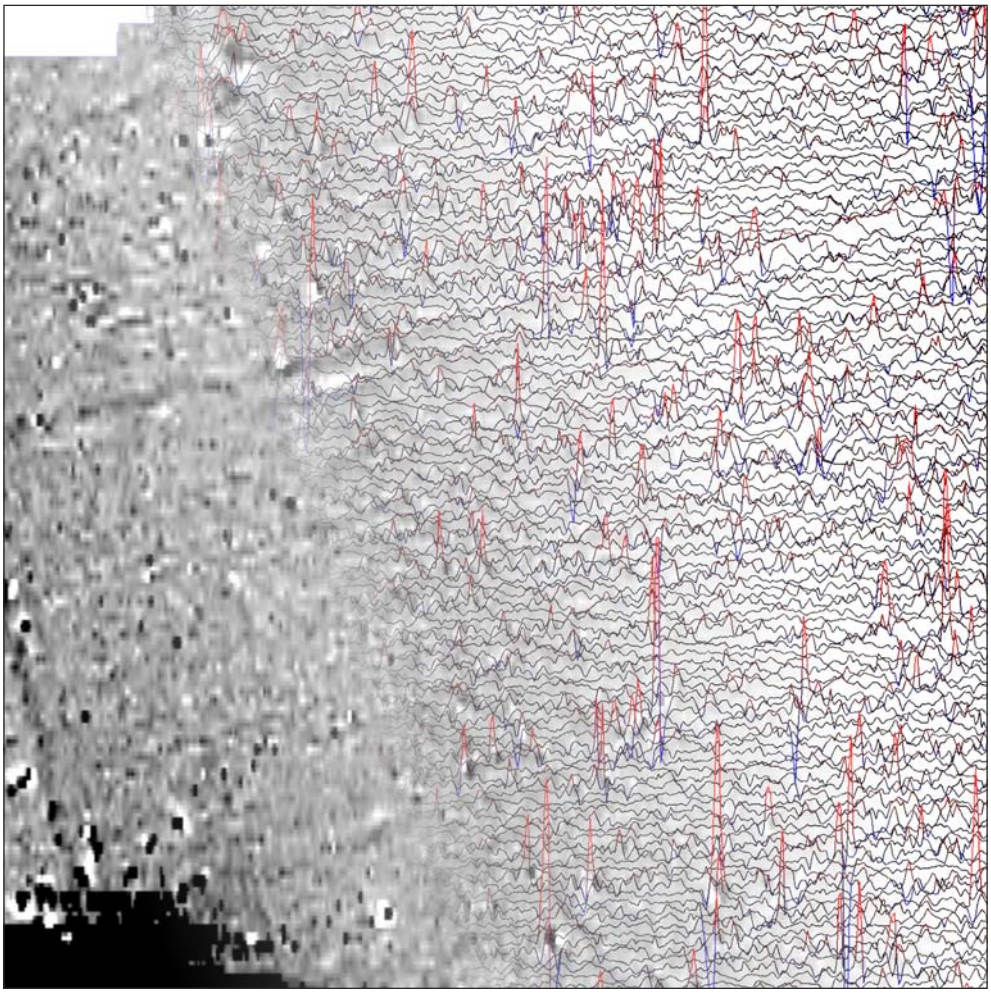
making sense of heritage

Tillhouse
Ottery St. Mary, Devon

Detailed Gradiometer Survey Report



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geoservices

Tillhouse
Ottery St. Mary, Devon

Detailed Gradiometer Survey Report

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Tillhouse
Ottery St. Mary, Devon

Detailed Gradiometer Survey Report

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land off Saundercroft Road, near Ottery St. Mary, Devon. The project was commissioned by MS Power Projects Limited with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The site comprises eight arable and pasture fields to the south of Saundercroft Road, approximately 4km west of Whimple and 10km northeast of Exeter. The site lies on the southern flank of a low hill, sloping gently downwards from northwest to southeast. The gradiometer survey covered 25.4ha and has demonstrated the presence of anomalies of probable and possible archaeological interest within the survey area, along with regions of increased magnetic response and ploughing trends.

Across the western and northern parts of the site, linear anomalies were identified that are likely to represent parts of former field systems. In places, the anomalies extend from junctions in existing boundaries, supporting this interpretation. Whilst it has not been possible to date these former boundaries, it is likely that they relate to historic subdivisions of the existing field system.

Elsewhere, other linear anomalies and isolated pit-like responses may be of possible archaeological interest, although their origin is unclear; typically they are not clearly defined and appear to be randomly distributed.

