Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Area RAD31C Kilmersdon Road, Haydon Radstock, Somerset

Ordnance Survey E/N: 368793,154066 (point)

Report: 140305

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7 March 2014

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1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer
Date of survey: between 28 February and 3 March 2014
Area surveyed: 4.5ha
Lead surveyor: Ross Dean BSc MSc MA MIfA

Client
Southwest Archaeology Ltd, The Old Dairy, Hacche Lane Business Park, Pathfields Business Park, South Molton, Devon EX36 3LH

Location

Site:	Land at Area RAD31C, Kilmersdon Road, Haydon
Civil Parish:	Norton Radstock
Unitary Authority:	Bath and North East Somerset
Nearest Postcode:	BA3 3RB
NGR:	ST 687 540 (point)
Ordnance Survey E/N:	368793,154066 (point)
OASIS number:	substrata1-173619
Archive:	At the time of writing, the archive of this survey will be held by Substrata.

Summary
This report was commissioned by Southwest Archaeology Ltd on behalf of Silverwood Partnership was prepared by Substrata as supporting information for a forthcoming planning application at the above site. The location of the site is shown in figure 4, appendix 1.

An Historic Environment Assessment for the site was completed by AC Archaeology Ltd during January 2014 (Thorne, 2014).

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

Two anomaly groups were identified as relating to potential archaeology, each being a well-defined linear anomaly of unknown provenance. Numerous oval anomalies were recorded across the survey area. While their random and widespread distribution suggests that they reflect natural deposits, some could represent archaeological features such as filled pits. Should any further archaeological work take place on the site, it is recommended that some of these anomalies be investigated to confirm their nature.

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 proposed development site lies within a large field approximately 1km south of the centre of Radstock. The survey area comprised the entire development site which is bordered by Kilmersdon Road to the south and east, Grovewood Road to the west and the remainder of the field to the north. An area of scrub-woodland and a disused quarry lie on the north-eastern corner of the site (figure 4, appendix 1).

Land use at the time of the survey
Crop stubble.

Geology
The site is located on a solid geology of interbedded mudstones and limestones of the Jurassic and Triassic Langport Member and Blue Lias Formation (British Geological Survey, undated).

The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

AC Archaeology Ltd produced an Historic Environment Assessment of the site and surrounding area during January 2014 (Thorne, 2014). 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.

Historic landscape characterisation
The application area lies within land classified as ‘Group A’ landscape character type defined as ’landscapes derived from medieval (or earlier) common (or shared) field systems, generally associated with nucleated settlements’. The land is further classified as ’Group A1’; ’late medieval enclosed open fields created by local arrangement and exchange.’ Fields produced in this manner tend to be small, regular and follow the natural topography. The field boundaries often preserve the outlines of previous cultivation strips (Thorne, 2014: 13 after Chapman, 1997:5).

Heritage assets within and adjacent to the survey area
There are no recorded designated or non-designated assets within the proposed development area.

Non-designated assets are recorded in the Heritage Gateway Historic Environment Record just outside the north-eastern corner of the application area (Thorne, 2014: 8, 18 after English Heritage, undated):

> MBN1178 & MBN10536: Evidence of Romano-British (AD 43 to AD 410) activity recovered during the late 19th century operations at a quarry on the northeast corner of the proposed development area. The quarry itself is recorded in HER entry MBN10536. The evidence comprised a large circular pit approximately 2m diameter containing pottery including 60 sherds of Samian ware, bronze instruments, a bar of lead, a bone pin and a coin of Constantine I (HER entry MBN1178). Nearby back-filled v-shaped trenches were found extending in parallel across the quarry and into the adjoining land. In 1905 and

extended human skeleton was found in one of these trenches which also yielded Romano-British pottery and three bronze fibulae. Nearby undated earthworks were also recorded (MBN1178). A noted dated 1976 in the Historic Environment Record stated that there was no sign of the ditches or Romano-British material in the ploughed fields surrounding the quarry or anything visible in the quarry face.

Previous work in or adjacent to the survey area

The above features (HER entry MBN1178) were excavated by McMurtie in 1897 and 1898 (McMurtie, 1907).

