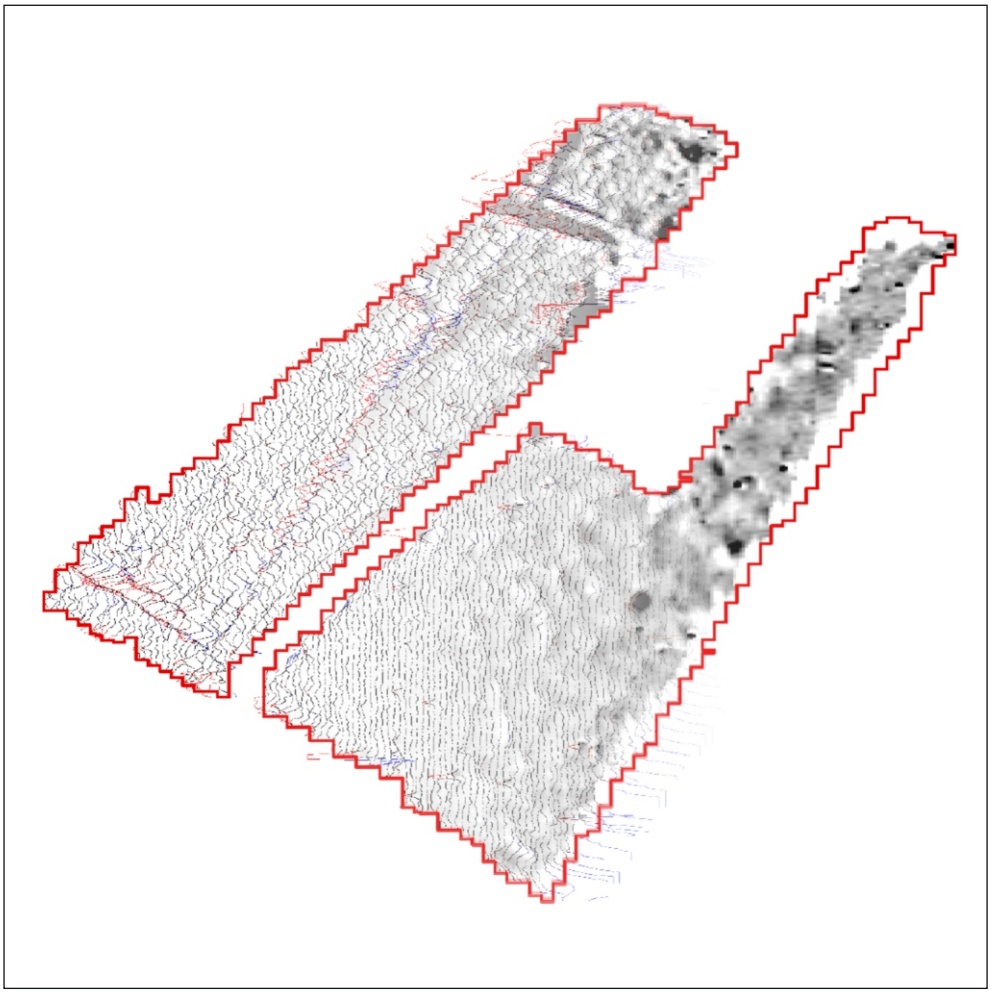
making sense of heritage

Land At Pisky Farm, Playing Place Cornwall

Detailed Gradiometer Survey Report



Ref: 101830.02
November 2013

geoservices

Land At Pisky Farm, Playing Place
Cornwall

Detailed Gradiometer Survey Report

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November 2013

Report Ref. 101830.02

Quality Assurance

Project Code	101830	**Accession Code**		**Client Ref.**	101830.02
Planning Application Ref.	PA13/01305/PREAPP	**Ordnance Survey (OS) national grid reference (NGR)**	181025, 041250		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	*RDL*	*BCU*		06/11/2013
File:	X:\PROJECTS\101830\Geophysics\Report\101830_Geophysics_Report_RDL.Docx				
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* I = Internal Draft; E = External Draft; F = Final

Land at Pisky Farm, Playing Place
Cornwall

Detailed Gradiometer Survey Report

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Summary

A detailed gradiometer survey was conducted over land near Pisky Farm, Playing Place, Cornwall. The project was commissioned by Coastline Housing 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 two arable fields to the east of the A39, approximately 3.9km SSW of Truro and occupies an area of relatively flat land on top of a ridge. The gradiometer survey covered c. 1ha and has demonstrated the presence of anomalies of definite, probable and possible archaeological interest within the survey area, along with numerous linear and curvilinear trends.

