

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

**Land at Rowlands Corner, Tregear
Elgoscerry, Launceston, Cornwall**

Ordnance Survey E/N: 225187,86871(point)

Report: 131028
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28 October 2013

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Accompanying CD-ROM

Report.....	Adobe PDF format
Copies of report figures	Adobe PDF format
Data files.....	grid files generated using DW Consulting TerraSurveyor3
Minimal processing data plots and metadata	Adobe PDF format
GIS project, shape files and classification schema	
GIS project and shape files	ESRI standard
GIS classification schema	Adobe PDF format
AutoCAD version of the survey interpretation	AutoCAD DXF

1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer
Date of survey: 24 October 2013
Area surveyed: 1 ha.
Lead surveyor: Ross Dean BSc MSc MA MifA

Client

Capture Energy Limited

Location

Site: Land at Rowlands Corner
Town: Tregeare
Civil Parish: Elgoscerry
Town: Launceston
County: Cornwall
Nearest Postcode: PL15 8RY
NGR: SX 251 868
Ordnance Survey E/N: 225187,86871 (point)
OASIS record: substrat1-162623
Archive: At the time of writing, the archive of this survey will be held by Substrata.

Summary

This report was commissioned by Capture Energy Limited on behalf of a client and was produced by Substrata in preparation for submission of a forthcoming planning application for a single wind turbine.

The magnetic contrast across the survey area was relatively low but was sufficient to distinguish between anomalies representing potential archaeology and natural deposits.

Five magnetic anomaly groups were identified as signifying potential archaeological deposits. Two groups represent areas of relatively high magnetic contrast. One of these may denote a well defined deposit of possibly burnt material that could be of archaeological significance (group 1, figure 1). The other is less defined and will relate to either a scatter of archaeological deposits or natural variations in the local geology. One linear group may represent an archaeological deposit or a recent service trench. The remaining two groups are traces of relatively recent ploughing or similar cultivation activities.

Survey aims

1. define and characterise and detectable archaeological remains on the site
2. inform any future archaeological investigation of the area

Survey Objectives

1. complete a gradiometer survey across agreed parts of the survey area
2. identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts
3. within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies
4. accurately record the location of the identified anomalies
5. produce a report based on the survey that is sufficiently detailed to inform any subsequent development on the site about the location and possible archaeological character of the recorded anomalies

Standards

The standards used to complete this survey are defined by the Institute for Archaeologists (2011). The codes of approved practice that were followed are those of the Institute for Archaeologists (2008 and 2009) and Archaeology Data Service/Digital Antiquity Guides (undated). The document text was written using the house style of the Institute for

Archaeologists (Institute for Archaeologists, undated).

2 Site description

Landscape

The survey area comprised 1 field of rising ground between approximately 207m and 217m O.D. on the upper slopes of Tregear-down Beacon as shown in figure 4.

Land use at the time of the survey

Grass pasture.

Geology

The site is located on a solid geology of the Visian Teign Valley Group, Teign Chert Formation. These comprise thin to medium bedded cherts varying from white, grey and green to bluish black; rarely jasper red. Beds range from a few millimetres to 0.6m, generally separated by siliceous mudstone beds and partings. Also present are bluish black mudstone and thin to medium-bedded argillaceous limestones. Some areas are dominated by mudstone, others by chert or limestone (British Geological Survey, undated).

Historic Landscape Characterisation

Modern Enclosed land.

Mainly Anciently Enclosed Land or Post Medieval Enclosed land whose field systems have been substantially altered by large scale hedge removal in the twentieth century. It also includes, however, twentieth century intakes from rough ground, woodland and marsh (Cornwall Council, undated 2).

Known archaeological sites within a 500m radius of NGR SX 251 868

Please refer to figure 4 for the location of the survey area.

The following are summaries of entries of the Cornwall and Scilly Historic Environment Record (CSHER) (Cornwall Council, undated). They were collated using the Heritage Gateway which provides access to local and national records on the historic environment and is managed by English Heritage in partnership with the Association of Local Government Archaeological Officers and the Institute of Historic Building Conservation.

