RESEARCH REPORT SERIES no. 9-2015

PAXCROFT, HILPERTON, WILTSHIRE
REPORT ON GEOPHYSICAL SURVEYS, MAY AND SEPTEMBER 2014

Neil Linford, Paul Linford, Andrew Payne and Zoe Edwards

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ENGLISH HERITAGE

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SUMMARY

A vehicle towed caesium magnetometer survey was conducted over an area of 27.5ha covering a range of probable Iron Age to Roman enclosed settlements at Paxcroft Farm, Hilperton, Wiltshire, recorded through the initial aerial photographic phase of the National Archaeological Identification Survey (NAIS) Lowland Pilot Project: West Wiltshire (A350 corridor). More limited earth resistance survey (0.9ha) was carried out during the preliminary phase of magnetometer coverage, in advance of an excavation within the southern oval enclosure. The geophysical surveys successfully clarified the extent and layout of the plough levelled enclosure remains, resolving some confusion between geological and archaeological responses that had hindered the interpretation of the aerial photographic evidence.

CONTRIBUTORS

The field work was conducted by Neil Linford, Paul Linford and Andy Payne from the English Heritage Geophysics Team, together with Zoe Edwards who was undertaking a Heritage Environment Placement working with the team.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to Bill Austin and Carl Triggs of Trowbridge Town Council and Tom Oatley at Paxcroft Farm for granting access to the farmland to allow the surveys to take place. We are also grateful to Stratascan SUMO who supplied magnetometer data from their 2004 survey of the adjacent Trowbridge Rugby Club site.

ARCHIVE LOCATION

Fort Cumberland, Portsmouth.

DATE OF SURVEY

The fieldwork was conducted between 12th and 13th May 2014 (southern oval enclosure) and 16th to 19th September 2014. The report was completed on 30th March 2015. The cover shows an aerial view of the northern enclosure complex (NRHE monument 1578781) with the underlying geological variability visible as soil marks (EHA 27729_022, 12-JUL-2013).

CONTACT DETAILS

Andrew Payne, Geophysics Team (Remote Sensing), English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD.
Tel: 02392 856750. Email: andy.payne@english-heritage.org.uk

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INTRODUCTION

Caesium magnetometer and earth resistance surveys were conducted at Paxcroft Farm, Hilperton, Trowbridge, Wiltshire, over a group of later prehistoric and Roman enclosed settlement complexes identified from cropmark evidence by aerial photography undertaken for the National Archaeological Identification Survey (NAIS) Lowland Pilot Project: West Wiltshire (RaSMIS 6303). The West Wiltshire NAIS covers a 199 sq km area broadly following the (north-south) A350 road corridor between the towns of Chippenham and Trowbridge, and aims to improve both the understanding of known sites and areas where the current archaeological record is sparse through the integrated application of different investigative techniques, including geophysical survey (Last 2014). The results of the project will be used to inform the management and protection of the historic environment in an area potentially subject to development pressure and the impact of arable farming regimes.

Geophysical survey was included in the project to complement the initial aerial investigation on selected sites in the project area, where ground-based methods could potentially enhance the assessment of the archaeological evidence. The southern oval enclosure (NRHE 1578812, NGR ST 8837 5962) is similar to other possible middle Iron Age large curvilinear enclosures (over 100m across) identified in the project area and also seen in and around Salisbury Plain and in the Danebury environs (McOmish *et al* 2002; Carpenter and Winton 2011). A rectilinear ditched enclosure complex with internal sub-divisions is found to the north, more typical of the late Iron Age to Roman period (NHRE 1578781, NGR ST 8825 5995), together with partially investigated sub-rectangular enclosure to the north-east (NHRE 1578817, NGR ST 8855 5996).

A previous commercial evaluation of the adjacent Trowbridge Rugby Club site included a fluxgate gradiometer survey covering both a small sub-rectangular ditched complex (NRHE 992859) and part of the southern oval enclosure (Sabin 2004, Figures 1 and 2). Subsequent archaeological evaluation revealed evidence for a possible Late Neolithic or Bronze Age ring ditch, two enclosures of prehistoric or Romano-British date, two possible Anglo-Saxon Sunken-Feature Buildings, as well as a number of undated ditches, perhaps representing associated field systems (Young 2005).

The site occupies a ridge of higher ground between the valleys of the Paxcroft Brook and Semington Brook to the east of Hilperton, situated on Jurassic Great Oolite Cornbrash limestone solid geology overlain by shallow well drained brashy calcareous fine loamy soils of the Elmton 1 association (Geological Survey of Great Britain 1965; Soil Survey of England and Wales 1983). No superficial geology is mapped in the area, although aerial photography suggests the presence of both geological and local soil variation in the vicinity of the enclosures (see cover photograph). The central strip of the southern oval enclosure was down to pasture and was surveyed in advance of the excavation, whilst the wider area coverage was conducted over arable fields following the harvest. Weather conditions during the field work were generally warm, dry and sunny but interrupted by occasional heavy rain showers.

METHOD

Magnetometer survey

The magnetometer data was collected along the instrument swaths shown on Figure 1 using an array of six high sensitivity Geometrics G862 caesium vapour magnetometer sensors mounted on a non-magnetic sledge. This sledge was towed behind a low impact, All Terrain Vehicle (ATV) which also provided the power supply and housed the data logging electronics. Five of the sensors were mounted in a linear array transverse to the direction of travel 0.5m apart and, vertically, ~0.2m above the ground surface. The sixth was fixed 1.0m directly above the central magnetometer in the array to act as a gradient sensor. The sensors were set to sample at a rate of 20Hz based on the typical average travel speed of the ATV (3.2m/s) giving a sampling density of ~0.16m by 0.5m along successive swaths. Each swath was separated from the last by approximately 2.5m, navigation and positional control being achieved using a Trimble R8 series Global Navigation Satellite System (GNSS) receiver mounted on the sensor platform 1.75m in front of the central sensor. Sensor output and survey location was monitored during acquisition to ensure data quality and minimise the risk of gaps in the coverage due to the use of a grid-less system.

