Substrata
Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land east of Taunton Road
North Petherton, Somerset

Centred on NGR (E/N): 328947,132160

Report: 1802TAU-R-1

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1 Introduction

This report presents the results of an archaeological geophysical survey at the site listed below, hereafter referred to as the Site. It has been prepared for Cotswold Archaeology Ltd as part of a programme of archaeological investigation on behalf of Persimmon Homes Severn Valley in relation to planning application 37/18/00003 to Sedgemoor District Council. The survey and report were completed in compliance with a Written Scheme of Investigation (Dean, 2018) approved by the Senior Historic Environment Officer, South West Heritage Trust.

The Site location is shown in Figure 1.

2 Survey description

2.1 Survey

Method:	magnetometry
Instrument:	twin-sensor fluxgate gradiometer
Date:	8 March 2018
Area:	2.5ha

2.2 Location

Site name:	Land east of Taunton Road, adjacent to North Petherton Rugby Football Club
Town and Civil Parish:	North Petherton
District:	Sedgemoor
County:	Somerset
Nearest Postcode:	TA6 6NN
NGR:	ST 28947 32160 (point)
NGR (E/N):	328947 132160 (point)
Historic environment designation:	None

2.3 Client

Cotswold Archaeology Ltd, Unit 53 Basepoint Business Centre, Yeoford Way, March Barton Trading Estate, Exeter, Devon EX2 8LB

3 Summary

A magnetometer survey was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Site (see Section 12). 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 4.

As demonstrated by the fading of two sets of data trends likely to represent ploughing disturbance, the magnetic response is reduced in the southern part of the Site compared to the northern part. This may be due to a different agricultural regime in the two parts of the Site which were separated by a field boundary between 1904-5 and 1962. Alternatively, the change in magnetic response may be due to geological variations and/or to possible changes in the Site soils with a potentially wetter surface and sub-surface environment to the south. This reduction in magnetic response was also highlighted by a lack of a linear anomaly in the survey data associated with the above mentioned field boundary. The differences in magnetic responses across the Site were sufficient to be able to differentiate between some anomalies representing possible archaeological features and background magnetic responses but it must be presumed that more archaeological features may be present than those specified in this report.

Four magnetic anomaly groups were mapped as representing potential buried archaeology. Of these, two may represent disrupted, linear features such as remnants of field boundaries. The two other groups may represent rubble or near-surface bedrock. If representing rubble then, speculatively, they could denote the presence demolition rubble from the former adjacent field boundary mentioned above.

4 Aims and objectives

4.1 Aims

Within the framework set out in Chartered Institute for Archaeologists (2014a), complete an archaeological geophysical survey and report to:

1. As far as possible inform on the presence of absence, character, extent and in some cases, apparent relative phasing of buried archaeology, in order to make an assessment of its merit in the appropriate context, which may lead to one or more of the following:
    a. The formulation of a strategy to ensure further recording, preservation or management of the resource
    b. The formulation of a strategy to mitigate a threat to the archaeological resource
    c. The formulation of a proposal for further archaeological investigation within a programme of research (ibid, 2014a: 4).
2. Provide in the report sufficient objective data to enable an informed and reasonable planning decision (ibid, 2014a: 13).

4.2 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 technique(s) 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.

5 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).

6 Methodology

The magnetometer survey was undertaken in accordance with a Written Scheme of Investigation (Dean, 2018) to achieve the aims and objectives set out in Section 4 using the standards and guidance specified in Section 5. The survey method was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Site (see Section 12).

Data processing was undertaken using appropriate software (Table 3), 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. It conforms to the Chartered Institute for Archaeologists standard for geophysical survey (CIfA, 2014a).

7 Site

7.1 Land use

The Site is an agricultural field with an area of approximately 2.5ha situated on the southern extent of dense development in North Petherton (Figure 1).

7.2 Topology

The field is bounded by hedgerows and a watercourse runs along the southern boundary. The Site is on a southward slope descending from approximately 45m above Ordnance Datum (AOD) in the north-eastern corner to approximately 33m AOD at the south-western edge (Arkley, 2017: 13)

7.3 Geology

The bedrock across the Site is sandstone of the Triassic Helsby Sandstone Formation. Generically, these rocks comprise fine- to medium-grained, locally micaceous, cross-bedded and flat-bedded fluvial and aeolian sandstones, weathering to sand near the surface. Pebbles may be common, particularly near the base of the formation, and thin units of hard intraformational conglomerate occur in the south-west. Thin lenticular beds of reddish brown siltstone and mudstone occur and may be common in fining-upward sequences (British Geological Survey, undated).

