your application dated 23 May 2019, to carry out a geophysical survey at the above site.

Historic England is empowered to grant licences for such activity and I can confirm that we are prepared to do so as set out below.

By virtue of powers contained in section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) Historic England hereby grants permission for geophysical survey of ROMANO-BRITISH KILNS 150YDS (135M) SSW OF TOTTENHAM HOUSE, for the areas shown on the map that accompanied your application. This permission is subject to the following conditions.

1. The permission shall only be exercised by David Harrison, and 'nominated representative/s' where relevant and by no other person. It is not transferable to another individual.

2. The permission shall commence on 1 June 2019 and shall cease to have effect on 31 August 2019.

3. A full report summarising the results of the geophysical survey and their interpretation shall be sent in hard copy to Laura Phillips at the address below and electronic (pdf) format to Hugh.Beamish@HistoricEngland.org.uk, copied to Paul.Linford@HistoricEngland.org.uk no later than 3 months after the completion of the survey.

4. The enclosed questionnaire shall be completed and appended to the survey

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report. For convenience an electronic version of this questionnaire can be downloaded from http://HistoricEngland.org.uk/advice/technical-advice/archaeological-science/geophysics.

5. A copy of the report shall also be sent (in their preferred format) to the local Historic Environment Record (HER). The local HER's contact details can be found at http://www.heritagegateway.org.uk/gateway/chr/default.aspx.

6. A record signposting your investigation shall be made with the Archaeology Data Service using their online OASIS Data Collection form no later than 12 months after completion of the survey. Please see http://oasis.ac.uk/ for details or contact oasis@HistoricEngland.org.uk for information and training.

This letter does not carry any consent or approval required under any enactment, bye-law, order or regulation other than section 42 of the 1979 Act (as amended).

You are advised that the person nominated under this licence to carry out the activity should keep a copy of this licence in their possession in case they should be challenged whilst on site.

Yours sincerely

Hugh Beamish
Inspector of Ancient Monuments
E-mail: Hugh.beamish@HistoricEngland.org.uk
cc Ms Melanie Pomeroy-Kellinger

Historic England

Enclosure:

Historic England Geophysical Survey Summary Questionnaire

Survey Details

Name of Site: ROMANO-BRITISH KILNS 150YDS (135M) SSW OF TOTTENHAM HOUSE

County: Wiltshire

NGR Grid Reference (Centre of survey to nearest 100m): SU 2469 6362

Start Date: 11-06-2019 **End Date: 13-06-2019**

Geology at site (Drift and Solid): Newhaven Chalk overlain with Clay-with-flints Formation

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)
ROMANO-BRITISH KILNS 150YDS (135M) SSW OF TOTTENHAM HOUSE

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

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

Name of Client, if any:
BSA Heritage

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Purpose of Survey:
The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the Scheduled Monument.

The specific archaeological objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any anomalies identified;
- to locate two historic parkland drives which pass through the Scheduled Monument;
- to therefore model the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey

Location of:

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

b) Full Report:
Headland Archaeology, Leeds

Historic England

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): 3.6

Traverse Separation, if regular: 1 **Reading/Sample Interval: 10Hz**

Type, Make and model of Instrumentation: 4 x Bartington GRAD1000l sensors mounted on a rigid carry-frame with dGPS

For Resistivity Survey:

Probe configuration:

Probe Spacing:

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

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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): 0.5

Traverse Separation, if regular: 1.0m **Reading/Sample Interval: 0.5m**

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 / Park

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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.):

The magnetometer survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10-15cm sample interval) on roaming traverses (swaths) 4m apart (Illus 5). These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

The resistivity survey areas were positioned to target both the historic parkland drives and specific magnetic anomalies identified in the magnetometer survey.

List of terms for Survey Type

Magnetometer (includes gradiometer)

Resistivity

Resistivity Profile

Magnetic Susceptibility

Electro-Magnetic Survey

Ground Penetrating Radar

Other (please specify)

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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)

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