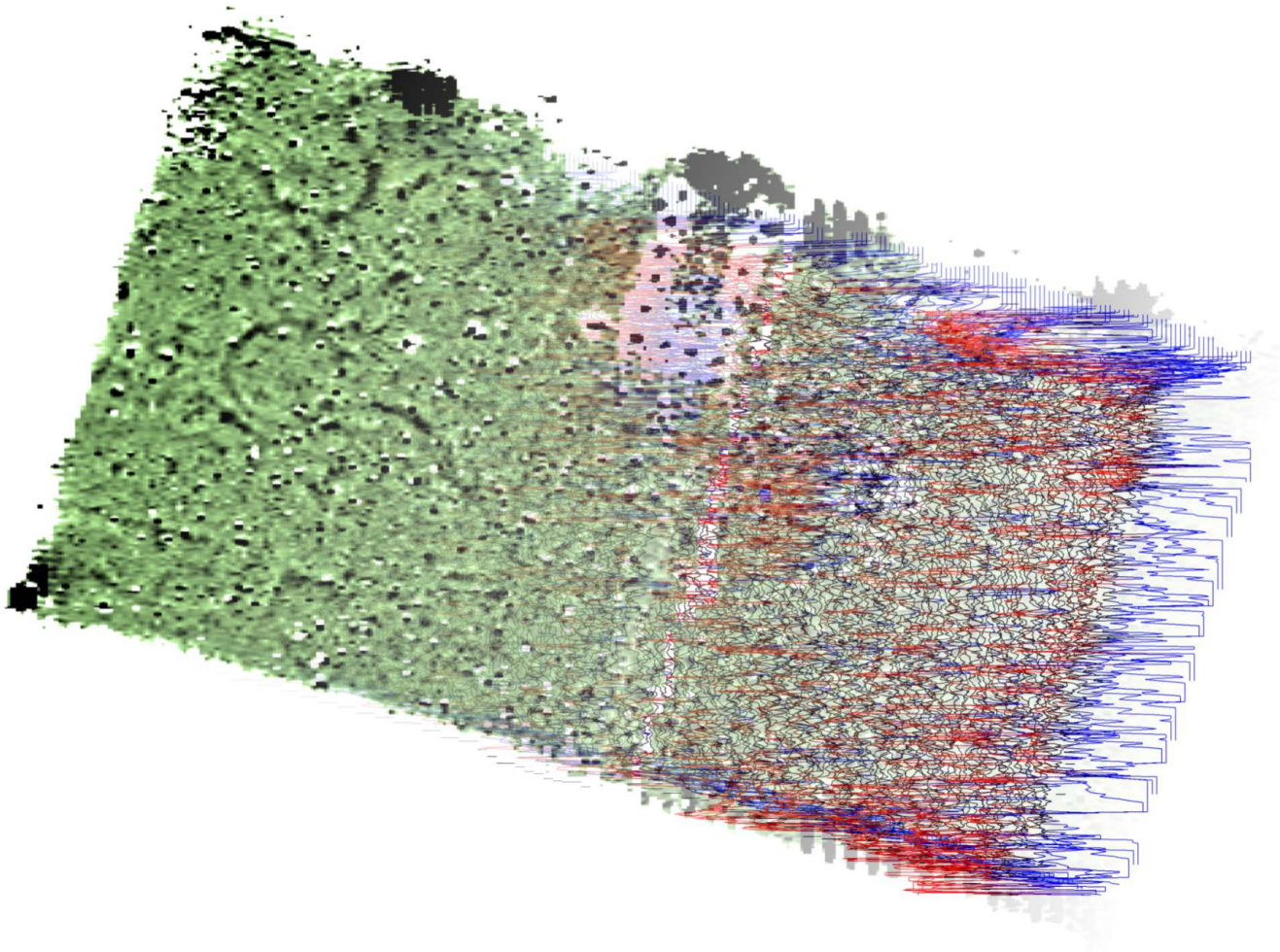
making sense of heritage

Land North of Harwell Primary School Harwell, Oxfordshire

Detailed Gradiometer Survey Report



Ref: 87551.01
February 2014

geoservices

Land north of Harwell Primary School, Harwell, Oxfordshire

Detailed Gradiometer Survey Report

Prepared for:
Taylor Wimpey (UK) Ltd
Windrush Court Suite J
Abingdon Business Park
Abingdon
OX14 1SY