7.4 Soils

A summary of the soil profile across the Site is provided in Table 1

8 Archaeological background

8.1 Historic Environment Status

None.

8.2 Historic landscape characterisation

'Recently Enclosed Land 17th to 18th century'. General field size, 3-6ha. Between 25% and 50% boundary loss since 1905.' (Archaeology Data Service, undated b)

8.3 Summary

A detailed Heritage Assessment of the Site is presented in Arkley (2017). The assessment concluded that there were no know designated or non-designated heritage assets within the Site boundary. At the time of publication, no potential features of high significance were anticipated but a later archaeological evaluation on a nearby area revealed hitherto unknown prehistoric activity including Romano-British settlement close to the proposed development.

9 Results

9.1 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 changes in the magnetism 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.

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.

9.2 Analysis

Figure 2 shows the interpretation of the survey data which includes the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers. Table 2 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 along with Table 2 comprise the analysis of the survey data.

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

10 Discussion

10.1 General points

10.1.1 Discussion scope

Not all anomalies or anomaly groups identified in Table 2 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

10.1.2 Data collection

Data collection along the survey area edges was restricted as shown in Figures 2 to 5 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 2.

One north-south, single high response line in the data of survey grid a19 (Figure 6) was characterised as a data recording error caused by a delay in sensor reaction occasionally encountered when a relatively high magnetic response is passed at a reasonably fast survey speed (in this case 1.6 m/s).

10.1.3 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 were mapped as potential archaeology when they were associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 2.

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 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.

10.1.4 Data trends

The north-north-west to south-south-east set of closely spaced, parallel lines in the data are likely to relate to ploughing disturbance. The trend fades in the southern half of the Site but is still present (Figures 3 to 5).

A second, much fainter, west-south-west to east-north-east can be seen across some sections of the Site. As with the above mentioned trend, it fades in the southern half of the Site but is occasionally discernible (Figures 3 to 5). This trend follows that of the potential buried archaeology represented by anomaly groups 1 and 4 discussed below (Section 10.3).

10.2 Data relating to historic maps and other records

No magnetic anomaly groups pertained to features mapped on historic maps or noted in other historic records.

10.3 Data with no previous archaeological provenance

Magnetic anomaly group **1** has characteristics of a possible linear archaeological linear feature, possibly a former field boundary, highly disrupted by later ploughing.

Anomaly groups **2** and **3** may represent two deposits of rubble. Their location approximately coincides with a field boundary mapped between 1904-5 and 1962 and, speculatively, the rubble may be associated with demolition rubble from the former boundary. There are no other traces of the boundary in the dataset.

Magnetic anomaly group **4** has characteristics of a possible linear archaeological linear feature, possibly a former field boundary or, less likely but possible, a palaeochannel of the extant stream that runs along the southern boundary of the Site.

11 Conclusions

As demonstrated by the fading of two sets of data trends likely to represent ploughing disturbance, the magnetic response is reduced in the southern part of the Site compared to the northern part. This may be due to a different agricultural regime in the two parts of the Site which were separated by a field boundary between 1904-5 and 1962. Alternatively, the change in magnetic response may be due to geological variations and/or to possible changes in the Site soils, as noted in Table 1, with a potentially wetter surface and sub-surface environment to the south. This reduction in magnetic response was also highlighted by a lack of a linear anomaly in the survey data associated with the above mentioned field boundary. The differences in magnetic responses across the Site were sufficient to be able to differentiate between some anomalies representing possible archaeological features and background magnetic responses but it must be presumed that more archaeological features may be present than those specified in this report.

Four magnetic anomaly groups were mapped as representing potential buried archaeology (Figure 2). Of these, two (groups 1 and 4) may represent disrupted, linear features such as remnants of field boundaries. The two other groups (2 and 3) may represent rubble or near-surface bedrock. If representing rubble then, speculatively, they could denote the presence demolition rubble from the former adjacent field boundary mentioned above.

12 Disclaimer

The description and discussion of the results presented in this report are the author's, 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.

13 Copyright

14 Archive

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

OASIS ID: substrat1-311848

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

14.2 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.

14.3 Archaeological Data Service (ADS)

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

14.4 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.

15 Acknowledgements

Substrata would like to thank Zoe Arkley, Heritage Consultant, Cotswold Archaeology Ltd for commissioning us to complete this survey.