Ploughing trends appear in each of the survey areas, generally oriented parallel with the longest boundary in each field. Their responses are more clearly defined in places, which may be the result of near-surface geology being ploughed to the surface.

A curvilinear anomaly towards the southeastern corner of the site is characteristic of a former channel, with its broad response and poorly defined extents supporting its interpretation as a naturally occurring feature.

A number of regions of magnetic disturbance have been identified. The strongest of these are centred upon pylons located in the field boundaries and the disturbance extends some 60m in diameter; two other anomalies consistent with former pylon bases have also been identified in the northern survey area. A further region of magnetic disturbance lies close to a small wood near the centre of the site and is thought to be associated with the backfilling of a former pond or quarry.

The survey was carried out from the 26th to the 30th November 2012.

Tillhouse
Ottery St. Mary, Devon

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by MS Power Projects Limited. The assistance of Larry Mark (MS Power Projects Ltd) is gratefully acknowledged in this regard.

The data was acquired under the direction of Wessex Archaeology. Ben Urmston processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Caroline Budd.

Tillhouse
Ottery St. Mary, Devon

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by MS Power Projects Limited to carry out a geophysical survey of land at Tillhouse, near Ottery St. Mary, Devon (**Figure 1**), hereafter "the Site" (centred on NGR 301165 96550). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of a proposed solar farm development at the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The survey area comprises eight arable and pasture fields to the south of Saundercroft Road and north of Crannaford Farm, some 3.5 km west of Whimple and 10 km northeast of the centre of Exeter (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 25.4 ha.

1.2.2 The Site is situated on the southern flank of a low hill, sloping from 40m above Ordnance Datum (aOD) at its northern extent to 25m aOD at the southern boundary. The survey area was bordered by Saundercroft Road to the north, Woodside to the west, Crannaford Farm to the south and by arable and pasture fields to the east.

1.2.3 The soils underlying the Site are likely to be stagnogleyic brown earths of the 572f (Whimple 3) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The detailed gradiometer survey was undertaken under the direction of WA between 26th November and 3rd December 2012. Field conditions at the time of the survey were largely good, although some fields had been ploughed prior to the fieldwork.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using an RTK GNSS system, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of probable and possible archaeological interest across the Site, along with regions of increased magnetic response. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2**, **3**, **5** and **6**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figures 4** and **7**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 Within Area A at the western extent of the Site, two probable ditches are visible. Linear anomaly **4000** extends SW-NE and is likely to represent a former field boundary; it appears to be a continuation of the edge of the remnants of Crannaford Coppice. Curvilinear anomaly **4001** is similar in character to **4000** and it is possible that it also marks the line of a former boundary, although it does not appear to align with the extant boundaries.

3.2.2 Region of magnetic disturbance **4002** is associated with an extant pylon. Numerous ploughing trends can be seen parallel with the southernmost boundary of Area A. Elsewhere, weak curvilinear trends and isolated pit-like anomalies have been identified.

3.2.3 Within Area B, rectilinear anomalies **4003** may represent part of a field system or enclosures; these anomalies exhibit only weak contrast with the magnetic background. Linear anomaly **4004** is similar in character and may indicate a further element of the field

system or enclosure. Region of increased magnetic response **4005** is amorphous in plan and not well defined from the local background, and its origin cannot be determined conclusively.

3.2.4 Linear trends consistent with ploughing can be seen in the northern and southern portions of Area B. Towards the centre of the survey area, other linear trends more characteristic of field drainage are evident. Region of magnetic disturbance **4006** is coincident with a field entrance; similar magnetic disturbance can be seen in close proximity to the southern boundary.

3.2.5 Towards the north of Area C, rectilinear anomaly **4007** is likely to be part of a former field system; it is probably associated with anomaly **4011** in Area D. Linear anomaly **4008** is oriented WSW-ENE, perpendicular to **4007**, and is consistent with part of a former field system or enclosure. Several isolated pit-like anomalies can be seen distributed apparently at random within the survey area.

3.2.6 Linear trends **4009** are arranged in a herringbone pattern typical of field drainage; these trends appear to be strong towards the south, e.g. **4010**, perhaps suggesting different phases of drainage.

3.2.7 Within the northwestern portion of Area D, a series of orthogonal linear anomalies probably relates to a former field system; anomalies **4011** and **4014** are oriented WSW-ENE and anomalies **4012**, **4013** and **4015** are oriented NNW-SSE. Region of increased magnetic response **4016** shares a similar alignment and may also represent part of a field system; parallel linear trends extend northwards and southwards from **4016**. Further rectilinear anomalies **4017** and **4018** can be seen towards the northeastern extent of the field.

