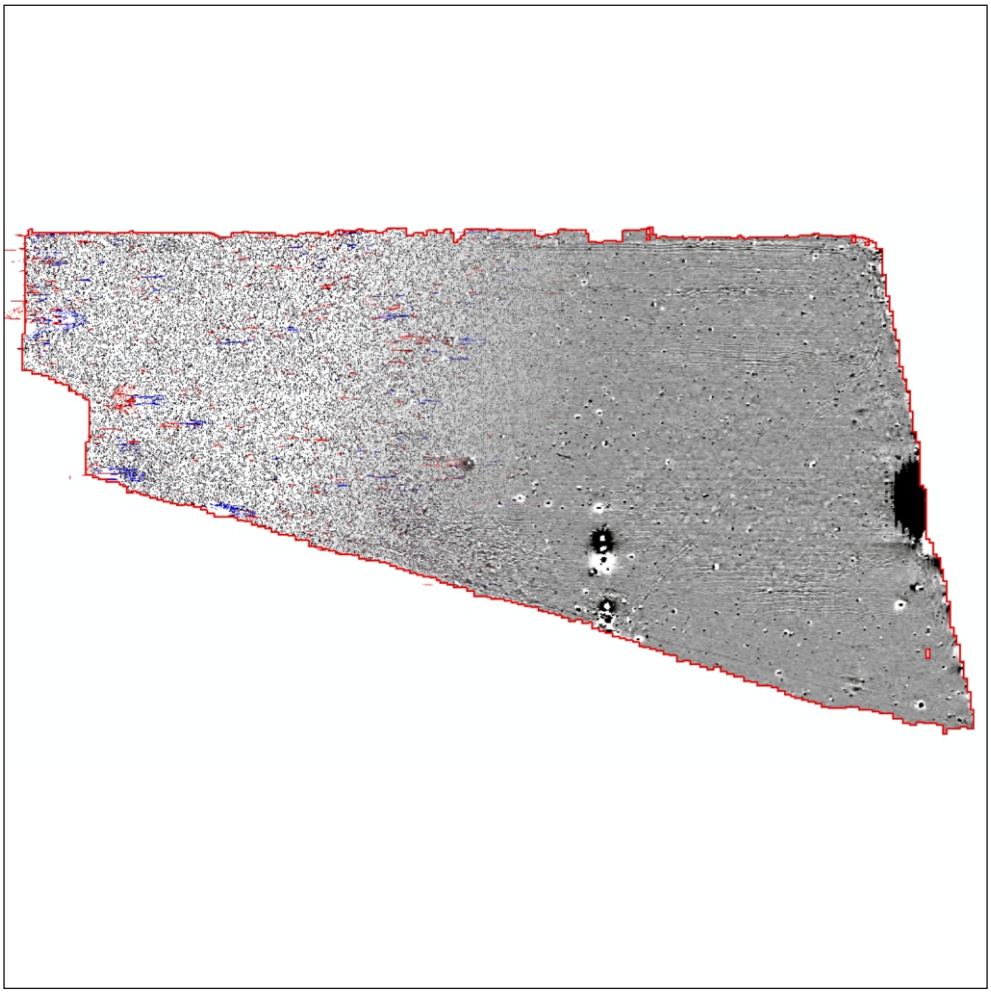
making sense of heritage

Land at Warren Farm
East of Romsey, Hampshire

Detailed Gradiometer Survey Report



Ref: 108400.02
March 2015

geoservices

Land at Warren Farm, East of Romsey Hampshire

Detailed Gradiometer Survey Report

Prepared for:
Terence O'Rourke Ltd
Everdene House
Deansleigh Road
Bournemouth
BH7 7DU

On behalf of:
Solstice Renewables Ltd
The Barn, Ford Farm
Aldbourne
Marlborough
SN8 2DP

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

www.wessexarch.co.uk

March 2015

Report Ref. 108400.02

Quality Assurance

Project Code	108400	**Accession Code**	02	**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	438125,120820		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	E	*ECR*	*LJL*		20/3/2015
File:	X:\PROJECTS\108400_Reports\108400_Warren_Farm_Geophysics_Report_ECR.docx				
v02	F	*ECR*	*LJL*		23/3/2015
File:	X:\PROJECTS\108400_Reports\108400_WarrenFarm_GeophysicsFinal_LJL.docx				

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

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Summary

A detailed gradiometer survey was conducted over land at Warren Farm, near Romsey The project was commissioned by Terence O'Rourke Ltd on behalf of Solstice Renewables Ltd with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on site ahead of the proposed development.