After data collection the corresponding readings from the gradient sensor were subtracted from the measurements made by the other five magnetometers to remove any transient magnetic field effects caused by the towing ATV. The median value of each instrument traverse was then adjusted to zero by subtracting a running median value calculated over a 60m 1D window. This operation corrects for slight biases added to the measurements owing to the diurnal variation of the Earth's magnetic field and any slight directional sensitivity of the sensors. A linear greyscale image of the combined magnetic data is shown superimposed over the base Ordnance Survey (OS) mapping on Figure 2 and minimally processed versions of the range truncated data (±150nT/m) are presented as a traceplot and a linear greyscale image in Figures 4 and 5 respectively.

Earth resistance survey

Measurements were recorded over a series of 30m grids established with a Trimble R8 series GNNS (Figure 1) using a Geoscan RM15 resistance meter, a PA5 electrode frame in the Twin-Electrode configuration and a MPX15 multiplexer, to allow two separate surveys, with electrode separations of 0.5m and 1.0m, to be collected simultaneously. The 0.5m electrode separation is optimised for detection of near-surface anomalies in the upper 0.5m of the subsurface whilst the 1.0m separation is more sensitive to a depth range between approximately 1.0m and 1.25m. For the 0.5m electrode separation survey, readings were taken at a density of 0.5m by 1.0 m whilst for the 1.0m separation they were collected at 1.0m by 1.0m.

Extreme values caused by high contact resistance were removed from both datasets using an adaptive thresholding median filter with radius 1m (Scollar *et al* 1990, 492). The results for the near-surface 0.5m electrode separation survey are depicted as a linear greyscale image in Figure 3 superimposed on OS map. Figure 6 shows the minimally processed raw data from both electrode separations presented as X-Y traceplots, linear and histogram equalised greyscale images.

RESULTS

Magnetic survey

A graphical summary of the significant magnetic anomalies, [**m1-35**], discussed in the following text, superimposed on the base OS map data, is provided in Figure 7.

General response

The site has produced a generally good magnetic response with some modern interference, such as the probable cinder trackway [**m1**] (extant on the 2013 aerial photography) found in the paddock together with magnetic disturbance associated with temporary buildings, horse jumps and ferrous rubbish along the field boundaries. Buried services at [**m2**] and [**m3**] and disturbance [**m4**] from overhead power lines also cross the site. Some weak parallel linear anomalies both in the paddock, for example [**m5**] and [**m6**], and at [**m7-9**] in the arable fields may relate to ridge and furrow, together with more localised evidence for field drains [**m10**] and [**m11**] (cf Young 2005, fig 2).

Linear anomalies at [**m12**] in an area identified as Moon Light and Lower Moon Light fields on the 1838 tithe map may represent former field boundaries, perhaps either medieval strip fields or associated with the allotment cultivation shown in this area on the historic mapping (OS Historic County Mapping Series: Wiltshire, Epoch 1, 1891 to 1921; hEdge Maps 2015). A linear area of geological response is found at [**m13**] together with more localised disturbance, such as [**m14**], related to either the limestone bedding or, perhaps, evidence for possible quarrying. The remains of a ferrous fence line [**m15**] correlates with a recent field boundary shown on the first edition, Post War OS mapping.

The southern oval enclosure

The enclosure is replicated as a series of curvi-linear anomalies [**m16**] and [**m17**] that corroborate the cropmark and adjacent geophysical survey data (Sabin 2004). Additional details to enhance the aerial photography have been resolved, including a possible 5m wide entrance gap [**m18**] with in-turned ditches to the south flanked by [**m19**] a possible approach corridor or outwork to accentuate or screen the entrance to the enclosure, and more tentative evidence for causeways or re-cutting of the ditch at [m20] to the north (cf Figure 7.

Evidence for occupation activity within the enclosure is represented by possible internal sub-divisions [m21], partially obscured by modern disturbance, and the tentative identification of a hut circle [m22], although the data is insufficiently clear to be certain. A further large pit or quarry may be present centrally at [m23], together with a number of other pit-type anomalies [m24] although these may also be due to geological variations (cf Sabin 2004; Young 2005).

Overlapping anomalies [m25] and [m26] may indicate that the eastern segment of the ditch circuit was realigned at some point and, just inside the enclosure perimeter, a circular response [m27] indicative of a ring-gully of a hut circle or roundhouse (possibly with an entrance facing north-west) confirms the site is likely to have functioned as a settlement. Anomaly [m28] may indicate a further partition of the enclosure, perhaps related to the separation of occupied space in the vicinity of the probable dwelling at [m27].

The northern rectilinear enclosure system

A series of conjoined sub-rectangular enclosures in three main blocks is defined by multiple [m29] and single [m30] ditches, with the whole complex apparently aligned to a trackway [m31] that forms the western boundary of the settlement. It is possible that [m31] extends south towards the southern oval enclosure, although the data is not particularly clear. The west of the enclosure complex exhibits the greatest complexity of internal sub-divisions with a smaller rectangular enclosure [m32], perhaps indicative of occupation activity, in the area investigated by the 2014 excavation. There are some similarities between the system of bounded rectilinear enclosures mapped here and other Late Iron Age and Roman settlement sites covered recently by geophysical survey in the Vale of Pewsey (Linford *et al* 2013a, 2013b) and within the wider aerial record elsewhere in the West Wiltshire NAIS. This date range would be also consistent with the material assemblage recovered from the limited evaluation trenches excavated within the vicinity of [m32] (D Roberts pers comm).

