Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Mount View, Camelford, Cornwall

Centred on NGR (E/N): 210410,083080 (point)

Report: 1611MOU-R-1

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30 March 2017

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Project archive

Report ..... Adobe PDF format
Copies of report figures ..... Adobe PDF format
Raw and processed grid & composite files ..... DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata ..... DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata ..... DW Consulting TerraSurveyor 3 formats
GIS project, shape files and classification schema
- GIS project ..... Manifold 8 '.map' file
- GIS shape files ..... ESRI standard
- GIS classification schema ..... Adobe PDF format

AutoCAD version of the survey interpretation ..... AutoCAD DXF

Website: substrata.co.uk
For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	27 February 2017
Area:	3.02ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA

1.2 Clients

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch Nr Exeter, Devon EX5 4QL

1.3 Location

Site:	Mount View
Town & Civil Parish:	Camelford
County:	Cornwall
Nearest Postcode:	PL32 9RA
NGR:	SX 104 831 (point)
NGR (E/N):	210410,083080 (point)

1.4 Archive

OASIS number:	substrat1-280900
Archive:	At the time of writing, the archive of this survey will be held by Substrata. Depending on local authority policy, an archive of the unprocessed data may be deposited with the Archaeological Data Service

1.5 Introduction

This report presents the results of an archaeological magnetometer survey at the above site, hereafter referred to as the survey area. It has been prepared for AC Archaeology Ltd on behalf of clients. The survey area location is shown in Figure 1.

1.6 Summary

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Eighteen magnetic anomaly groups were mapped as representing potential archaeological deposits or features. One anomaly group may represent a double ditched, curvilinear feature and may be part of a former enclosure. An adjacent group may represent an area of archaeological deposition partially scattered by later ridge-and-furrow and modern ploughing. Within the same field, one group may represent part of a former ditch-edged routeway.

Elsewhere three groups may represent a single entity or a group of deposits, They may be archaeological in nature but cannot be further characterised. One nearby group may represent an archaeological pit or a modern deposit or artefact. An adjacent anomaly group may represent a pit.

The other anomaly groups mapped as representing potential archaeological deposits and features have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

2 Survey aims and objectives

2.1 Aims

To establish the presence or absence, extent and character of any archaeological features and deposits within the survey area.

2.2 Survey objectives

1. Complete a magnetometer 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 survey area about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

4 Site description

4.1 Landscape and land use

The site comprises nine fields and enclosures on the eastern side of Camelford. It covers an area of approximately 6ha. The 3ha area that was suitable for survey slopes west to east from approximately 210m to 200m AOD. Further east the land descends steeply to approximately 175m AOD and the River Camel as shown in Figure 1. Domestic buildings and agricultural land border the field to the north. To the west and south are agricultural fields. The western boundary comprises the A39 and town infrastructure.

4.2 Geology

The bedrock across the site is hornfelsed slate of the Devonian Trevose Slate Formation and Rosenum Formation (undifferentiated) (British Geological Survey, undated).

Within the proposed development site but to the east of the survey area, the Camel valley has superficial deposits of Quaternary alluvium. Otherwise the superficial geology is unknown (ibid).

5 Archaeological background

5.1 Historic landscape characterisation

Name: Farmland: Medieval

Summary: The agricultural heartland, with farming settlements documented before the 17th century AD and whose field patterns are morphologically distinct from the generally straight-sided fields of later enclosure. Either medieval or prehistoric origins (Cornwall Council, undated)

5.2 Summary of archaeological background

At the time of publication of this report, an Historical Environment Impact Assessment is being produced by AC Archaeology for the same programme of work (ACD1527/2/0, in progress). This report will contain an analysis of the historic environment of the site.

No historic environment assets have been recorded within the proposed development area.

6 Results, discussion and conclusions

6.1 Scope and definitions

This survey was designed to record magnetic anomalies. A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can depend on the magnetism of underlying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface artefacts can also create magnetic anomalies.

The terms ‘archaeological deposit’, ‘structure’ and ‘feature’ refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity, excluding recent land maintenance and farming.

Magnetic anomalies cannot be regarded as physical archaeological deposits, structures or features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits, structures and features.

The reader is referred to section 7.