The survey area comprises one arable field, approximately 13ha in size. All areas accessible at the time of survey were covered with a total of 11.2ha of data collected. The width of field boundaries and artificial obstructions (telegraph pylon) reduced the size of the area that could be surveyed. The gradiometer survey has demonstrated the presence of anomalies of modern agricultural and geological origin within the survey area.

The site as a whole is dominated by the deep plough and tractor furrows from modern agricultural activity across the area as well as large scale ferrous responses. There are several small positive oval features across the site of possible archaeological potential however their lack of alignment prevents a confident interpretation.

The survey was undertaken between 9th and 12th of March 2015 by the in-house geophysics team at Wessex Archaeology.

Land at Warren Farm, East of Romsey Hampshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Terence O'Rourke Ltd (Bournemouth) on behalf of Solstice Renewables. The assistance of John Trehy is gratefully acknowledged in this regard.

The fieldwork was undertaken by Lizzie Richley, Alistair Black and Jen Smith. Jen Smith processed and interpreted the geophysical data and the report was written by Lizzie Richley. The geophysical work was quality controlled by Lucy Learmonth and Lizzie Richley. Illustrations were prepared by Lizzie Richley and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Lucy Learmonth.

Land at Warren Farm, East of Romsey Hampshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by Terence O'Rourke Ltd (Bournemouth) on behalf of Solstice Renewables Ltd to carry out geophysical survey an area of land at Warren Farm near Romsey, Hampshire (**Figure 1**), hereafter "the Site" (centred on National Grid Reference (NGR) 438125,120820).

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 Site Location and Topography

1.2.1 The Site is located approximately 2.8km east of the centre of Romsey and 9.2km northwest of the centre of Southampton. The Site is located immediately to north of the A27 Botley Road that runs between North Baddesley and Romsey, and to the east of Highwood Lane. The Site comprises one arable field with the survey extents defined by field boundaries to the north and east, by Highwood Lane to the west and by an area of trees to the SW and south.

1.2.2 The Site is set on a gentle west facing slope with the height falling from just over 44m above Ordnance Datum (aOD) in the northwest corner to 36m aOD in the northeast corner. There are no watercourses present on site.

1.3 Soils and Geology

1.3.1 The bedrock geology under the Site is recorded as Earnley Sand Formation and is composed of Sand, Silt and Clay. This is a sedimentary bedrock formed approximately 40-49 million years ago in the Palaeogene Period (BGS).

1.3.2 The soils at the Site are recorded primarily as Eutric Luvic Planosols of the 711g Wickham 3 association underlying the majority of the Site with siltic Luvisols of the 571z Hamble 1 association on the western edge of the Site. These are predominantly slowly permeable seasonally wet slightly acid but rich loamy and clayey soils.

1.3.3 Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

1.4 Archaeological Background

1.4.1 The following information is summarised from the Heritage Gateway website (www.heritagegateway.org.uk). A search was performed for all heritage assets within 1km of the Site.

1.4.2 There are no recorded archaeological features within the survey extents at Warren Farm. The recorded archaeological sites within close vicinity to the Site are mostly prehistoric in date. There are no prehistoric sites but several find spots suggest this area to be of importance within the Lower Palaeolithic. On the other side of the A27 Botley road (to the south of the site) over 100 lower Palaeolithic hand axes were found alongside other material of a similar data at Test Road Gravel Pit (NMR No. SU32 SE 97). Similarly in the Luzborough Gravel Pits (NMR No SU 32 SE 8) digging revealed lithic implements that include burnt flint, acheulian type palaeoliths, a levallois flake as well as urns and burials.

1.4.3 Luzborough House located on the other side of the A27 c 500m from the southern extent of the site) is dated from the mid-16th Century. Further away lies Broadlands House, which is the original manor house and belonged to Romsey Abbey.