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 identifies and characterises 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 including 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
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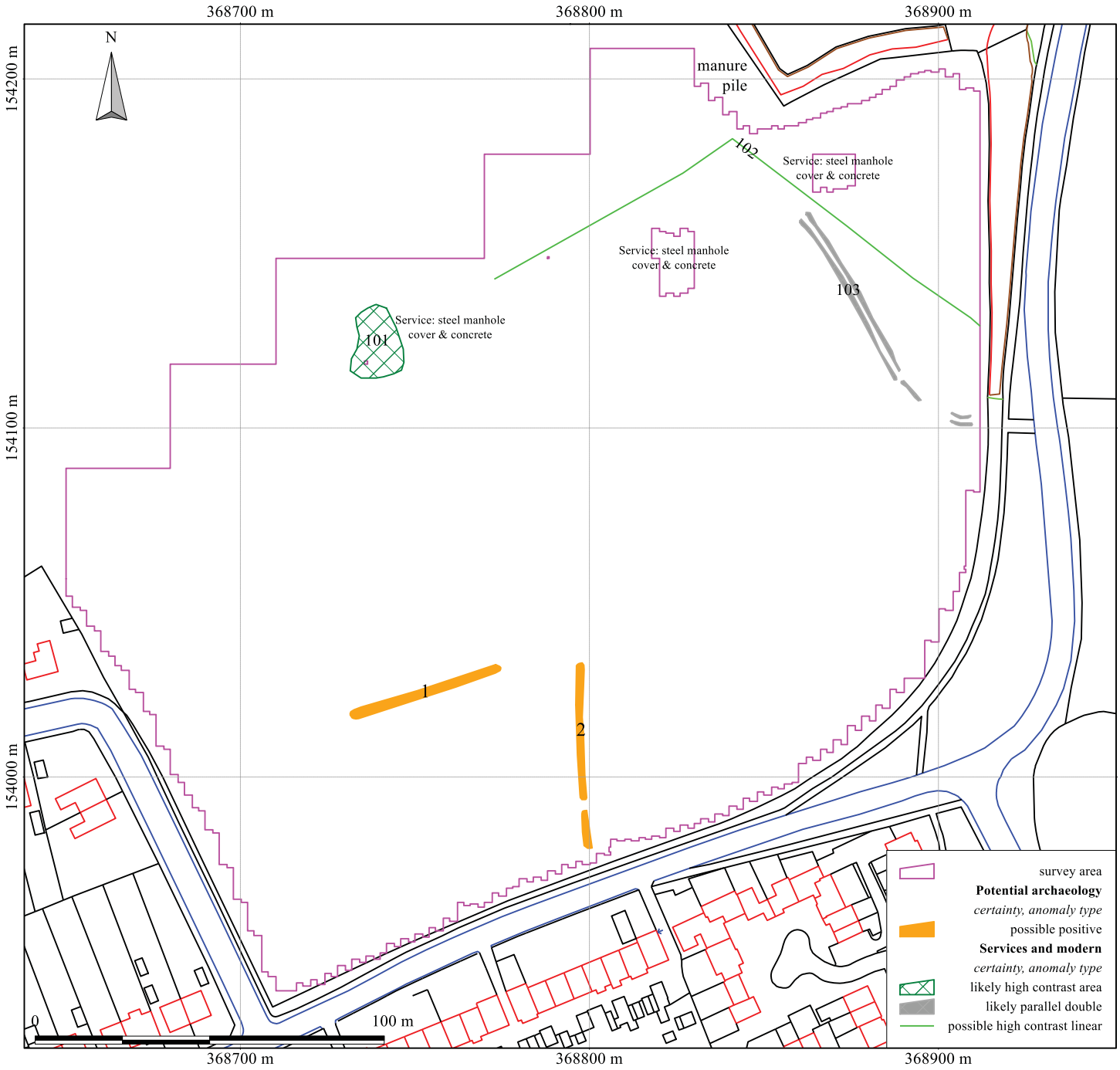
anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		possible positive	linear			
2		possible positive	disrupted linear			
101		likely high contrast area		steel man hole cover & concrete	anomalies indicate more than one focus of ferrous material	observed by surveyors
102		possible high contrast linear		ferrous cable, pipe or drain		
103		likely parallel double		recent vehicle tracks		observed by surveyors

Table 1: data analysis



British Grid
centre X: 368794.50 m, centre Y: 154069.00 m

Scale: 1:1200 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 deposit

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Figure 1: survey interpretation

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6.2 Discussion

Refer to figures 1, 2, 3 and 4.