The information provided through the Heritage Gateway is updated four times a year. The summaries below are provided as an indication of the archaeological potential of the survey area and as points of discussion when referring to the geophysical survey data. The summaries below should not be used as a definitive guide to the historic environment records (HERs) for the site. Readers are directed to the Cornwall and Scilly Historic Environment Service for a complete set of records.

While there are no HER entries for the field in which the survey was located, there are a number of entries for adjacent fields. The majority listed below are on Tregear-down Beacon which lies to the west of the survey area in an adjacent field (figure 4). These comprise a possible Neolithic (4000 BC to 2501 BC) or Iron Age/Romano-British (800 BC to AD 409) enclosure, a Bronze Age (2500 BC to 801 BC) barrow or Post Medieval (AD 1540 to AD 1900) pond, and a Medieval (AD 1066 to AD 1539) or Post-Medieval beacon. Also relevant to setting the context of this survey are the site of the Medieval to modern settlement of Slipperhill to the east of the survey area (figure 4) and an Early Medieval (410 AD to 1066 AD) or later field boundary to the south.

A summary of the relevant entries within a 500m radius is provided below.

HER 2147

TREGAAREDOWN BEACON - Medieval/Post Medieval beacon

The alleged site of a beacon

SX 2492 8677, adjacent field on western site boundary (figure 4)

Scheduled Monument CO87: Tregear camp

The name Tregear-down Beacon suggests the site of a beacon. However, the Ordnance Survey (OS) consider this to be an unlikely site for a beacon since the earthwork is slightly below the hilltop with restricted views to the north east. The hilltop, with OS trig station, would form a far more likely beacon site

HER 2417 and 2417.20 (part of HER 2417):

TREGAEREDOWN BEACON - Neolithic Causewayed enclosure (2417) or Iron Age/Romano British round (2417.20)

An enclosure approximately 50m in diameter formed by an intermittent bank and ditch
SX 2493 8678, *adjacent field on western site boundary (figure 4)*

Scheduled Monument CO87: Tregear camp

The enclosure on Tregear-down Beacon comprises an area approximately 50m in diameter, seeming, from the various accounts, to be delimited by a fairly continuous bank and ditch on the south, but by intermittent portions of bank and ditch on the north. The bank is up to 1.8m high and the ditch is up to 0.8m deep. Gang work would seem to be indicated, but there is no trace of a 'setting out' ditch, and the entrance position cannot be determined. This site is visible on aerial photographs and was plotted during the Cornwall National Mapping Project (NMP)

HER 2417 records the monument as a Neolithic causewayed enclosure but the above interpretation is preferred by the CSHE.

HER 2417.40 and 2417.50 (part of HER 2417):

TREGAEREDOWN BEACON - Bronze Age barrow (2417.40) or Post Medieval pond (2417.50)

An earthwork consisting of a circular bank 4.5m wide and 0.5m high with an overall diameter of 16m with an interior hollowed out to 0.5m below ground level

SX 2492 8677, *adjacent field on western site boundary (figure 4)*

Scheduled Monument CO87: Tregear camp

Within the enclosure on Tregear-down Beacon. The depression is regular and seems to be in an original state. Suggested as the site of a beacon and listed as a doubtful barrow by the Ordnance Survey (OS) who also note its similarity to a constructed pond. This site is visible on aerial photographs and was plotted during the Cornwall NMP

HER 2516

SLIPPERHILL—Medieval Settlement

The settlement of Slipperhill is first recorded in AD 1529

SX 2560 8694, *hamlet to the east of the survey site (figure 4)*

Visible on aerial photographs and was plotted during the Cornwall NMP

HER 58448

TREGAERE DOWN - Early Medieval field boundary

A banked field boundary of medieval or later date, visible as cropmarks on aerial photographs

SX 2521 8644, *to the south of the survey area*

Visible on aerial photographs and was plotted during the Cornwall NMP

3. Results, discussion and conclusions

This survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below attempts to identify and characterise anomalies and anomaly groups that may pertain to archaeological deposits and structures.

The reader is referred to section 4.

