Substrata
Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land off Exeter Road, Topsham Exeter, Devon

Centred on NGR (E/N): 296117,088935(point)

Report: 1605TOP-R-1

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10 July 2016

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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:	13 May 2016
Area:	1.1ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA with contributions from Mark Edwards BA

1.2 Clients

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

1.3 Location

Site:	Land off Exeter Road, Topsham
District:	Exeter
County:	Devon
Nearest Postcode:	EX3 0LX
NGR:	SX 96117 88935 (point)
Ordnance Survey NGR (E/N):	296117, 088935 (point)

1.4 Archive

OASIS number:	substrat1-257153
Archive:	At the time of writing, the archive of this survey will be held by Substrata.

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.

Six magnetic anomaly groups were mapped as representing possible archaeological deposits or features. Of these, one group represents a field boundary mapped between 1842 and at least 1966. It was removed before 1980. The remaining groups are most likely to represent linear and disrupted linear deposits, such as former ditches or banks, of unknown period.

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 survey area lies within one field on the north-western edge of Topsham which lies on a spur of land between the Exe and Clyst rivers. The field is relatively flat and lies between 10m and 15m AOD. It is bounded on its southern side by Exeter Road and is otherwise surrounded by fields (Figure 1). At the time of the survey the land was under grass.

4.2 Geology

The survey area has a solid geology of the Permian Dawlish Sandstone Formation which comprises cross-bedded reddish brown sands and sandstones with intercalated thin lenses and beds of breccia and mudstone. The superficial geology is Quaternary River Terrace Deposits which generically comprise sand and gravel, locally with lenses of silt, clay or peat (British Geological Survey, undated).

5 Archaeological background

5.1 Definitions

5.1.1 Heritage assets

Archaeological sites, buildings, historic parks and gardens, conservation areas, registered battlefields and other aspects of the historic environment that are significant because of their historic, archaeological, architectural or artistic interest are considered heritage assets. Designated heritage assets are afforded protection as either scheduled monuments, listed buildings or through their inclusion within conservation areas. Non-designated heritage assets are potential archaeological remains and historic landscapes.

5.1.2 Historic Environment Records (HERs) are sources of, and signposts to, information relating to landscapes, buildings , monuments, sites, places, areas and archaeological finds spanning more than 700,000 years of human endeavour. Based mainly in local authorities, they are used for planning and development control but they also fulfil an educational role (Historic England, undated b).

5.1.2 Archaeological periods

Archaeological periods use in this report are defined as follows:

Prehistoric: before AD 43
Palaeolithic: circa 500,000 BC to circa 10,000 BC
Mesolithic: circa 10,000 BC to circa 4,000 BC
Neolithic: circa 4,000 BC to 2,200 BC
Bronze Age: 2,200 BC to 700 BC
Iron Age: circa 700 BC to AD 43
Romano-British: AD 43 to circa AD 410
Early Medieval: circa AD 410 to AD 1066
Medieval: AD 1066 to AD 1540
Post-medieval: AD 1540 to AD 1901
Modern: AD 1901 onwards

5.1.3 Grid references, distances and bearings

The centre of the survey area is provided in Section 1 as a twelve figure National Grid easting/

northing (E/N) and as a ten figure National Grid reference (NGR), both of which define a 1m square with its south-western corner on the reference point. Eight figure NGRs define a 10m square. Six figure NGRs a 100m square and so on. The distances and bearings provided below are relative to the south-western corner of the square defined by the NGR quoted.

All distances and bearings provided below are relative to the Ordnance Survey NGR centre point of the site recorded in Section 1.

5.2 Historic landscape characterisation

Modern enclosures

Modern enclosures that have, in this case, been created by adapting earlier Barton fields. Barton fields are relatively large, regular enclosures that seem likely to have been laid out between fifteenth and eighteenth centuries. Some curving boundaries may be following earlier divisions in the pre-existing Medieval fields (Turner, 2015).