Prepared by:
Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

www.wessexarch.co.uk

February 2014

Report Ref. 87551.01

Quality Assurance

Project Code	87551	**Accession Code**		**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	48781 89461		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	E	*JS*	*BCU*		06/02/2014
File:	X:\PROJECTS\87551\Geophysics\Report\87551_Geophysics_Report_JS.Docx				
File:					
File:					
File:					

* I = Internal Draft; E = External Draft; F = Final

Land north of Harwell Primary School, Harwell, Oxfordshire

Detailed Gradiometer Survey Report

Contents

Figures

Land north of Harwell Primary School, Harwell, Oxfordshire

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land north of Harwell Primary School, near Harwell, south Oxfordshire. The project was commissioned by Taylor Wimpey (UK) Ltd. 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 of 2 pasture fields to the south of Grove Road, approximately 370m north-west of the centre of Harwell and 1.1 km north-east of the village of Rowstock. The Site occupies an area of relatively flat land with a shallow slope which slopes to the north-east. The gradiometer survey covered 2.6ha and has demonstrated the presence of anomalies of probable and possible archaeological interest within the survey area, along with regions of magnetic disturbance and ferrous response.

Several partial ring-shaped anomalies were detected towards the northwestern extent of the survey area, which are consistent with the remnants of barrow ditches or roundhouses. Their responses are not clearly defined from the general magnetic background however, which makes the interpretation less conclusive and it is possible that this is through damage by later ploughing. Evidence for this can be seen throughout the survey area, with faint trends oriented NNE-SSW.

Other linear anomalies and pit-like responses have been classified as being of possible archaeological interest, as it is not possible to exclude this interpretation entirely; it is possible that some are the result of natural processes or agricultural activity, however.

Two ditch-like anomalies were identified oriented parallel with the southeastern boundary, and it is possible that they represent a former field boundary. Towards the northwestern extent of the survey area, ploughing trends aligned with the current agricultural regime are apparent. Weak linear and curvilinear trends were observed throughout the dataset, although their origins are unclear.

No modern services were detected within the Site, although it is possible that the foundations of a former structure lie at the centre of the northern boundary of the survey area.

Extensive magnetic disturbance associated with agricultural processes and numerous small-scale ferrous responses were seen throughout the dataset, particularly around the field boundaries.

Land north of Harwell Primary School, Harwell, Oxfordshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Taylor Wimpey (UK) Ltd. The assistance of Andy Cattermole is gratefully acknowledged in this regard.

The fieldwork was directed by Laura Andrews, Jen Smith and Rachel Williams. Ben Urmston and Rachel Williams processed and interpreted the geophysical data, and Jen Smith wrote this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Ken Lymer. The project was managed on behalf of Wessex Archaeology by Sue Farr.

Land north of Harwell Primary School, Harwell, Oxfordshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Taylor Wimpey (UK) Ltd to carry out a geophysical survey of land north of Harwell Primary School, Harwell, South Oxfordshire (**Figure 1**), hereafter "the Site" (centred on NGR 48781 89461). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed 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 of 2 pasture fields off Grove Road, some 370m to the north-west of the centre of Harwell, 1.1 km north-east of Rowstock and 3.8 km south-west of Didcot (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 2.6 ha.

1.2.2 The Site occupies an area of relatively flat land with a shallow slope which slopes to the north-east. The land lies at a height of over 80m above the Ordnance datum (aOD). The survey extents are defined by Grove Road to the north, a housing estate to the east and south-east and Harwell Primary School to the south.