3.1 Results

Figure 1 (this section) shows the interpretation of the survey across all survey areas and table 1 is an extract from a detailed analysis of the survey data provided in the attribute tables of the GIS project on the accompanying CD-ROM.

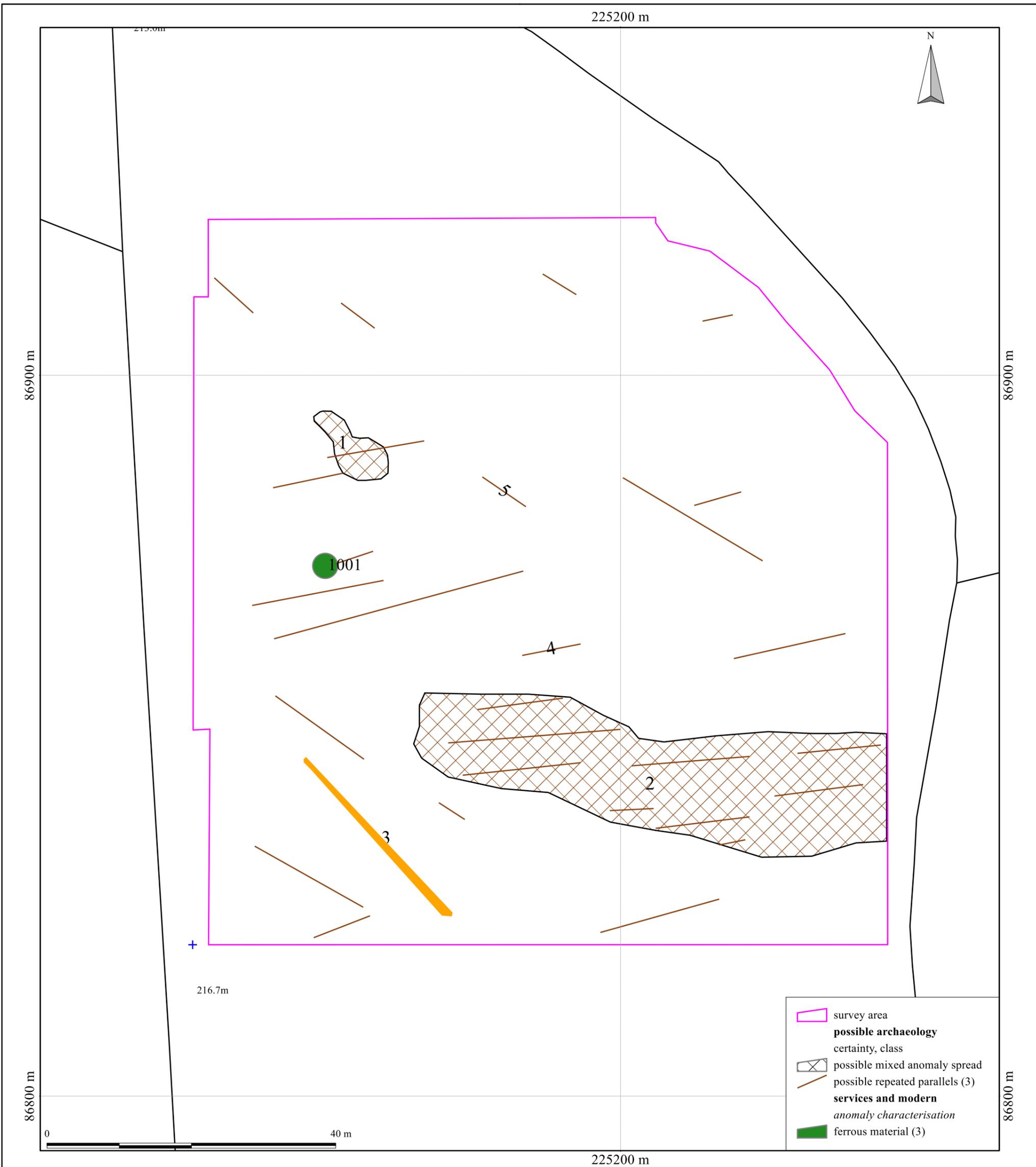
Figure 1 and table 1 comprise the analysis and interpretation of the survey data.