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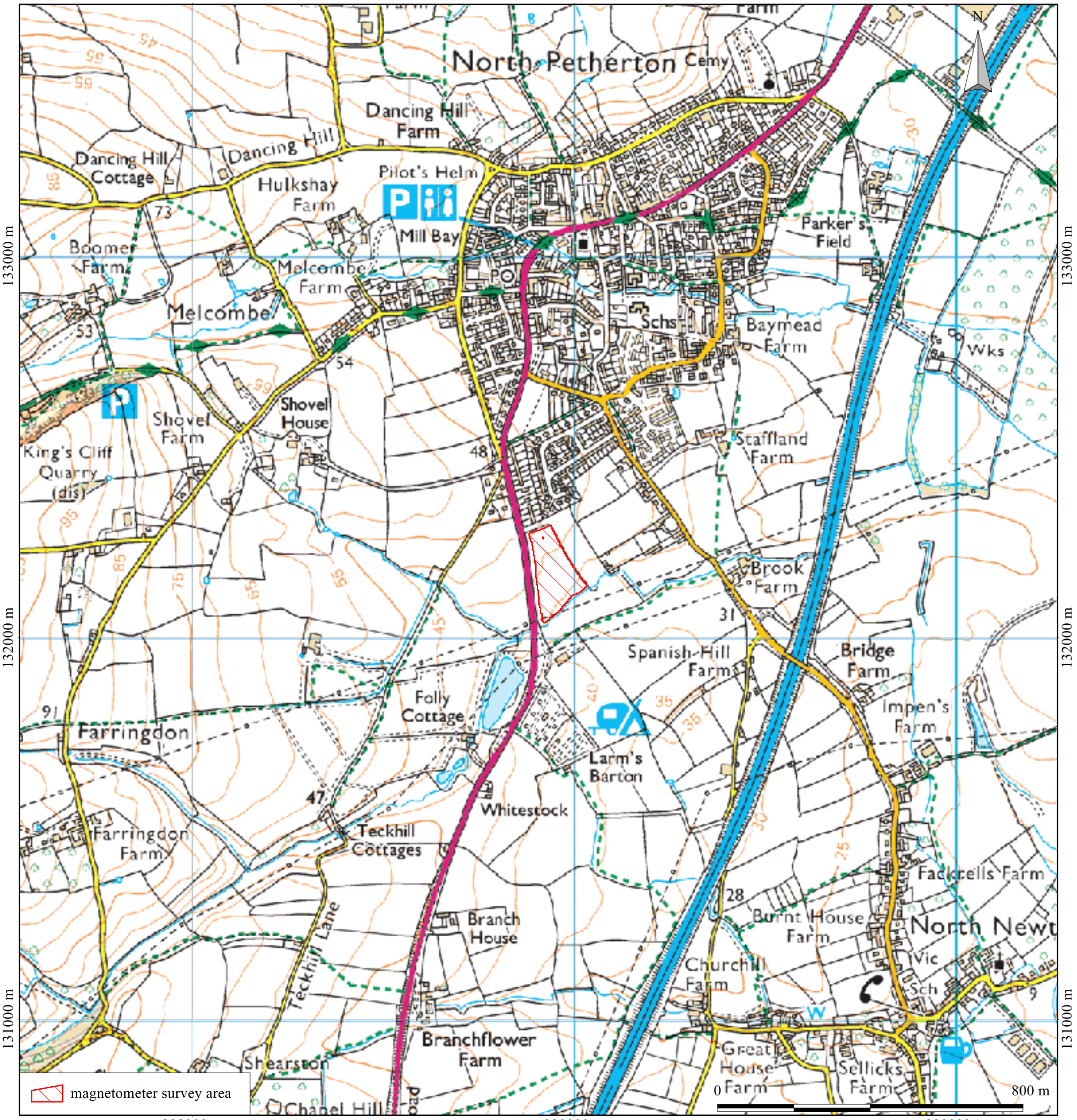
Appendix 1 Figures

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: 328906.44 m, centre Y: 132204.07 m

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

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
Centred on NGR (E/N): 328947,132160
Report: 1802TAU-R-1

Figure 1: location map

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328900 m

329000 m

132300 m

132200 m

132100 m

N

301

43.9m

1

2

3

4

FTL

35.4m

magnetometer survey area
certainty, anomaly type (2)
Potential archaeology
possible, positive
possible, enhanced
Potential services & modern
possible, low contrast linear

0

80 m

328900 m

329000 m

British Grid
centre X: 328933.69 m, centre Y: 132163.59 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 geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
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Figure 2: survey interpretation