Fortunately, the background geological variation [m13] in this area, presumably from soil filled fissures in the underlying Cornbrash, has a weaker magnitude of response and differing orientation to the more strongly magnetised and morphologically distinct archaeological anomalies, allowing the two sources to be more readily distinguished. However, come confusion between the geological and archaeological responses does occur in places, for example in the region of [m31] along the western edge of the rectilinear enclosure system. It does appear that the enclosure complex is situated in an area of quite complex local geological variability, with deeper soils or superficial drift deposits capping the ridge of higher ground (D Roberts pers comm).

The north-eastern sub-rectangular enclosure

The continuous circuit of the enclosure ditch [m33] is now confirmed within the area available for the survey and enhances the previous AP evidence (Figure 7).

There is little internal activity within the enclosure with the exception of a group of pit-type anomalies [m34] and possible ring gully [m35], although both could also potentially be geologically responses.

Earth Resistance

A graphical summary of the significant earth resistance anomalies, [r1-15], discussed in the following text, superimposed on the base OS map data, is provided in Figure 8.

The enclosure circuit ditches are defined as low resistance curvi-linear responses that confirm both the southern entrance gap [r1] and the narrower flanking outwork [r2] (corresponding with [m18] and [m19] respectively), with more pronounced ditch terminals than the magnetic data. A greater complexity is suggested along the course of the enclosure circuit to the north where [r3] and [r4] may indicate recuts or augmentation of the perimeter ditch, perhaps similar to the evidence to the east at [m25] and [m26]. Slightly raised resistance at [r5] and [r6] may provide tentative evidence for an external bank along this section of the enclosure circuit, perhaps surviving better to the north under the extant layer of ridge and furrow [r7].

Increased background resistance at [r8] probably relates to geological or soil variation, but may also be related to the introduction of gravel, sand or hardcore related to the horse paddocks, and the probable cinder track [m1] is replicated as a low resistance linear anomaly [r9]. Further irregular and curvilinear low resistance anomalies [r10-12] may indicate either internal sub-divisions not resolved by the magnetic survey due to the effects of modern interference, or natural geological variation such as [r13]. A broad low resistance anomaly [r14] is suggestive of a large in-filled quarry or pit, but as [r11] appears to run through [r14] without interruption it is more likely to be related to underlying geological variation.

Figure 6 suggests the modern trackway [r9], ridge and furrow [r7], and the outwork ditch [r2] are less evident in the deeper penetrating 1.0m mobile probe spacing dataset, indicating these are likely to be near surface responses, although [r2] may be less well resolved in the coarser sample density of the 1.0m survey. A very narrow linear anomaly [r15] has been uniquely resolved in the 1.0m data and correlates with a negative magnetic anomaly suggesting a deeply buried source, perhaps due to a non-ferrous cable. Geological variations identified in the 0.5m data, such as [r13] and [r14] continue as strongly defined anomalies in the deeper 1.0m probe separation data confirming the likely origin of these responses.

CONCLUSIONS

The caesium magnetometer survey has successfully provided enhanced information on the form and extent of the enclosure complexes, particularly in areas of the site where the underlying geological variation prevented clear resolution of the crop marks in the initial aerial survey records. This has refined both the morphology of the perimeter ditches together with additional detail, such as possible entrance gaps, the presence of more complex outworks and an internal hut circle within the southern oval enclosure. Some further significant anomalies have been revealed in the wider landscape, although these may be related to more recent landuse history including remnants of former field boundaries, land drains and patterns of ridge and furrow cultivation. The more limited earth resistance coverage in the southern oval enclosure corroborated the magnetic results and provided detail within areas adversely affected by ferrous disturbance. Taken together with the adjacent fluxgate gradiometer survey the geophysical results present a more complete record of the site that will, hopefully, enhance both the interpretation and protection of the remains.