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 data analysis table 1.

General points
Data collection along the field edges was restricted as shown in figures 2 and 3 due to the presence of magnetic materials in and adjacent to the field boundaries.

There is a background linear trend running west-south-west to east-north-east across the survey area. This trend, shown as parallel linear patterns in figures 2 and 3, is likely to reflect near-surface deposits affected by relatively recent ploughing.

There are numerous oval positive anomalies across the dataset which are likely to reflect filled hollows (figure 2). Their relatively random distribution suggests that they represent natural features rather than archaeological deposits such as pits although this cannot be confirmed without further investigations.

Data relating to historical maps and other records
None of the recorded anomalies relate to features recorded on historical maps, aerial photographs and other records.

Data with no previous provenance
While the magnetic response across the site was reasonable, only two linear anomalies, groups **1** and **2** in figure 1, were recorded that may relate to archaeological deposits. Their relative isolation means that no further archaeological characterisation of either anomaly can be made.

6.3 Conclusions

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

Two anomaly groups were identified as relating to potential archaeology, each being a well-defined linear anomaly of unknown provenance. Numerous oval anomalies were recorded across the survey area. While their random and widespread distribution suggests that they reflect natural deposits, some could represent archaeological features such as filled pits. Should any further archaeological work take place on the site, it is recommended that some of these anomalies be investigated to confirm their nature.

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 Dr Bryn Morris of Southwest Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

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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: 368794.50 m, centre Y: 154069.00 m

Scale: 1:1200 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 2: shade plot of processed data

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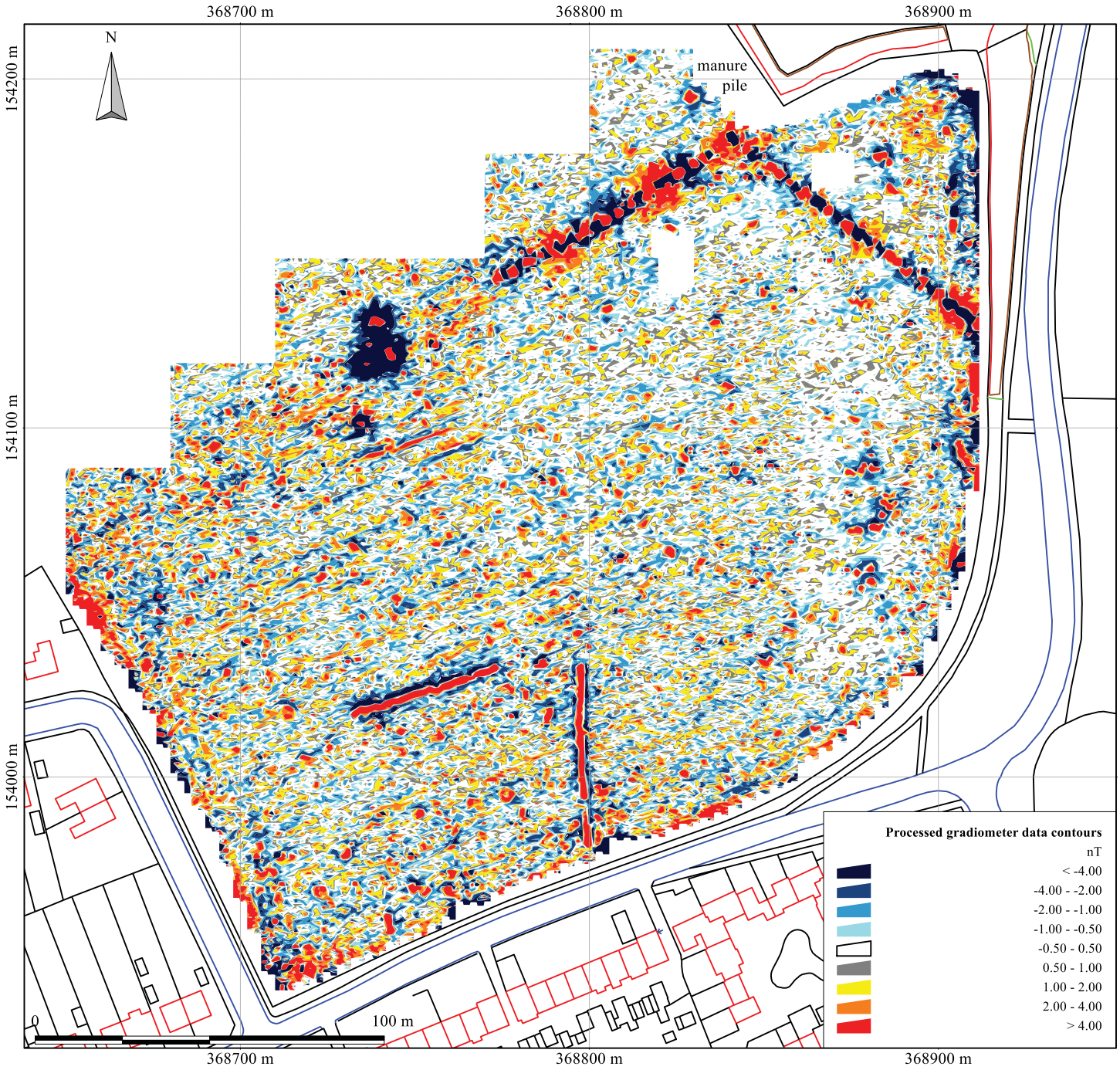

