Substrata
Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land adjacent to Bovey Fir Cross Bovey Farm, Beer, Seaton, Devon

Centred on NGR: 320930,089680

Report: 1808BOV-R-1

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22 August 2018

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1 Introduction

This report presents the results of an archaeological geophysical survey at the site listed in Section 4 and shown in Figure 1, hereafter referred to as the 'Survey Area'. Figure 2 shows the proposed development plot within the Survey Area. The survey was commissioned by Clinton Devon Estates through their agent Country Design Group in support of a planning application for a new slurry storage lagoon. The commissioning of this report was in keeping with the National Planning Policy Framework, Chapter 16, Paragraph 189 (Ministry of Housing, Communities & Local Government, 2018). The survey and report were completed in compliance with a Survey Method Statement (Dean, 2018).

As can be seen from Figures 2 and 3, the Survey Area was designed to be larger than the proposed development plot to allow for flexibility in the siting of the slurry storage lagoon should the survey data indicate the presence of buried archaeology.

2 Client details

Client: Clinton Devon Estates, The Rolle Estate, Bicton Arena, East Budleigh, Salterton, Devon EX9 7BL
Agent: County Design Group, 8 Meadow View, Blanford DT11 7JB

3 Copyright

4 Survey type and location

4.1 Survey

Method:	shallow depth magnetometer survey
Instrument:	twin-sensor fluxgate gradiometer
Date:	14 August 2018
Area:	2ha

4.2 Location

Site name:	Land adjacent to Bovey Fir Cross
Address:	Bovey Farm, Beer, Seaton, Devon EX12 3AB
Civil Parish:	Brandscombe
District:	East Devon
County:	Devon
Survey centre NGR:	SY 20930 89680
Survey centre NGR (E/N):	320930,89680
Historic environment designation:	None
OASIS ID:	substrat1-326566

5 Summary

A magnetometer survey was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Survey Area (see Section 14). The magnetic anomaly groups pertaining to potential buried archaeology were georeferenced to the Ordnance Survey National Grid, mapped, characterised and assigned with an appropriate degree of certainty in conformance with the survey aims and objectives set out in Section 6.

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Seven magnetic anomaly groups were characterised as representing potential archaeological deposits although none of these were located within the proposed development plot (Figures 2 and 3). One anomaly group is likely to represent a former field boundary recorded on historic maps between at least 1840 and 1963. Two groups may indicate the presence of large pits or earthen surfaces disrupted by later ploughing although natural origins cannot be ruled out. Two groups may represent smaller pits. Two groups may depict linear deposits although one of these may represent a service trench.

6 Aims and objectives

6.1 Aims

1. Within the framework set out in Chartered Institute for Archaeologists (2014a), complete an archaeological geophysical survey and report which will, as far as possible, establish the presence or absence, extent and character of any buried archaeology within the Survey Area.
2. Provide sufficient information on the nature of any archaeological remains to facilitate the assessment of their interest prior to the determination of the planning application.

6.2 Objectives

1. Complete a magnetometer survey across the Survey Area.
2. Identify any magnetic anomalies that may be related to buried archaeology.
3. Within the limits of the technique 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 informs any subsequent development on the survey area about the location and possible archaeological character of the recorded anomalies.

7 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2008). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

8 Methodology

The magnetometer survey was undertaken in accordance a Survey Method Statement (Dean, 2018) to achieve the aims and objectives set out in Section 6 using the standards and guidance specified in Section 7. The survey method was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Survey Area (see Section 14).

Data processing was undertaken using appropriate software (Table 2), with all anomalies being digitised and geo-referenced. The final report (this document) includes 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. The survey and report conform to the Chartered Institute for Archaeologists standard for geophysical survey (CIfA, 2014a).

9 Survey Area

9.1 Location and description

The Survey Area comprises a single plot of land within a larger field approximately 2000m west-north-west of the village of Beer (Figure 1). It is bounded to the north and east by a Devon bank with some wire fencing and by the remainder of the field to the south and west (Figure 2).

The Survey Area was relatively flat at approximately 145m aOD and under stubble at the time

of the survey.

9.2 Geology

The bedrock across the Survey Area is chalk of the Cretaceous Chalk Group. Generically, these rocks comprise chalk, with or without flint and discrete limestone, marl (calcareous mudstone), sponge, calcarenite, phosphatic, hardground and fossil-rich beds (British Geological Survey, undated).

The superficial geology is clay, silt, sand and gravel of the Quaternary and Neogene Clay-with-flints Formation. This formation is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. Angular flints are derived from the Chalk, and rounded flints, sand and clay from Palaeogene formations. There is commonly a discontinuous basal layer up to 10 cm thick, with dark brown to black matrix, stiff, waxy and fissured, with relatively fresh flint nodules stained black or dark green with manganese or glauconite. The deposit locally includes bodies of yellow fine- to medium- grained sand, reddish brown clayey silt, and sandy clay with beds of well-rounded flint pebbles, derived from Palaeogene formations. There are records of boreholes less than 800m to the north of the Survey Area and the depth of the Clay-with-flints Formation can be gauged from two of the borehole logs provided in Table 5 (British Geological Survey, undated).