1.2.3 The soils underlying the Site are likely to be typical argillic brown earths of the 571i (Harwell) 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 geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on 13th January 2014. Field conditions at the time of the survey were good.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, 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 several anomalies of probable and possible archaeological interest within the Site, along with areas of magnetic disturbance and ferrous responses. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1,250 (**Figures 2** and **3**). The data is 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 (**Figure 4**). 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 Near the northwestern corner of the westernmost field, two well-defined sub-annular anomalies **4000** are likely to be of some archaeological interest; their form suggests that they are consistent with barrow ditches or roundhouses. They are situated close to one another with no discernable central features, along with several discrete pit-like anomalies. The westernmost anomaly shows more contrast with the magnetic background and is considered to be of probable archaeological origins; the other to the southeast is less clearly defined and is therefore of possible archaeological interest.

3.2.2 A linear trend extending ENE-WSW respectively can be seen to either side of the north-western most curvilinear anomaly **4000**, as well as a group of curvilinear trends to the south.

3.2.3 Near the western extent of the survey area, a well-defined sub-annular anomaly **4001** of probable archaeological interest is located to the south of similar curvilinear anomalies

4000. Its form in plan is consistent with a barrow ditch or round house and may therefore be associated with anomalies **4000**.

3.2.4 At the centre of Field 1, two short sub-linear anomalies **4002** of some archaeological interest are visible close to the east of a larger curvilinear anomaly **4001**. It is not clear whether they are associated with other nearby anomalies, e.g. **4001**.

3.2.5 At the southwestern extent of the survey area, two linear anomalies **4003** of possible archaeological interest extend parallel with the southern field boundary and it is possible that they represent a continuous feature. It is unclear whether **4003** is associated with a former field boundary or relates to agricultural activity. Two curvilinear trends can be seen to the south of these anomalies although the origins of these responses are unclear.

3.2.6 At the northeastern corner of the western field, U-shaped anomaly **4004** can be seen located within a region of strong magnetic disturbance. It is likely to be modern in provenance and is consistent with the remnants of foundations; it may therefore indicate the presence of a former structure.

3.2.7 In the eastern field, linear anomaly **4005** is visible extending NNE-SSW and it is considered likely that this linear represents part of a former field boundary. Whilst it is considered to be of probable archaeological interest, it is unclear from what period it dates and it is possible that it is historic in origin.

3.2.8 Pit-like anomalies are also located within and around Field 2; their form and size suggest that they may be of some archaeological interest although their origin is not conclusively archaeological and it is possible that they relate to natural features, such as tree throws, or agricultural activity.

3.2.9 Numerous linear and other curvilinear trends, e.g. **4006**, can be seen throughout Field 2. It is likely that some of these are the result of ploughing, or other agricultural activity, and these extend predominately NNW-SSE.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 There are no modern services located in the data however gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

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 several modern services.

4.1.2 Sub-annular anomalies **4000** and **4001** are consistent with barrow ditches or roundhouses. There do not appear to be responses indicating internal features to these anomalies, perhaps therefore suggesting the former interpretation is more likely. None of the anomalies displays strong contrast with the magnetic background, making their interpretation less definitive, and the presence of ploughing trends in the immediate vicinity may indicate that the relatively weak responses due to truncation.

4.1.3 Linear anomalies **4002**, **4003** and **4005** are typical of former field boundaries, although it is not clear from what period these date; the name Grove Road may indicate the former use of these fields as orchards. **4005** is oriented parallel with the extant boundaries to the east and west, and **4002** and **4003** with the southern boundary and Grove Road. The numerous linear trends seen within the dataset are consistent with agricultural use.

4.1.4 Several clusters of isolated pit-like anomalies have been identified although it is difficult to be certain about their origins. An archaeological interpretation cannot be excluded entirely, resulting in their classification as being of possible interest. No clear coherent spatial pattern is apparent within their distribution, however, and it is possible that they are natural or agricultural in origin.

4.1.5 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. However, the detection of ploughing trends and other weak responses suggests that more substantial archaeological features would have produced measurable magnetic anomalies.

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. *Sheet 5, Soils of 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.