5.3 Historical and archaeological background

The following is a short summary of information obtained from Steinmetzer (2014) and the Devon HER within approximately 500m of the survey area and relevant to the understanding of the geophysical survey. The HER information was obtained using the Heritage Gateway portal (Historic England, undated a).

5.3.1 Heritage assets within the survey area

The site forms part of a very regular field pattern (Historic Environment Record MDV63890, National Grid Reference SX 961 888) aligned at right angles to Exeter road of likely Medieval origin and comprising strips of cultivated land within a large open field. These were gradually amalgamated and enclosed with hedges to produce the landscape mapped in the mid-nineteenth century.

5.3.2 Heritage assets within 500m of the survey area

A Late Neolithic/Beaker period settlement (MDV14344, SX 9567 8897) is located approximately 438m from the centre of the survey area on a bearing N274.

The remains of a first century Roman military base and a later Roman inhumation cemetery are located 438m from site on N274 (MDV67998, SX 9627 8839). A geophysical survey recorded a rectangular enclosure 321m from the site on N287 which when excavated by Exeter archaeology in 1999 found Roman pottery fragments and tile fragments (MDV63891, SX 9580 8903). The site of a Roman farmstead on Exeter road, 438m on N274 from the survey centre, was excavated in 1974 (MDV14394, SX 9567 8897). The remains of a Roman building have been recorded 257m bearing N159 from the site (MDV14346, SX 962 887). A rectilinear enclosure of potential Roman date (MDV56062, SX 958 890) has been recorded 321m from the site on the bearing N279. It is visible as a cropmark ditch on oblique aerial photographs of 1994, on the northeast side of Exeter Road, Topsham. The remains of a Roman bake house with two ovens is recorded in Yarde's Field, Topsham (MDV9946, SX 9623 8875) approximately 222m from the survey area on N146. Trial excavations in Park Field, Topsham (209m on N190) revealed two channels at right angles to each other, the channels contained a considerable amount of Roman pottery (MDV9961, SX 9607 8873). Excavations approximately 412m on N278 located a late third or fourth century cremation within a small square timber structure (MDV14343, SX 9570 8900).

The site of Medieval field system is located approximately 86m from the site on bearing N122 (MDV63890, SX 9618 8889). Two Post-medieval field boundaries are located 573m from site on the bearing N160 to the north of Orchard Way in Topsham (MDV MDV65501, SX 963 884).

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 result from variations in the chemistry or 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 actual 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 (see also Section 7).

6.2 Results

Figure 2 shows the interpretation of the survey data. It 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.

Figure 2 and Table 1 comprise the analysis of the survey data.

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

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 adjacent to the survey area. Strong magnetic responses mapped close to survey boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

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 or relate to relatively recent cultivation. The area of the survey was mapped as an orchard between 1905 and at least 1966 but as a field by 1980 (source: Ordnance Survey 1905 to 1966, 1:2500, 1:10560 and 1:10000 maps). Many of anomalies seen are likely to relate to tree boles or tree removal disturbance. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns not thought to relate to recent activities.

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. If mapped, they are listed in Table 1 but are not discussed below.

Anomalies thought to relate to natural features were not mapped.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent ferrous objects.

6.3.2 Data relating to historic maps and other records

Magnetic anomaly group **1** coincides with a field boundary mapped between 1842 and at least 1966 as specified in Table 1.

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly groups **2 to 6** are likely to represent linear and disrupted linear deposits, such as former ditches or banks, of unknown period.

Two linear trends exist in the data set (Figures 2, 3 and 4) although not assigned group numbers in Figure 2. Such groups can represent land disturbance such as field drains and/or ploughing of unknown period.

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.

Six magnetic anomaly groups were mapped as representing possible archaeological deposits or features. Of these, one group represents a field boundary mapped between 1842 and at least 1966. It was removed before 1980. The remaining groups are most likely to represent linear and disrupted linear deposits, such as former ditches or banks, of unknown period.