9.3 Soils and near-surface deposits

The topsoil is 'Slightly acid loamy and clayey soils with impeded drainage' (LandIS, undated).

No site-relevant geotechnical reports of near-surface deposits were available at the time of writing. The near-surface deposits from two borehole logs are provided in Table 5.

10 Archaeological background

10.1 Historic landscape characterisation

'Modern enclosures'

These modern fields have been created out of probable medieval enclosures, themselves probably based on strip fields first enclosed with hedge-banks during the later middle ages. The sinuous medieval boundaries survive in places (Devon County Council, undated).

10.2 Statement of research

The Devon County Council Historic Environment Record (HER) was examined via the Heritage Gateway (Historic England, undated) to gain an appreciation of historic assets pertinent to the geophysical survey data within approximately 500m of the survey area perimeter. Whilst providing a useful context for the data analysis, this source is not necessarily comprehensive and detailed publication of the information in commercial reports is not permitted.

Two records are worthy of mention: there is a prehistoric barrow used as windmill mound at Bovey Fir Cross adjacent to the north-eastern boundary of the Survey Area at SY 209 898 (HER entry MDV11098, Scheduled Monument 1018055) and a neolithic flint scatter was recorded in the field at SY 208 897 (HER entry MDV22348).

11 Results

11.1 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 differences in the magnetic properties of the 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 dimensions of magnetic anomalies mapped as representing potential buried archaeology do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to buried archaeology.

11.2 Analysis

Figure 3 shows the interpretation of the survey data and 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 3 and Table 1 comprise the analysis of the survey data.

Figures 4 and 5 are plots of the processed data as specified in Table 3. Figure 6 is a plot of minimally processed data as specified in Table 4. Figure 7 shows the location of the survey grid and grid data files.

12 Discussion

12.1 General points

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 in the survey archive.

Data collection

Data collection along the survey area edges was restricted as shown in the figures due to the presence of dense, rough vegetation and magnetic materials within and adjacent to the plot boundaries. Strong magnetic responses mapped close to the boundaries are likely to relate to the magnetic materials except where otherwise indicated in Figure 3 and Table 1.

Anomaly characterisation

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 mapped as potential archaeology when they are well defined in the data, associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 1.

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

Numerous dipole magnetic anomalies are present within the dataset. 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

There is a distinct curvilinear, parallel trend in the dataset as shown in Figures 4 and 5. This is likely to reflect relatively recent ploughing and vehicle ground disturbance.

12.2 Data relating to historic maps and other records

Magnetic anomaly group **5** (Figure 3) corresponds with, and likely represents, a field boundary recorded on historic maps from at least 1840 and removed sometime between 1963 and 1986.

12.3 Data with no previous archaeological provenance

Anomaly groups **1** and **2** (Figure 3) may represent linear deposits such as ditches. Alternatively, group 2 may represent a service trench.

Magnetic anomaly groups **3** and **4** may represent archaeological deposits such as relatively large pits or earthen surfaces later disrupted by ploughing. Alternative options are that the

anomaly groups depict small quarries or natural deposits. Given their proximity to a prehistoric barrow to the northeast (Section 10.2), an archaeological origin cannot be dismissed at this stage.

Groups **6** and **7** are distinct in the dataset and may represent archaeological pits although natural origins cannot be ruled out. Other apparently similar anomalies (Figure 5) are less well defined and are likely to represent natural deposits.

13 Conclusions

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Seven magnetic anomaly groups were characterised as representing potential archaeological deposits although none of these were located within the proposed development plot (Figure 2). One anomaly group (5) is likely to represent a former field boundary recorded on historic maps between at least 1840 and 1963. Two groups (3 and 4) may indicate the presence of large pits or earthen surfaces disrupted by later ploughing although natural origins cannot be ruled out. Two groups (6 and 7) may represent smaller pits. Two groups (1 and 2) may depict linear deposits although one of these may represent a service trench.

14 Disclaimer

The description and discussion of the results presented in this report are the authors', based on their 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.

15 Archive

15.1 Online Access to the Index of archaeological investigationS (OASIS)

OASIS ID: substrat1-326566

The OASIS entry has been completed and the boundary file and report uploaded with six months delay in publication.

15.2 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as specified in Appendix 3.

15.3 Archaeological Data Service (ADS)

Depending on local authority policy, an archive may be deposited with the ADS as specified in Appendix 3.

15.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF or printed copy of the report will be submitted to the appropriate HER within six months of completion.

16 Acknowledgements

Substrata would like to thank Clinton Devon Estate for commissioning us to complete this survey and Colin Haysom of County Design Group for managing the commissioning process and for his project management of the work.