6.2 Results

Figures 2 and 3 show the interpretation of the survey data which includes the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers. Table 1 is an extract of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive.

Figures 2 and 3 along with Table 1 comprise the analysis of the survey data.

Figures 4 and 5 are plots of processed data as specified in Table 3. Figure 6 is a plot of unprocessed data with its metadata.

6.3 Discussion

6.3.1 General points

Discussion scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

Data collection

Data collection along the survey area edges was restricted as shown in the figures due to the presence of magnetic materials within and adjacent to boundaries. Strong magnetic responses mapped close to the boundaries are likely to relate to these materials except where otherwise indicated in Figure 2 and Table 1.

Anomaly characterisation and mapping

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

Anomalies thought to relate to natural features and recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent ferrous objects. They are only mapped if they could influence the analysis of anomaly groups thought to have an archaeological origin.

Data trends

A number of parallel, linear trends are present in the data set (Figure 4). Some of these are likely to reflect historical ridge-and-furrow ploughing and are recorded in Figure 2. The remainder are likely to represent relatively recent ploughing disturbance.

6.3.2 Data relating to historic maps and other records

None of the magnetic anomaly groups related to known historic records or assets.

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly groups **4**, **5** and **6** together create an unusual pattern. It is not clear if the anomalies are related and so they are shown separately in Figure 2. Adjacent groups **7** and **8** may relate to archaeological pits or to natural deposits. There is a possibility that group 7 reflects a modern deposit or artefact.

Group **12** is clear in the data set and represents a double curvilinear anomaly group is most likely to reflect the deposits of a double ditch, possibly from an enclosure or similar archaeological structure.

Group **14** has larger than typical magnetic response for the survey area. Such groups can reflect archaeological deposits partially scattered by later ploughing.

Anomaly group **15** has characteristics typical of either a ditch-edged routeway such as a former track or a Cornish hedge. In this case the anomaly groups imply a width more in keeping with a track.

The other anomaly groups mapped as representing potential archaeological deposits and features have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

6.4 Conclusions

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Eighteen magnetic anomaly groups were mapped as representing potential archaeological deposits or features. One anomaly group (12) may represent a double ditched, curvilinear feature and may be part of a former enclosure. An adjacent group may represent an area of archaeological deposition partially scattered by later ridge-and-furrow and modern ploughing. Within the same field, one group may represent part of a former ditch-edged routeway (15).

Elsewhere three groups (4, 5 and 6) may represent a single entity or a group of deposits, They may be archaeological in nature but cannot be further characterised. One nearby group (7) may represent an archaeological pit or a modern deposit or artefact. An adjacent anomaly group may represent a pit.

The other anomaly groups mapped as representing potential archaeological deposits and features have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

7 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.

8 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

Archaeology Data Service (undated) *Archaeology Data Service/Digital Antiquity Guides to Good Practice: Geophysical Data in Archaeology.* [Online], Available: http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc [February 2017]

British Geological Survey (undated) *Geology of Britain viewer, 1:50000 scale data.* [Online], Available: http://www.bgs.ac.uk/discovering Geology/geologyOfBritain/viewer.html [February 2017]

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Dean, R. (2017) *A survey method statement for a detailed magnetometer survey Mount View, Camelford, Cornwall.* Substrata Ltd unpublished document 1611MOU-M-1