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

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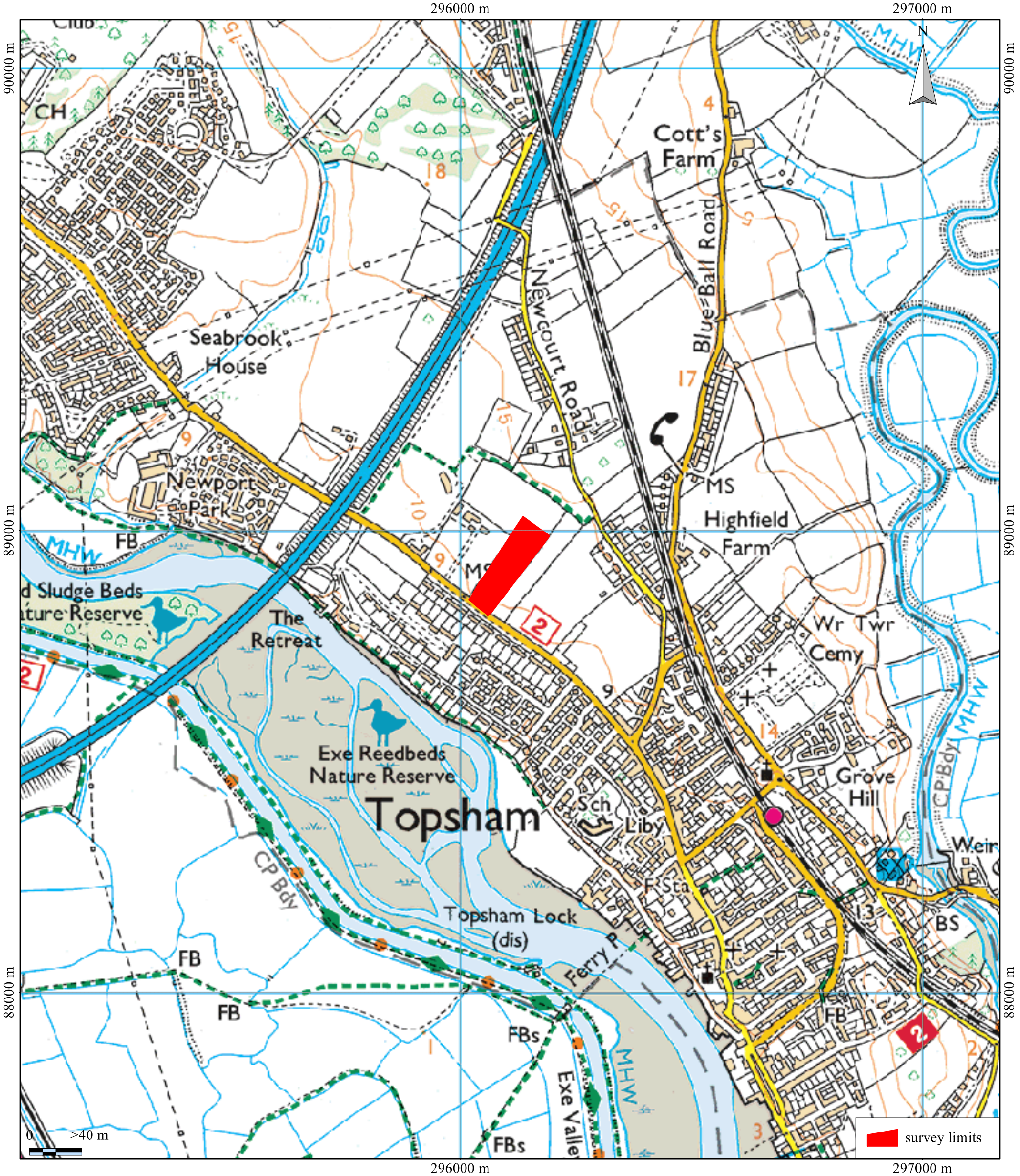
Turner, S. (2015) *Devon Historic Landscape Characterisation (HLC)* [data-set]. York: Archaeology Data Service [distributor], [Online], Available: http://archaeologydataservice.ac.uk/archives/view/ devon_hlc_2015/index.cfm [July 2016]