Two pit-like anomalies were identified along with a number of linear anomalies that may represent former field boundaries or enclosures. These possible field boundaries do not appear on historic maps and therefore may be of archaeological potential. Weak linear and curvilinear trends were observed throughout the dataset, although their origins are unclear. Other responses are characteristic of geological and agricultural processes.

The geophysical survey was undertaken on 25th October 2013.

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Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Coastline Housing Ltd. The assistance of Alison Johns is gratefully acknowledged in this regard.

The fieldwork was directed by Jennifer Smith and assisted by Rachel Williams. Ross Lefort processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston. Illustrations were prepared by Adela Murray Brown. The project was managed on behalf of Wessex Archaeology by Paul Baggaley.

Land at Pisky Farm, Playing Place Cornwall

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Coastline Housing Ltd to carry out a geophysical survey of land near Pisky Farm, Playing Place, Cornwall (**Figure 1**), hereafter "the Site" (centred on NGR 181025, 041250). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at the Site.

1.1.2 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology (2013), which outlines the main aim of the survey which 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, Topography, Soils and Geology

1.2.1 The survey area comprises two arable fields off the A39 just outside Playing Place, some 3.9km SSW of the centre of Truro (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of c. 1ha.

1.2.2 The Site occupies a crest at a junction of low ridges, with the land falling away to the northwest, northeast and southeast. Standing at 90m above Ordnance Datum, the Site is surrounded by arable and pasture farmland divided by field boundaries with wooded areas. There are several small watercourses flowing close to the Site that flow into the Truro River to the east. The survey area is bounded to the northwest by the A39 and to the northeast by a modern housing development; the remaining extents are defined by field boundaries.

1.2.3 The soils underlying the Site are likely to be the typical brown earths of the 541k (Denbigh 2) association overlying Devonian mudstones, shales and slates (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 25th October 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 were 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 likely, probable and possible archaeological interest across the Site, along with numerous linear and curvilinear trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1000 (**Figure 2**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and 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 3**). 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 The western field contains the greatest concentration of archaeological anomalies with several rectilinear ditches present. There are two parallel ditches present at **4000**, apparent as positive anomalies and one is L-shaped in plan whereas the other is linear. Both are aligned roughly northwest to southeast with another linear present at **4001** that is aligned perpendicular to these. Another linear aligned northwest to southeast is present around **4002** and completes a rectilinear boundary along with **4000** and **4001**. This group of features is considered to represent a former field boundary that is not visible on historic maps; there is little indication from the data that these ditches define a settlement enclosure. This feature is classed as archaeology as it is uncertain to what period it dates from.

3.2.2 There are more ditch-like anomalies at **4003** that are on a similar alignment to the anomalies discussed below. The northwest to southeast aligned section is defined by three parallel linear positive anomalies. These ditches have also been classed as archaeology and are considered to be related to, and part of, the boundary defined by **4000**, **4001** and **4002**.

3.2.3 There is an L-shaped positive anomaly at **4004** that has been classed as probable archaeology due to its shape in plan.

3.2.4 The northeastern extent of the first field contains a concentration of irregular to sub-oval shaped anomalies such as those around **4005**; these features are classed as possible archaeology as there is no significant patterning in their spatial distribution and there is a possibility that they may prove to be geological. If these features prove to be archaeological they may represent cut features such as pits and postholes. There are more of these small positive anomalies in lower concentrations in the rest of the data and these are also classed as possible archaeology.

3.2.5 The most significant anomalies in the eastern field are two pit-like anomalies at **4006** and **4007**; their profile shape in the XY plot suggests they may represent pits given their smooth, regular form. They are both sub-oval in shape and both measure more than 2.8m in length. These features are classed as archaeology and are considered to represent pits.

3.2.6 There are two short linear positive anomalies along the southwest edge of the survey area at **4008** and **4009**; they have diffuse edges and are classed as probable archaeology as they may relate to the present field boundary.

3.2.7 There are numerous trends visible across the data; most of these are considered to represent ploughing trends such as those around **4010** but other linear and curvilinear examples such as those around **4011** may prove to be archaeological. The remaining anomalies are a concentration of weak and diffuse bipolar responses (black and white) in the eastern field; this spread is classed as superficial geology.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 There are at no modern services visible in the data. Gradiometer survey 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 likely, probable and possible archaeological interest within the Site, in addition to numerous linear and curvilinear trends.