1.4.4 Romsey itself, to the west of the Site, dates from 907 AD and has several standing structures of medieval and post medieval date. The development of Romsey and the surrounding area was fuelled by the lucrative wool industry that was powered by the watermills. The post-medieval period saw the decline of the wool industry and the rise brewing, papermaking and sack manufacture which were all reliant upon the waters of the River Test.

1.4.5 Based on these results, the archaeological potential of the Site is classed as low to medium.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed gradiometer 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 between 9th and 12th March 2015. Field conditions at the time of the survey were medium to poor across most of the survey area, with deep furrows from ploughing and the stubble from the recent crop making conditions difficult. Across the Site deep plough and tractor furrows held standing water.

2.1.3 A total of 11.2ha of a possible 13ha was surveyed; the surveyable area was reduced by the width of the field boundaries that surround the Site, in particular the southern boundary with the A27 Botley Road has been enlarged with a width of approximately 30m being obstructed by the presence of sapling trees.

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 guidelines (2008).

2.2.2 The gradiometer 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 English Heritage 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 (±10nT thresholds) applied to correct for any variation between the two Bartington sensors used, a deslope function, a multiply function and a de-step function to account for variations in traverse position due to varying ground cover. These four 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 across the survey areas. Many of the features identified are related to modern agricultural features and ferrous responses.

3.1.2 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2** to **4**). 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.

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

3.1.4 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 The Site is categorised by the strong linear plough lines that are a result of the modern agricultural activity on the site. These varied in size, both width and depth, and also in frequency across the Site with closely spaced furrows in some areas and wider spaced in others.

3.2.2 Several small, positive features can be seen across the site, in particular at **4000**, **4001** and **4002** measuring between 2 and 5nT. These are likely to refer to small scale cut features, perhaps pits, and have been interpreted as possible archaeology, although these could possibly be natural hollows. An agricultural track way is present at **4003**, and is clear in aerial imagery.

3.2.3 The eastern half of the site is visibly different to the western side and shows a large degree of superficial geology highlighted at **4004**. The soil survey map shows a change in the geology in the eastern part of the Site and is probable that this is the reason for the stark contrast in this area. To the south of the Site there were gravel quarries and it is probable that gravel deposits are present across this part of the Site.

3.2.4 Across the Site there are several ferrous responses and linear trends. Older aerial photographs demonstrate ploughing direction has changed in recent years and may well account for some of the linear trends that are visible. Historic mappings shows the field boundaries have remained unchanged since the mid-19th Century, with no internal subdivisions or structures detailed.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 No modern services have been identified in the geophysical data however it should be noted that gradiometer survey may not detect 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 gradiometer survey has been successful in identifying a number of anomalies of possible archaeological interest across the survey areas. The most prolific features detected during the survey however are the modern agricultural features in the form of plough and tractor furrows and a track way.

4.1.2 The majority of the detected features appear to relate to agricultural activity with numerous boundaries detected that can be related to mapped features. Ploughing trends are visible across the entire dataset, largely aligned with modern boundaries.

4.1.3 There are numerous small positive anomalies scattered across the dataset. These have been interpreted as possible archaeology and could represent cut features such as pits or post holes, however it should be noted a natural explanation may also be possible for them (e.g. tree throws). As they have no significant patterning in their spatial distribution they should be regarded as having a low archaeological potential.

4.1.4 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

5.1 Bibliography

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

5.2 Cartographic Sources

British Geological Survey
http://www.bgs.ac.uk/discoveringgeology/geologyofbritain/viewer.html

Soil Survey of England and Wales (SSEW), 1983: *Sheet 6, 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 four main categories: archaeological, modern, agricultural and uncertain origin/geological.

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 modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological 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.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.