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 (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: 296107.67 m, centre Y: 88872.39 m

Scale: 1:8000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land off Exeter Road, Topsham, Exeter, Devon
Centred on NGR (E/N): 296117,088935 (point)
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Figure 1: location map

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296100 m

296200 m

89000 m

88900 m

N

1

2

4

1

3

overgrown hedge with wire fencing

4

5

6

wire fence

road & fencing

0

40 m

survey limits

survey area

Potential archaeology

certainty, anomaly type (2)

likely, positive (3)

possible, positive

possible, repeated parallels (4)

296100 m

296200 m

British Grid
centre X: 296111.27 m, centre Y: 88935.89 m

Scale: 1:800 @ 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. Representative; 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
Land off Exeter Road, Topsham, Exeter, Devon
Centred on NGR (E/N): 296117,088935 (point)
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Figure 2: survey interpretation

Substrata
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Site: An archaeological magnetometer survey
Land off Exeter Road, Topsham, Exeter, Devon
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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	likely, positive	disrupted linear	field boundary	the anomaly group coincides with a field boundary mapped in 1842 and removed after 1966 and before 1980	1842 Topsham Tithe map, Ordnance Survey maps 1966 1:2500 to 1980 1:10000
2	possible, positive	disrupted linear			
3	possible, positive	disrupted linear			
4	possible, positive	disrupted linear	field boundary	the anomaly group is likely to represent a field boundary removed before the publication of the 1842	1842 Topsham Tithe map, Ordnance Survey 1889-90 1st edition map
5	possible, positive	linear			
6	possible, positive	linear			

Table 1: data analysis

296100 m

296200 m

N

89000 m

88900 m

overgrown hedge with wire fencing

wire fence

road & fencing

survey limits

Processed gradiometer data shade plot (nT)

1.5

-1.5

0

40 m

British Grid
centre X: 296111.27 m, centre Y: 88935.89 m

Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land off Exeter Road, Topsham, Exeter, Devon
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Figure 3: shade plot of processed data

Substrata
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296100 m

296200 m

N

89000 m

88900 m

overgrown hedge with wire fencing

wire fence

road & fencing

0

40 m

survey limits

Processed gradiometer data

contour plot (nT)

> 4.00

2.00 - 4.00

1.00 - 2.00

0.50 - 1.00

0.00 - 0.50

-0.50 - 0.00

-1.00 - -0.50

-2.00 - -1.00

-4.00 - -2.00

< -4.00

296100 m

296200 m

British Grid

centre X: 296111.27 m, centre Y: 88935.89 m

Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
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Figure 4: contour plot of processed data

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Appendix 2 Methodology Summary

Table 2: methodology summary	
Documents Survey methodology statement: Dean (2016)	
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 *Instrument:* Bartington Instruments grad601-2 *Firmware:* version 6.1	**Data Capture** *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	