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328900 m

329000 m

132300 m

132200 m

132100 m

N

43.9m

35.4m

magnetometer survey area
Processed magnetometer data (nT)
1.5
-1.5
Sensor separation: 1m

0

80 m

British Grid
centre X: 328933.69 m, centre Y: 132163.59 m

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

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
Centred on NGR (E/N): 328947,132160
Report: 1802TAU-R-1

Figure 3: shade plot of processed data

Substrata Limited
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Email: enquiries@substrata.co.uk
Web: substrata.co.uk

328900 m

329000 m

132300 m

132200 m

132100 m

N

41.9m

35.4m

magnetometer survey area

Processed magnetometer data (nT)

> 4.00

2.00 - 4.00

1.00 - 2.00

0.50 - 1.00

-0.50 - 0.50

-1.00 - -0.50

-2.00 - -1.00

-4.00 - -2.00

< -4.00

Sensor separation: 1m

0

80 m

British Grid
centre X: 328933.69 m, centre Y: 132163.59 m

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

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
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Figure 4: contour plot of processed data

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328900 m

329000 m

132300 m

132200 m

132100 m

N

43.9m

35.4m

magnetometer survey area
Minimally processed
magnetometer data (nT)
2
-2
Sensor separation: 1m

0

80 m

British Grid
centre X: 328933.69 m, centre Y: 132163.59 m

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

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
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Figure 5: shade plot of minimally processed magnetometer data

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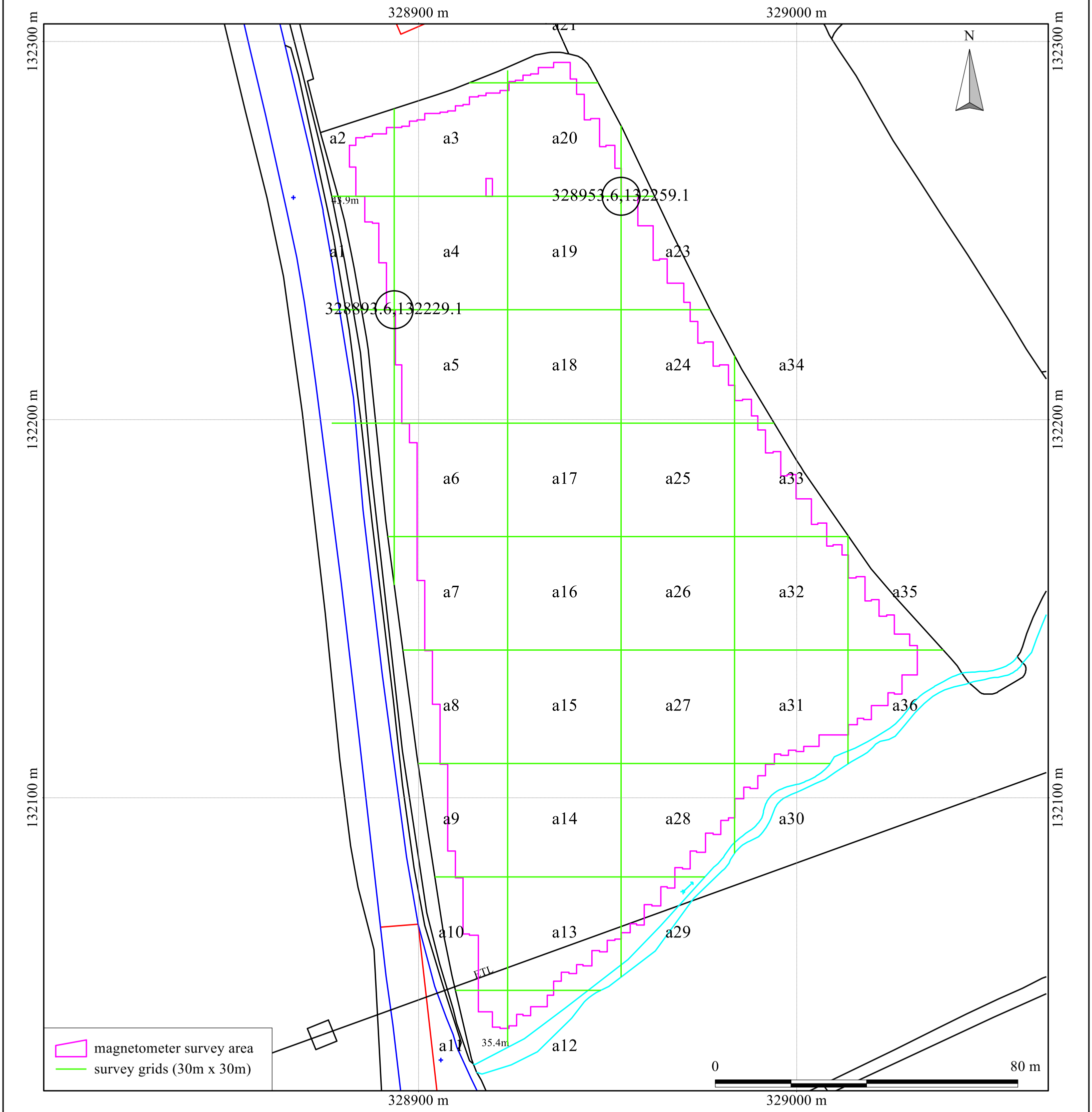