17 Bibliography

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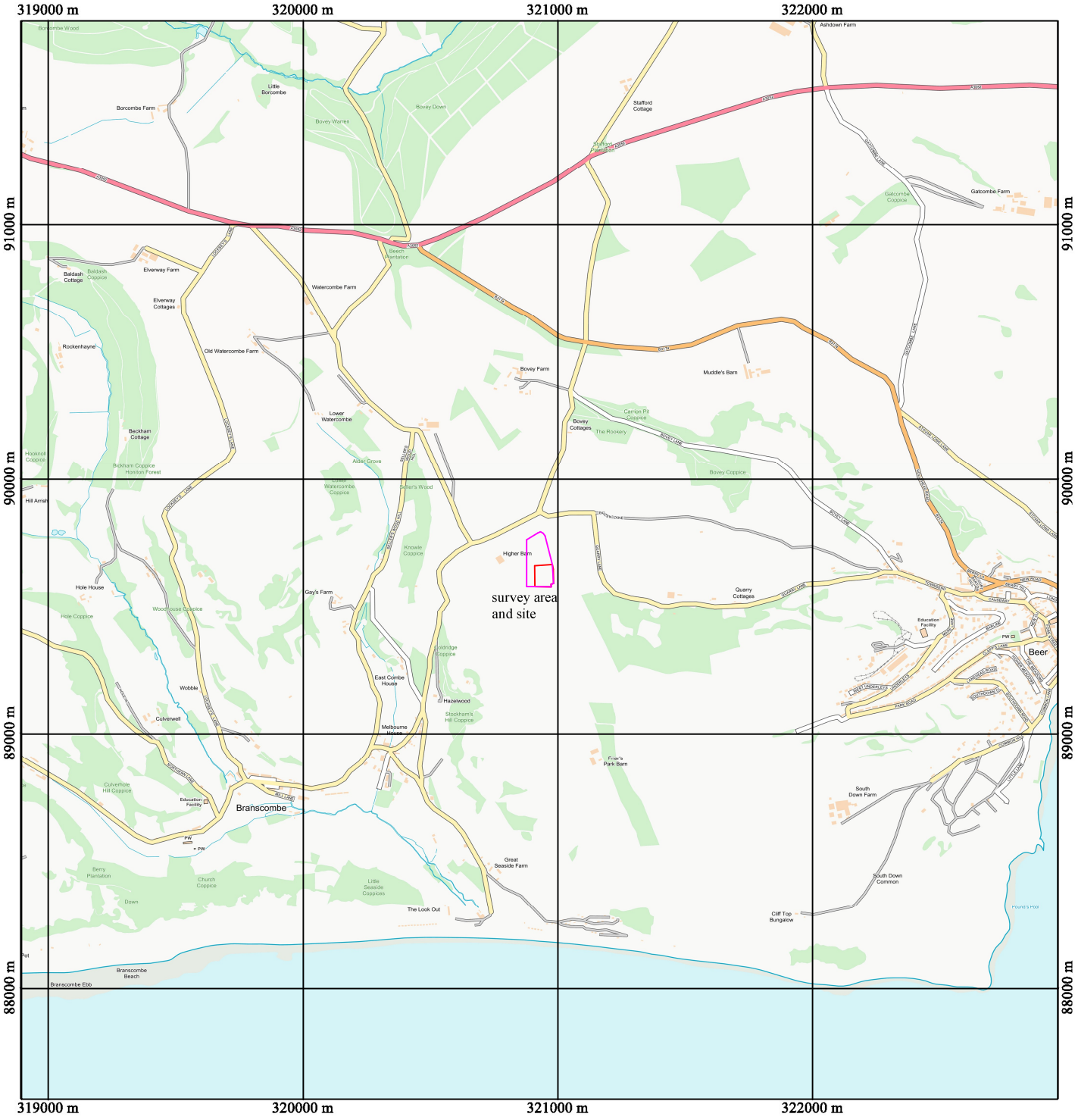
Appendix 1 Figures

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 .

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: 320928.42 m, centre Y: 89681.63 m

Scale: 1:15000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
Bovey Farm, Beer, Seaton, Devon
Centred on NGR: 320930,89680
Report: 1808BOV-R-1