British Grid
centre X: 368794.50 m, centre Y: 154069.00 m

Scale: 1:1200 @ 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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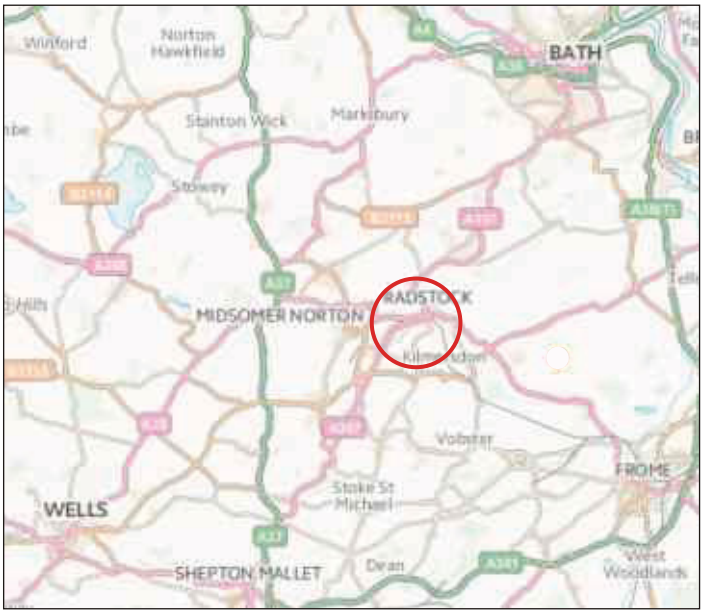