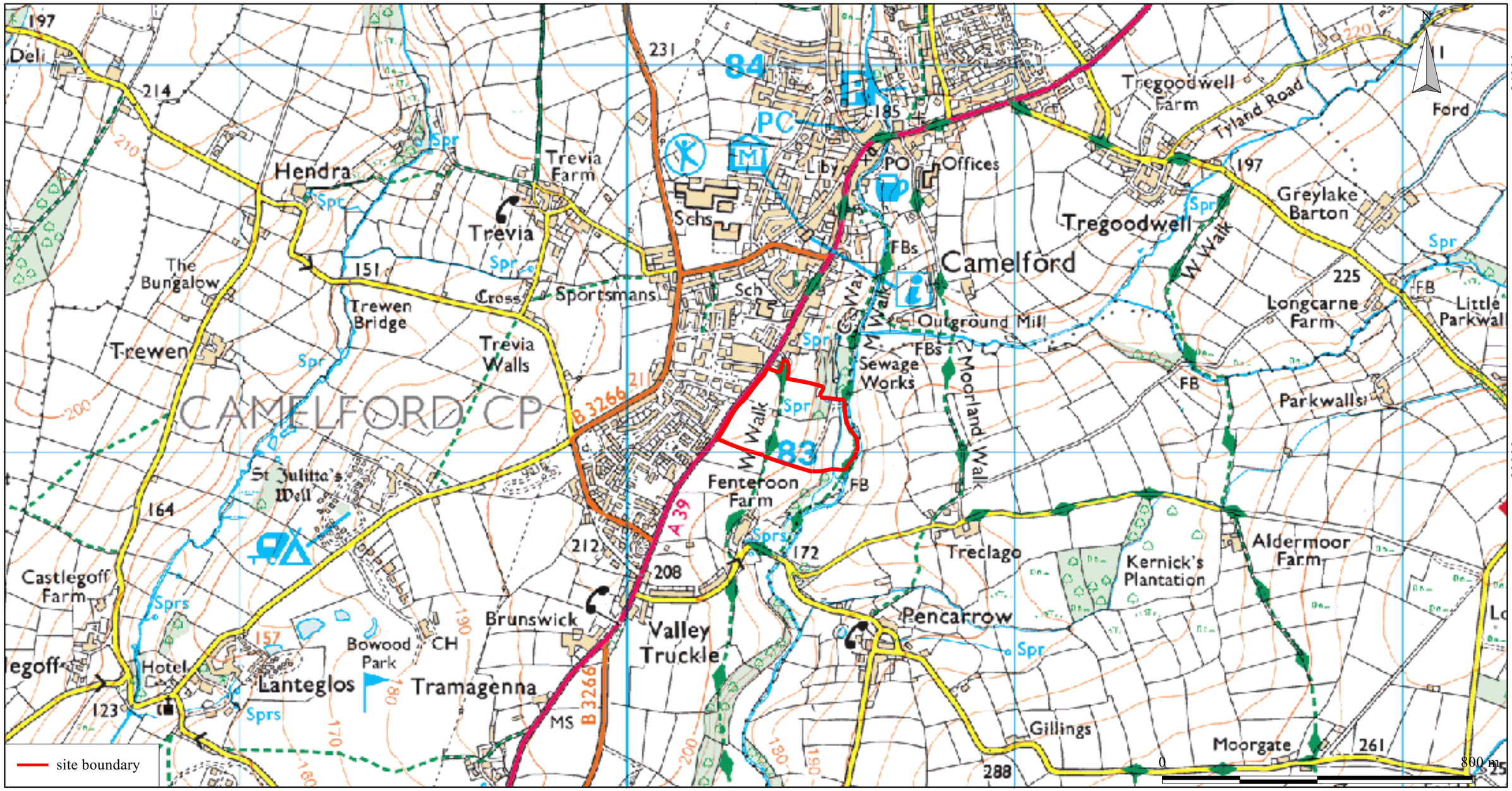
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation*. [Online], Available: https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/ [February 2017]

Appendix 1 Figures

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 (see Section 6.1).

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: 210333.93 m, centre Y: 83145.07 m

Scale: 1:10000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Mount View, Camelford, Cornwall
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Figure 1: location map