Site

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Site location and detailed survey extents

Figure 1

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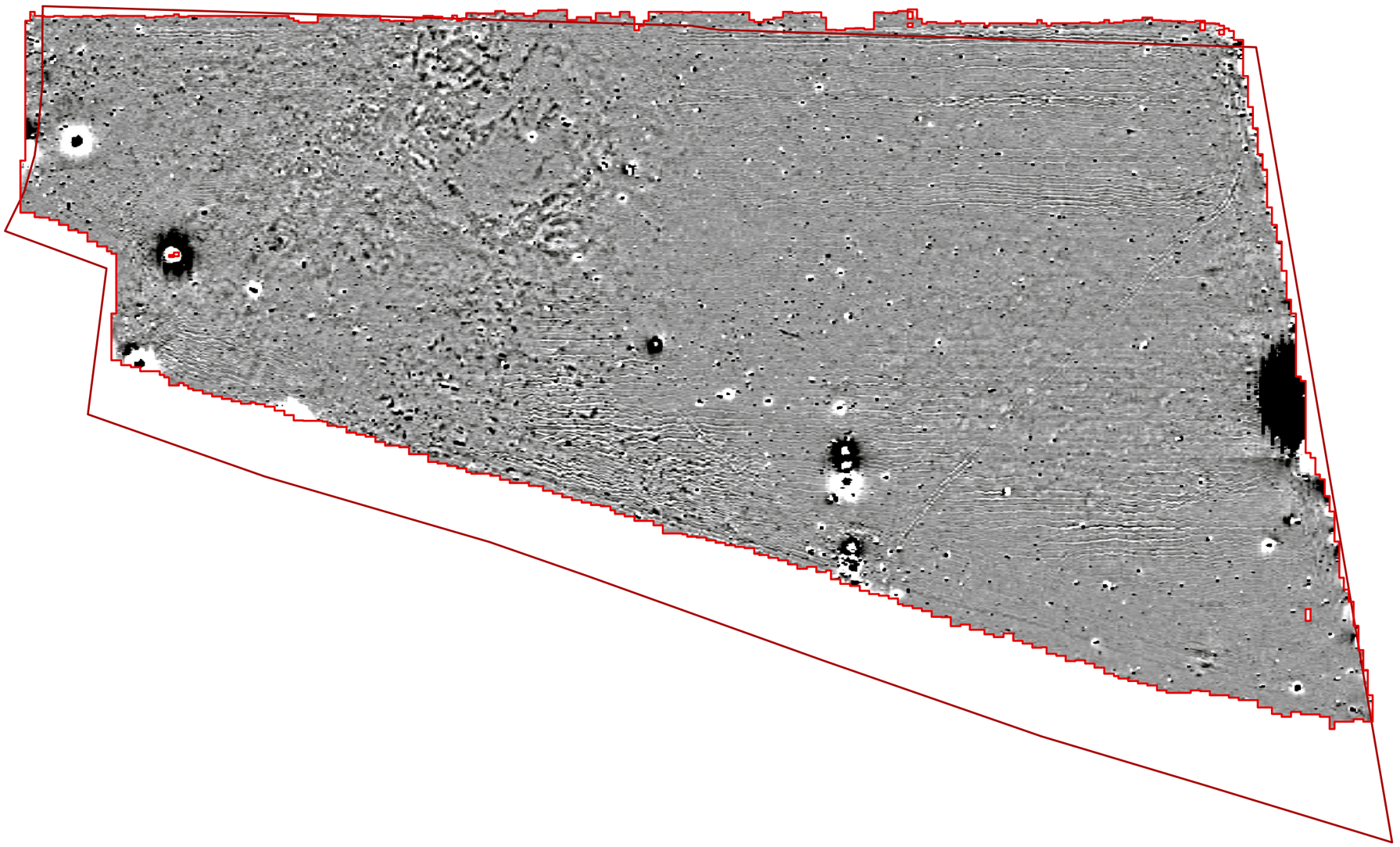

