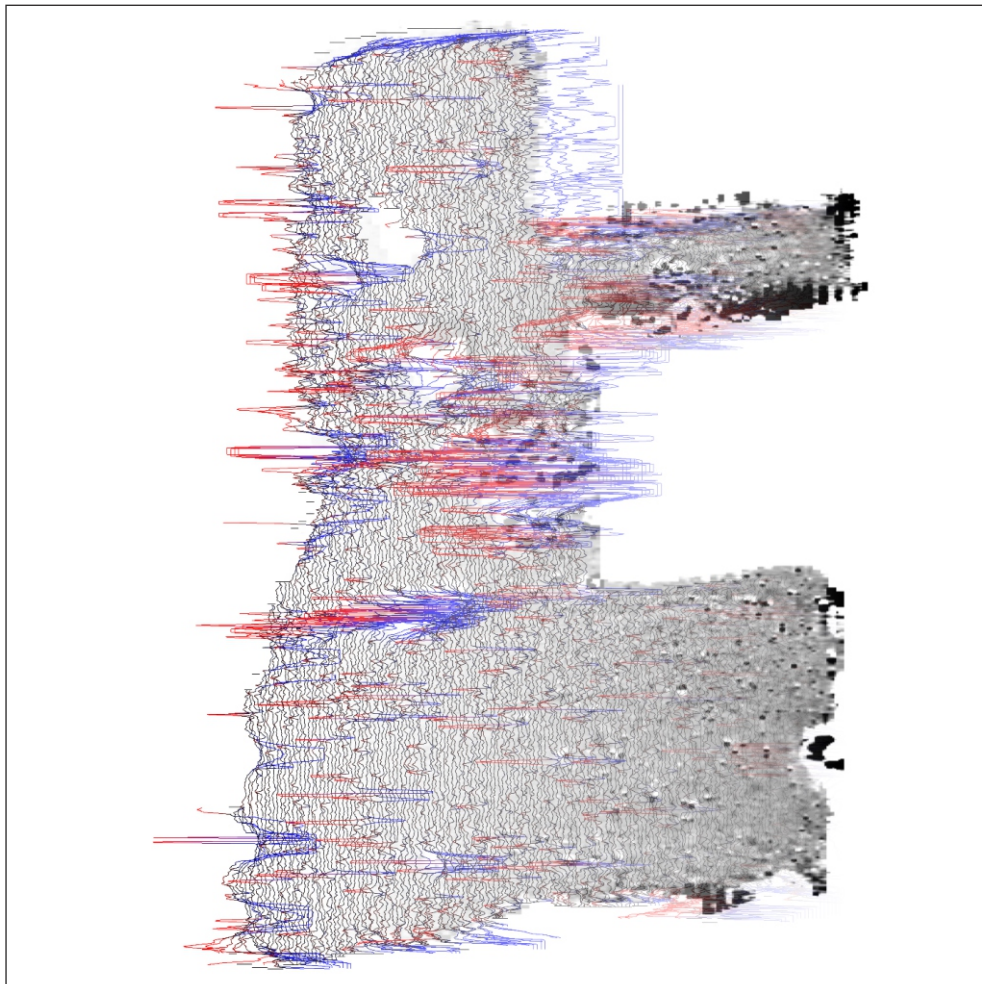




making sense of heritage

Land at Bight Farm, Kempsey, Worcestershire

Detailed Gradiometer Survey



Ref: 101800.01
October 2013



Land At Bight Farm, Kempsey Worcestershire

Detailed Gradiometer Survey Report

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October 2013

Report Ref. 101800.01



Quality Assurance

Project Code	101800	Accession Code		Client Ref.	101800.01
Planning Application Ref.		Ordnance Survey (OS) national grid reference (NGR)	385275, 248425		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	RDL	APN		15/10/13
File:	X:\PROJECTS\101800\Geophysics\Report\101800_Geophysics_Report_RDL.Docx				
v02	E		APN		15/10/13
File:					
v03	F		PG		15/10/13
File:	X:\PROJECTS\101800\Geophysics\Report\101800_Geophysics_Report				
File:					

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

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Land at Bight Farm, Kempsey Worcestershire

Detailed Gradiometer Survey Report

Contents

Summary	ii
Acknowledgements.....	iii
1 INTRODUCTION.....	1
1.1 Project Background.....	1
1.2 The Site.....	1
2 METHODOLOGY.....	1
2.1 Introduction	1
2.2 Method.....	2
3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION.....	2
3.1 Introduction	2
3.2 Gradiometer Survey Results and Interpretation.....	2
3.3 Gradiometer Survey Results and Interpretation: Modern Services	3
4 CONCLUSION	3
5 REFERENCES.....	4
APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING.....	5
APPENDIX 2: GEOPHYSICAL INTERPRETATION.....	7

Figures

- Figure 1 Site location and survey extents
Figure 2 a) Greyscale b) XY trace c) Interpretation



Land at Bight Farm, Kempsey Worcestershire

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land off Main Road, Kempsey, Worcestershire. The project was commissioned by CgMs Consulting 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 an arable field to the west of Main Road, approximately 6.6km south of Worcester. The site occupies an area of relatively flat land, sloping down towards the west towards the River Severn. The gradiometer survey covered 2.54ha and has demonstrated the presence of anomalies of possible archaeological interest within the survey area, along with several regions of increased magnetic response.