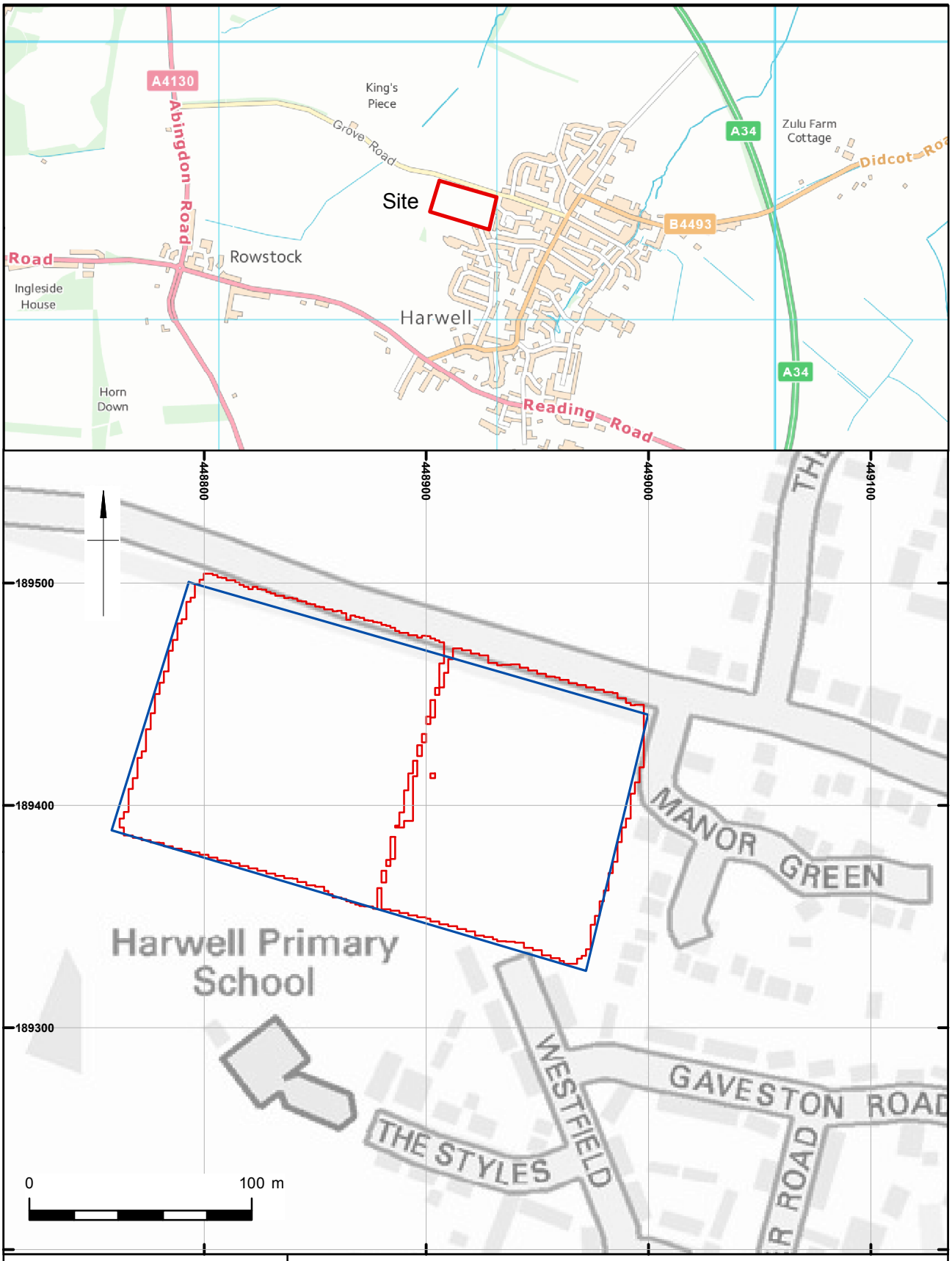
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