Plots of the processed data are provided in figures 2 and 3 in appendix 1.

Site: An archaeological gradiometer survey
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 Elgokerry, Launceston, Cornwall
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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments
1	mixed spread	irregular	area of enhanced magnetic contrast	anomaly contrast indicates a possible area of archaeological activity and possibly a deposit of burnt material - such groups can denote a barrow or similar monument
2	mixed spread	irregular	area of enhanced magnetic contrast	anomaly contrast indicates a possible area of scatter archaeological deposits or a local geological variation
3	possible positive	linear		
4	repeated parallels		cultivation traces	may be medieval, post-medieval or modern
5	repeated parallels		cultivation traces	may be medieval, post-medieval or modern
1001	dipole		ferrous material	anomaly group relates to a deposit of ferrous material which is probably relatively recent

Table 1: data analysis



British Grid
centre X: 225186.04 m, centre Y: 86870.34 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Crown Copyright & Database Right 2013

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely " have supporting evidence e.g. historical maps and or visible earthworks.
3. Representative; not all instances are mapped.
4. Anomalies likely to represent geological or other natural deposits are not mapped.

3.2 Discussion

Refer to figures 1 (this section) and 2 (appendix 1).

Not all anomalies or anomaly groups identified in the survey dataset are discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM. Those anomaly groups possibly representing archaeological deposits are included in data analysis table 1.

Of the 5 magnetic anomaly groups characterised as representing possible archaeological deposits, none can be related to former or current features recorded on historical and modern Ordnance Survey maps.

Anomaly group **1** is a well defined area of relatively high magnetic contrast compared to the majority of the data set. Such groups can indicate deposits of burnt material and have been known to represent the sites of barrows and similar monuments. While group 1 could represent a relatively recent buried ferrous item, its magnetic signature is not typical of such a deposit and it may warrant further archaeological investigation.

Group **2** is also an area of relatively high magnetic contrast. In this case the pattern is indicative of a possible scatter of archaeological deposits demonstrated by the enhancement of relatively recent ploughing disturbance (anomaly group **4**) within the area. The possibility remains, however, that group 2 represents natural variations in the underlying solid or superficial geology.

Group **3** is a linear anomaly set which may denote an archaeological deposit. It lies in isolation with no similar anomalies in the data set rendering further archaeological characterisation speculative. It may denote the presence of a filled ditch, earthen bank or a recent service such as a non-ferrous water pipe or drain.

In addition to the anomaly group 4, group **5** is also a sequence of parallel linear anomalies that are likely to represent relatively recent ploughing.

3.3 Conclusions

The magnetic contrast across the survey area was relatively low but was sufficient to distinguish between anomalies representing potential archaeology and natural deposits.

Five magnetic anomaly groups were identified as signifying potential archaeological deposits. Two groups represent areas of relatively high magnetic contrast. One of these may denote a well defined deposit of possibly burnt material that could be of archaeological significance (group 1, figure 1). The other is less defined and will relate to either a scatter of archaeological deposits or natural variations in the local geology. One linear group may represent an archaeological deposit or a recent service trench. The remaining two groups are traces of relatively recent ploughing or similar cultivation activities.

4 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79).

5 Acknowledgements

Substrata would like to thank Nicola Davies, Planning Project Manager, Capture Energy Limited, for commissioning us to complete this survey.