Only very small positive anomalies were identified in the data that were classed as possible archaeology. Given their lack of any significant spatial patterning it is considered likely that these are geological, but an archaeological origin cannot be entirely discounted.

The geophysical survey was undertaken on the 23rd September 2013. The archive is currently held at Wessex Archaeology's Salisbury office and if required will be deposited in due course.



Land at Bight Farm, Kempsey Worcestershire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by CgMs Consulting Ltd on behalf of Countrywide Property Management Ltd. The assistance of Paul Gajos is gratefully acknowledged in this regard.

The fieldwork was directed by Jennifer Smith and assisted by Clara Dickinson. Rachel Williams processed the geophysical data which was interpreted by Ross Lefort and Rachel Williams. This report was written by Ross Lefort. 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 Andrew Norton.



Land at Bight Farm, Kempsey Worcestershire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project Background

- 1.1.1 Wessex Archaeology was commissioned by Countrywide Property Management Ltd to carry out a geophysical survey of land off Main Road (A38), Kempsey, Worcestershire (**Figure 1**), hereafter “the Site” (centred on NGR 385275, 248425). 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 one arable field off Main Road (A38), Kempsey and some 6.6km south of the centre of Worcester (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 2.54ha.
- 1.2.2 The Site occupies an area of gently sloping land at a height around 18m above Ordnance Datum (aOD) and slopes downhill toward the west; the River Severn lies 1km to the west of the survey area. The survey extents are defined by the surrounding field boundaries.
- 1.2.3 The solid geology on Site is recorded as marl (Triassic) and the Quaternary deposits nearby are recorded as alluvium and river terrace deposits (Ordnance Survey 1957 and 1977). The soils underlying the Site are likely to be typical brown earths of the 541r (Wick 1) 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 the 23rd September 2013. Field conditions at the time of the survey were good, with firm ground under foot and little vegetation present on Site.

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 ($\pm 8\text{nT}$ 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 possible archaeological interest across the Site, along with several areas of increased magnetic response. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figure 2**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ 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 2**). 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 There are no anomalies of definite or probable archaeological interest in the geophysical data. The only anomalies of any significance are classed as possible archaeology. There are numerous, small positive anomalies present throughout the data such as at **4000**; they have magnetic values over +2nT and are sub-oval and sub-circular in shape. These anomalies are considered to possibly represent small archaeological cut features such as postholes, and they have been classed as possible archaeology. However, as there is no significant patterning in their spatial distribution a geological origin is considered more likely.



3.2.2 There are numerous linear and curvilinear trends visible in the data, most are considered to be related to ploughing such as those around **4003**, but some others such as those around **4001** and **4002** may prove to be archaeological.

3.2.3 The remaining anomalies present are concentrated spreads of small bipolar and dipolar responses (black and white) such as those around **4004** and **4005**. These responses are considered to represent small pieces of ferrous metal and ceramic fragments and are considered to be fairly modern spreads given their concentration around the field edges.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 There are no clear modern services located in the data. There are however a few ferrous anomalies such as at **4006** that look regular in form, although they are not considered to represent services.

3.3.2 It is not clear from the geophysical data whether any services identified are in active use or not. Also 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 identified no anomalies of definite or probable archaeological interest within the Site. Although there are wide spreads of ferrous responses there is not enough to cover substantial archaeological features. Similarly the geology does not appear to be strong enough to mask strongly magnetised archaeological features. The absence of archaeological features in the geophysical data either indicates that none are present in this field, or that any archaeological features present within this field do not give any magnetic contrast to allow them to be detected through gradiometer survey.

4.1.2 The only features of possible archaeological interest are a series of small positive anomalies that may prove to be small cut features such as postholes but are considered more likely to be geological. None of these small features form any significant patterning to suggest that they may be of archaeological significance.



5 REFERENCES

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

Ordnance Survey, 1977. *Quaternary Map of the United Kingdom: South*. Ordnance Survey: Southampton.

Ordnance Survey, 1957. *Sheet 2, Geological Map of Great Britain: England and Wales*. Ordnance Survey: Chessington.

Soil Survey of England and Wales, 1983. *Sheet 3, Midland and Western 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 ± 100 nT 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.