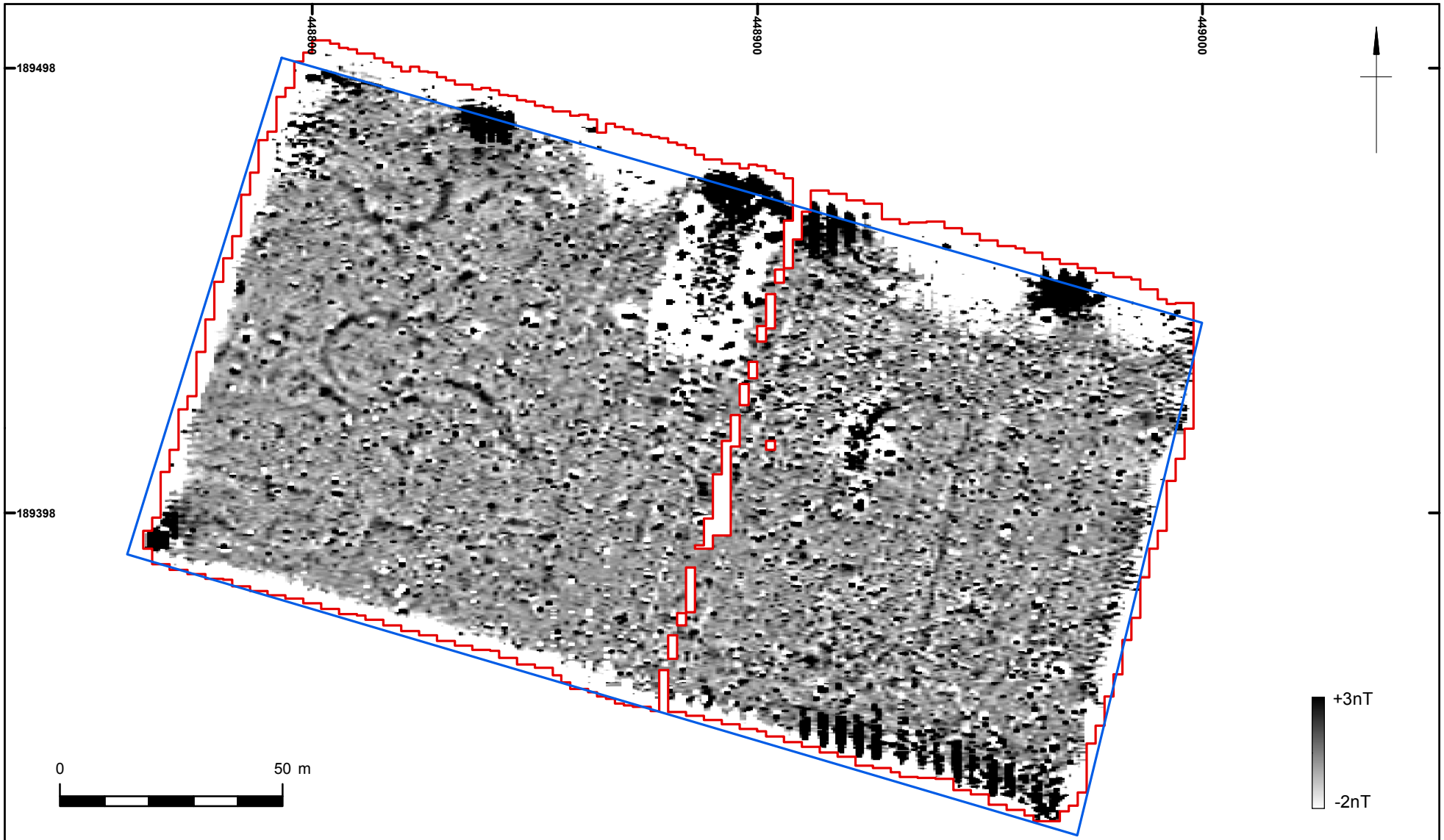
Site area

Geophysical survey extents

Date:	04/02/2014	Revision Number:	0
Scale:	1:2500 at A4	Illustrator:	KL
Path:	X:\PROJECTS\87551\GIS\FigsMXD\geophys\Fig01.mxd		

Site location and survey extents

Figure 1



This material is for client report only © Wessex Archaeology. No unauthorised reproduction.

