

**Pinhoe Quarry
Exeter
Devon**

MAGNETOMETER SURVEY REPORT

for

Pinhoe Quarry LLP

David Sabin and Kerry Donaldson

February 2011

Ref. no. 355

ARCHAEOLOGICAL SURVEYS LTD

Pinhoe Quarry, Exeter, Devon

Magnetometer Survey

for

Pinhoe Quarry LLP

Fieldwork by David Sabin
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey date - **17th February 2011**
Ordnance Survey Grid Reference – **SX 956 949**

Archaeological Surveys Ltd
PO Box 2862, Castle Combe, Chippenham, Wiltshire, SN14 7WZ
Tel: 01249 782234 Fax: 0871 661 8804
Email: info@archaeological-surveys.co.uk
Web: www.archaeological-surveys.co.uk

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SUMMARY

A magnetometer survey was commissioned by Pinhoe Quarry LLP and carried out over 1.2ha immediately to the north of Pinhoe Quarry, Exeter, ahead of a proposed redevelopment of the site to include residential dwellings and associated infrastructure. The detailed magnetometer survey was conducted within two separate fields and located a number of positive and negative anomalies that relate to features with enhanced and suppressed magnetic susceptibility respectively. It has not been possible to confidently determine whether anomalies are produced by anthropogenic activity or whether they have a natural origin.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by GK Heritage on behalf of Pinhoe Quarry LLP, to undertake a magnetometer survey of an area of land to the north of Pinhoe Quarry, near Exeter, Devon. The site has been outlined for a proposed residential development. The survey forms part of an archaeological assessment of the site.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to development of the site.

1.2.2 The methodology is considered an efficient and effective approach to archaeological prospection. The survey and report generally follow the recommendations set out by: English Heritage, 2008, *Geophysical survey in archaeological field evaluation*; Institute for Archaeologists, 2002, *The use of Geophysical Techniques in Archaeological Evaluations*.

1.3 Site location, description and survey conditions

1.3.1 The survey area is located north of Pinhoe Quarry on the northern edge of Exeter in Devon and centred on Ordnance Survey National Grid Reference (OS NGR) SX 956 949, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 1.2ha of pasture land split within two fields immediately north of the quarry edge, see Plates 2 and 3. Area 1, forming the eastern part of the site, contains a steep and narrow valley and small stream that were unsuitable for survey, see Plate 1.



Plate 1: Unsurveyable part of Area 1



Plate 2: Area 1 looking towards the north east



Plate 3: Area 2 looking towards the north west

1.3.3 The ground conditions across the site were generally poor due to heavily waterlogged ground, steep slopes and boggy zones. Survey was not possible across some parts of Area 1. Weather conditions during the survey were generally fine.

1.4 Site history and archaeological potential

1.4.1 A desk-based assessment carried out by GK Heritage (2010), identified that there are no cultural heritage assets within the survey area. In the wider vicinity, a series of possible pits and linear features, as well as a Bronze Age hoard, have been found approximately 300m to the north east.

1.5 *Geology and soils*

- 1.5.1 The underlying geology is interbedded mudstones and sandstones from the Crackington Formation, a sequence of Carboniferous sandstones and shales.
- 1.5.2 The overlying soils across the site are from the Halstow association which are typical non-calcareous pelosols. These consist of slowly permeable, clayey soils often over shale (Soil Survey of England and Wales, 1983).

2 METHODOLOGY

2.1 *Technical synopsis*

- 2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.
- 2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.
- 2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.
- 2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 *Equipment configuration, data collection and survey detail*

- 2.2.1 The detailed magnetic survey was carried out using Bartington Grad601-2 gradiometers. The instruments effectively measure a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally.
- 2.2.2 The instruments are extremely sensitive and are able to measure magnetic variation to 0.01nanoTesla (nT), with an effective resolution of 0.03nT. The data are limited to ± 100 nT when surveying with the highest sensitivity. All readings are saved to an integral data logger for analysis and presentation.

- 2.2.3 The instruments are operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change.
- 2.2.4 It can be very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that may be associated with large ferrous objects, geological/pedological features, 'magnetic debris' within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme.
- 2.2.5 The Bartington gradiometers undergo regular servicing and calibration by the manufacturer. A current assessment of the instruments is shown in Table 1 below.