4.1.2 There appear to be several field divisions visible in the data although it is difficult to be sure of this as a very narrow area has been surveyed. None of these features matches up with any field boundaries or other features marked on early OS maps so their potential significance cannot be assessed from the geophysical data alone. The two probable pits located at **4006** and **4007** are considered to be of archaeological significance.

4.1.3 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. *Sheet 5, South West England*. Ordnance Survey, Southampton.

Wessex Archaeology, 2013. *Land at Pisky Farm, Playing Place, Cornwall: Written Scheme of Investigation for Geophysical Survey.* Unpublished Report. Client reference: 101830.01

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.

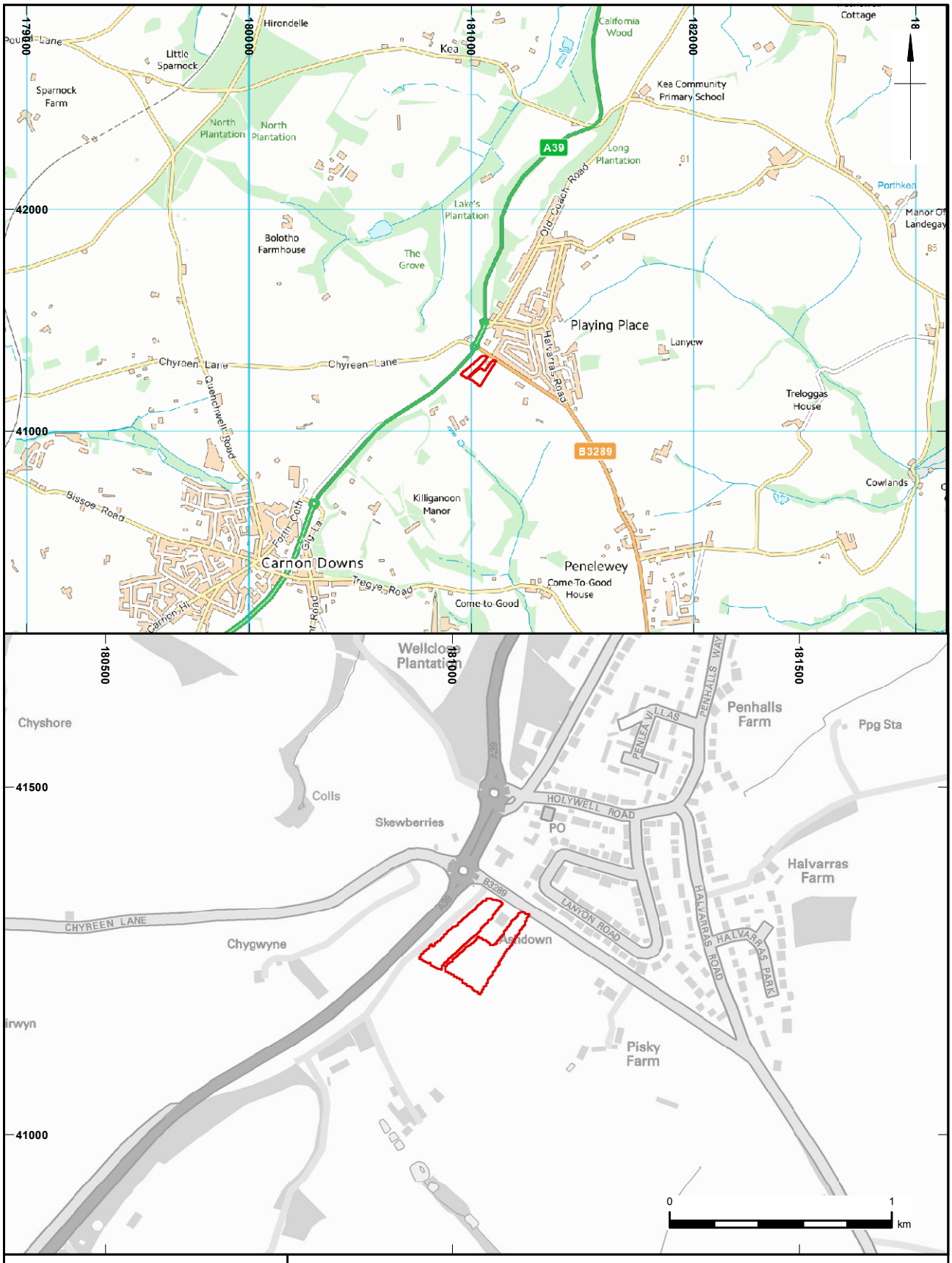
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