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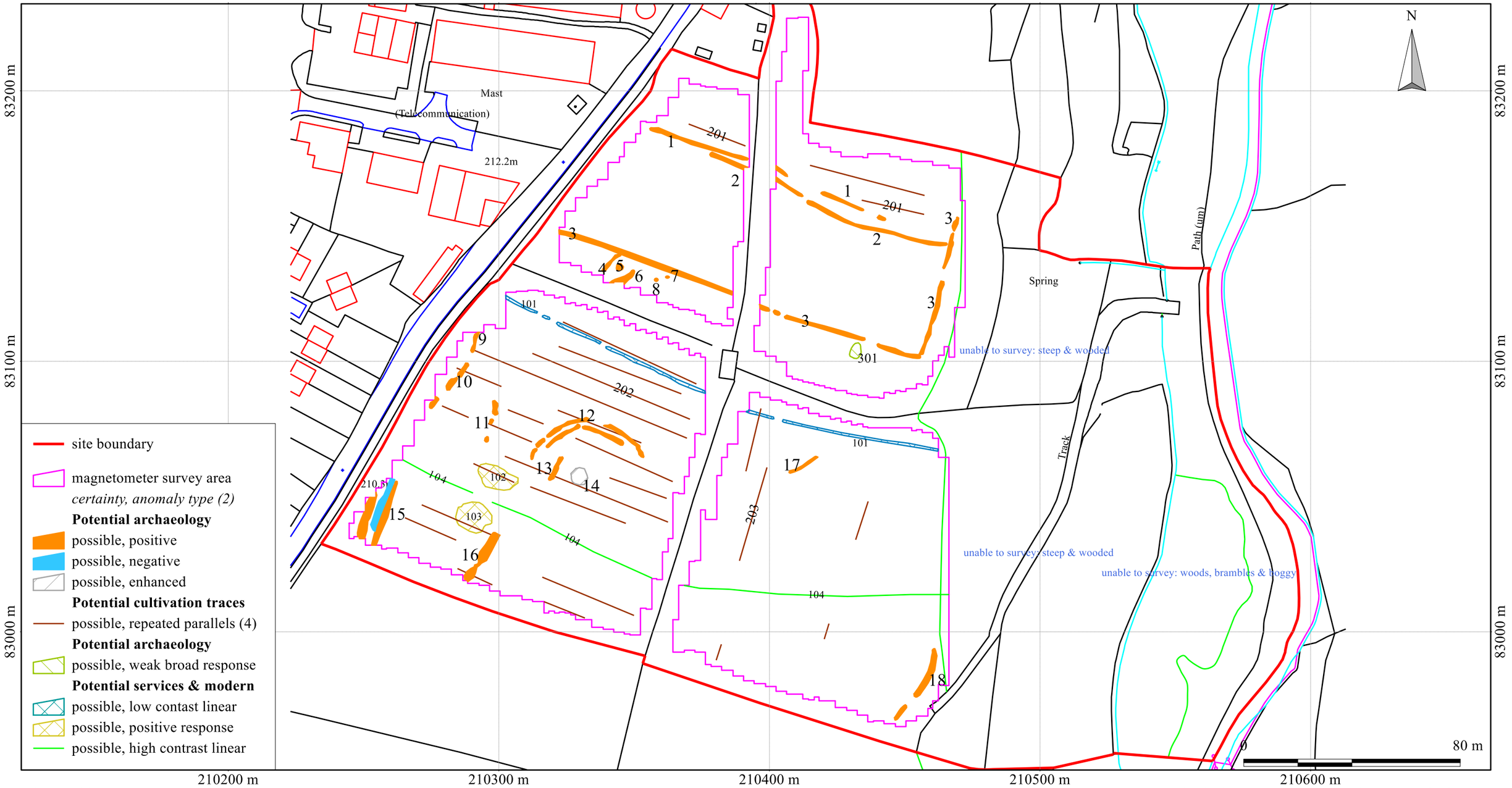

British Grid
centre X: 210395.05 m, centre Y: 83090.52 m

Scale: 1:1400 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer survey
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Figure 2: survey interpretation