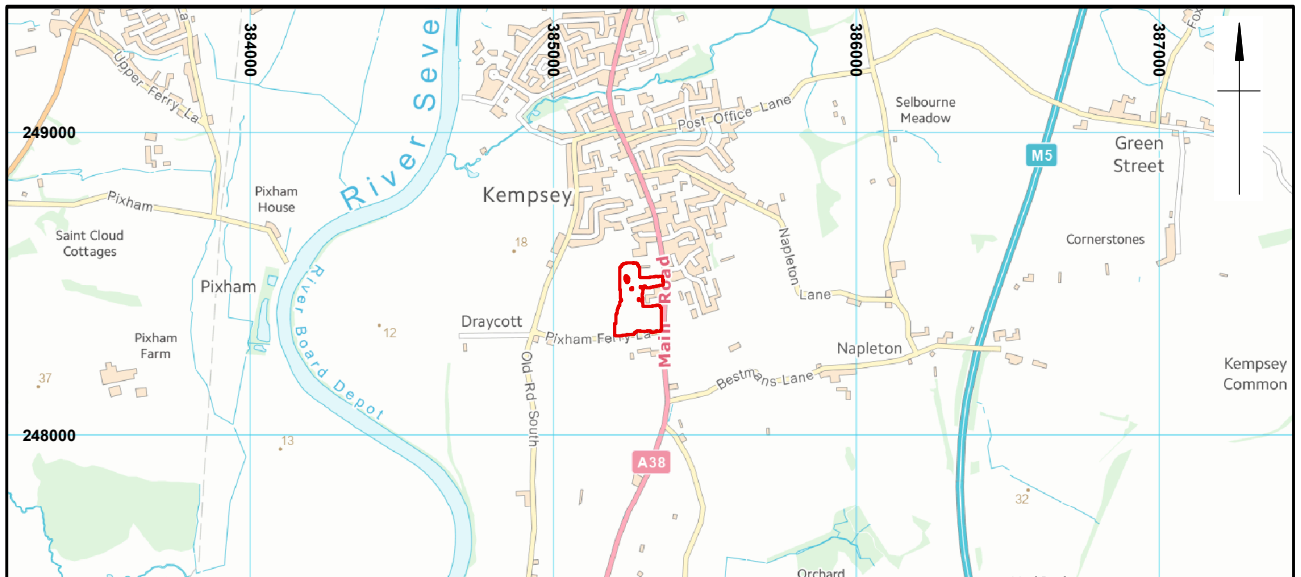
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