3.2.8 A cluster of linear anomalies is visible towards the south of Area D, comprising **4019**, **4020** and **4021**. It is possible that these anomalies are also indicative of a former field system. Across the northern portion of Area D, ploughing trends can be seen oriented parallel with Saundercroft Road; towards the southeastern extent, the ploughing trends are parallel with the southeastern boundary and elements of **4019**.

3.2.9 Several regions of strong magnetic disturbance (**4022**, **4023**, **4024** and **4025**) can be seen within Area D and all are associated with pylons; the responses of **4022** and **4024** are consistent with the bases of former pylons that have been cut off at ground level. The effects of the disturbance extend south into Area F.

3.2.10 Within Area E, towards the eastern extent of the Site, faint curvilinear anomalies **4026** appear near the northern extent of the survey area. Whilst their origins are unclear, it is possible that they are of archaeological interest. Two regions of increased magnetic response appear within the survey area, the largest at **4027**. It is possible that these regions represent near-surface geological changes, although an archaeological origin cannot be excluded. Ploughing trends are evident parallel with the eastern boundary.

3.2.11 Linear anomaly **4028** bisects the western portion of Area F and appears to form an extension of extant boundaries to the northeast and southwest; it is therefore likely that it represents a former field boundary. Ploughing trends can be seen on a variety of orientations, perhaps relating to the number of different phases of field system.

3.2.12 Region of magnetic disturbance **4029** lies close to a narrowing of the field; its response is consistent with the remnants of a backfilled pond or quarry. Several other regions of

magnetic disturbance can be seen; two of these relate to the pylons **4023** and **4025** in Area D, with a further pylon at **4030**.

3.2.13 Towards the southeastern extent of the Site, a loose cluster of pit-like responses **4031** appears within Area G; the origins of these anomalies are unclear and it is possible that they are of archaeological interest, given the generally quiet magnetic background. Curvilinear anomaly **4032** is consistent with a former channel; its weak contrast with and poor definition from the magnetic background support the interpretation that it is natural in origin.

3.2.14 The magnetic background of Area H, towards the southernmost extent of the Site, is relatively quiet. Amorphous anomaly **4033** extends northeast from the western boundary, although it origin is somewhat unclear. Elsewhere within the survey area, ploughing trends are visible but exhibit only weak contrast with the magnetic background, e.g. **4034**. Magnetic disturbance along the field boundary at the southern corner of the field is due to the proximity of the buildings at Crannaford Farm.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and ploughing trends.

4.1.2 The majority of the anomalies of probable archaeological interest comprise elements of former field systems or enclosures. There appears to be a widespread network of such features across the western and northern portions of the Site. Given their coincident orientations with extant boundaries, it is likely that some of these anomalies will be historic in origin, although it is difficult to provide relative phasing with any confidence.

4.1.3 A number of other anomalies of possible archaeological interest have been identified, largely comprising isolated pit-like responses and short lengths of linear anomalies. The confidence of their interpretation has been hampered generally by their lack of contrast with the magnetic background and apparently random distribution.

4.1.4 Region of magnetic disturbance within Area F (**4029**), thought to be associated with a former pond or quarry, exhibits a certain coherency to the strongly magnetised responses and appears well defined around its western and northern perimeters. The strong magnetisation suggests that it is likely to have been backfilled with material such as demolition debris or upcast from quarrying.

4.1.5 The presence of the pylons within the survey area has caused regions of magnetic disturbance some 60m in diameter centred upon each pylon. Whilst this disturbance is sufficiently strong to have masked any weaker archaeological anomalies present, the relative infrequency of such anomalies elsewhere within the survey areas suggests a relatively low potential for archaeological features within the immediate proximity of the pylons.

4.1.6 Given the appearance of ploughing trends within the data, it is considered likely that more substantial archaeological features would have produced magnetic anomalies, should any be present. However, it should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.

5 REFERENCES

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No 1, 2nd edition.

Soil Survey of England and Wales, 1983. *Soils of England and Wales Sheet 5, South West England*. Ordnance Survey, Southampton.