Detailed survey extents

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Site location plan

Figure 1

A

181000

181100

41300

41200

+3nT

-2nT

B

181000

181100

41300

41200

+25nT

-25nT

Detailed survey extents

0

50

m

Date:	14.11.2013	Revision Number:	0
Scale:	1:1000 at A3	Illustrator:	AMB
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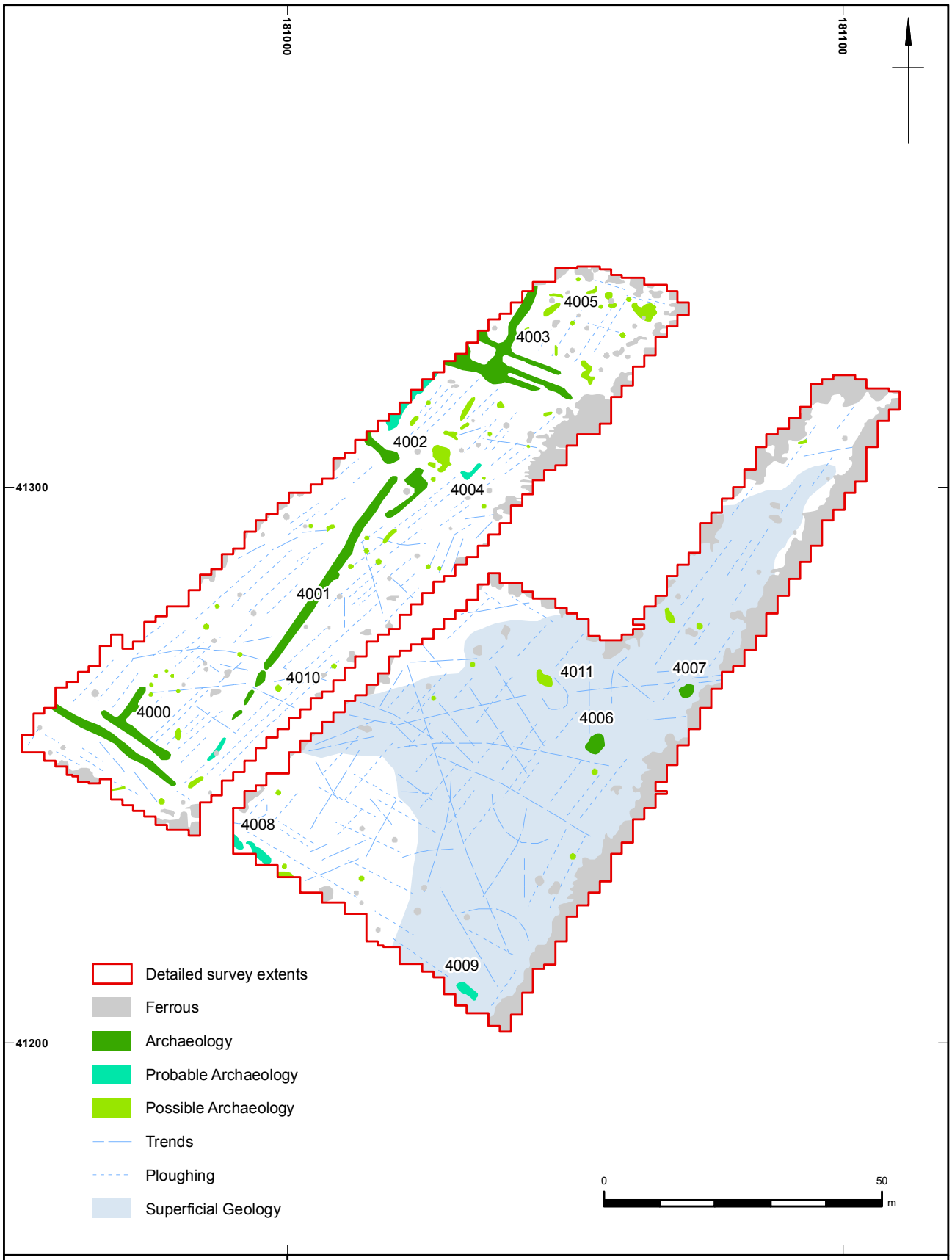
A: Greyscale B: XY Trace

Figure 2



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Interpretation

Figure 3

wessex archaeology

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