LIST OF ENCLOSED FIGURES

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Figure 1

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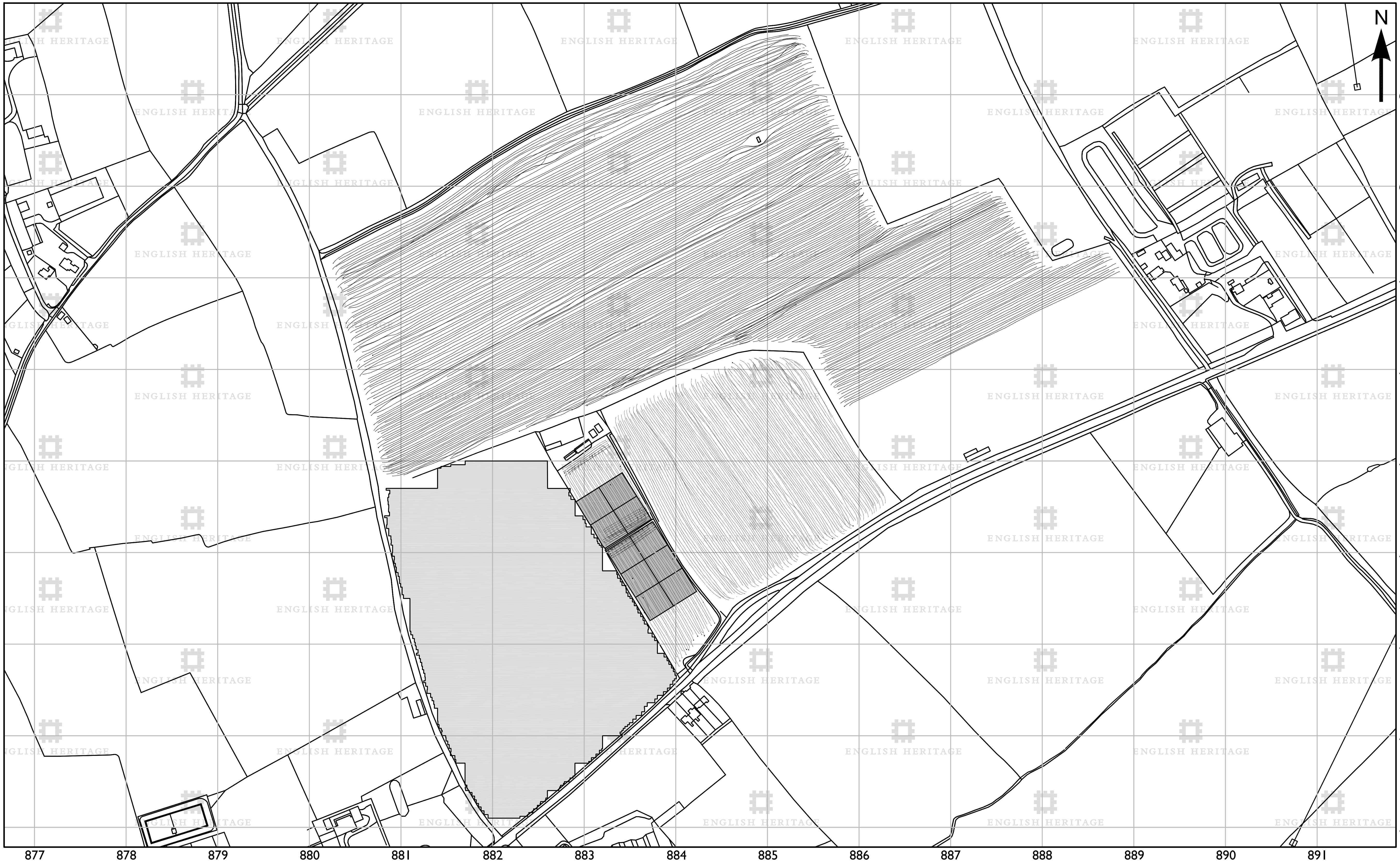
Location of geophysical surveys, May and September 2014

ST8759



0 150m
1:4000

fluxgate gradiometer survey (Stratascan 2004)
earth resistance survey
caesium magnetometer survey swaths

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Figure 2

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Location of caesium magnetometer survey, May and September 2014