6 References

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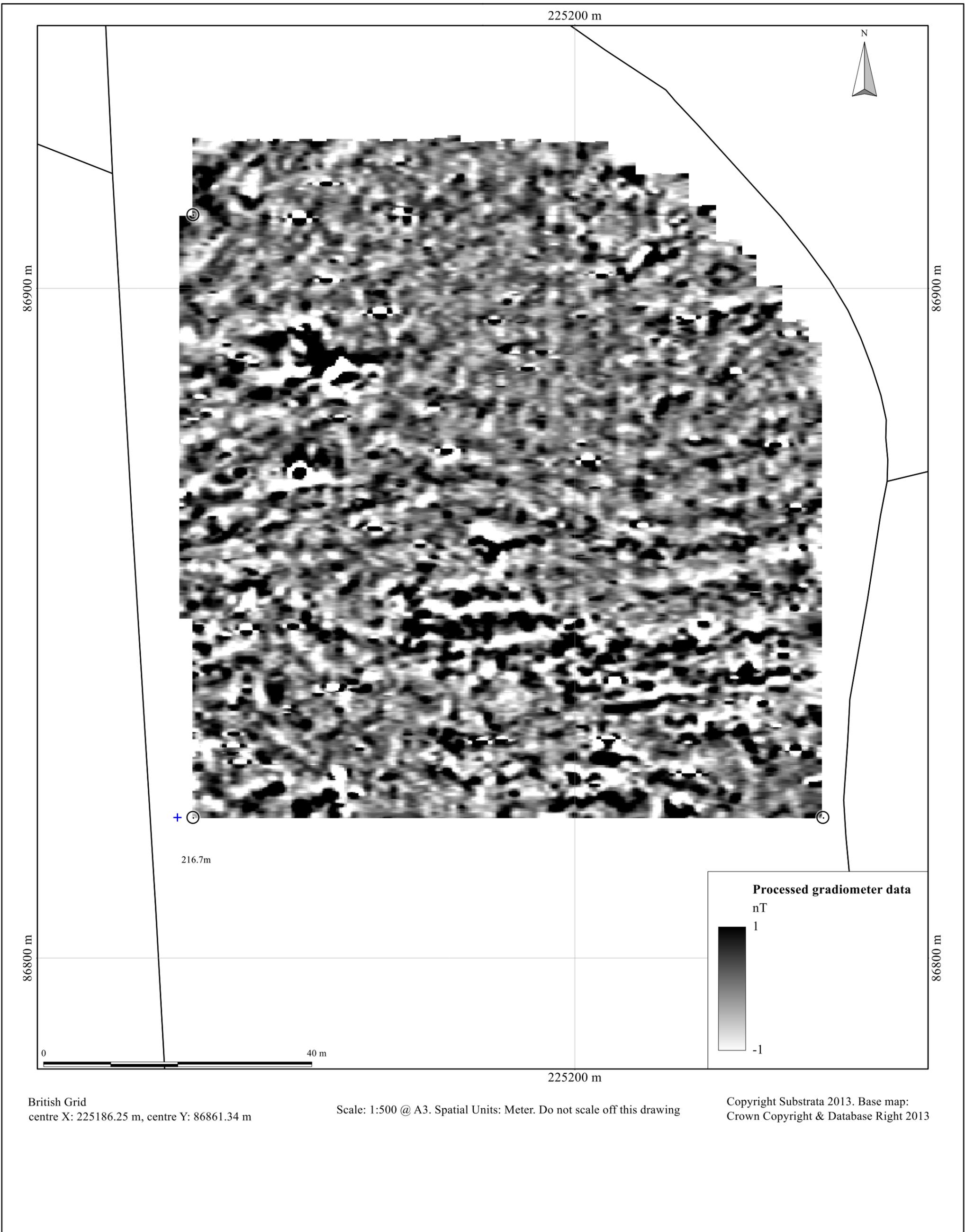
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