Figure 1: location map

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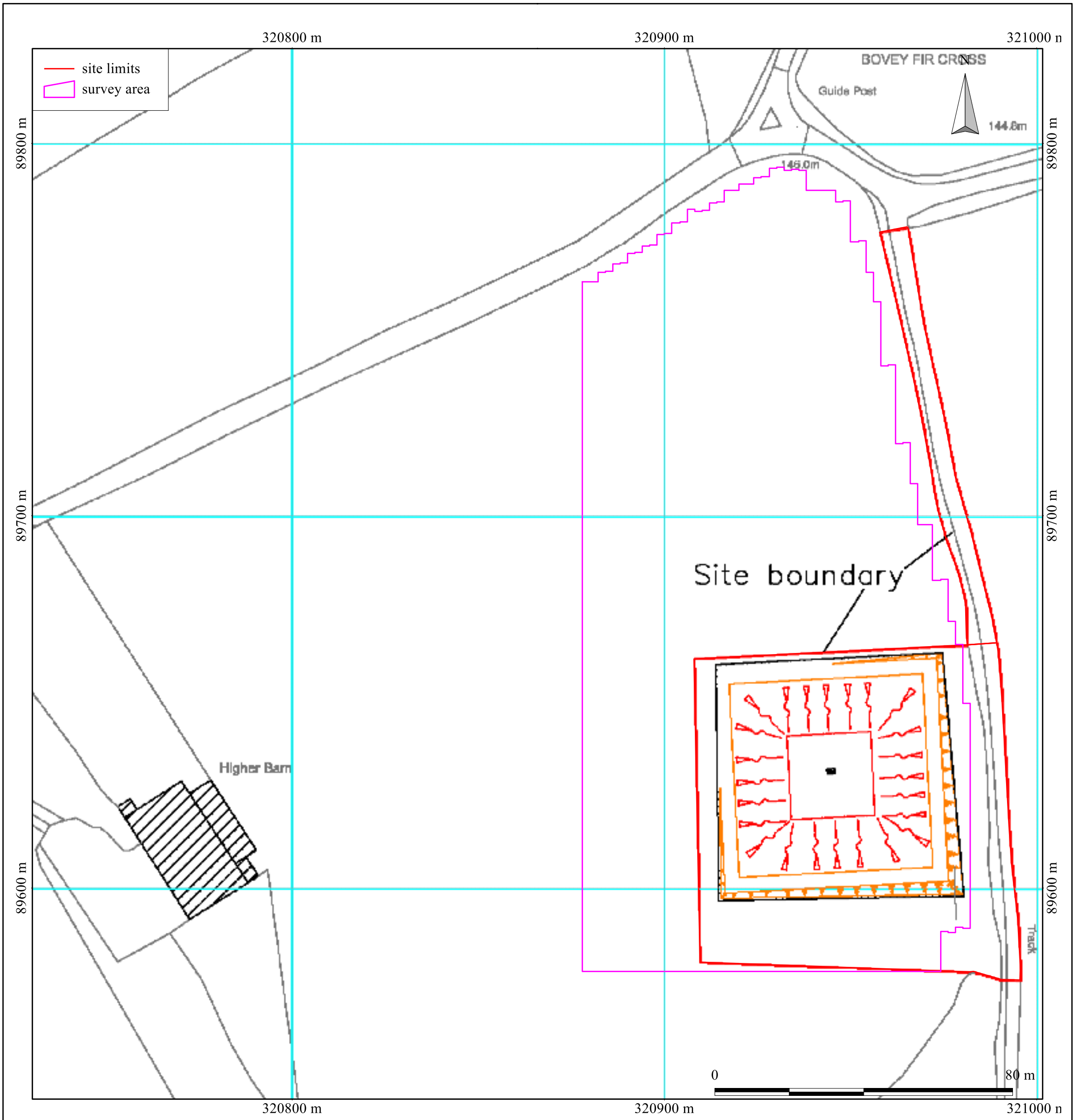
Web: substrata.co.uk



