

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land off Station Road Castle Cary, Somerset

Ordnance Survey E/N: 363400,132500 (point)

Report: 140320

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24 March 2014

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Contents

1. Survey description and summary.....	1
2. Survey aims and objectives.....	1
3. Standards.....	2
4. Site description	2
5. Archaeological background	2
6. Results, discussion and conclusions.....	4
7. Disclaimer and copyright	9
8. Acknowledgements.....	9
9. Bibliography	9
Appendix 1 Supporting plots	10
Appendix 2 Methodology	14
Appendix 3 Data processing	15
Appendix 4 Geophysical survey techniques	16

Figures

Figure 1: survey interpretation.....	6
Figure 2: shade plot of processed data.....	11
Figure 3: contour plot of processed data.....	12
Figure 4: location map	13

Tables

Table 1: gradiometer data analysis	5
Table 2: methodology	14
Table 3: processed gradiometer data metadata	15

Accompanying CD-ROM

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	Adobe PDF format
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

1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer
Date of survey: between 13 and 18 March 2014
Area surveyed: 10 ha
Lead surveyor: Ross Dean BSc MSc MA MifA

Client

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

Location

Site: Land off Station Road, Castle Cary
Civil Parish: Castle Cary
District: South Somerset
County: Somerset
Nearest Postcode: BA7 7DS
NGR: ST 6340 3250 (point)
Ordnance Survey E/N: 363400,132500 (point)
OASIS number: substrata1-175576
Archive: At the time of writing, the archive of this survey will be held by Substrata.

Summary

This report was commissioned by AC Archaeology Ltd on behalf of Bell Cornwell LLP. It was prepared by Substrata as supporting information for a forthcoming planning application relating to a proposed housing development at the above site. The location of the site is shown in figure 4.

An Historic Environment Assessment was completed for the site and its surrounding area by AC Archaeology Ltd during May and June 2013 (Chadwick, 2013).

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

Twenty-eight magnetic anomaly groups were identified as pertaining to archaeological deposits or structures. Of these, ten coincide with features mapped during a site assessment conducted by AC Archaeology Ltd as possible drainage ditches or leats. Two groups coincide with features mapped during the same assessment as potentially relating to Post-medieval flax retting. Their patterns indicate that they may relate to natural palaeochannels or, possibly, hybrid natural and man-made deposits. One group is likely to reflect a deposit of rubble. The remaining groups are most likely to represent former field or enclosure boundaries not recorded on historical maps.

2 Survey aims and objectives

Survey aims

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

Survey Objectives

1. Complete a gradiometer survey across agreed parts of the survey area.
2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
3. Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
4. Accurately record the location of the identified anomalies.
5. Produce a report based on the survey that is sufficiently detailed to inform any

subsequent development on the site about the location and possible archaeological character of the recorded anomalies.

3 Standards

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

4 Site description

Landscape

The survey area was situated within three fields on the north-western side of Castle Cary (figure 4). The site is bordered by agricultural fields to the north, the B3125 Station Road to the east, industrial and residential developments to the south and the Torbay Road industrial estate to the west (figure 1). The ground slopes down from the east to the west and southwest from approximately 60m to 50m O.D.

Land use at the time of the survey

Grass pasture.

Geology

The site is located on a solid geology of Jurassic and Triassic mudstones of the Langport Member of the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) (British Geological Survey, undated). The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

AC Archaeology Ltd have produced an Historic Environment Assessment of the site and surrounding area (Chadwick, 2013). The reader is referred to this document for a comprehensive analysis of the historical and archaeological background of the site. What follows is a short summary of the information presented in the Assessment relevant to the understanding of the gradiometer survey.

Historical landscape characterisation

The proposed development site has been classified as:

‘Anciently Enclosed Land pre-17th century. General field size 6-12ha. Between 25% and 50% boundary loss since 1905.’
(Chadwick, 2013: 8 after Aldred, 2001)

Heritage assets within or immediately adjacent to the survey area

There are no designated heritage assets and two non-designated heritage asset within the proposed development site, one of which was initially identified during the AC Archaeology assessment (Chadwick, 2013). One further non-designated heritage asset was identified by AC Archaeology Ltd.

HER entry: EHA 1433805

A Palaeolithic flint axe found in Hither Wood, Castle Cary. The museum no longer exists and the location of Hither Wood cannot be established. The current location of the axe is unknown
Location Grid Reference: NGR E/N: 63 32 (possibly somewhere near the southeast area of the site).