Sensor type and serial numbers	Bartington Grad - 01 – 1000 Nos. 084, 085, 242 and 396
Date of certified calibration/service	Sensors 084 and 085 - 6 th August 2010 (due Aug 2012) Sensors 242 and 396 - 3 rd December 2009 (due Dec 2011)
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instruments were considered to be in good working order prior to the survey, with no known faults or defects.

- 2.2.6 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 30m by 30m grids (900m²) giving 3600 recorded measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 2008).
- 2.2.7 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Penmap RTK GPS. The GPS is used in conjunction with Topcon's TopNet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).
- 2.2.8 The fixed orientation of survey grids based on the OSGB36 datum was considered appropriate given that the orientation of land boundaries was variable and consequently partial survey grids were unavoidable. In addition, there is an optimum north – south traverse direction for magnetic survey (English Heritage, 2008). Survey in this direction can produce anomalies with a higher contrast when compared to other orientations; this is a function of their presence within the Earth's

magnetic field. A fixed grid across the site also simplifies its relocation should that be required.

2.3 *Data processing and presentation*

2.3.1 Magnetometry data downloaded from the Grad 601-2 data logger are analysed and processed in specialist software known as ArcheoSurveyor. The software allows greyscale and trace plots to be produced for presentation and display. Survey grids are assembled to form an overall composite of data (composite file) creating a dataset of the complete survey area. Appendix C contains specific information concerning the survey and data attributes and is derived directly from ArcheoSurveyor; this should be used in conjunction with information provided by Figure 02.

2.3.2 Only minimal processing is carried out in order to enhance the results of the survey for display. Raw data are always analysed, as processing can modify anomalies. The following schedule sets out the data and image processing used in this survey:

- clipping of the raw data at $\pm 30\text{nT}$ to improve greyscale resolution,
- clipping of processed data at $\pm 5\text{nT}$ to enhance low magnitude anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix B for further information on the specific processes carried out on the data. Appendix C metadata includes details on the processing sequence used for each survey area.

2.3.3 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area.

2.3.4 The main form of data display prepared for this report is the greyscale plot. Both 'raw' and 'processed' data have been shown followed by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.5 Graphic raster images in bitmap format (.BMP) are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by ArcheoSurveyor from left to right; this corresponds to a direction of south to north in the field. Prior to displaying against base mapping, raster graphics require a rotation of 90° anticlockwise to restore north to the top of the image. Greyscale images are rotated by AutoCAD.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2009 and AutoCAD LT 2007, creating DWG file formats. All

images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.. A digital archive, including raster images, is produced with this report allowing separate analysis if necessary, see Appendix D below.

3 RESULTS

3.1 General overview

- 3.1.1 The detailed magnetic survey was carried out over a total of two survey areas covering approximately 1.2ha. Geophysical anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, linear anomalies of an agricultural origin, areas of magnetic disturbance and strong discrete dipolar anomalies relating to ferrous objects. Anomalies located within each survey area have been numbered and are described below.
- 3.1.2 Data are considered representative of the anomalies present within the survey area. Despite poor ground conditions, there is no significant positional distortion. Magnetic disturbance from adjacent security fencing along the northern part of the site has influenced the data and subsequent processing, although it is unlikely that significant anomalies have been obscured.
- 3.1.3 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading CAD layer names and plot colour	Description and origin of anomalies
<p><i>Anomalies with an uncertain origin</i></p> <p>AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG NEG AREA UNCERTAIN</p> 	<p>The category applies to a range of anomalies where <u>there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered.</u> Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.</p>

<p>Anomalies with an agricultural origin</p> <p>AS-ABST MAG AGRICULTURAL </p>	<p>The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.</p>
<p>Anomalies associated with magnetic debris</p> <p>AS-ABST MAG STRONG DIPOLAR </p>	<p>Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.</p>
<p>Anomalies with a modern origin</p> <p>AS-ABST MAG DISTURBANCE </p>	<p>The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.</p>

Table 2: List and description of interpretation categories

3.2 List of anomalies - Area 1

Area centred on OS NGR 295725 94925.

Anomalies with an uncertain origin

(1) – A linear zone of magnetic enhancement may correlate with evidence for an occasional spring that appears to have left a small scar particularly close to the western limit of the survey area. Although the anomaly could be consistent with a former ditch-like feature, it cannot be confidently determined whether the feature is of natural or anthropogenic origin.