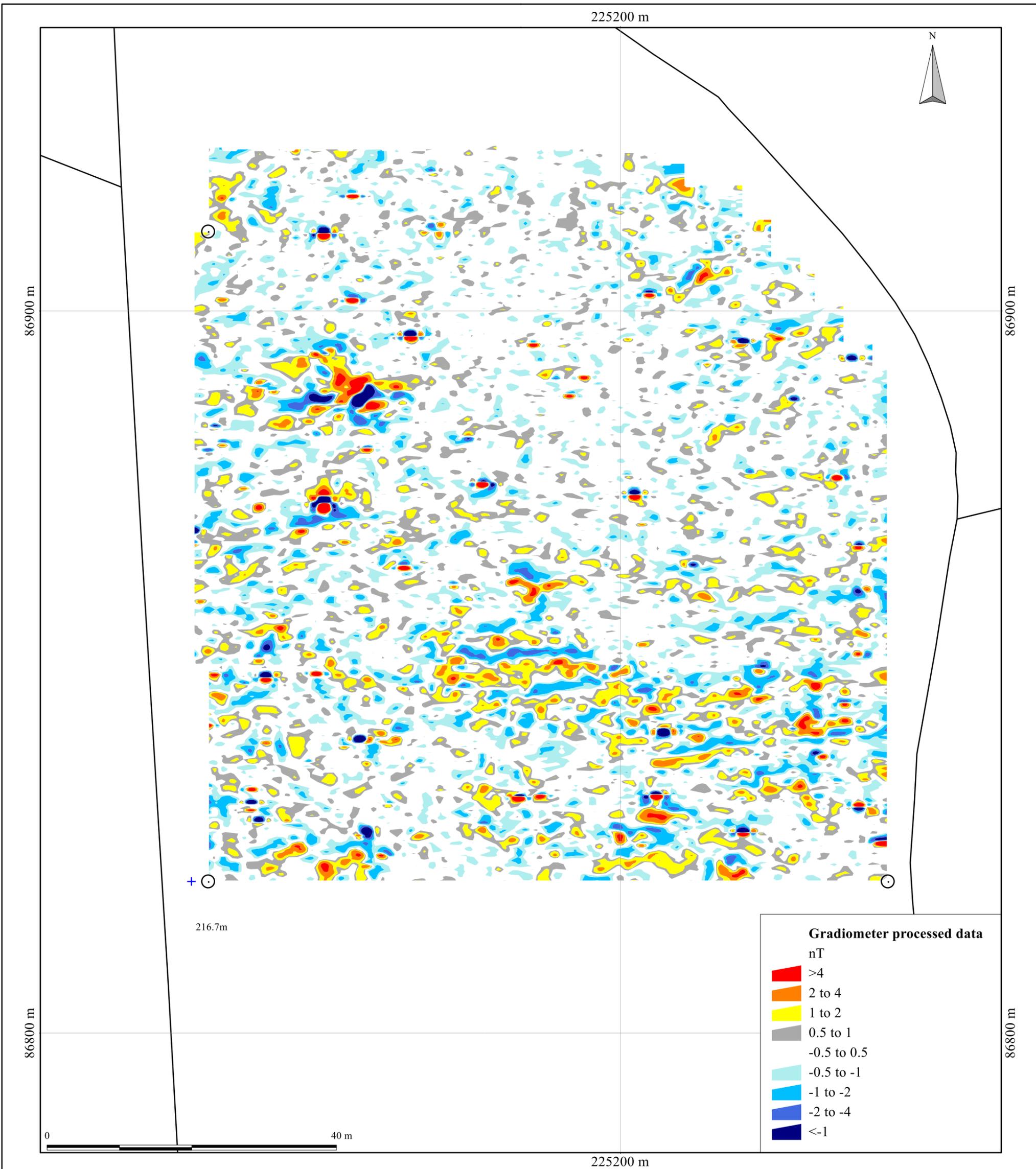
Appendix 1 Supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.