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

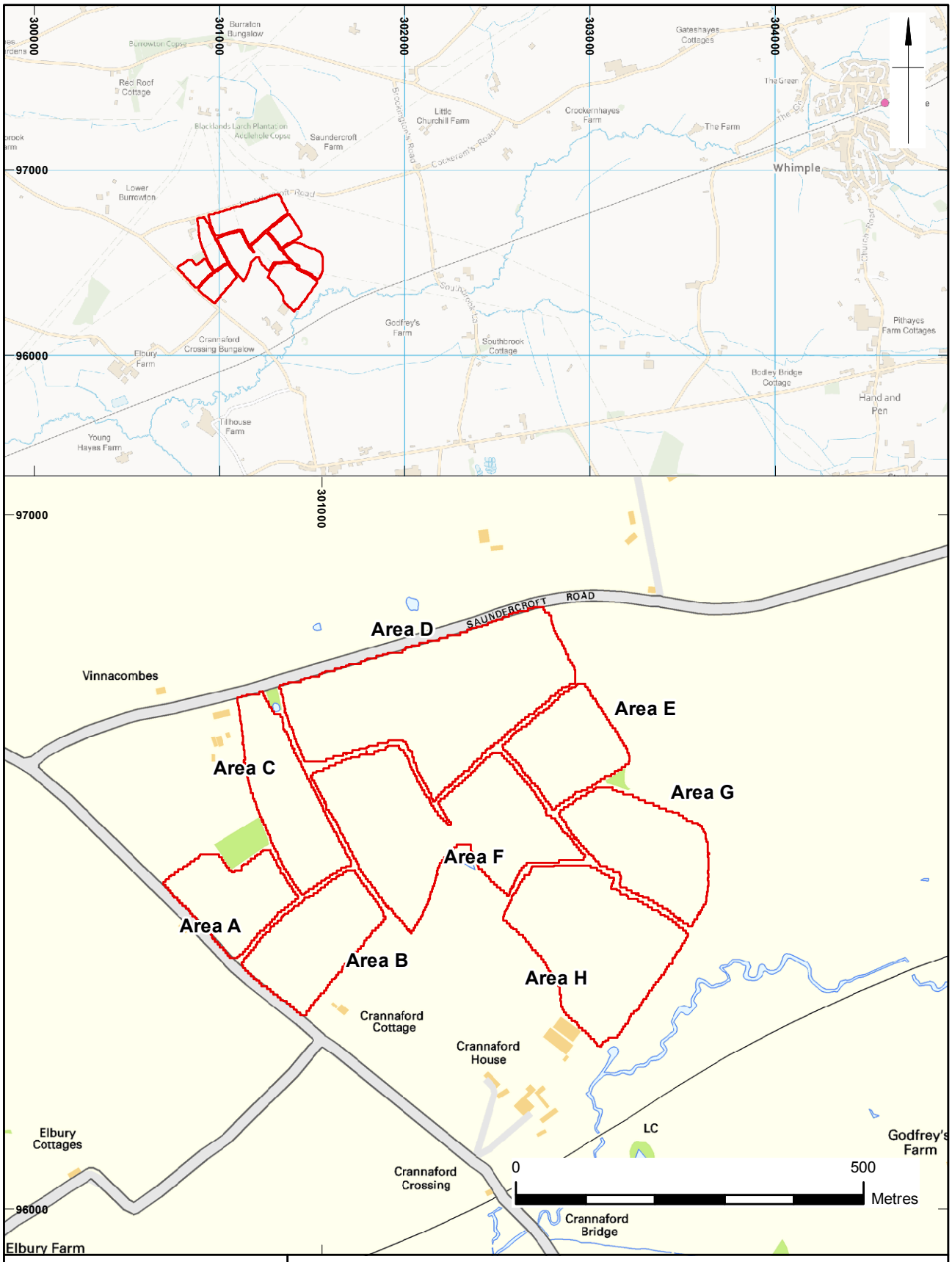
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



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Site location and survey extents

Figure 1

300800
300900
301000
301100
301200

96800
96700
96600
96500
96400
96300

Area D
Area C
Area F
Area A
Area B

+3nT
-2nT

0
100
m

Detail Survey Extents

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Scale:	1:2000 at A3	Illustrator:	LJC
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Greyscale, western areas