British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
Bovey Farm, Beer, Seaton, Devon
Centred on NGR: 320930,89680
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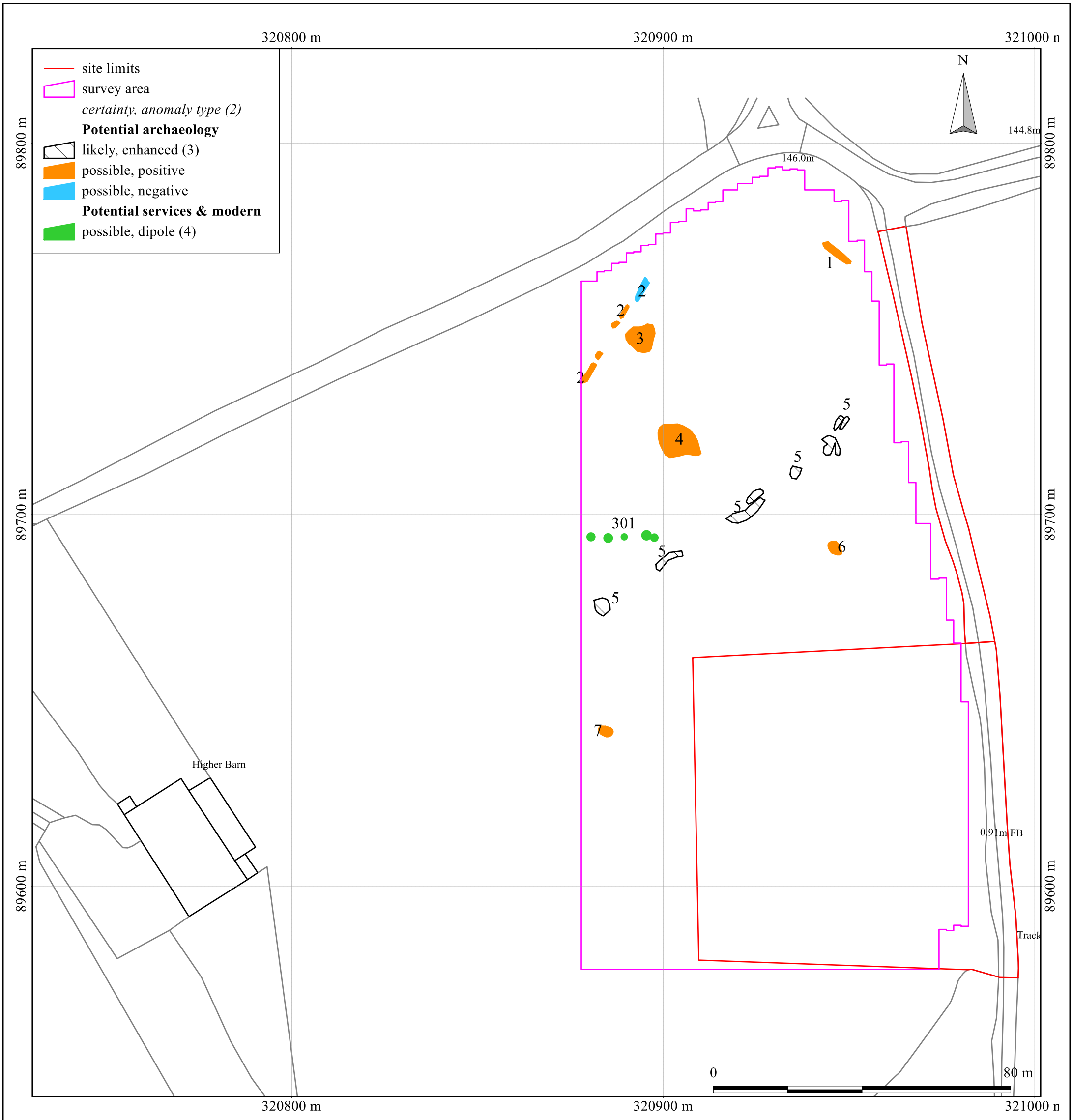
Figure 2: proposed site location plan after County Design Group



British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ 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 recent deposits or ground disturbance, or geological and other natural deposits are not mapped unless relevant to potential buried archaeology.

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
Bovey Farm, Beer, Seaton, Devon
Centred on NGR: 320930,89680
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Figure 3: survey interpretation

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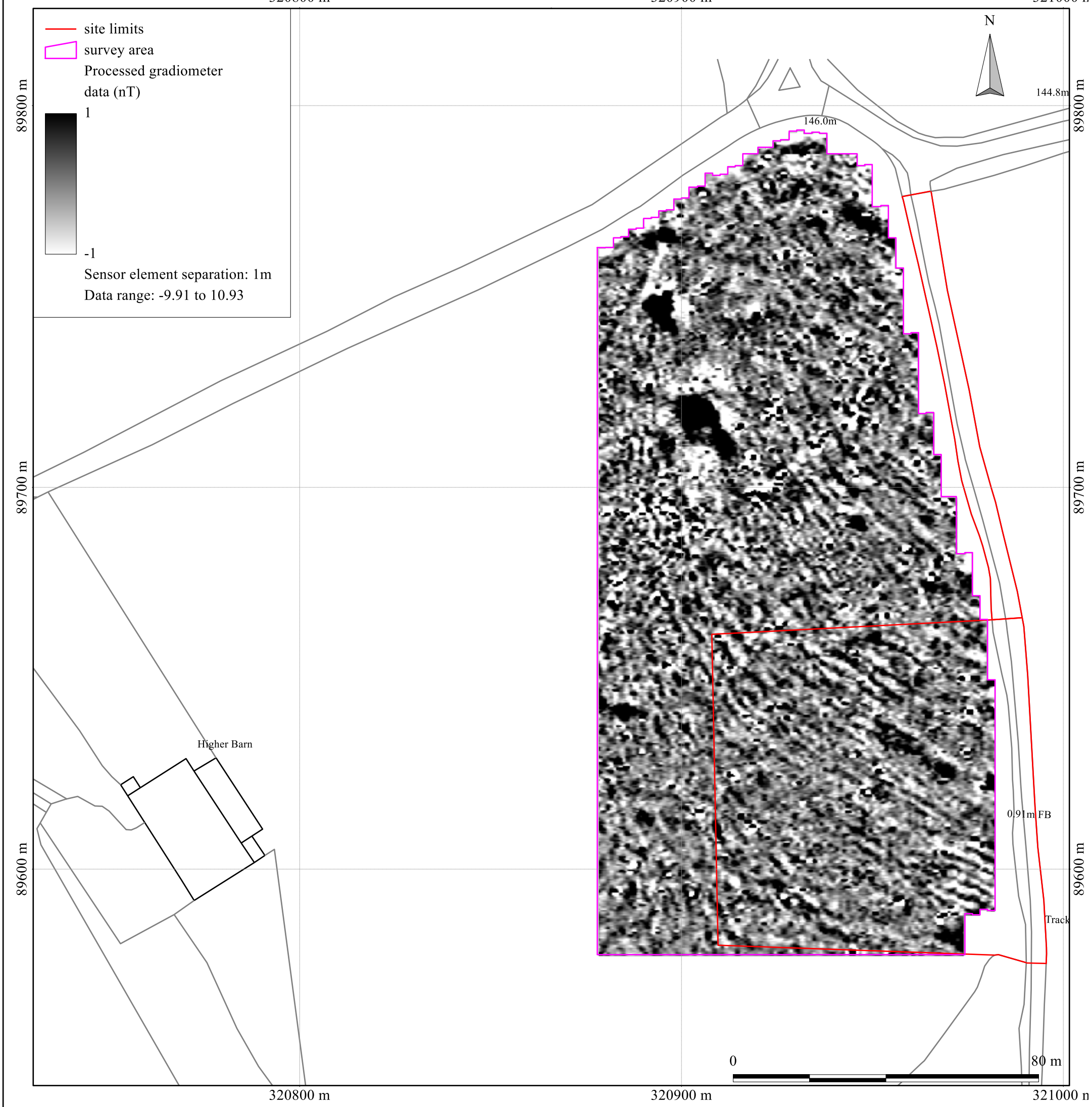