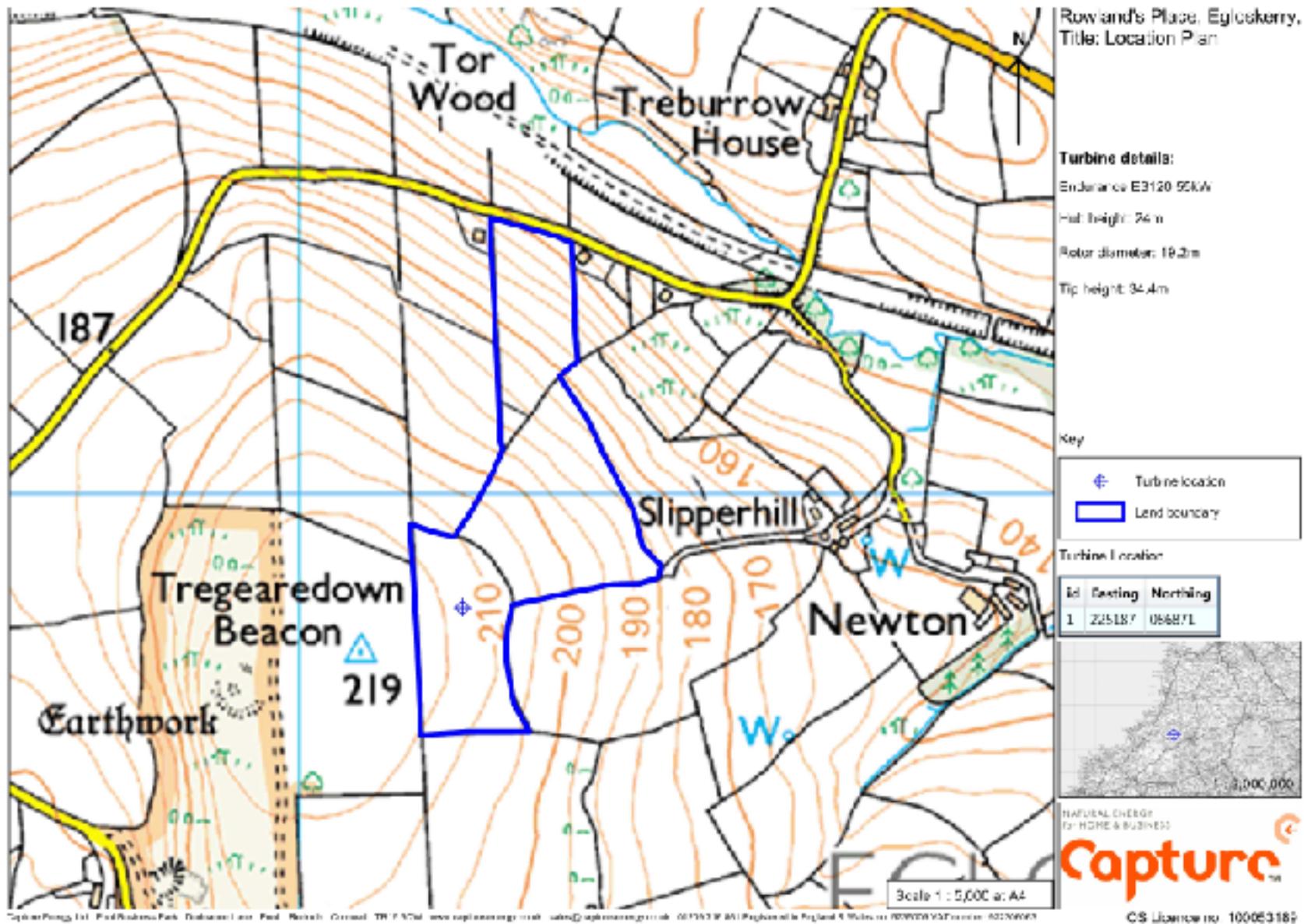


British Grid
centre X: 225186.25 m, centre Y: 86861.34 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: contour plot of processed data



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Figure 4: survey location

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 Email: geophysics@substrata.co.uk
 Web: substrata.co.uk

Appendix 2 Methodology

Table 2: methodology	
<p>Documents Project design: Dean (2013)</p>	
<p>Methodology</p> <ol style="list-style-type: none"> 1. The work was undertaken in accordance with the project design. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011) and Archaeology Data Service/Digital Antiquity Guides (undated). 2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology. 	
<p>Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles.</p>	
<p>Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p>Data Capture <i>Sample Interval:</i> 0.25-metres <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p>Data Processing, Analysis and Presentation Software DW Consulting TerraSurveyor3 Manifold System 8 Microsoft Corp. Office Publisher 2013.</p>	