(2) – A positive linear anomaly in the northern part of the survey area may be associated with an emerging spring.

(3) – The survey area contains several discrete positive anomalies that appear pit-like; however, it is not possible to determine if they are anthropogenic or natural in origin.

Anomalies with an agricultural origin

(4) – Series of weak linear anomalies appear to relate to former agricultural activity.

Anomalies associated with magnetic debris

(5) – The survey area contains a few strong discrete dipolar anomalies that relate to ferrous objects in the topsoil.

Anomalies with a modern origin

(6) – Magnetic disturbance around the northern and eastern edges of the survey area are a response to ferrous material within the surrounding fencing.

3.3 List of anomalies - Area 2

Area centred on OS NGR 295615 94905.

Anomalies with an uncertain origin

(7) – A positive linear and discrete anomaly located in the south eastern corner of the survey area. It is possible that they have a similar origin to anomaly (1) in Area 1.

(8) – The survey area contains several weak positive linear anomalies; however, their form and magnitude prevent confident interpretation.

(9) – Weak, discrete positive anomalies may relate to pit-like features but it is not possible to determine their origin.

(10) – Negative, broadly linear anomalies located in the southern part of the survey area. A negative response indicates material with lower magnetic susceptibility than the surrounding topsoil, such as subsoil or rock; however, it is not possible to determine if they are anthropogenic in origin, or if they are geological/pedological.

4 CONCLUSION

4.1.1 The magnetometer survey located a number of positive linear and discrete anomalies within the two survey areas. Although these anomalies may indicate a response to magnetically enhanced material within cut ditch-like or pit-like features, it is not possible to confidently determine whether they have an anthropogenic or natural origin. Negative linear anomalies in Area 2, on the western side of the site, are a response to material with low magnetic susceptibility, such as rock or subsoil; however, the morphology of the anomalies prevents confident interpretation.

4.1.2 Waterlogged and steep ground within Area 1 was not surveyed and the nature of the topography forming the western part of the area was considered unlikely to be conducive to former settlement.

5 REFERENCES

British Geological Survey, 2010. *Geology of Britain viewer, 1:50 000 scale [online]* available from <http://maps.bgs.ac.uk/geologyviewer/> [accessed 21/2/2011].

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1. 2nd ed.* Swindon: English Heritage.

GK Heritage, 2010. *Proposed Residential Development with Associated Community Facilities at Pinhoe Quarry.* Unpublished typescript document

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations.* IFA Paper No. 6. IFA, University of Reading.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England.*

Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremanent material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremanent magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremanent features include ovens, hearths, and kilns. In addition thermoremanent material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between $\pm 5nT$ and $\pm 1nT$ often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

De-stagger

Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount. Data lost at the end of each traverse are extrapolated from adjacent value in the same row.

Deslope

Corrects for striping and distortion caused by metal objects/services etc.. The process calculates a curve based on a polynomial best fit mathematical function for each traverse. This curve is then subtracted from the actual data.

FFT (Fast Fourier Transform) spectral filtering

A mathematical process used to determine the frequency components of a traverse. Repetitive features, such as plough marks, produce characteristic spectral zones that can be suppressed allowing greyscale images to appear clearer.

Appendix C – survey and data information

Area 1 raw data

COMPOSITE

Filename: J355-mag-Area1-raw.xcp
 Instrument Type: Bartington (Gradiometer)
 Units: nT
 Surveyed by: on 18/02/2011
 Assembled by: on 18/02/2011
 Direction of 1st Traverse: 0 deg
 Collection Method: ZigZag
 Sensors: 2 @ 1.00 m spacing.
 Dummy Value: 32702

Dimensions

Composite Size (readings): 600 x 90
 Survey Size (meters): 150 m x 90 m
 Grid Size: 30 m x 30 m
 X Interval: 0.25 m
 Y Interval: 1 m

Stats

Max: 30.00
 Min: -30.00
 Std Dev: 3.44
 Mean: 0.43
 Median: 0.00
 Composite Area: 1.35 ha
 Surveyed Area: 0.4309 ha

Processes: 2

- 1 Base Layer
- 2 Clip from -30.00 to 30.00 nT

Source Grids: 10

- 1 Col:0 Row:0 grids\01.xgd
- 2 Col:0 Row:1 grids\02.xgd
- 3 Col:1 Row:0 grids\03.xgd
- 4 Col:1 Row:1 grids\04.xgd
- 5 Col:2 Row:0 grids\05.xgd
- 6 Col:2 Row:1 grids\06.xgd
- 7 Col:2 Row:2 grids\07.xgd
- 8 Col:3 Row:0 grids\08.xgd
- 9 Col:3 Row:1 grids\09.xgd
- 10 Col:4 Row:0 grids\10.xgd