Figure 2

300800
300900
301000
301100
301200

96800
96700
96600
96500
96400
96300

Area D
Area C
Area F
Area A
Area B

+25nT
-25nT

0
100
m

Detail Survey Extents

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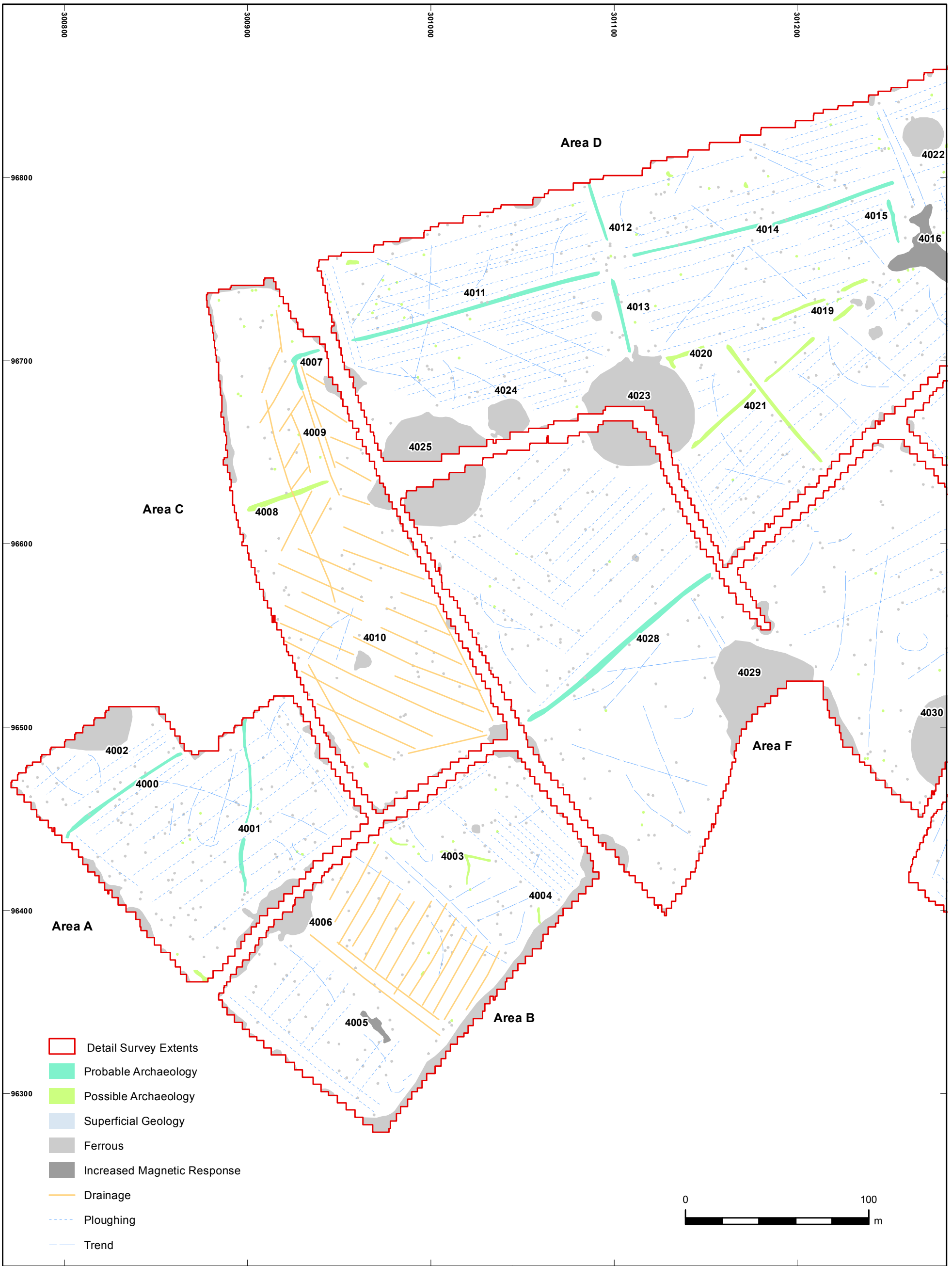
XY trace, western areas

Figure 3



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Interpretation, western areas

Figure 4

301100
301200
301300
301400
301500

96800
96700
96600
96500
96400
96300

Area D
Area E
Area F
Area G
Area H

+3nT
-2nT

0
100
m

Detail Survey Extents

Date:	14/01/13	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	LJC
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Greyscale, eastern areas