ST8759

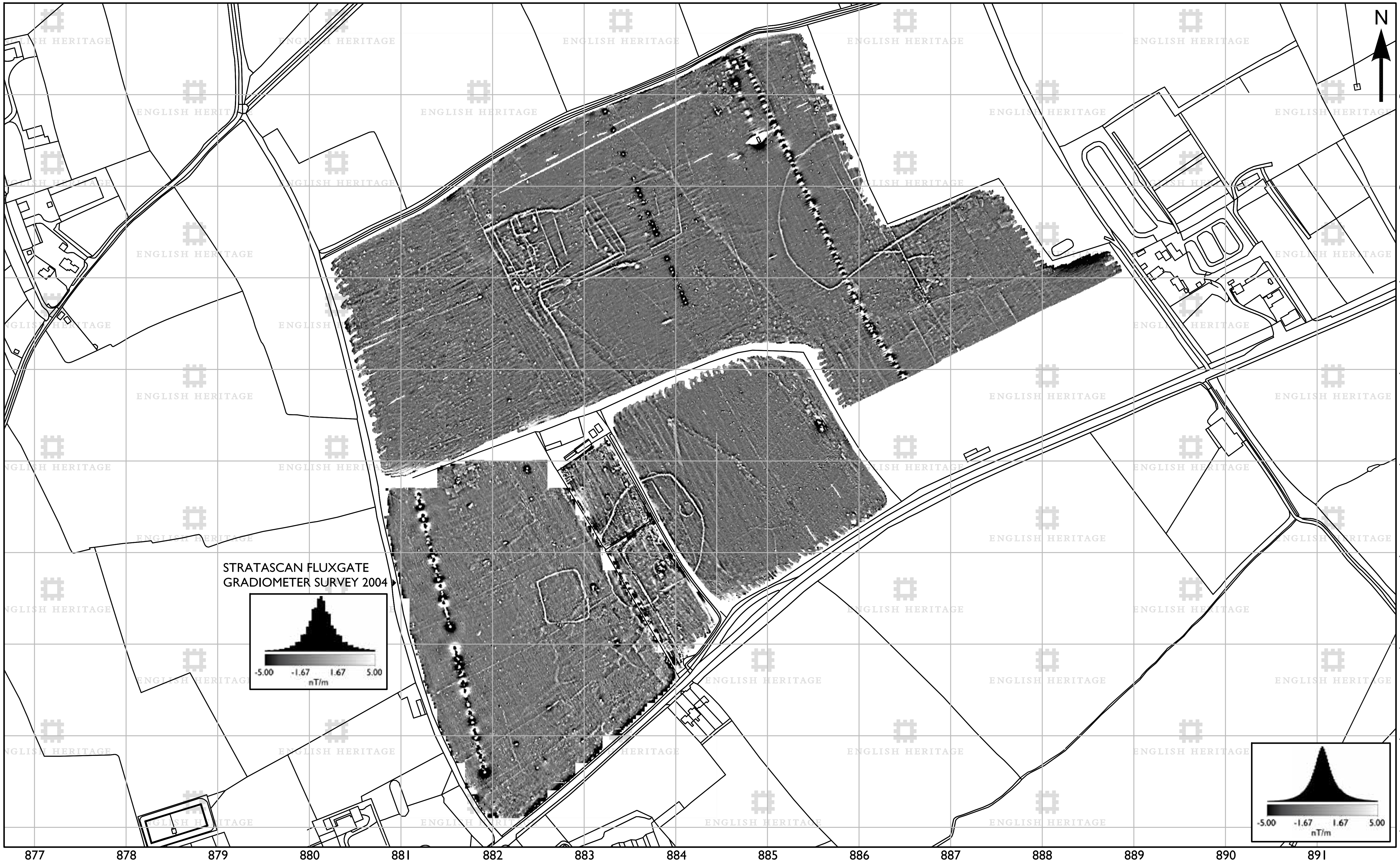

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Figure 3

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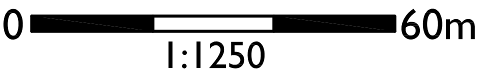
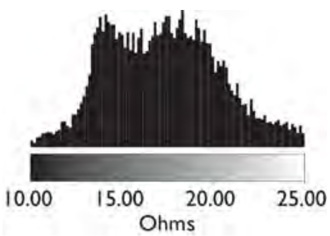
Location of earth resistance survey, May 2014





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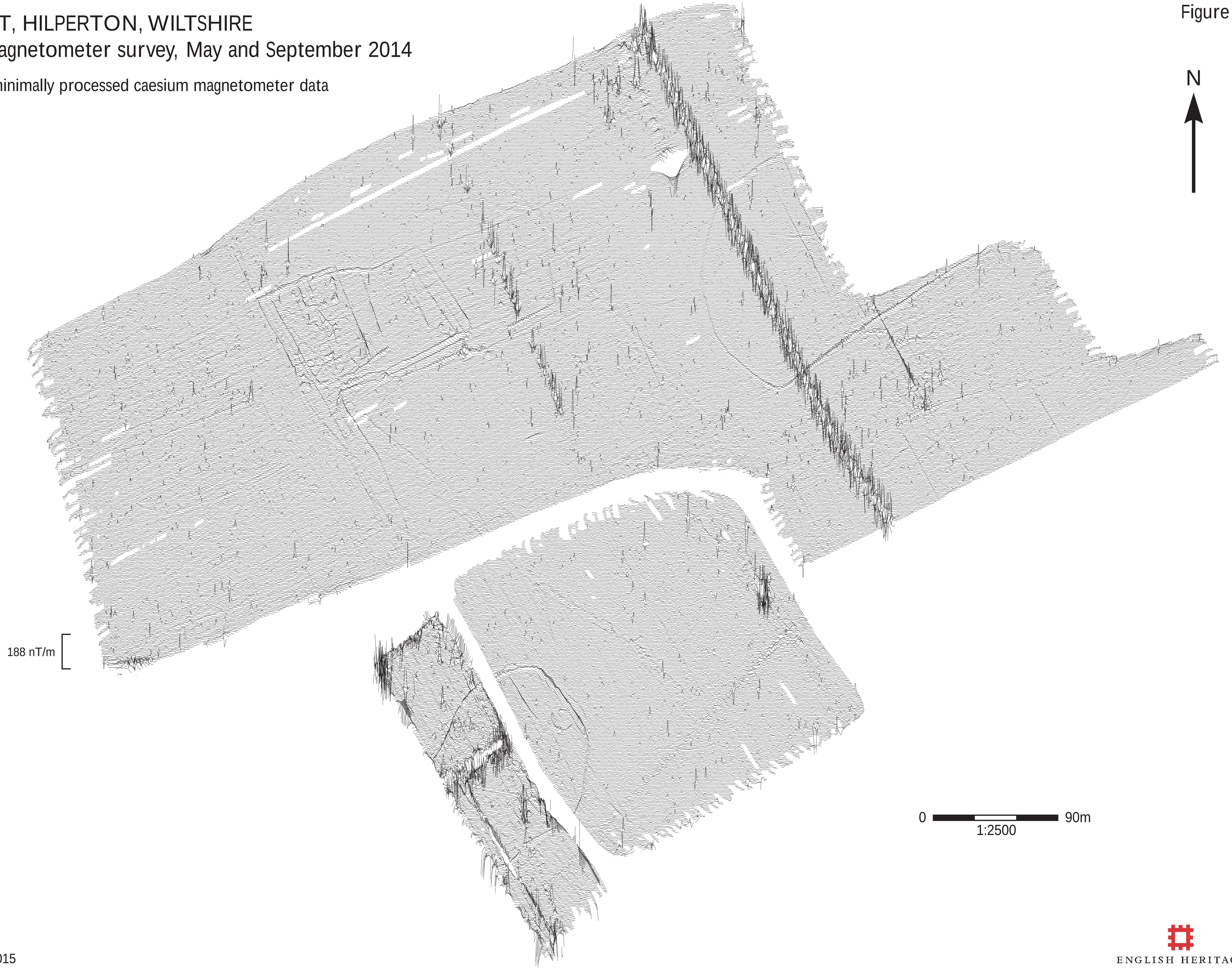
Caesium magnetometer survey, May and September 2014

Traceplot of minimally processed caesium magnetometer data

Figure 4



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Caesium magnetometer survey, May and September 2014