British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
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Figure 4: shade plot of processed data

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British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
Bovey Farm, Beer, Seaton, Devon
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Report: 1808BOV-R-1

Figure 5: contour plot of processed data

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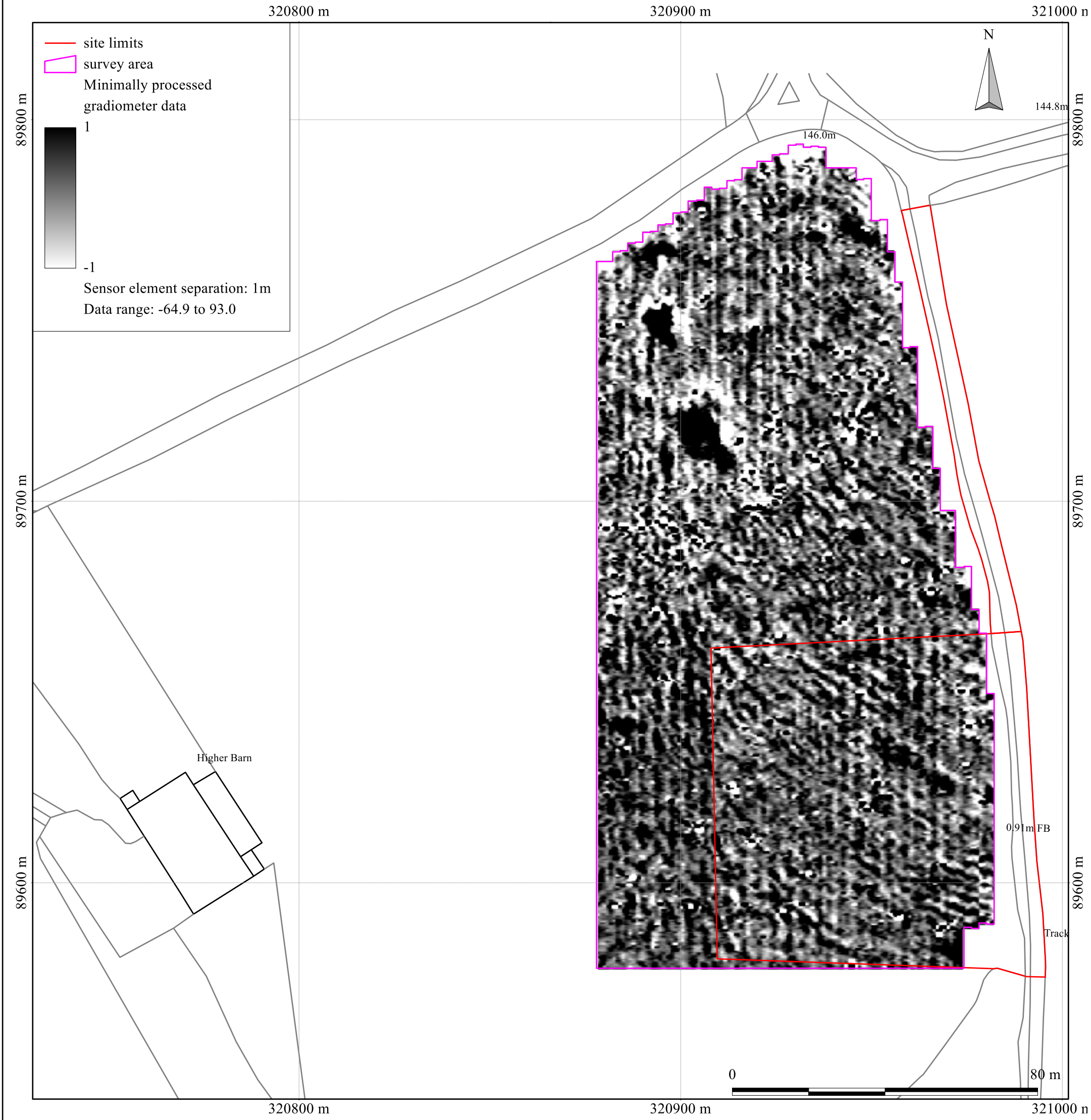