Figure 5

301100
301200
301300
301400
301500

Area D

96800

96700

Area E

96600

Area G

96500

Area F

96400

Area H

96300

+25nT

-25nT

0 100 m

Detail Survey Extents

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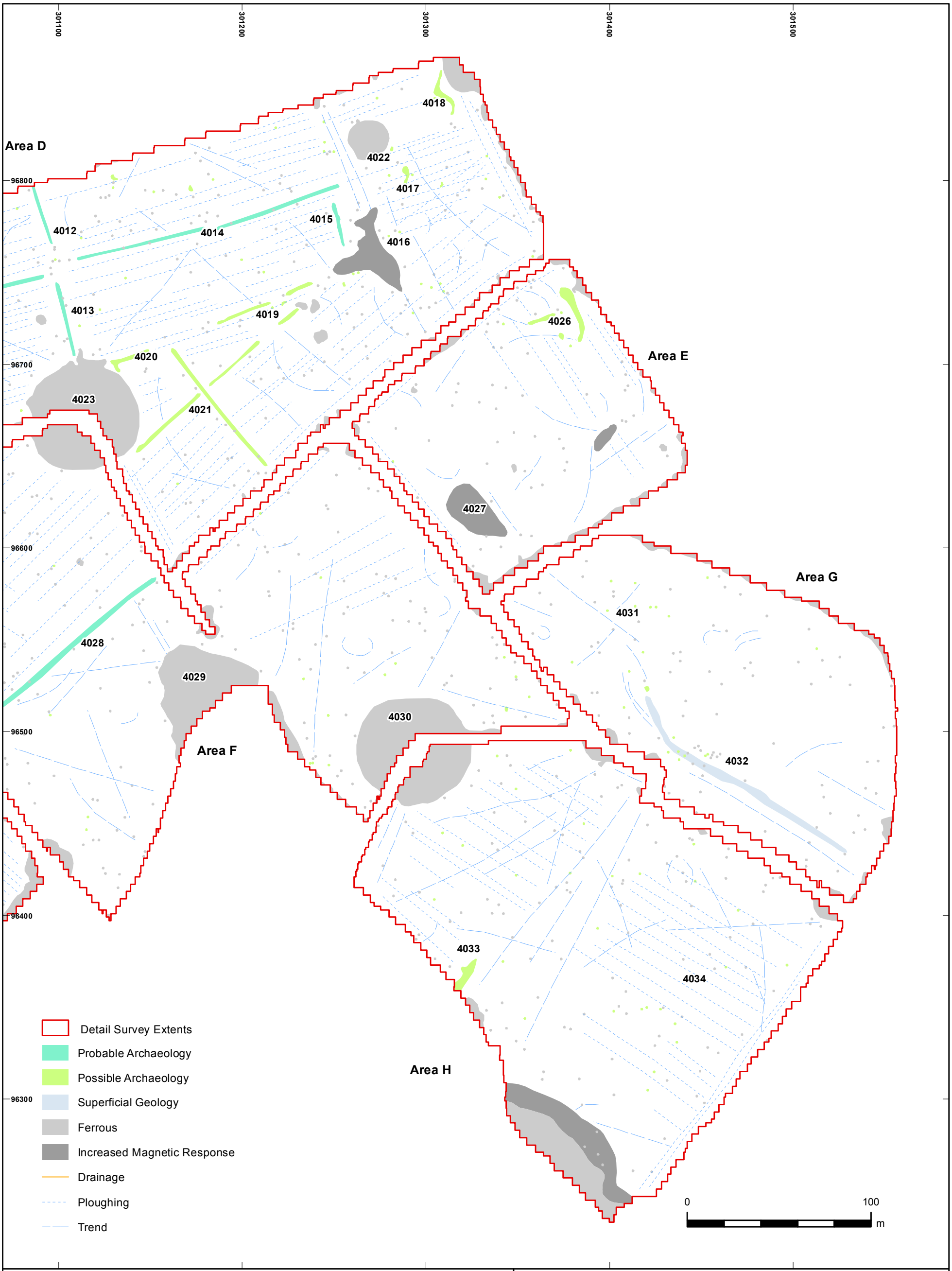
XY trace, eastern areas

Figure 6



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Interpretation, eastern areas

Figure 7

301000

301500

96500

Area A

Area B

Area C

Area D

Area E

Area F

Area G

Area H

4000

4001

4002

4003

4004

4005

4006

4007

4008

4009

4010

4011

4012

4013

4014

4015

4016

4017

4018

4019

4020

4021

4022

4023

4024

4025

4026

4027

4028

4029

4030

4031

4032

4033

4034

Detail Survey Extents

Probable Archaeology

Possible Archaeology

Superficial Geology

Ferrous

Increased Magnetic Response

Drainage

Ploughing

Trend

0

150

Metres

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Interpretation, all areas

Figure 8

wessex archaeology

salisbury rochester sheffield edinburgh

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