HER entry: 32476

Aerial photographs of 1930 and 1947 show a sub-rectangular shallow depression. Along the NW side is a rectangular ditched platform connected by a ditch to another ditch running SW-NE across the field. A small building lies to the S. The feature appears to be a shallow pond fed by leats and probably connected with the know flax industry in Castle Cary. It is not shown on historical mapping and has now been ploughed out.

Location Grid Reference: NGR E/N: 6331 3258 (point).

Magnetic anomalies 19, 23 and 25 in figure 1 may relate to these cropmarks.

AC Archaeology:

A series of features identified as earthworks/cropmarks from aerial photographs; probably representing drainage ditches or leats.

Location Grid Reference: NGR E/N: 363465,132685 (point).

Magnetic anomalies 1 to 4, 8, 9, 12 and 18 in figure 1 are likely to relate to these cropmarks.

Archaeological works adjacent to the survey area

There are no records for work within the survey area.

The following work took place in an area to the northwest of the proposed development site:

HER entries EHA 1433805, HER 17073, HER 16995, HER16993

A two stage evaluation comprising geophysical survey and trench evaluation recorded a large ditch of Middle Bronze Age date containing Deveril Rimbury pottery and an undated area of in situ burning.

Location Grid Reference: NGR E/N: 63000,32750 (point).

6 Results, discussion and conclusions

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

The reader is referred to section 7.

6.1 Results

Figure 1 (this section) shows the interpretation of the survey and includes the anomaly groups identified as pertaining to archaeological deposits along with their numbers. Table 1 is an extract from a detailed analysis of the survey data provided in the attribute tables of the GIS project on the accompanying CD-ROM.

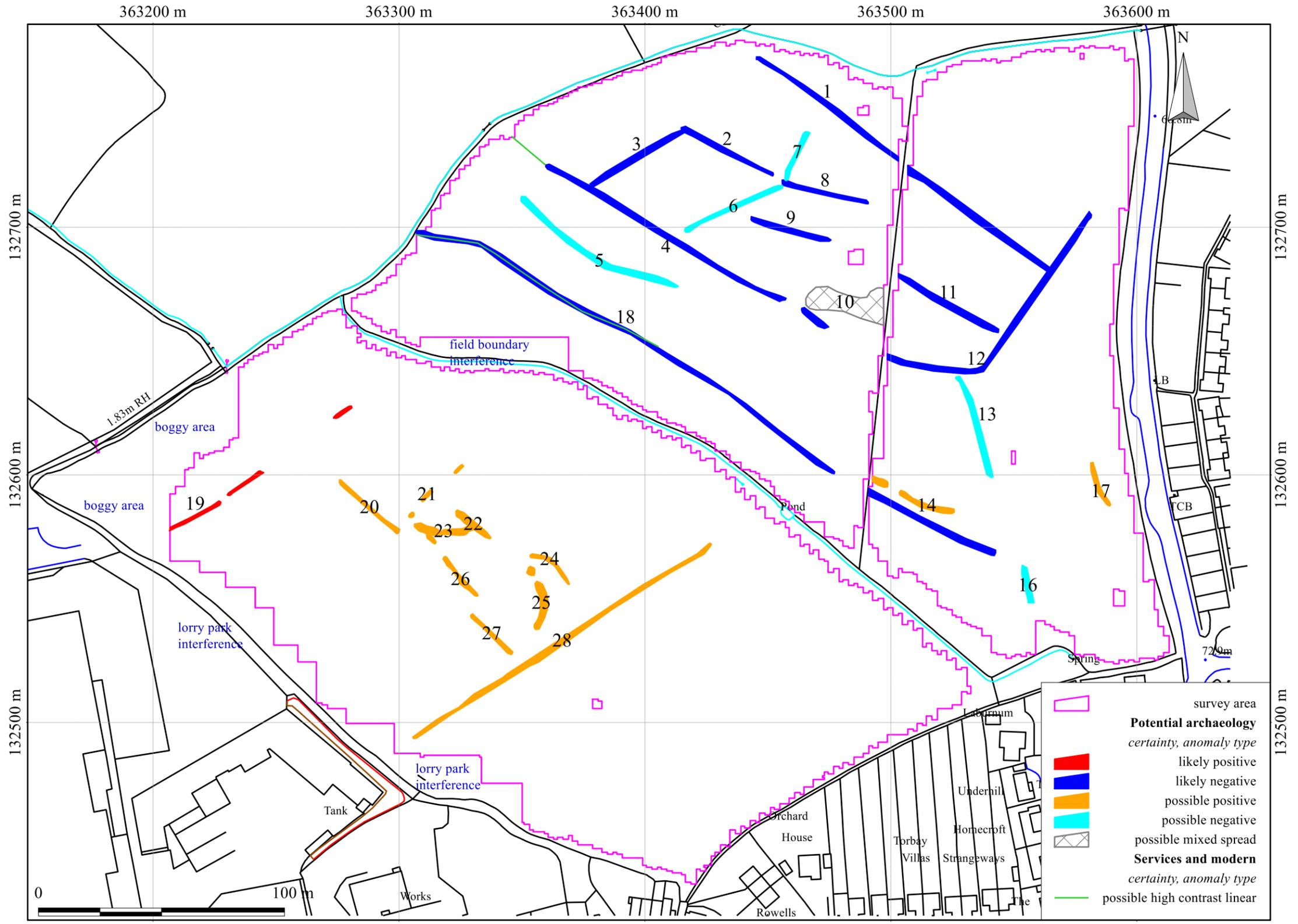
Figure 1 and table 1 comprise the analysis of the survey data.