British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
Bovey Farm, Beer, Seaton, Devon
Centred on NGR: 320930,89680
Report: 1808BOV-R-1

Figure 6: shade plot of minimally processed data

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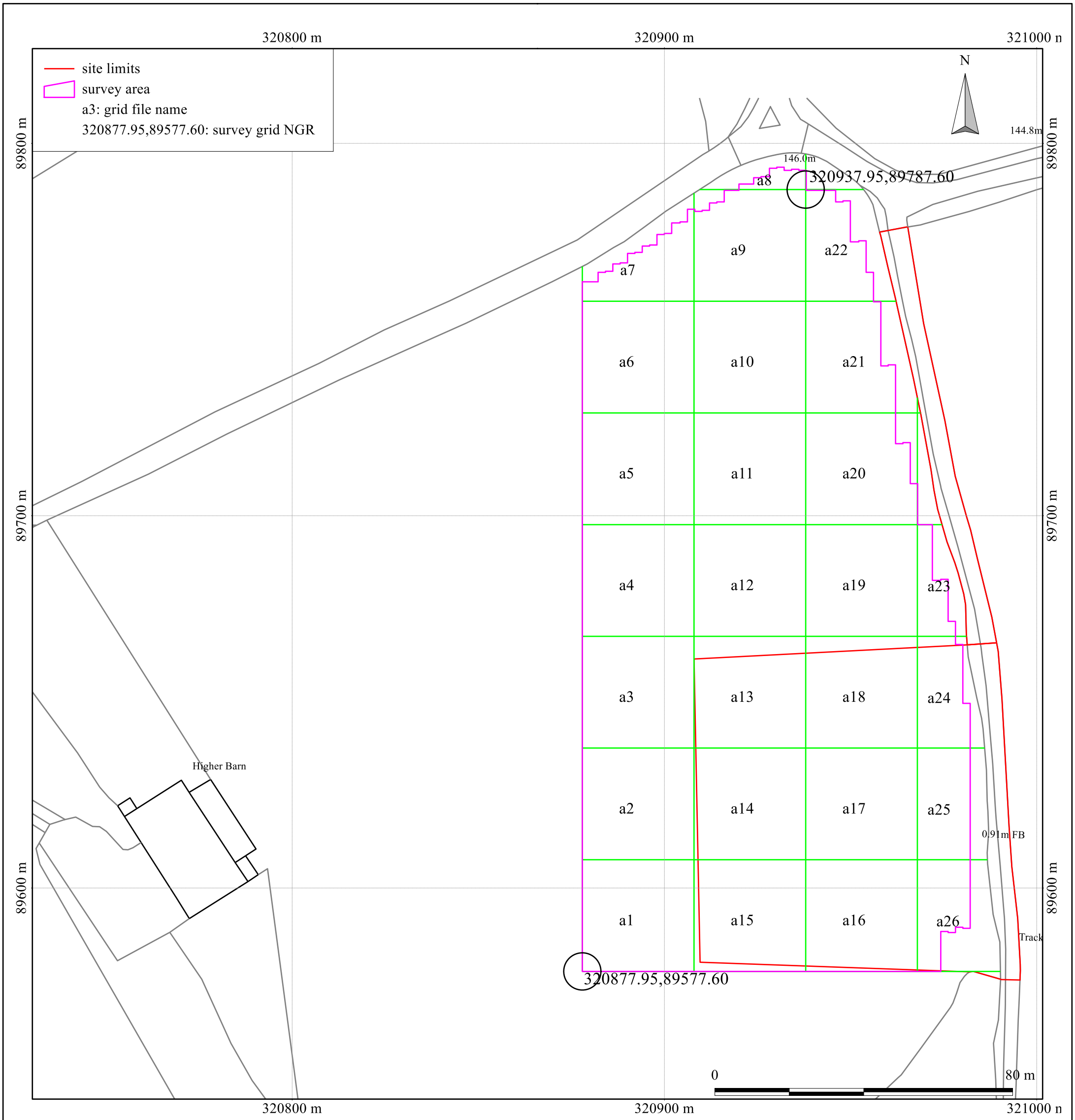

British Grid
centre X: 320865.90 m, centre Y: 89684.38 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land adjacent to Bovey Fir Cross
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Figure 7: survey grid plan and location