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
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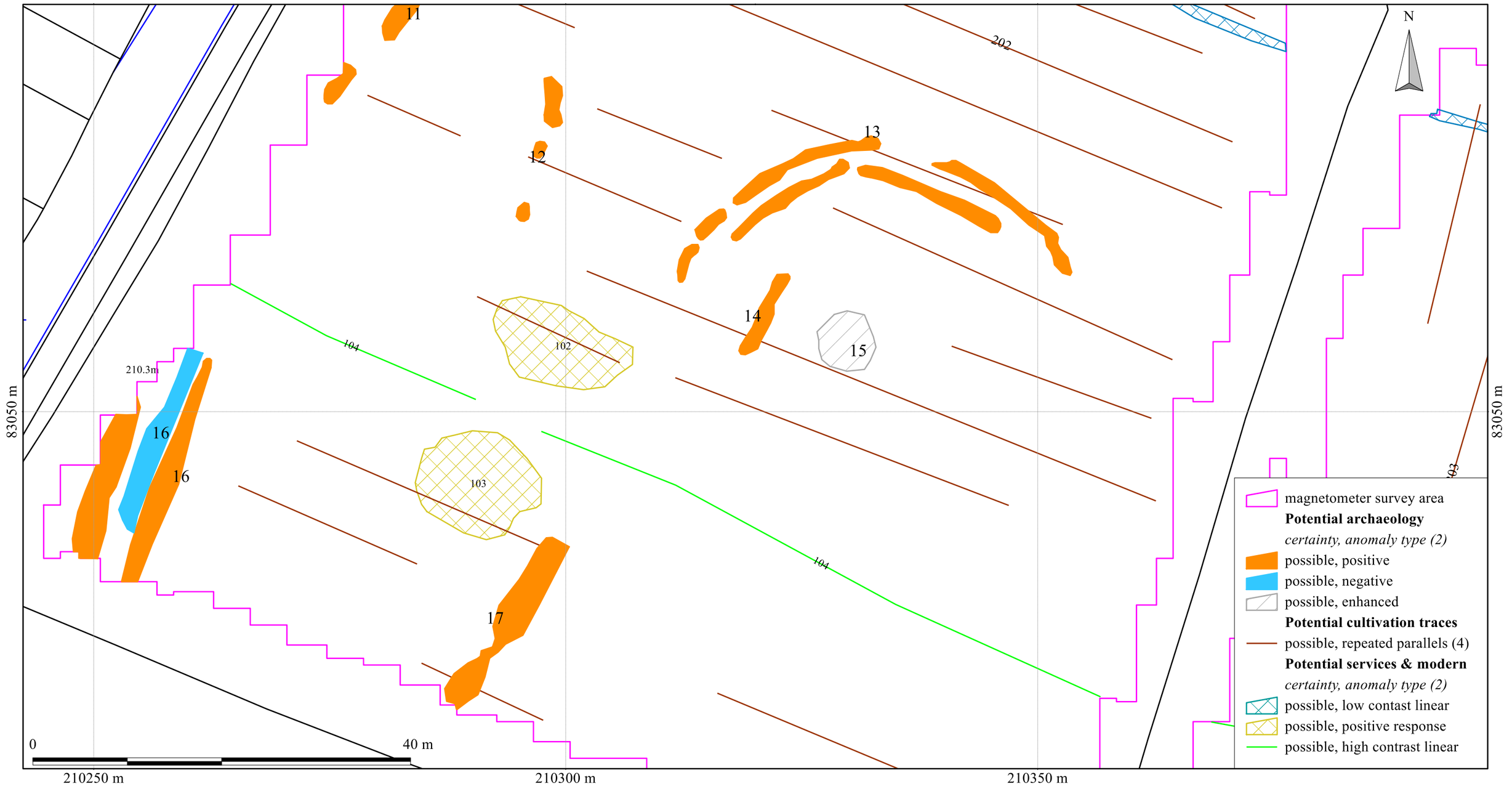

British Grid
centre X: 210320.09 m, centre Y: 83052.66 m

Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer survey
Mount View, Camelford, Cornwall
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Figure 3: survey interpretation, south-western area

Substrata Limited
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Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