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

Site: An archaeological gradiometer survey
Land off Station Road, Castle Cary, Somerset
Ordnance Survey (E/N): 363400,132500 (point)
Report 140320

anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
2	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
3	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
4	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
5	possible negative	linear	drainage	drainage ditches or leats	
6	possible negative	linear	drainage	drainage ditches or leats	
7	possible negative	linear	drainage	drainage ditches or leats	
8	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
9	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
10	possible mixed spread	irregular	rubble		
11	likely negative	linear		anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
12	likely negative	linear		anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
13	possible negative	linear		drainage ditches or leats	
14	possible positive	linear		anomaly group may represent either archaeological or natural deposits	
16	possible negative	linear		drainage ditches or leats	
17	possible positive	linear		anomaly group may represent either archaeological or natural deposits	
18	likely negative	linear	drainage	anomaly group coincides with cropmarks recorded on aerial photographs and earthworks noted during a walkover survey thought to be drainage ditches or leats, possibly 19th century	AC Archaeology Ltd Document ACW539/1/1 July 2013
19	likely positive	disrupted linear		anomaly group coincides with cropmarks recorded on aerial photographs	Somerset County Council HER entry 32476
20	possible positive	linear			
21	possible positive	disrupted linear			
22	possible positive	curvilinear		anomaly group coincides with cropmarks recorded on aerial photographs but anomaly pattern may indicate palaeochannels	Somerset County Council HER entry 32476
23	possible positive	curvilinear		anomaly pattern may indicate either archaeological deposits or palaeochannels	
24	possible positive	curvilinear			
25	possible positive	curvilinear		anomaly group coincides with cropmarks recorded on aerial photographs but anomaly pattern may indicate palaeochannels	Somerset County Council HER entry 32476
26	possible positive	disrupted linear			
27	possible positive	linear			
28	possible positive	linear			

Table 1: data analysis



British Grid
 centre X: 363401.65 m, centre Y: 132601.09 m

Scale: 1:1700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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

Figure 1: survey interpretation

6.2 Discussion

Refer to figures 1 (this section), 2 and 3 (appendix 1).

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

General points

There is a distinct change in magnetic response between the south-western side of the site and the remaining area as shown in figures 2 and 3. The magnetically quieter areas reflect the leaching and alteration of magnetic minerals as a result of relatively wet conditions in the sub-soils and deeper deposits.

The more magnetically contrasting area shows a number of anomalies likely to pertain to palaeochannels. With the possible exception of anomaly groups 22 and 25 discussed below, no man-made alteration of these channels could be discerned in the survey dataset. Anomalies thought to relate to natural features have not been mapped.

There is a distinct northwest-southeast trend in the southern field that is likely to relate to relatively recent ground disturbance resulting from ploughing.

Data collection along the field edges was restricted as shown in figures 2 and 3 due to the presence of magnetic materials and objects in and adjacent to the field boundaries. Such items were particularly concentrated along the southern and eastern boundaries of the site. Strong magnetic responses mapped close to the field boundaries are likely to relate to these items except where indicated otherwise in figure 1.

All the fields (figure 1) had a relatively low magnetic response making the display of small survey errors inevitable. These can be seen as stripes trending north-south across the data set. They do not affect the analysis or interpretation of the survey data.