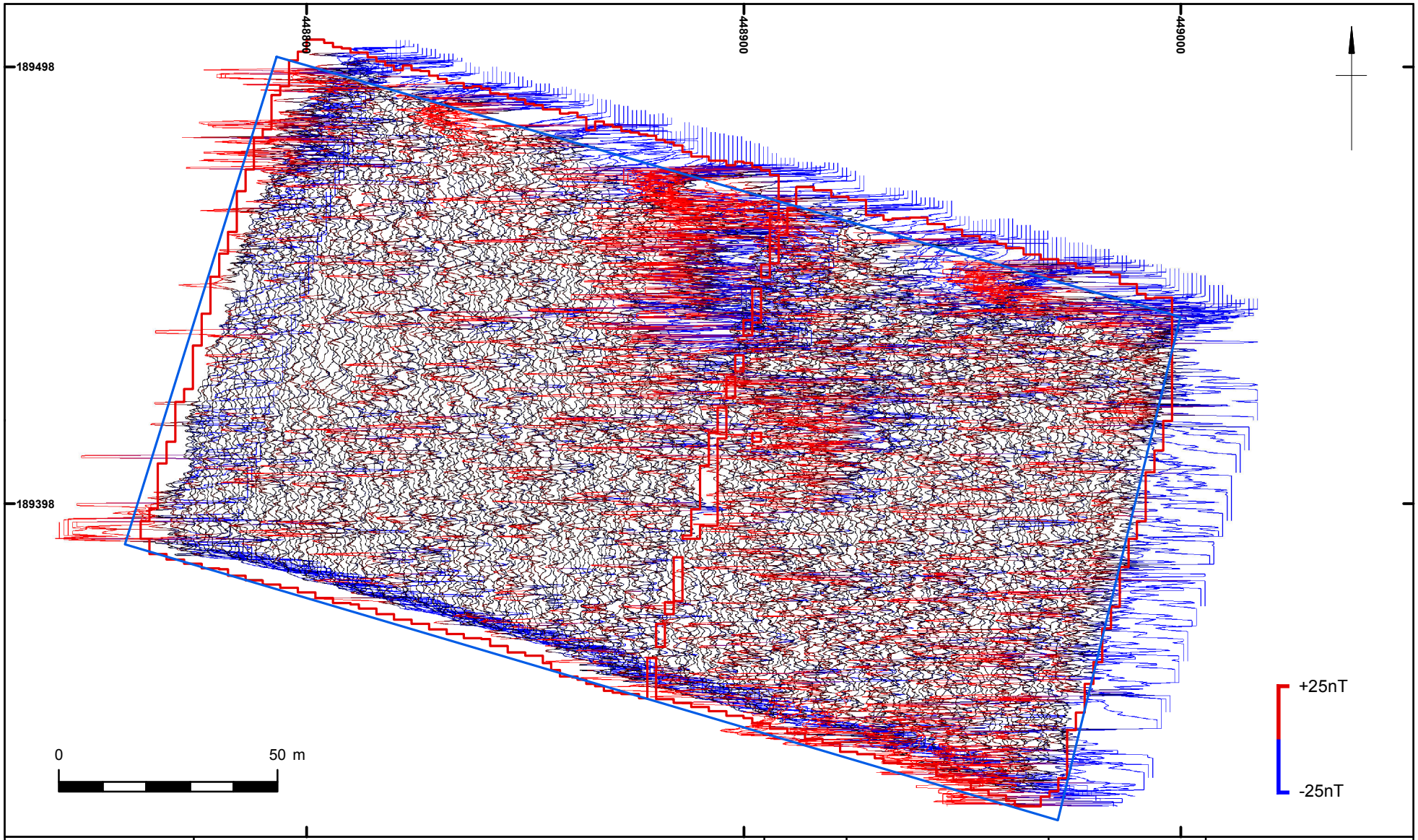
Site

Geophysical survey extents

Date:	04/02/14	Revision Number:	0
Scale:	1:1250 at A4	Illustrator:	KL
Path:	X:\PROJECTS\87551\GIS\FigsMXD\geophys\Fig02.mxd		