British Grid
centre X: 210395.05 m, centre Y: 83090.52 m

Scale: 1:1400 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Mount View, Camelford, Cornwall
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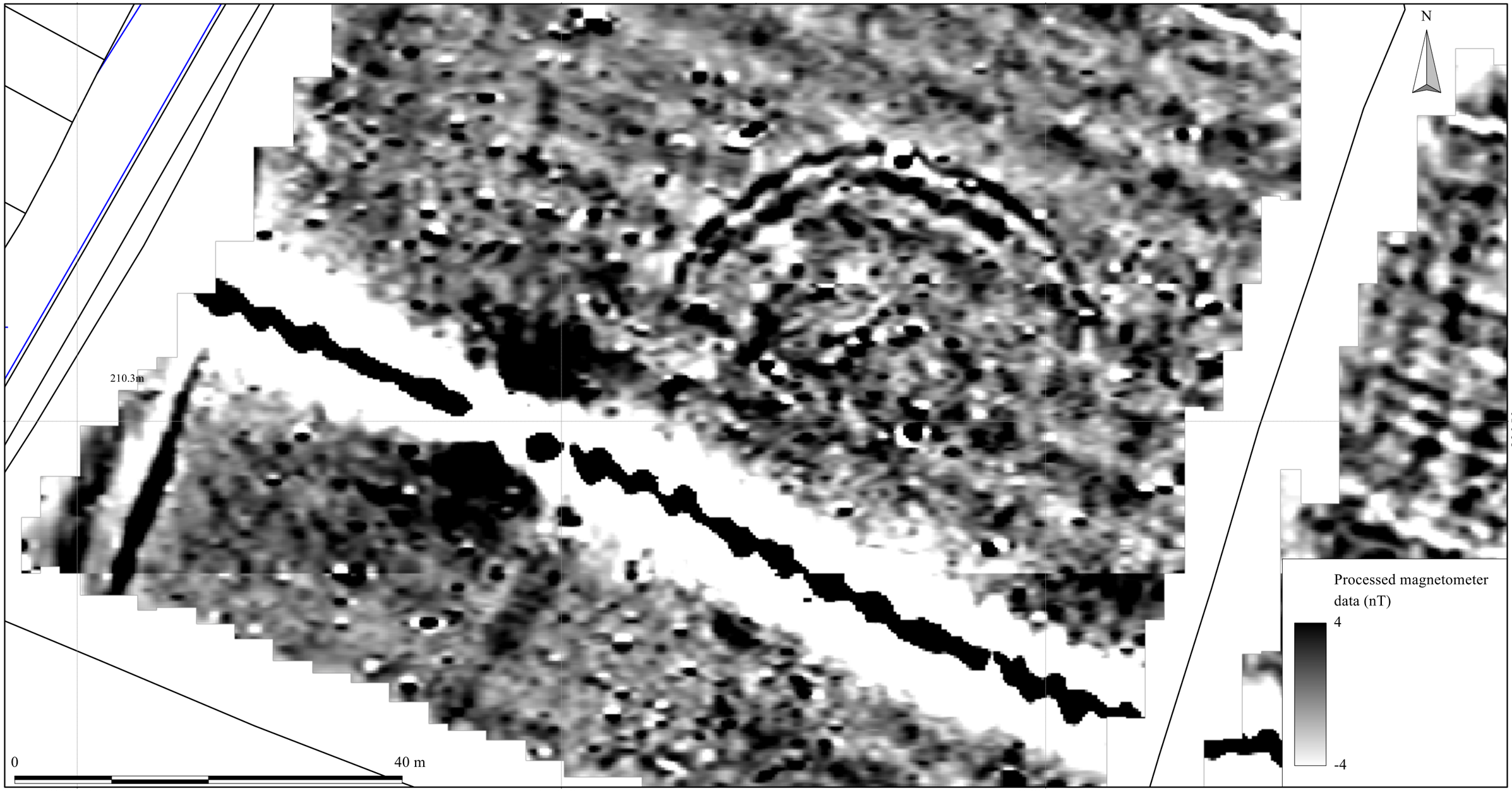
Figure 4: shade plot of processed data

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 210320.09 m, centre Y: 83052.66 m

Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Mount View, Camelford, Cornwall
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Figure 5: shade plot of processed data, south-western area