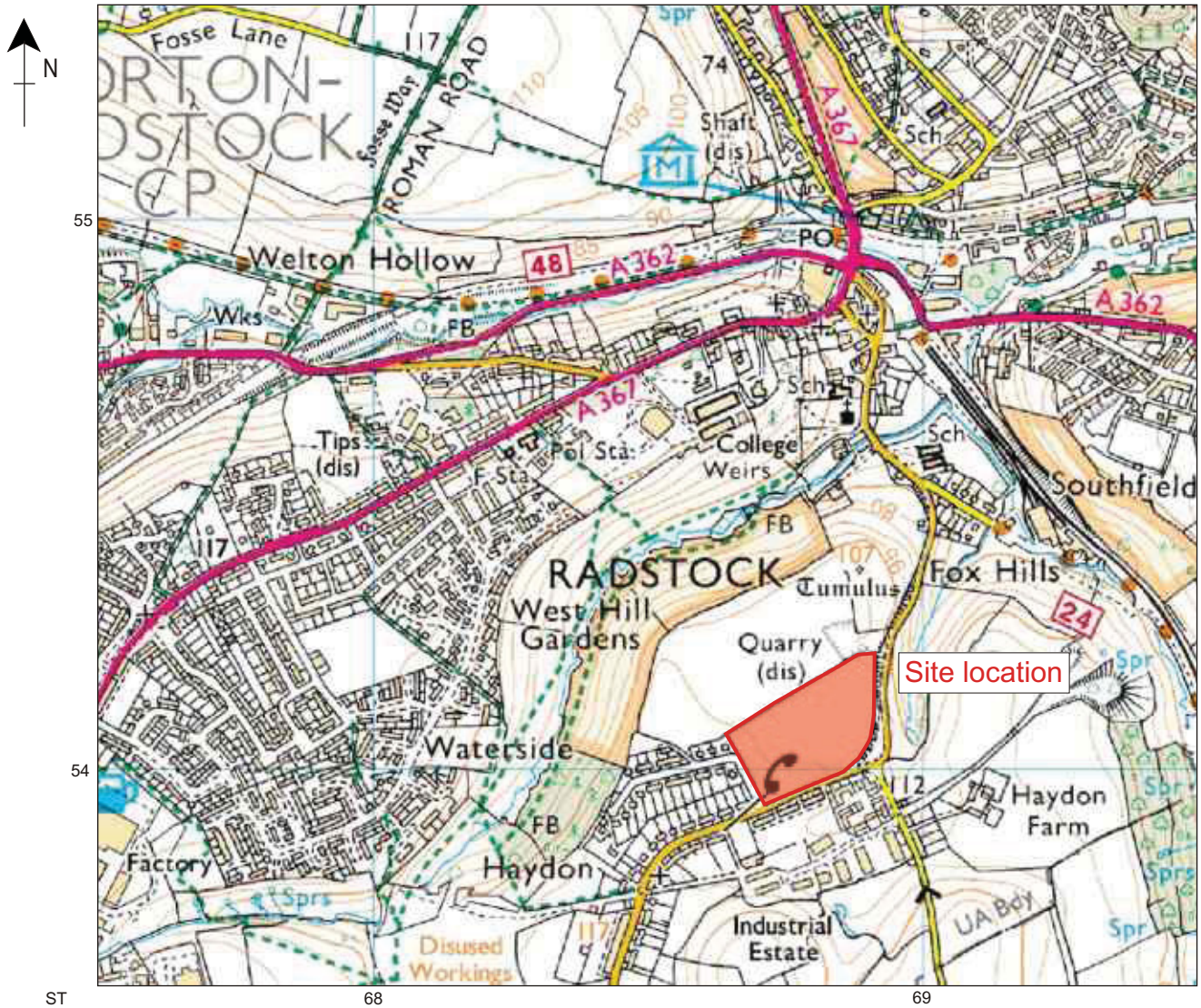

0 500m

Scale 1:12,500@A4

PROJECT

Area RAD31C, Haydon, Radstock, Somerset

TITLE

Fig. 4 : Location of site

AC archaeology

Appendix 2 Methodology Summary

Table 2: methodology summary	
Documents Survey methodology statement: Dean (20014)	
Methodology 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.	
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	**Data Capture** *Sample Interval:* 0.25-metres *Traverse Interval:* 1 metre *Traverse Method:* zigzag *Traverse Orientation:* N102
Data Processing, Analysis and Presentation Software Geoscan Research Geoplot 3 DW Consulting TerraSurveyor3 Manifold System 8 Microsoft Corp. Office Publisher 2013.	

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata

SITE
Instrument Type: Bartington Grad 610
Units: nT
Direction of 1st Traverse: N102 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

Stats
Max: 194.03
Min: -383.50
Std Dev: 8.62
Mean: 0.07
Median: 0.03
Surveyed Area: 4.5278 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.22.1

Processes: 8
1 Base Layer
2 Clip at 1.00 SD
3 DeStripe Median Sensors: All
4 De Stagger: Grids: All Mode: Both By: -4 intervals
5 De Stagger: Grids: rsb12.xgd rsb13.xgd rsb11.xgd rsb14.xgd Mode: Both By: 1 intervals
6 De Stagger: Grids: rsb15.xgd rsb16.xgd rsb17.xgd rsb18.xgd Mode: Both By: 1 intervals
7 De Stagger: Grids: rsb28.xgd rsb29.xgd rsb30.xgd rsb31.xgd rsb32.xgd rsb33.xgd Mode: Both By: 1 intervals
8 Interpolate: Match X & Y Doubled.

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 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.