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata, turbine area	
SITE	
Instrument Type:	Bartington Grad 610
Units:	nT
Direction of 1st Traverse:	0 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702
Dimensions	
Composite Size (readings):	480 x 480
Survey Size (meters):	120 m x 120 m
Grid Size:	30 m x 30 m
X Interval:	0.25 m
Y Interval:	0.25 m (surveyed @ 1 m)
Stats	
Max:	36.28
Min:	-27.02
Std Dev:	1.22
Mean:	0.02
Median:	0.00
Composite Area:	1.44 ha
Surveyed Area:	0.9212 ha
PROGRAM	
Name:	TerraSurveyor
Version:	3.0.22.1
Processes: 4	
1	Base Layer
2	Clip at 4.00 SD
3	De Stagger: Grids: All Mode: Both By: -1 intervals
4	DeStripe Median Sensors: All
Note: interpolation match x & y doubled is completed during export from TerraSurveyor to georeferenced ERSI format	

Appendix 4 Geophysical surveying techniques

1 Introduction

Substrata offers magnetometer and earth resistance surveying. We also provide other archaeology-specific geophysical surveys such as ground penetrating radar and resistivity. The particular method or combination of methods used depends on local soil conditions and the survey requirements. These methods are capable of delivering fast and accurate assessments of the archaeology of both large and small sites.

Further details can be found on our website at www.substrata.co.uk

2 Magnetometer surveying

Standard magnetometer surveys are the workhorse of archaeological surveying when speed and cost-effectiveness are important. Identifiable archaeological features include areas of occupation, hearths, kilns, furnaces, ditches, pits, post-holes, ridge-and-furrow, timber structures, wall footings, roads, tracks and similar buried features.

Magnetometer surveying is used to detect and map small changes in the earth's magnetic field caused by concentrations of ferrous-based minerals within the soil and subsoil, and by magnetised materials buried beneath the surface. While most of these changes are too small to affect a compass needle, they can be detected and mapped by sensitive field equipment. During surveys the different magnetic properties of top-soils, sub-soils, rock formations and archaeological features are recorded as variations against a background value. Subsequently magnetic anomalies resulting from potential archaeology can be identified and interpreted.

Bartington grad601-2 gradiometers

A gradiometer is a type of magnetometer and is sensitive to relatively small changes in the earth's magnetic field. Our primary surveying instruments are Bartington Grad601-2 (dual sensor) fluxgate gradiometers with automatic data loggers. They are specifically designed for field use by archaeologists. The Bartington gradiometers provide proven technology in archaeological magnetic surveying and offer fast, accurate set-up and survey rates. They are sensitive to depths of between 0 and 1.5m below ground level, with optimum sensitivity at depths of 1m or less.

Multiple sensor arrays

A technique relatively new to commercial archaeological surveying but well understood in academic circles involves the use of multiple magnetometer sensors towed behind a quad bike or similar vehicle. With multiple sensors and the use of on-board GPS units, it is possible to achieve faster survey rates at competitive commercial rates when compared to the use of multiple instruments and the techniques discussed above provided the ground is suitable for the vehicle and array. Substrata is pleased to announce that we now offer this service on suitable larger sites

3 Earth resistance surveying

Earth resistance surveying is an excellent tool for detecting buried archaeology. Its relatively slow rate of survey compared to magnetometer surveys means that it is usually employed in commercial surveys when a detailed understanding of buried building remains is required. This technique measures changes in the electrical resistance of the ground being surveyed. In practice, the recording of differences in the electrical resistance of near-surface deposits and structures allows the detection and interpretation of masonry and brick foundations, paving and floors, drains and other cavities, large pits, building platforms, robber trenches, ditches, graves and similar buried features.

Resistance to electrical current flow in the ground depends on the moisture content and structure of the soil and other materials buried beneath the surface. For example, the higher the moisture content of a soil, the less resistant it is to electrical current flow. A ditch completely buried beneath the present ground surface is likely to have an infill soil different to that surrounding the ditch in terms of compactness and composition. As a result, the soil filling the buried ditch will retain moisture in a different way to the surrounding soil which means it will

have an electrical resistance at variance with the surrounding environment. By passing a small current through the ground it is possible to detect, record, plot and interpret such changes in electrical resistance.

For earth resistance surveying Substrata uses the Geoscan Research RM15 series multi-probe resistance meters and purpose-built automatic data-loggers. The Geoscan MPX15 multiplexer is an integral part to the instrument configuration and facilitates multi-probe arrays which speed up survey area coverage rates and, if required, facilitate simultaneous multiple-depth data collection.