Data relating to historical maps and other records

Anomaly groups **1 to 4**, **8**, **9**, **11**, **12** and **18** coincide with features mapped by AC Archaeology Ltd from aerial photographs as possible drainage ditches or leats (Chadwick 2013: figure 2).

Group **19** coincides with features mapped by AC Archaeology Ltd from aerial photographs as possible drainage ditches or leats associated with flax retting (Chadwick, 2013: 8-11, figure 2; Somerset County Council, undated: HER entry 32476).

Data with no previous provenance

Anomaly groups **5**, **7**, **13** and **16**, while not mapped in any source, are likely to have the same origins as anomaly groups 1 to 4, 8, 9, 11, 12 and 18 discussed above.

Anomaly groups **22** and **25** coincide with features mapped by AC Archaeology Ltd from aerial photographs as possible features associated with flax retting (Chadwick, 2013: 8-11, figure 2; Somerset County Council, undated: entry 32476). Their pattern suggests that they relate to natural palaeochannels. Whether they are man-made, natural or, speculatively, augmented palaeochannels or natural deposits build up against man-made features can only be settled by further archaeological investigations.

Group **10** probably represents a deposit of rubble.

The remaining anomalies identified as potential archaeological deposits are all linear anomalies that may relate to former field or other enclosure boundaries not recorded on historical Ordnance Survey maps.

6.3 Conclusions

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

Twenty-eight magnetic anomaly groups were identified as pertaining to archaeological deposits or structures. Of these, ten coincide with features mapped during a site assessment conducted by AC Archaeology Ltd as possible drainage ditches or leats. Two groups coincide with features mapped during the same assessment as potentially relating to Post-medieval flax retting. Their patterns indicate that they may relate to natural palaeochannels or, possibly, hybrid natural and man-made deposits. One group is likely to reflect a deposit of rubble. The remaining groups are most likely to represent former field or enclosure boundaries not recorded on historical maps.

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.

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

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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Somerset County Council (undated) *Somerset County Council Historic Environment Record*, [Online], Available: <http://webapp1.somerset.gov.uk/her/map.asp?flash=true> [March 2014]