Appendix 3 Data processing

Table 3: magnetometer survey - processed data metadata

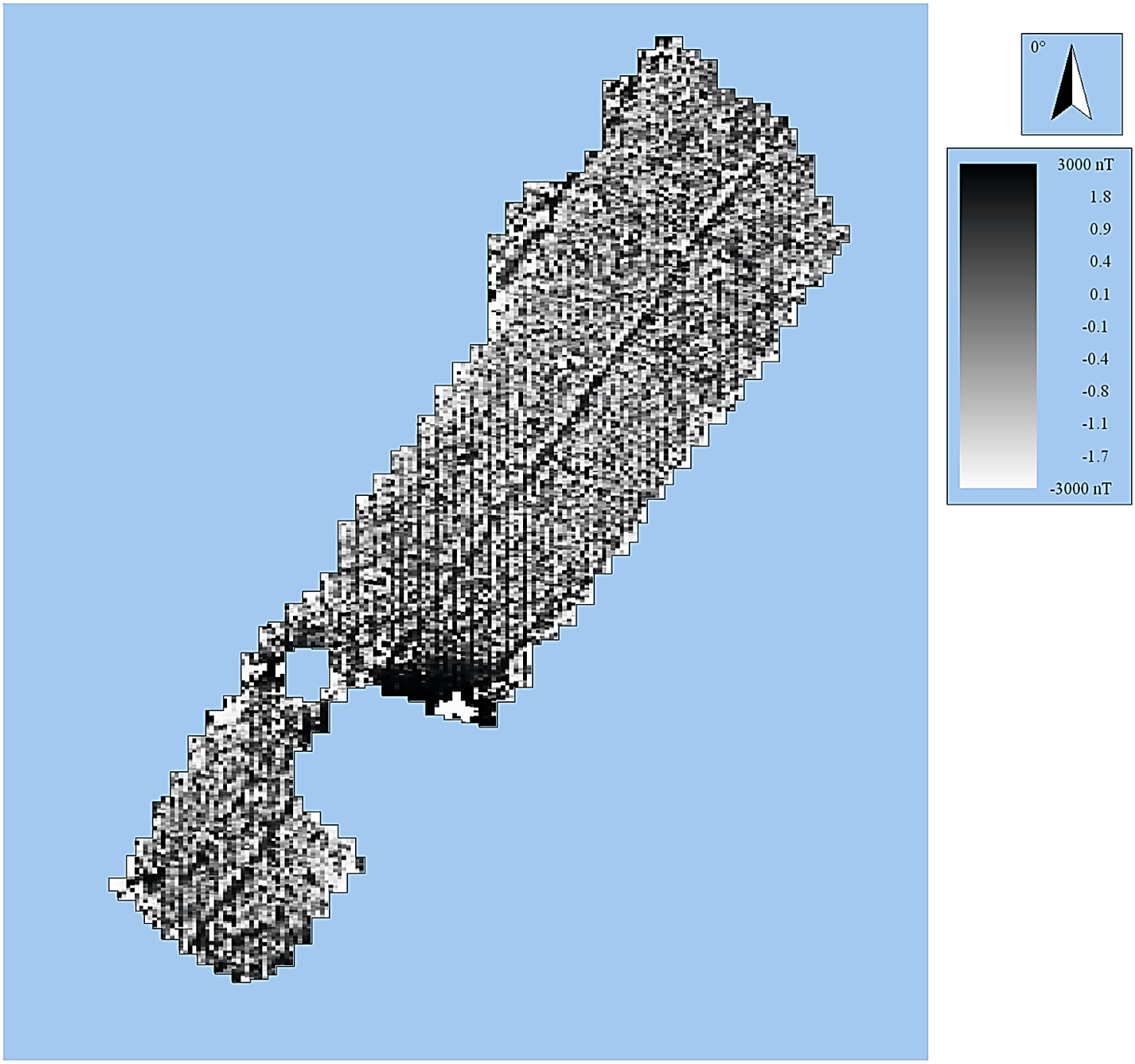
SITE
Instrument Type: Bartington Grad-601 gradiometer
Units: nT
Direction of 1st Traverse: see below
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Stats	
Max:	29.13
Min:	-23.90
Std Dev:	1.77
Mean:	0.11
Median:	0.01

Processes: 6
1 Base Layer
2 Clip at 1.00 SD
3 De Stagger: Grids: All Mode: Both By: -2 intervals
4 DeStripe Median Sensors: Grids: All
5 Clip at 2.00 SD
6 Interpolate: Match X & Y Doubled.

Appendix 4: Unprocessed data plot



Processes: 1
1 Base Layer

Instrument Type:	Bartington Grad 601
Units:	nT
Direction of 1st Traverse:	0 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702
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:	103.10
Mean:	-3.04
Median:	-0.10
Composite Area:	5.04 ha
Surveyed Area:	1.1318 ha

PROGRAM

Name:	TerraSurveyor
Version:	3.0.29.3

Figure 5: shade plot ofunprocessed data