British Grid
centre X: 328933.69 m, centre Y: 132163.59 m

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

An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
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Figure 6: survey grid location and labels

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Appendix 2 Tables

Horizon	Depth below ground level	Location within the Site	Description
Topsoil	0.20m to 0.30m	all	red brown sandy clay with fine rootlets; impeded drainage, possibly with freer drainage in north of the site (Arkley 2017 after LandIS undated)
Alluvium	0.30m to 2.20m	southwest	interbedded clayey sand and sandy clay
Solid geology	intact bedrock at between 1.20m to 2.20m	all	Helsby Sandstone Formation (Section 5.1) with weathered to medium dense clayey sand near the surface

Table 1: soil profile after Thornburn (2017)

Site: An archaeological magnetometer survey
Taunton Road, North Petherton, Somerset
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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	possible, positive	disrupted linear		The anomaly group lies approximately 6m north of a field boundary mapped between 1904 and 1962. It has a different bearing to the mapped field boundary. The 1904 to 1962 mapped boundary has the same position and trend as a field boundary mapped in the adjacent field to the east 1840 but not later.	1840 North Petherton tithe map, Ordnance Survey maps 1904-5 1:10560 to 1962 1:10560
2	possible, enhanced	irregular	rubble (archaeological or recent) or near-surface bedrock	The anomaly group approximately coincides with the location of a field boundary mapped between 1904-5 and 1962 and, speculatively, may be wall demolition rubble.	Ordnance Survey maps 1904-5 1:10560 to 1962 1:10560
3	possible, enhanced	irregular	rubble (archaeological or recent) or near-surface bedrock	The anomaly group approximately coincides with the location of a field boundary mapped between 1904-5 and 1962 and, speculatively, may be wall demolition rubble.	Ordnance Survey maps 1904-5 1:10560 to 1962 1:10560
4	possible, positive	disrupted linear	archaeological deposit or palaeochannel		
301	possible, low contrast linear		service trench	The anomaly group has the same trend as possible ploughing disturbance seen throughout the dataset but in this case a stone or gravel filled service trench is more likely than ploughing disturbance	

Table 2: data analysis

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 8.4
DW Consulting TerraSurveyor3
Manifold System 8 GIS
Microsoft Corp. Office 365: Excel, Publisher, Word
Adobe Systems Inc Adobe Acrobat 9 Pro Extended

Table 3: 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.
Dummy Value:	32702

Program

Name:	TerraSurveyor
Version:	3.0.33.6

Statistics		**Processing**
Max:	46.26	1 Base Layer
Min:	-47.06	2 Clip at 1.00 SD
Std Dev:	2.86	3 DeStripe Median Sensors: Grids: All
Mean:	0.12	4 De Stagger: Grids: All By: 0 intervals, 25.00cm
Median:	0.00	5 Interpolate: Match X & Y Doubled.

Table 4: 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.
Dummy Value:	32702

Program

Name:	TerraSurveyor
Version:	3.0.33.6

Statistics		**Processing**
Max:	3584.35	1 Base Layer
Min:	-3395.16	2 Interpolate: Match X & Y Doubled to allow export of the data to a GIS
Std Dev:	37.44	
Mean:	0.05	
Median:	-0.20	

Table 5: minimally processed data metadata

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 format
Raw grid & composite files:	DW Consulting TerraSurveyor 3 format xyz files
Final data processing composite files: (excluding interpolation processes)	DW Consulting TerraSurveyor 3 format xyz files
GIS project:	GIS project Manifold 8 .map format ESRI shape files
AutoCAD version of the survey interpretation: (if generated)	AutoCAD DXF
All project working files:	various (Table 3)

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

Metadata:	online form
Georeferenced survey boundary file:	ESRI shape file
Report:	Adobe PDF format

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.