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Appendix 2 Tables

Site: Land adjacent to Bovey Fir Cross, Bovey Farm, Beer, Seaton, Devon
Centred on NGR: 320930,89680

anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	possible, positive	linear			
2	possible, positive/negative	disrupted linear			
3	possible, positive	sub-circular with plough drag	archaeological or natural deposit	anomaly group may represent an archaeological deposit such as a filled pit or earthen surface disrupted by ploughing but a small quarry or natural depression cannot be ruled out	
4	possible, positive	sub-circular with plough drag	archaeological or natural deposit	anomaly group may represent an archaeological deposit such as a filled pit or earthen surface disrupted by ploughing but a small quarry or natural depression cannot be ruled out	
5	likely, enhanced	disrupted linear	field boundary	anomaly group coincides with, and likely represents, a former field boundary recorded on historic maps and removed between 1963 and 1986	1840 Brandscombe Tithe Map, Ordnance Survey maps 1889 1:2500 to 1986-91 1:1000
6	possible, positive	oval	pit or natural deposit		
7	possible, positive	oval	pit or natural deposit		
301	possible, dipole	linear distribution	ferrous material		

Table 1: data analysis

<table>
<tr><td colspan="2">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.</td></tr>
<tr><td>Equipment
Instrument: Bartington Instruments grad601-2
Firmware: version 6.1</td><td>Data Capture
Sample Interval: 0.25m
Traverse Interval: 1 metre
Traverse Method: zigzag
Traverse Orientation: GN</td></tr>
<tr><td colspan="2">Data Processing, Analysis and Presentation Software
IntelliCAD 8.4
DW Consulting TerraSurveyor3
Manifold System 8 GIS
Microsoft Corp. Office 365: Excel, Publisher, Word
Adobe Systems Inc Adobe Acrobat 9 Pro Extended</td></tr>
</table>

Table 2: methodology information

Instrument

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

Program

Name: TerraSurveyor
Version: 3.0.33.6

Statistics	
Max:	10.93
Min:	-9.91
Std Dev:	1.30
Mean:	0.11
Median:	0.00

Processing

1 Base Layer
2 Clip at 5.00 SD
3 DeStripe Median Traverse: Grids: All
4 De Stagger: Grids: All By: 0 intervals, 25.00cm

Interpolate match x & y double is imposed on export to the GIS

Table 3: processed data metadata

Instrument		
Type:	Bartington Grad-601 gradiometer	
Units:	nT	
Direction of 1st Traverse:	see below	
Collection Method:	ZigZag	
Sensors:	2 @ 1.00 m spacing, each with 1m separation	
Dummy Value:	32702	
Program		
Name:	TerraSurveyor	
Version:	3.0.33.6	
Statistics		Processing
Max:	93.00	None
Min:	-64.90	
Std Dev:	1.91	Interpolate match x & y double is imposed on export to the GIS
Mean:	0.36	
Median:	0.20	

Table 4: minimally processed data metadata

Site: Land adjacent to Bovey Fir Cross, Bovey Farm, Beer, Seaton, Devon EX12 3AB
Centred on NGR 320930,89680

BGS ID	BGS reference	NGR (E/N)	method	strata	depth (m)	level (m aOD)	thickness (m)
630338	SY29SW19	321150,90440	borehole	clay with heavy flints	0.00 to 8.83	no information	8.83
630344	SY29SW25 No II	321160,90430	borehole	clay with heavy flints	0 to 13.41	no information	13.41

Table 5: geological borehole logs to the north of the survey area in the same solid and superficial geology (British Geological Survey, undated) (deep boreholes - only superficial deposits reproduced here)

Appendix 3 Project archive contents

A3.1 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as follows:

Report:	Adobe PDF (.pdf), Microsoft Publisher (.pub)
Raw grid date files:	DW Consulting TerraSurveyor 3 (.xgd) and XYZ (.dat)
Minimally processed data composite files:	DW Consulting TerraSurveyor 3 (.xgd) and ESRI ASCII (.asc)
Final data processing composite files:	DW Consulting TerraSurveyor 3 (.xgd) and ESRI ASCII (.asc)
GIS project:	GIS project Manifold 8 (.map)
Survey interpretation:	ESRI shape files
AutoCAD version of the survey interpretation: (if generated)	AutoCAD (.dwg)
All project working files:	IntelliCAD 8.4 Microsoft Corp. Office 365: Excel, Publisher, Word Adobe Systems Inc Adobe Acrobat 9 Pro Extended

A3.2 Online Access to the Index of archaeological investigationS (OASIS)

Metadata:	online form
Georeferenced survey boundary file:	ESRI shape file
Report:	Adobe PDF (.pdf)

A3.3 Archaeological Data Service

Depending on local authority policy, an archive may be deposited with the ADS as follows:

Raw data composite file:	XYZ file
Processed data plot:	rendered images in TIFF format
Survey grid plot:	image in TIFF format
Details of data processing:	image in TIFF format
Interpretation plot:	rendered images in TIFF format
Metadata:	Microsoft Excel format

A3.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF copy of the report will be submitted to the appropriate HER within 6 months of the completion of this report via the OASIS process or by other means, depending on the relevant HER process.