Linear greyscale image of minimally processed caesium magnetometer data

Figure 5

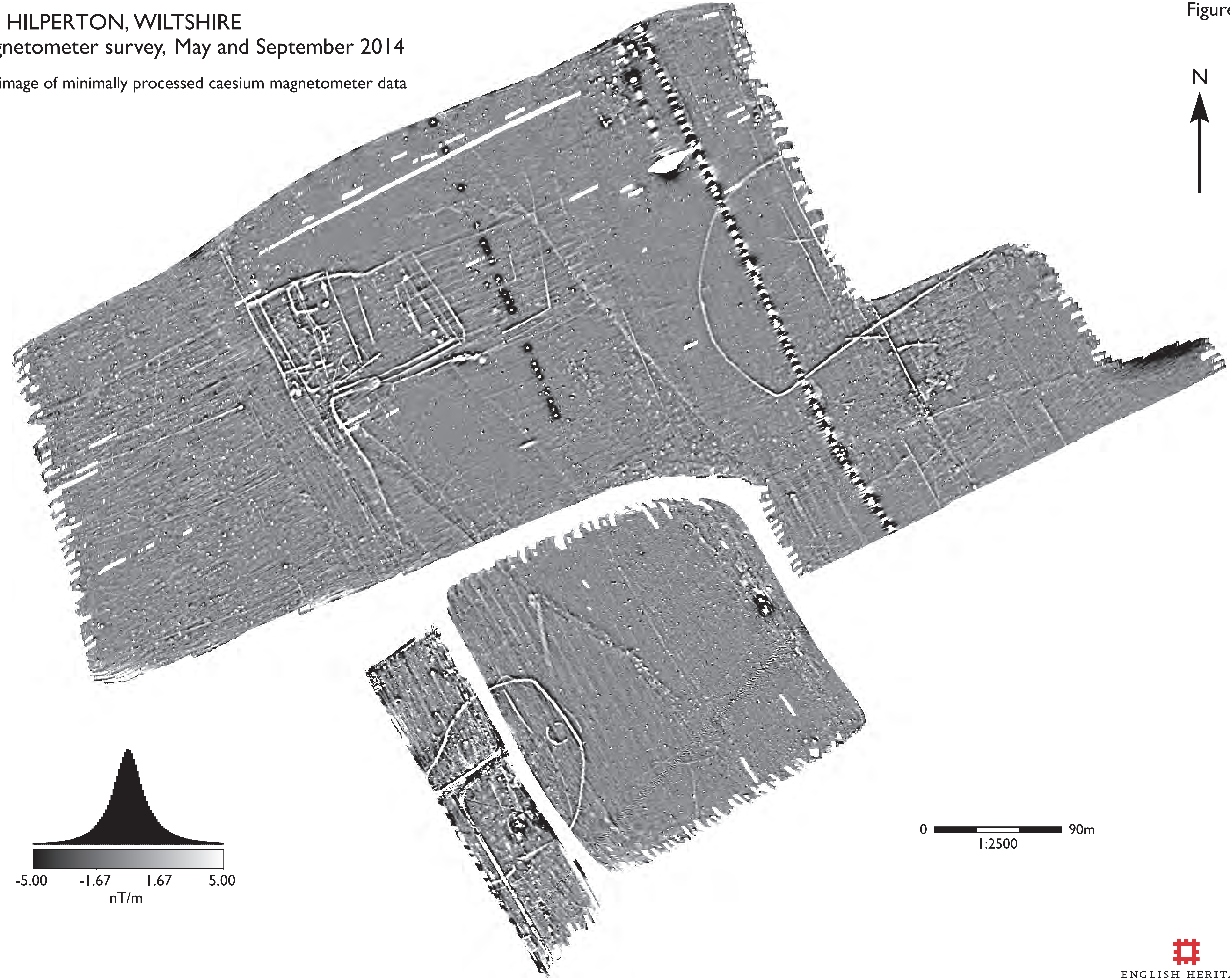

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Figure 6

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Earth resistance survey, May 2014