Appendix 1 Supporting plots

General Guidance

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

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

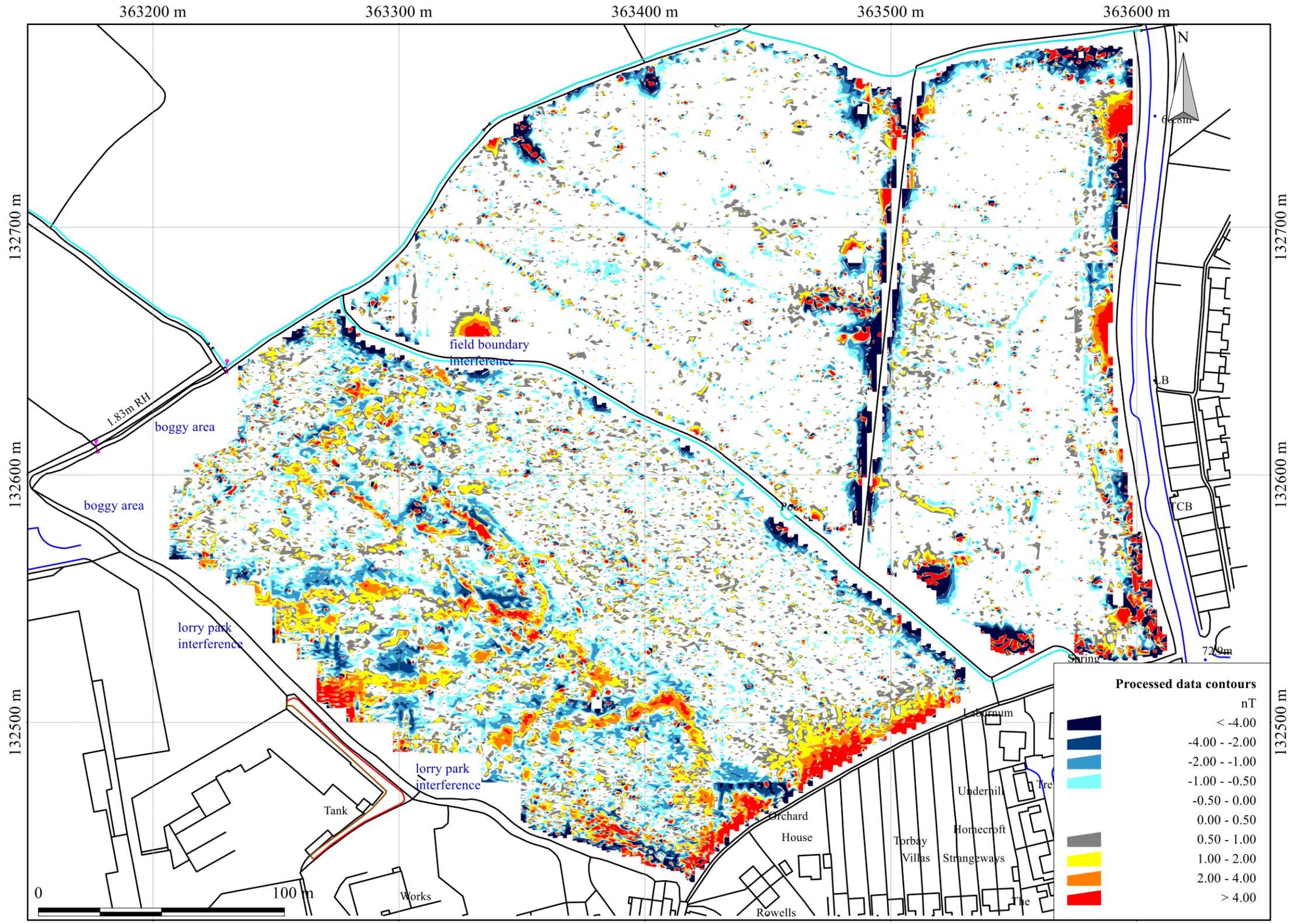


British Grid
 centre X: 363401.65 m, centre Y: 132601.09 m

Scale: 1:1700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 2: shade plot of processed data



British Grid
centre X: 363401.65 m, centre Y: 132601.09 m

Scale: 1:1700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: contour plot of processed data



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PROJECT
 Land off Station Road, Castle Cary

TITLE
 Figure 4:
 Location of designated heritage assets

Appendix 2 Methodology Summary

Table 2: methodology summary	
<p>Documents Survey methodology statement: Dean (2014)</p>	
<p>Methodology</p> <ol style="list-style-type: none"> 1. The work was undertaken in accordance with the survey methodology statement. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011) and Archaeology Data Service/Digital Antiquity Guides (undated). 2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology. 	
<p>Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</p>	
<p>Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p>Data Capture <i>Sample Interval:</i> 0.25-metres <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p>Data Processing, Analysis and Presentation Software IntelliCAD Technology Consortium IntelliCAD 7.2 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</p>	

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata	
SITE	
Instrument Type:	Bartington Grad 610
Units:	nT
Direction of 1st Traverse:	0 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702
PROGRAM	
Name:	TerraSurveyor
Version:	3.0.22.1
Stats	
Max:	423.91
Min:	-405.01
Std Dev:	18.64
Mean:	-0.36
Median:	0.00
Processes: 18	
1 Base Layer	
2 Clip at 3.00 SD	
3 De Stagger: Grids: All Mode: Both By: -3 intervals	
4 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 30, Left 540, Bottom 40, Right 582)	
5 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 39, Left 505, Bottom 52, Right 557)	
6 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 52, Left 444, Bottom 59, Right 524)	
7 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 60, Left 405, Bottom 69, Right 464)	
8 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 70, Left 367, Bottom 77, Right 437)	
9 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 89, Left 267, Bottom 108, Right 336)	
10 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 109, Left 202, Bottom 119, Right 288)	
11 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 150, Left 174, Bottom 160, Right 239)	
12 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 121, Left 242, Bottom 143, Right 286)	
13 DeStripe Median Sensors: All	
14 Search & Replace From: -500 To: 500 With: Dummy (Area: Top 98, Left 230, Bottom 144, Right 284)	
15 Edge Match (Area: Top 270, Left 240, Bottom 299, Right 359) to Right edge	
16 Edge Match (Area: Top 300, Left 240, Bottom 329, Right 359) to Right edge	
17 De Stagger: Grids: cccb7.xgd Mode: Both By: -2 intervals	
18 DeStripe Median Traverse: Grids: ccca20+ccca29.xgd ccca19+ccca30.xgd	
Note: exporting the processed data from TerraSurveyor into Manifold GIS for analysis imposes an 'x matches y' interpolation on the data which is reflected in the processed data figures.	

Appendix 4 Geophysical surveying techniques

1 Introduction

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

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

2 Magnetometer surveying

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

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

Bartington grad601-2 gradiometers

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

Multiple sensor arrays

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

3 Earth resistance surveying

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

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

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

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