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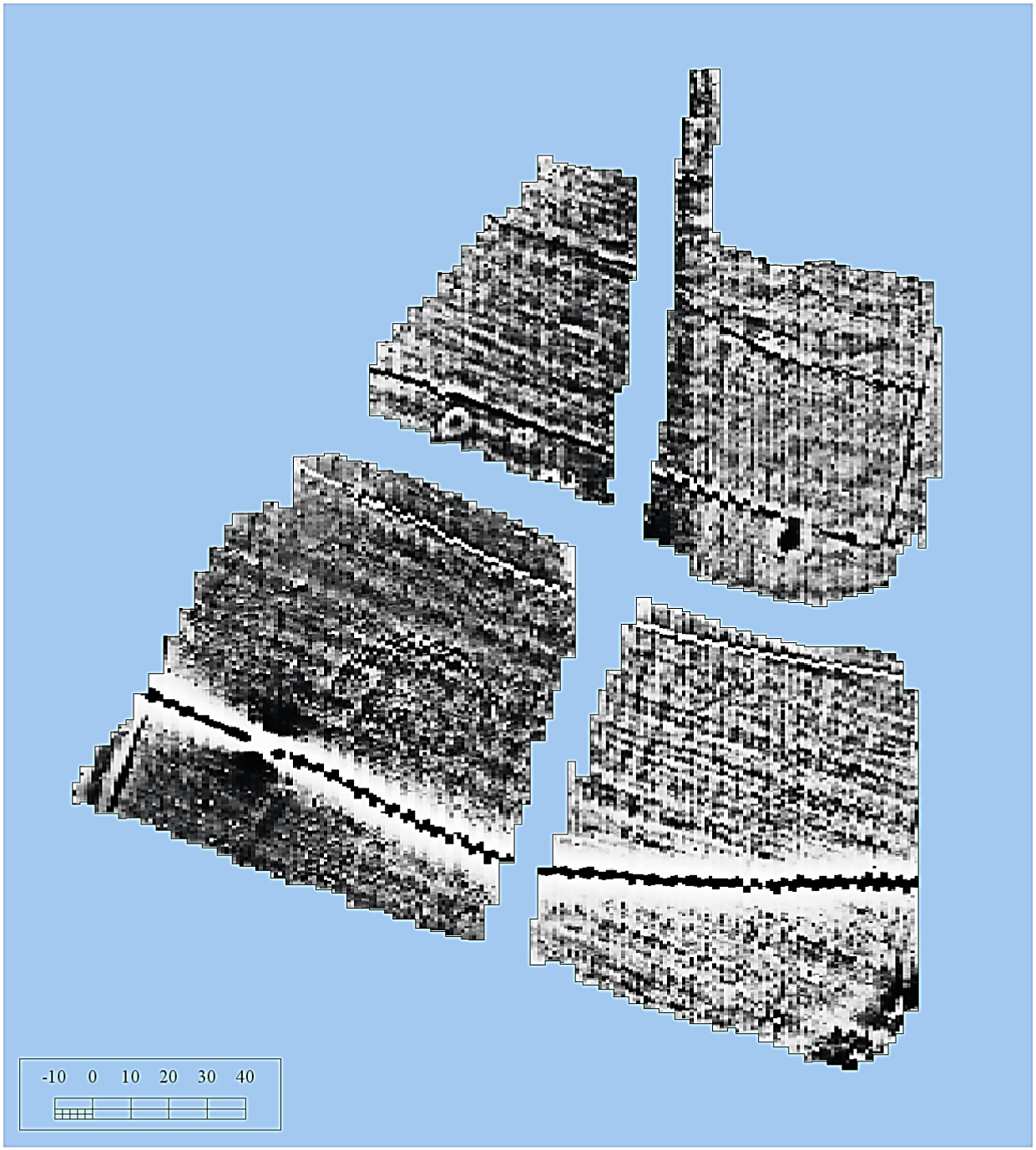

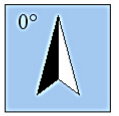

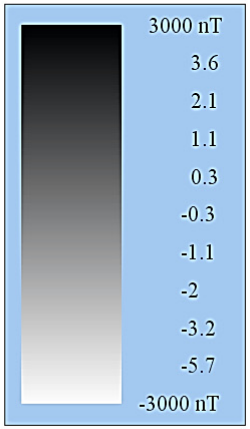

Processes: 1
1 Base Layer

Instrument type: Bartington grad601-2
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Dimensions
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 3000.00
Min: -3000.00
Std Dev: 258.18
Mean: 12.84
Median: -0.30
Surveyed Area: 3.0597 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Figure 6: shade plot of unprocessed data