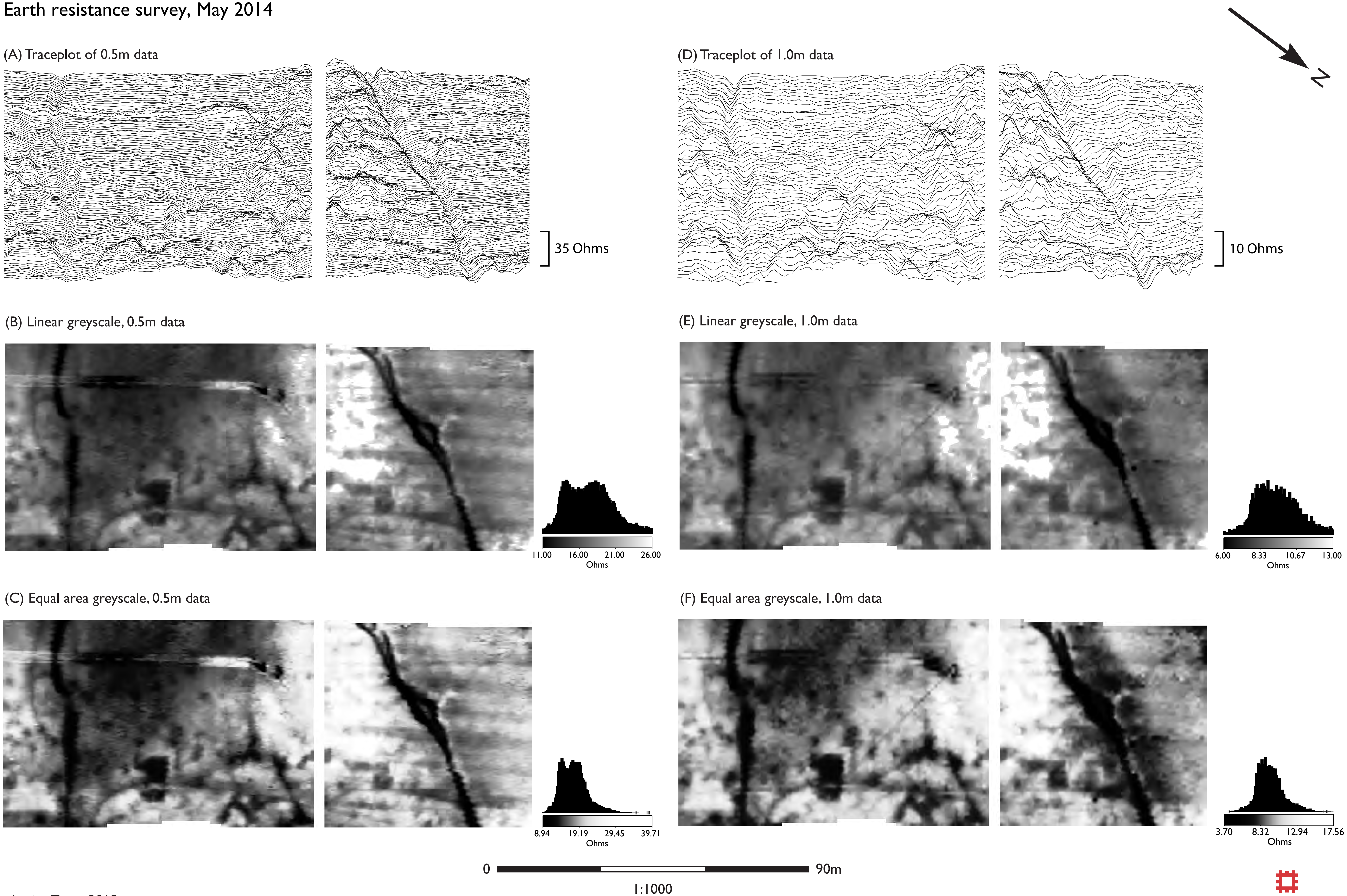

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Figure 7

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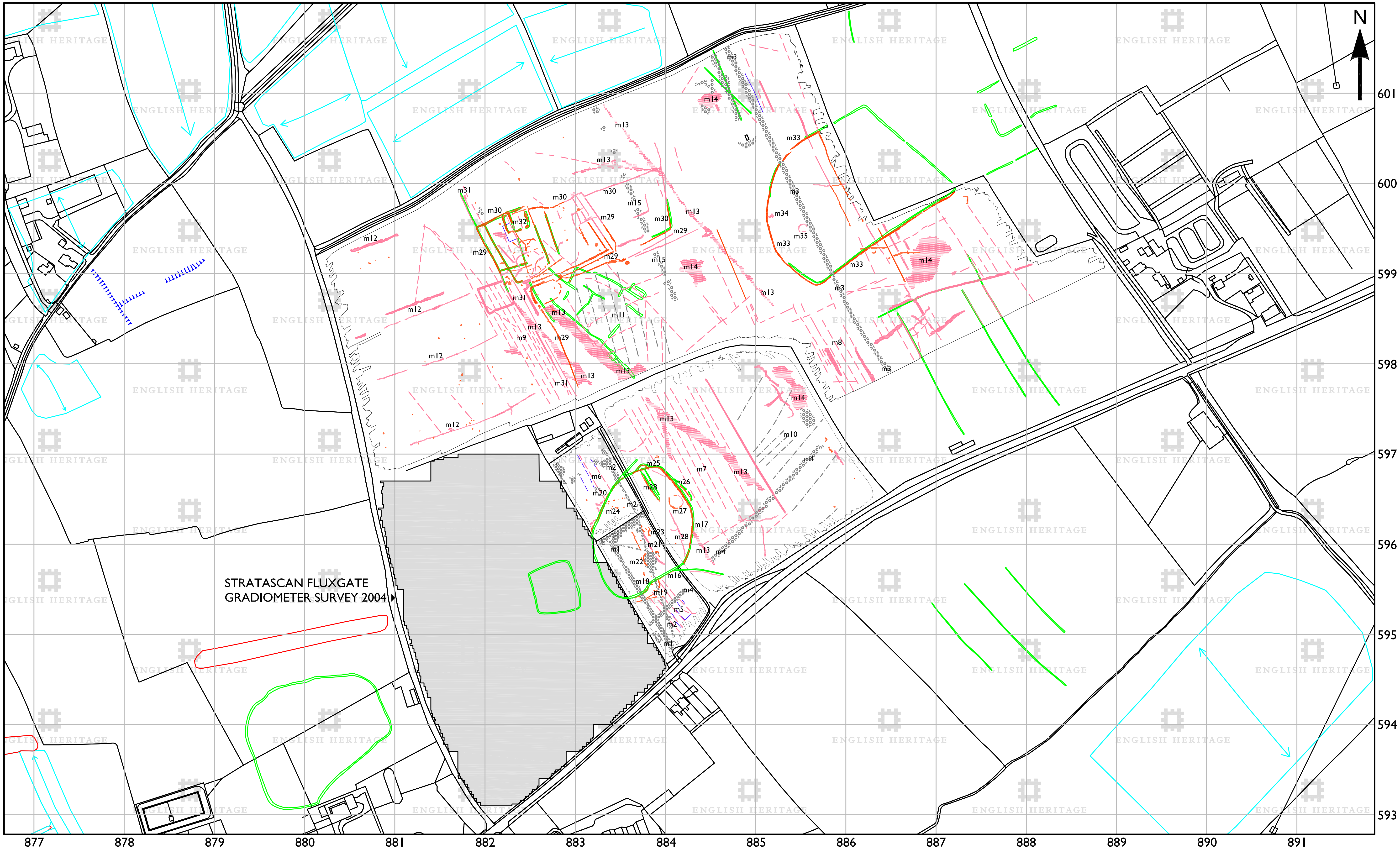
Graphical summary of significant magnetic anomalies combined with aerial mapping evidence