Greyscale

Figure 2



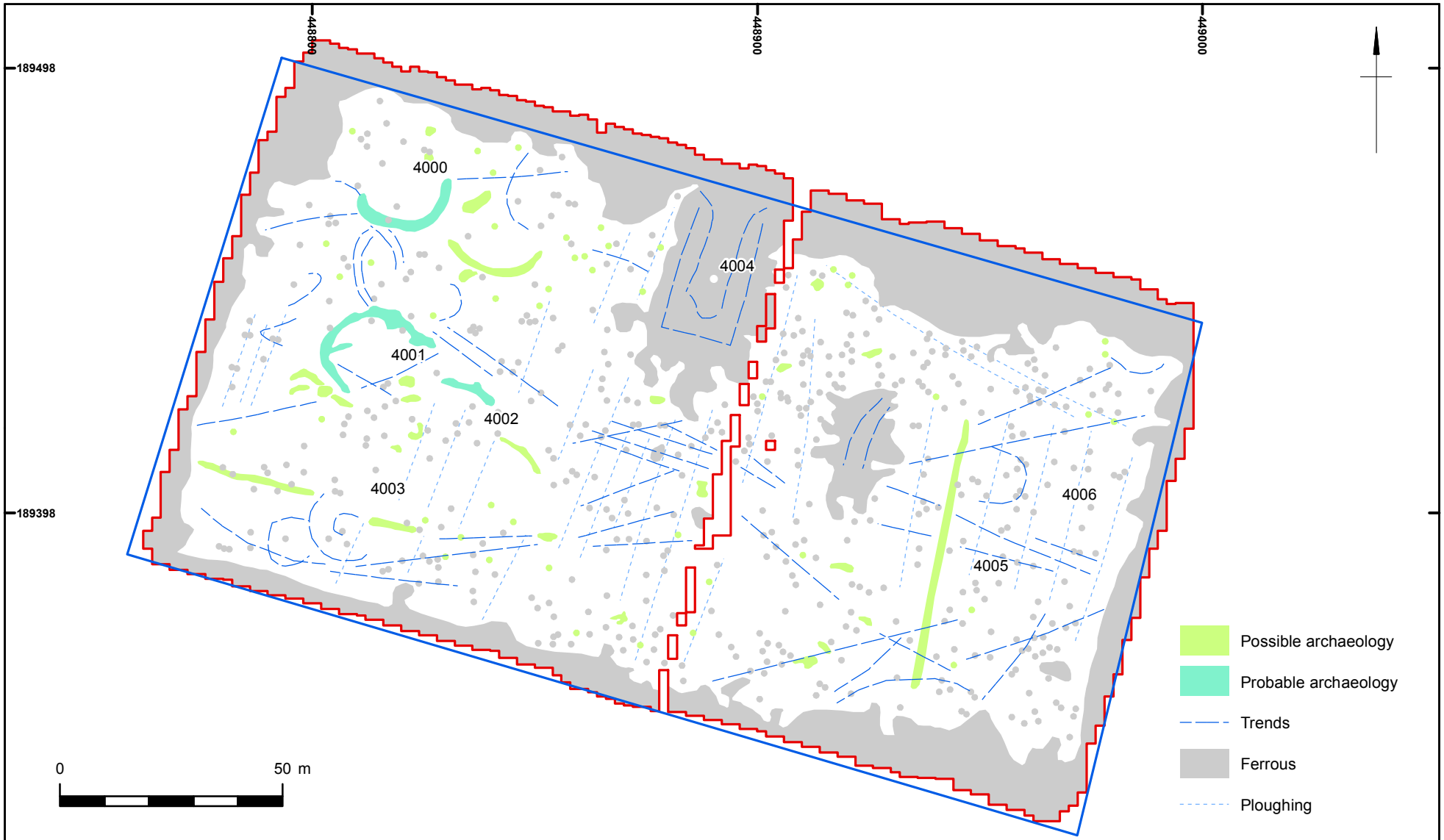
Site

Geophysical survey extents

Date:	04/02/14	Revision Number:	0
Scale:	1:1250 at A4	Illustrator:	KL
Path:	X:\PROJECTS\87551\GIS\FigsMXD\geophys\Fig03.mxd		

XY plot

Figure 3



Site

Geophysical survey extents

Date:	04/02/14	Revision Number:	0
Scale:	1:1250 at A4	Illustrator:	KL
Path:	X:\PROJECTS\87551\GIS\FigsMXD\geophys\Fig04.mxd		

Interpretation

Figure 4

wessex archaeology

salisbury rochester sheffield edinburgh

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk