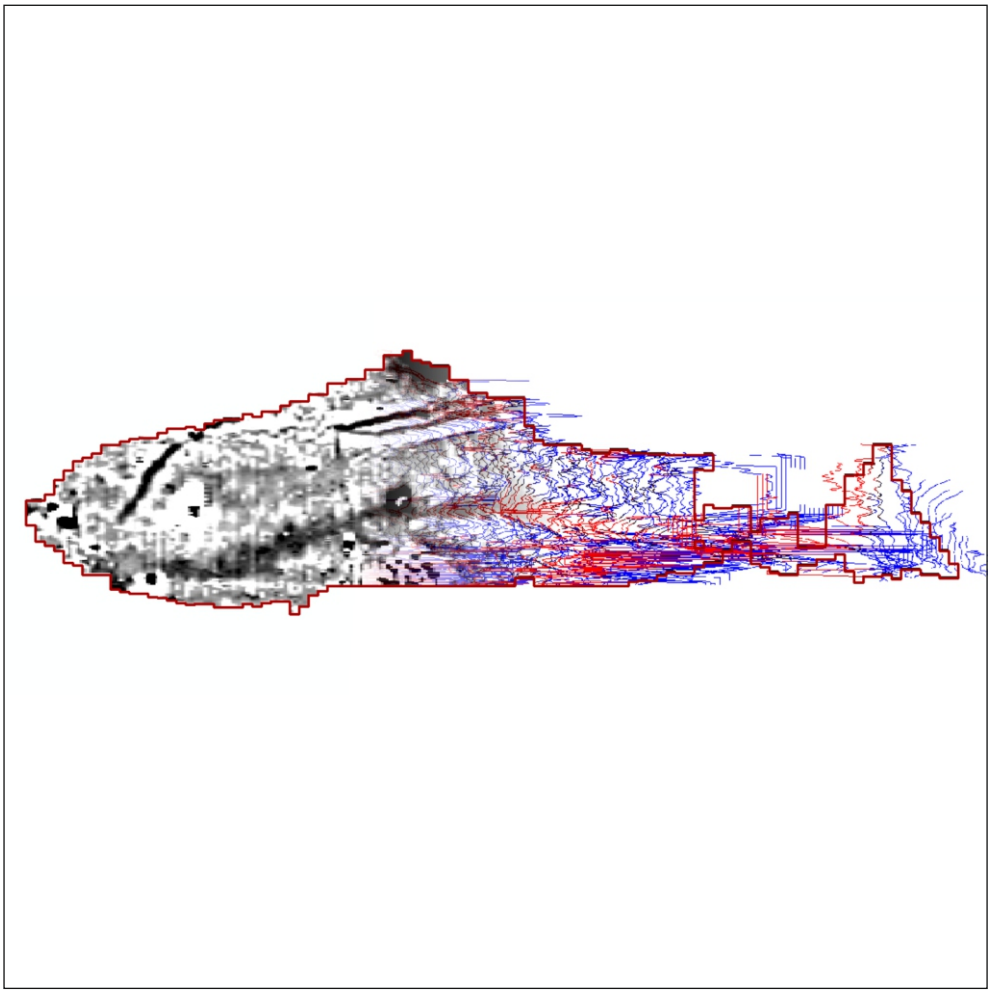
making sense of heritage

Bosvale Community Centre
Falmouth, Cornwall

Detailed Gradiometer Report



Ref: 107570.02
January 2015

geoservices

Bosvale Community Centre
Falmouth, Cornwall

Detailed Gradiometer Report

Prepared for:
Cluttons LLP
2 Portman Street
London
W1H 6DU

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

www.wessexarch.co.uk

January 2015

Report Ref: 107570.02

Quality Assurance

Project Code	107570	**Accession Code**		**Client Ref.**	LJL/107570.02
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	179465,31875		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	F	*ECR*	*LJL*		*28/01/15*
File:	X:\PROJECTS\107570_Reports\107570_Prislow_ECR_GJS_20150122				
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* I = Internal Draft; E = External Draft; F = Final

Bosvale Community Centre
Falmouth, Cornwall

Detailed Gradiometer Report

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Summary

Wessex Archaeology was commissioned by Cluttons LLP, London, to undertake a detailed gradiometer survey at Bosvale Community Centre, Falmouth centred on NGR 179465, 31875. The aim of the work was to establish the presence, or otherwise, and nature of detectable archaeological features on the site.

Bosvale Community Centre is situated in the Prislow area of Falmouth, Cornwall. Prislow is found approximately 1.7km WSW of the centre of Falmouth and 8km SSW of Truro. The site comprises an area of grass to the rear of the community centre and a tarmac parking area. The survey extents were defined by the hedgerows and vegetation on all sides of the survey.

Detailed gradiometer survey was undertaken over all accessible parts of the site, a total of 0.6ha, and has demonstrated the presence of anomalies of possible archaeological interest within the survey area, along with anomalies of increased magnetic response.

The possible archaeological features detected include several pit type features and two ditches, the first on a NE-SW alignment and the second on an E-W alignment. There is a possible palaeochannel or former watercourse running E-W and the east of the site is dominated by strong magnetic responses likely due to the metal storage containers, cistern, community centre and the car park.

The geophysical survey was undertaken between the 12th and 13th January 2015.

Bosvale Community Centre, Prislow
Falmouth, Cornwall

Detailed Gradiometer Report

Acknowledgements

This project was commissioned by Cluttons LLP, London and Wessex Archaeology is grateful to Nigel Abbot in this regard.

The fieldwork was carried out by Lizzie Richley and Alistair Salisbury. The geophysical data was processed and interpreted by Lizzie Richley. This report was written by Lizzie Richley. The geophysical work was quality controlled by Lucy Learmonth and Genevieve Shaw. Illustrations were prepared by Lizzie Richley, and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Simon Cleggett.

Bosvale Community Centre
Falmouth, Cornwall

Detailed Gradiometer Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by Cluttons LLP, London on behalf of their client The Abbeyfield Society to undertake a detailed gradiometer survey at Bosvale Community Centre, Falmouth, Cornwall (**Figure 1**) hereafter 'the Site' (centred on NGR 179465, 31875).

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 Bosvale Community Centre is situated in the Prislow area of Falmouth, Cornwall. Prislow is found approximately 1.7km WSW of the centre of Falmouth and 8km SSW of Truro (**Figure 1**). The site comprises an area of grass to the back of the community centre and a tarmac parking area. The survey extents were defined by the hedgerows and vegetation on all sides of the survey.

1.2.2 The site lies on a south facing slope, the eastern limit at an approximate height above Ordnance Datum (aOD) of 25m, and the western limit at approximately 35 aOD. A small watercourse runs along the southern edge of the site and runs from west to east.

1.3 Soils and Geology

1.3.1 The underlying geology is mapped as Mylor Slate formation which was formed approximately 359 to 385 million years ago in the Devonian Period. Superficial deposits are recorded as alluvium formed of clay, silt, sand and gravel formed in the Quaternary period when the local environment was dominated by rivers.

1.3.2 The soils underlying the site are unsurveyed due to urban and industrial use of the area. However, to the to the north, west and south of the site the soils are recorded as well drained fine loamy soils of the 541j (Denbigh 1) and 541k (Denbigh 2) 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 gradiometer 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 Lying to the west of the Site there is recorded a round crop mark of possible Iron Age or Romano-British origin (MCO8246). Two prehistoric enclosures are also documented, one NW (MCO33901) and a second NE (MCO8622) however the precise location of the second is unknown. To the south a Mesolithic find spot (MCO595) is recorded with an axe found.

1.4.3 In the area around The Site there are several records of medieval activity, in particular Prislow itself which is first recorded as a settlement in 1208 (MCO16507). East of the Site lies Boslowick medieval settlement first recorded in 1538 (MCO13522) and to the north Penmere medieval settlement (MCO16166). Further medieval and post-medieval evidence in the area includes a tannery (MCO29287) and a blacksmith's workshop (MCO09223).

1.4.4 There are several records for 19th century-modern monuments in the area including several World War II monuments including pill boxes and barrage balloon sites and a modern fuel store to the south (MCO42208).

2 METHODOLOGY

2.1 Introduction

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

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 12th and 13th January 2015. Field conditions at the time of the survey were wet with some standing water in the southern part of the Site. In total the geophysical survey covered 0.6ha.

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 EH guidelines (2008).

2.2.2 The Bartington Grad601-2 fluxgate gradiometer instrument 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 (ZMT) 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. The deslope and add functions were used to account for errors in the ZMT function and to remove grid edge discontinuities. 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 identified anomalies of possible archaeological interest; these anomalies include two ditch features and a number of pit features. Results are presented as a series of greyscale plots, XY trace plots, and archaeological interpretations at a scale of 1:1000 (**Figures 2** to **4**). The data are displayed at -6nT (white) to +9nT (black) for the greyscales and ±75nT at 75nT per cm for the XY traces.

3.1.2 The interpretation of the datasets highlights the presence of definite, probable and possible 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 The most noticeable feature at the site is a broad positive curvilinear anomaly at **4000** that crosses the field approximately east to west. This is likely to represent superficial geology and from its shape and size and weaker positive response is possibly a palaeochannel or former watercourse.

3.2.2 On the west side of the Site, a positive ditch anomaly at **4001** extends from the northern edge of the Site towards the southeast for approximately 20m and ends abruptly. It is not clear whether this feature may have extended further southwest and it is possible that this ditch feature represents a former field boundary. A further ditch feature, **4002**, appears to be two parallel linear positive anomalies extending from the eastern edge of the survey area and running for some 30m. The ditches appear to join at the western end.

3.2.3 A number of circular positive anomalies can be seen at **4003** and **4004**. These have been interpreted as possible archaeology and are considered to represent small cut features such as small pits or postholes.

3.2.4 There are several weakly positive linear trends across the Site that have no discernible origin; one example is seen crossing the possible palaeochannel feature at **4000** in an approximate L-shape layout. They have been interpreted as of uncertain origin but there is the possibility that they represent weaker linear features that are archaeological in origin but are being masked by the strong ferrous responses visible across the Site.

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 detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest; these include two possible ditches that may represent former field boundaries or old track ways.

4.1.2 The clearest feature detected is a broad positive linear band across the centre of the area which is geological in origin and possibly a palaeochannel or former watercourse, Immediately bordering the southern survey boundary is a tree-lined watercourse running parallel to the palaeochannel identified at **4000** and a spring is marked to the east of the Site on available OS mapping (Ordnance Survey 1880).

4.1.3 The single linear ditch at **4001** could represent a former field boundary, available OS mapping of the Site does show the area as having previous internal field divisions (Ordnance Survey 1880) and while the pair of ditches at **4002** is on a similar orientation to current field boundaries the ditch at **4001** is not.

4.1.4 There is a large amount of ferrous debris identified across the Site and this is expected of an urban, built-up area, there is the likelihood that the strong ferrous responses are masking smaller, weakly contrasting features potentially of archaeological origin. Several weak linear trends have been identified across the Site and interpreted as of uncertain origin because their form and layout cannot be ascertained further. They are potentially archaeological 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.

5 REFERENCES

5.1 Bibliography

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5.2 Cartographic Sources

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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:

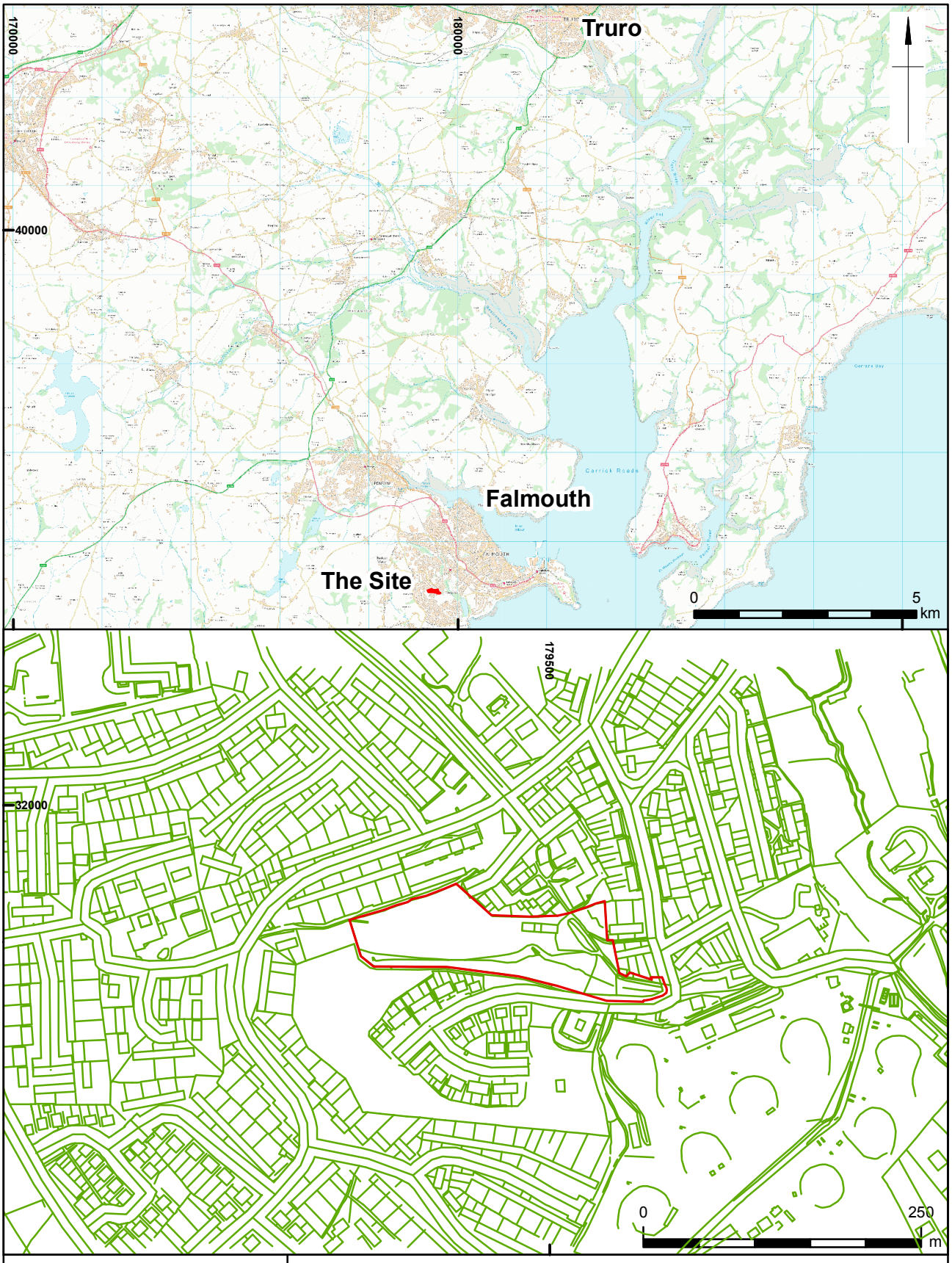
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be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



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SIte Location and Extent

Figure 1

Detailed Survey Extents

Site

9 nT

-6 nT

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Revision Number:	0
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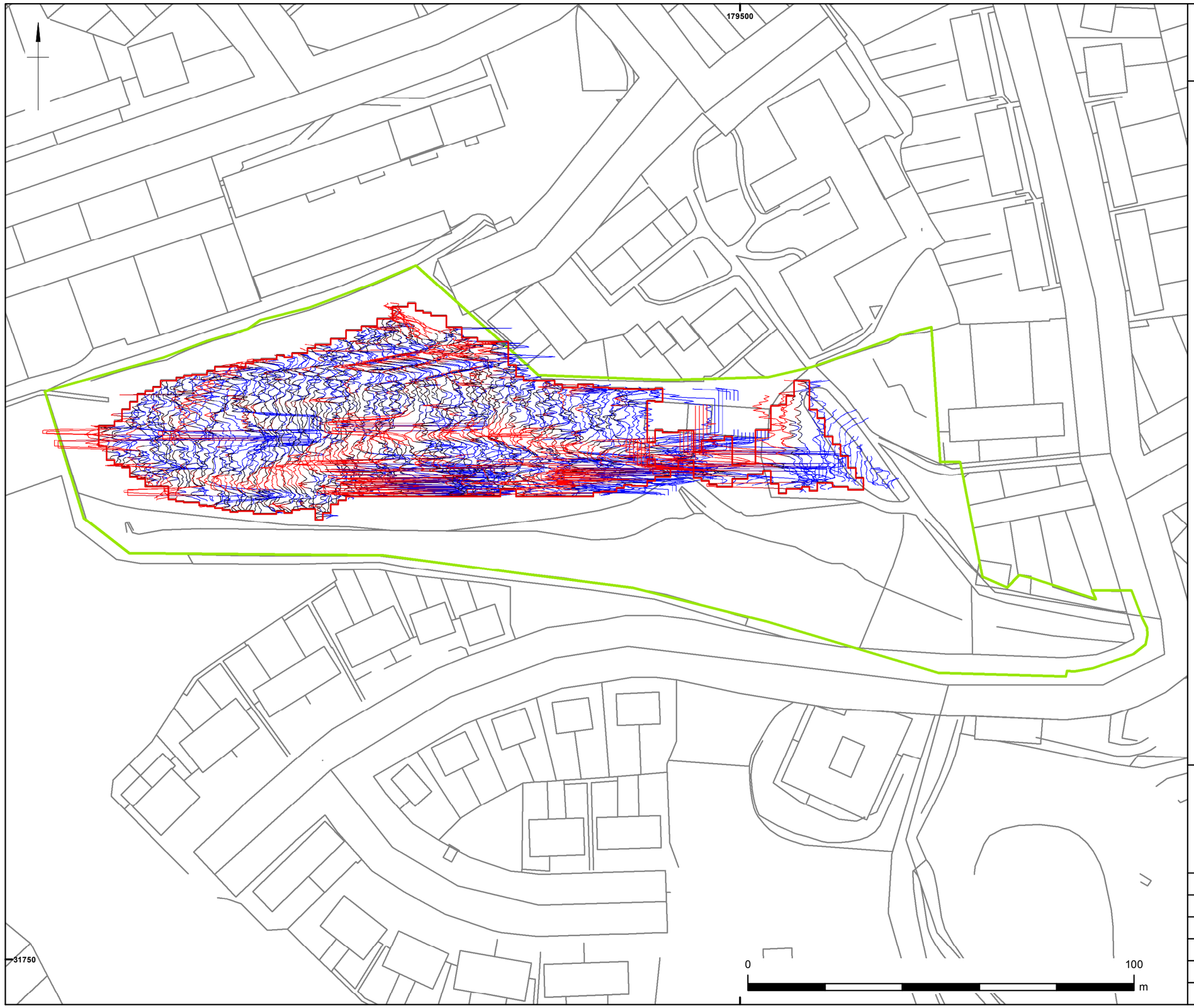
Gradiometer Results - Grayscale Plot

Figure 2



Detailed Survey Extents

Site

+75 nT

-75 nT

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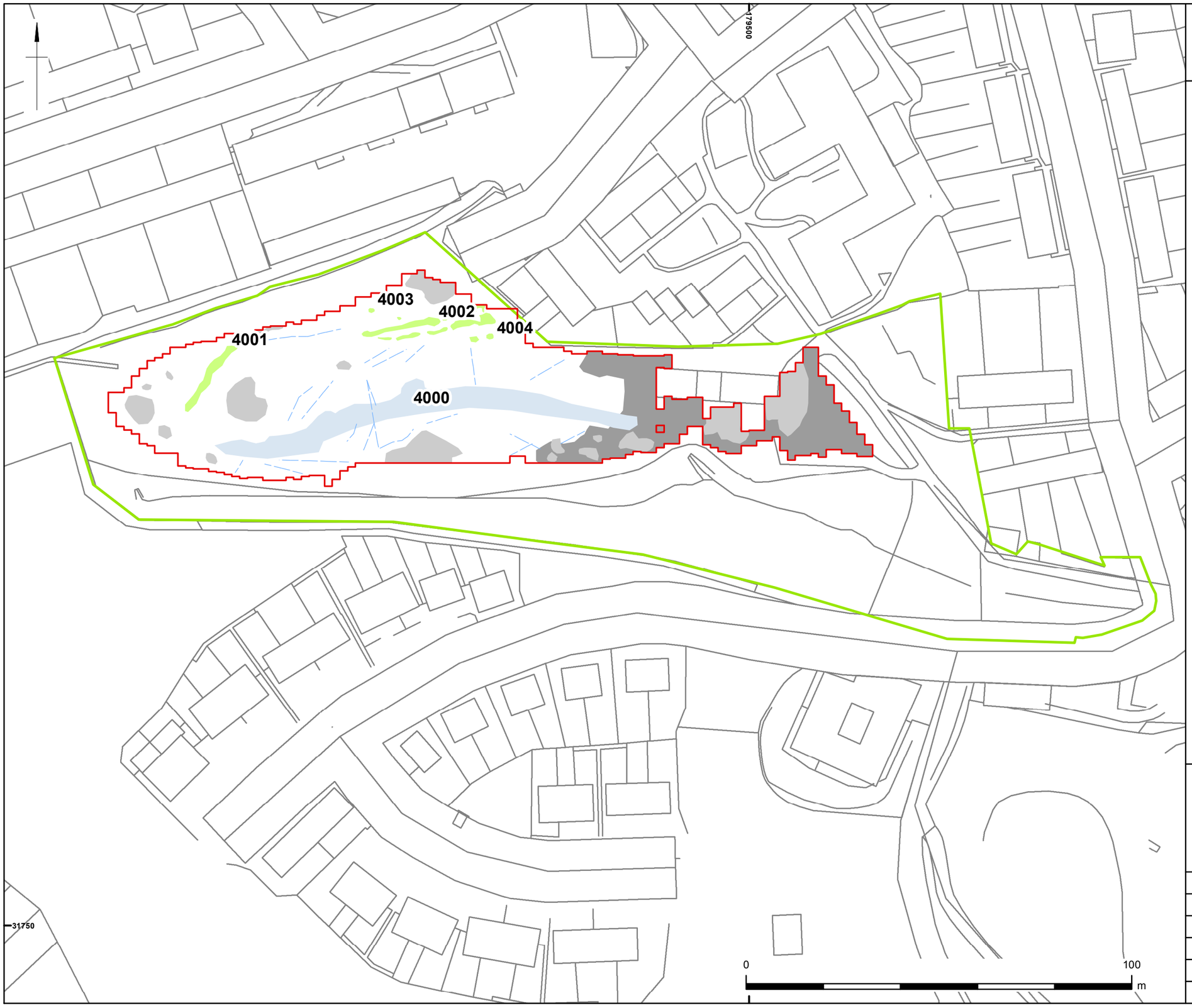
Gradiometer Results - XY Plot

Figure 3



Detailed Survey Extents
Trend
Possible Archaeology
Ferrous
Superficial Geology
Increased Magnetic Response
Site

Date:	19/01/2015
Revision Number:	0
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	GIS\FigsMXD

Gradiometer Results - 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