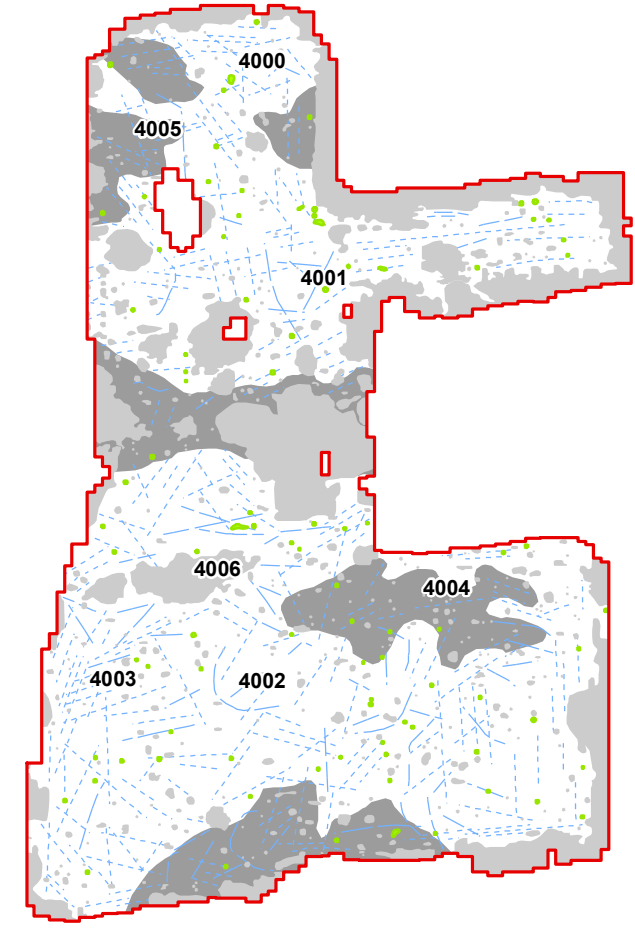
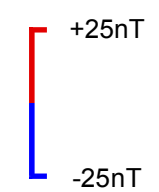
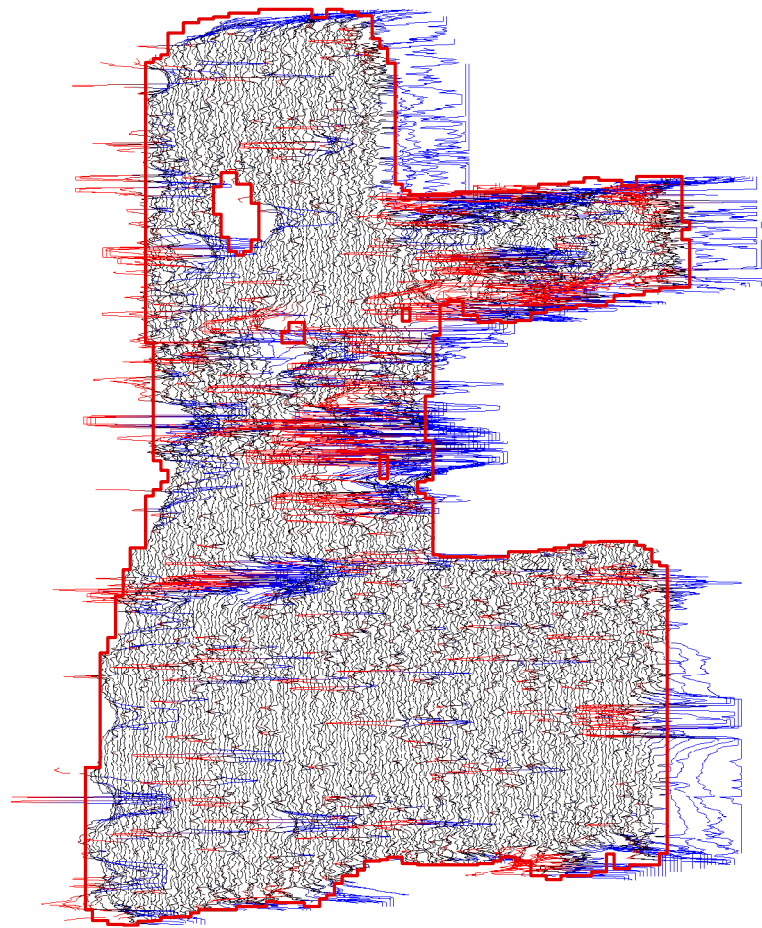
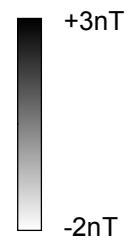
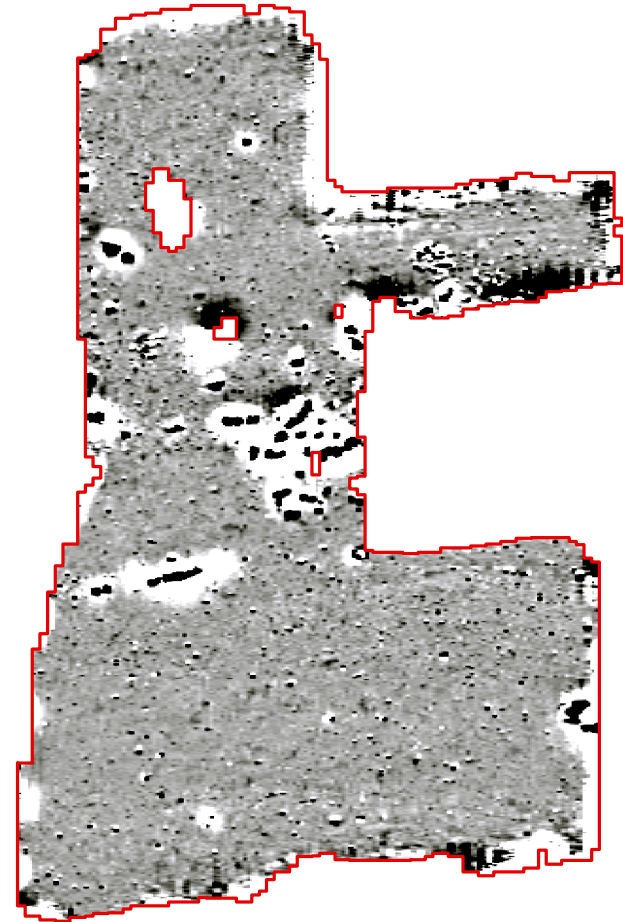
Finally, services such as water pipes are marked where they have been identified.



 Survey Extents 	Contains Ordnance Survey data © Crown copyright and database right 2013.			
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	Path:	X:\PROJECTS\101800\GIS\FigsMXD\101800_Fig01.mxd		

Site location and survey extents

Figure 1



- Survey Extents
- Possible Archaeology
- Trends
- Agricultural
- Ferrous
- Increased Magnetic Response

a)

b)

c)



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Date:	15/10/13	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	LJC
Path:	X:\PROJECTS\101800\GIS\FigsMXD\101800_Fig02.mxd		

a) Greyscale b) XY trace c) Interpretation

Figure 2



salisbury rochester sheffield edinburgh



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