Appendix 2 Tables

Site: An archaeological magnetometer survey
Mount View, Camelford, Cornwall
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anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments
1		possible, positive	disrupted curvilinear		
2		possible, positive	disrupted curvilinear		
3		possible, positive	disrupted return		
4	5? 6?	possible, positive	linear		anomaly groups together create an unusual pattern and may relate to a single deposit or structure or may represent separate entities
5	4? 6?	possible, positive	oval		anomaly groups together create an unusual pattern and may relate to a single deposit or structure or may represent separate entities
6	4? 5?	possible, positive	linear		anomaly groups together create an unusual pattern and may relate to a single deposit or structure or may represent separate entities
7		possible, positive	oval	pit or modern artefact	
8		possible, positive	oval	pit	
9		possible, positive	oval	pit	
9		possible, positive	linear		
10		possible, positive	disrupted linear		
11		possible, positive	disrupted linear		
12		possible, positive	double semi-circular	enclosure remnant	anomaly groups are slightly straightened along the line of possible ridge and furrow but this is likely to be the result of ploughing and does not represent the original feature
13		possible, positive	linear		
14		possible, enhanced	sub-circular	archaeological deposit or spread	
15		possible, positive/negative/positive	linear	ditch-lined routeway	
16		possible, positive	linear		
17		possible, positive	linear		
18		possible, positive	disrupted curvilinear		
101		possible, low contrast linear		service trench	anomaly group is most likely to represent a recent, gravel-filled service trench; less likely, it could represent a former field boundary
102		possible, positive response			anomaly group is most likely to be associated with the adjacent service
103		possible, positive response			anomaly group is most likely to be associated with the adjacent service
104		possible, high contrast linear		ferrous cable or pipe	
201		possible, repeated parallels		ridge-and-furrow	
202		possible, repeated parallels		ridge-and-furrow	
203		possible, repeated parallels		ridge-and-furrow	
301		possible, weak broad response		spring	anomaly group is most likely to represent a spring or, just possibly, a large natural filled hollow or archaeological pit

Table 1: data analysis

Documents
Survey methodology statement: Dean (2017)

Methodology

1. The work was undertaken in accordance with the survey methodology statement. The geophysical (magnetometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service (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.

Grid
Method of Fixing: DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates.
Composition: 30m by 30m grids
Recording: Geo-referenced and recorded using digital map tiles.
DGPS used: Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.

Equipment	**Data Capture**
Instrument: Bartington Instruments grad601-2 *Firmware:* version 6.1	*Sample Interval:* 0.25m *Traverse Interval:* 1 metre *Traverse Method:* zigzag *Traverse Orientation:* GN

Data Processing, Analysis and Presentation Software
IntelliCAD Technology Consortium IntelliCAD 8.0
DW Consulting TerraSurveyor3
Manifold System 8 GIS
Microsoft Corp. Office Excel 2013
Microsoft Corp. Office Publisher 2013
Adobe Systems Inc Adobe Acrobat 9 Pro Extended

Table 2: methodology summary

SITE
Instrument Type: Bartington Grad-601 gradiometer
Units: nT
Direction of 1st Traverse: see below
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Stats	
Max:	106.48
Min:	-105.91
Std Dev:	14.79
Mean:	-0.58
Median:	-0.11

Processes: 15
1 Base Layer
2 Clip at 1.00 SD
3 De Stagger: Grids: b4.xgd Mode: Both By: 2 intervals
4 De Stagger: Grids: b8.xgd Mode: Both By: 1 intervals
5 De Stagger: Grids: a13.xgd a20+b14.xgd a14.xgd b15+a19.xgd a15.xgd a18.xgd a16.xgd a27+a17.xgd Mode: Both By: -2 intervals
6 De Stagger: Grids: b21.xgd b28.xgd b22.xgd b27.xgd b23.xgd b26.xgd b24+b5.xgd b25+b6.xgd Mode: Both By: -1 intervals
7 De Stagger: Grids: b18.xgd Mode: Both By: -1 intervals
8 De Stagger: Grids: a20+b14.xgd Mode: Both By: 1 intervals
9 DeStripe Median Sensors: Grids: All
10 Edge Match (Area: Top 150, Left 240, Bottom 239, Right 359) to Right edge
11 De Stagger: Grids: b22.xgd Mode: Both By: -1 intervals
12 De Stagger: Grids: b3.xgd Mode: Both By: 1 intervals
13 De Stagger: Grids: b8.xgd Mode: Both By: 1 intervals
14 Interpolate: Match X & Y Doubled.
15 Clip at 4.00 SD

Table 3: processed data metadata