Survey Extents

Site

3nT

-2nT

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0 100 m

Greyscale Plot

Figure 2

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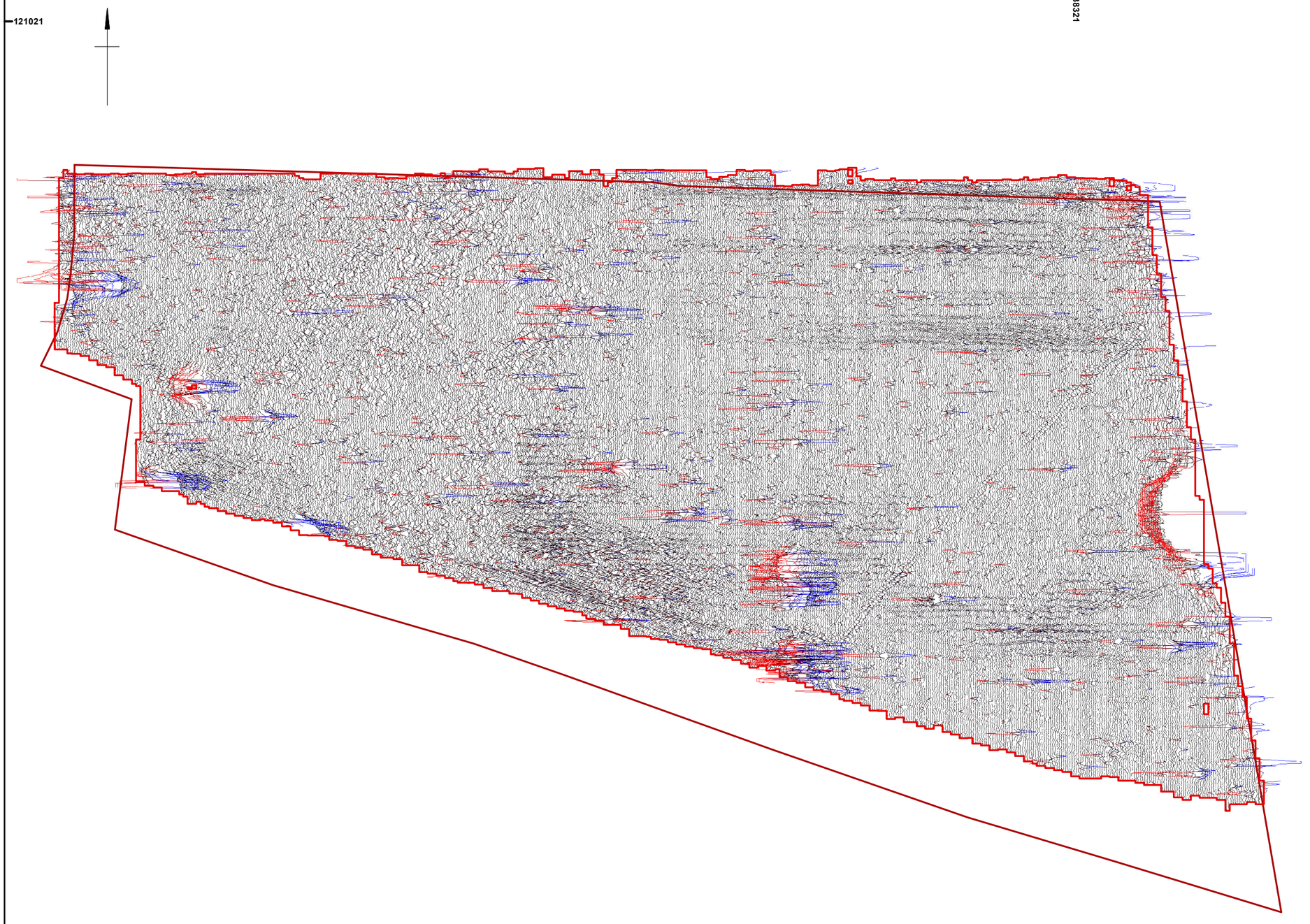

Survey Extents

Site

25nT

-25nT

0 100 m

Date:	17/03/2015
Revision Number:	0
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Illustrator:	ECR
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	GIS\FigsMXD

XY Trace Plot

Figure 3

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4004

4000

4002

4003

4001

0 100 m

Site
Survey Extents
Trends
Ploughing
Agricultural
Possible Archaeology
Ferrous
Superficial Geology

Date:	17/03/2015
Revision Number:	0
Scale:	1:2000 at A3
Illustrator:	ECR
Path:	X:\PROJECTS\T19980\
	GIS\FigsMXD

Interpretation

Figure 4

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