ST8759



0 150m
1:4000

strongly magnetic
positive magnetic
raised magnetic
negative magnetic
magnetic noise

aerial mapping evidence
rig and furrow area / alignment
bank
scarp
ditch

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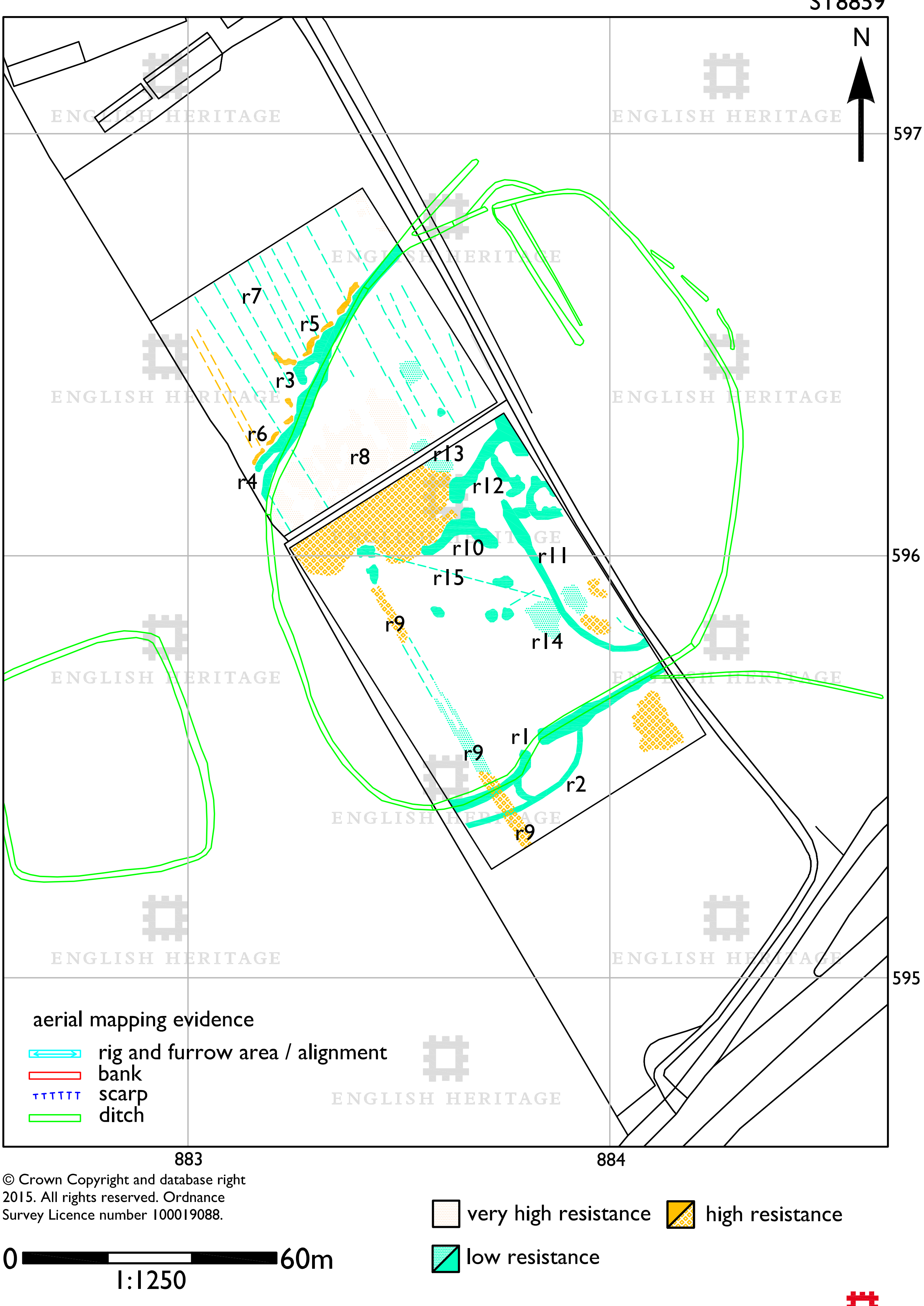
Figure 8

PAXCROFT, HILPERTON, WILTSHIRE

Graphical summary of significant earth resistance anomalies combined with aerial mapping evidence



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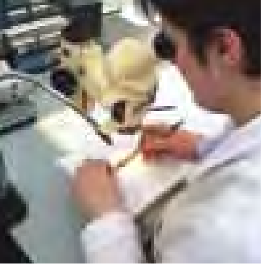
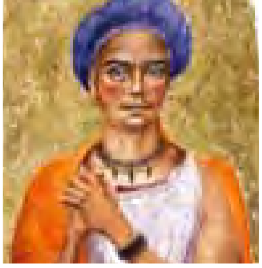

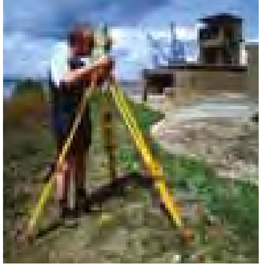
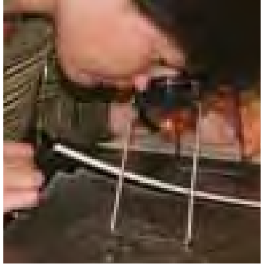


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