Area 1 processed data

COMPOSITE

Filename: J355-mag-Area1-proc.xcp

Stats

Max: 5.00
 Min: -5.00
 Std Dev: 1.89
 Mean: 0.27
 Median: 0.01

Processes: 3

- 1 Base Layer
- 2 DeStripe Mean Traverse: Grids: All Threshold: 1 SDs
- 3 Clip from -5.00 to 5.00 nT

Area 2 raw data

COMPOSITE

Filename: J355-mag-Area2-raw.xcp
 Instrument Type: Bartington (Gradiometer)
 Units: nT
 Surveyed by: on 18/02/2011
 Assembled by: on 18/02/2011
 Direction of 1st Traverse: 0 deg
 Collection Method: ZigZag
 Sensors: 2 @ 1.00 m spacing.
 Dummy Value: 32702

Dimensions

Composite Size (readings): 600 x 90
 Survey Size (meters): 150 m x 90 m
 Grid Size: 30 m x 30 m
 X Interval: 0.25 m
 Y Interval: 1 m

Stats

Max: 30.00
 Min: -30.00
 Std Dev: 3.21
 Mean: 0.22
 Median: 0.20
 Composite Area: 1.35 ha
 Surveyed Area: 0.7114 ha

Processes: 2

- 1 Base Layer
- 2 Clip from -30.00 to 30.00 nT

Source Grids: 13

- 1 Col:0 Row:1 grids\01.xgd
- 2 Col:1 Row:0 grids\02.xgd
- 3 Col:1 Row:1 grids\03.xgd
- 4 Col:1 Row:2 grids\04.xgd
- 5 Col:2 Row:0 grids\05.xgd
- 6 Col:2 Row:1 grids\06.xgd
- 7 Col:2 Row:2 grids\07.xgd
- 8 Col:3 Row:0 grids\08.xgd
- 9 Col:3 Row:1 grids\09.xgd
- 10 Col:3 Row:2 grids\10.xgd
- 11 Col:4 Row:0 grids\11.xgd
- 12 Col:4 Row:1 grids\12.xgd
- 13 Col:4 Row:2 grids\13.xgd

Area 2 processed data

COMPOSITE

Filename: J355-mag-Area2-proc.xcp

Stats

Max: 5.00
 Min: -5.00
 Std Dev: 1.59
 Mean: 0.04
 Median: -0.03

Processes: 3

- 1 Base Layer
- 2 DeStripe Mean Traverse: Grids: All Threshold: 1 SDs
- 3 Clip from -5.00 to 5.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at Castle Combe, Wiltshire (see inside cover for address). Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site. Digital data are also supplied to the client on CD ROM, see below.

Surveys are reported on in hardcopy (recycled paper) using A4 for text and A3 for plots (all plots are scaled for A3). The distribution of both hardcopy report and digital data is considered the responsibility of the Client unless explicitly stated in the survey Brief, Written Scheme of Investigation or other contractual agreement.

This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.5.8.46(geophysical data analysis),
- ProgeCAD Professional 2009 (report graphics),
- AutoCAD LT 2007 (report figures),
- OpenOffice.org 3.0.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data are supplied on CD ROM which includes the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- AutoCAD DWG files in 2000 and 2007 versions,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures,
- photographic record in JPEG format.

The CD ROM structure is formed from a tree of directories under the title J355 Pinhoe – CD. Directory titles include Data, Documentation, CAD, PDFs and Photos. Multiple directories exist under Data and hold Grid, Composite and Graphic files with CSV composite data held in Export.

The CAD file contains externally referenced graphics that are rotated with separate A3 size layouts for each figure. Layouts are fixed using frozen layers and named views allowing straightforward plotting or analysis on screen. (Note – CAD files are prepared using AutoCAD's e Transmit function to produce a directory containing the digital drawing along with any externally referenced graphics which may need reloading).

Geophysical Survey Pinhoe Quarry Exeter

Map of survey area

Reproduced from OS Explorer map no.114 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright. All rights reserved. Licence number 100043739.



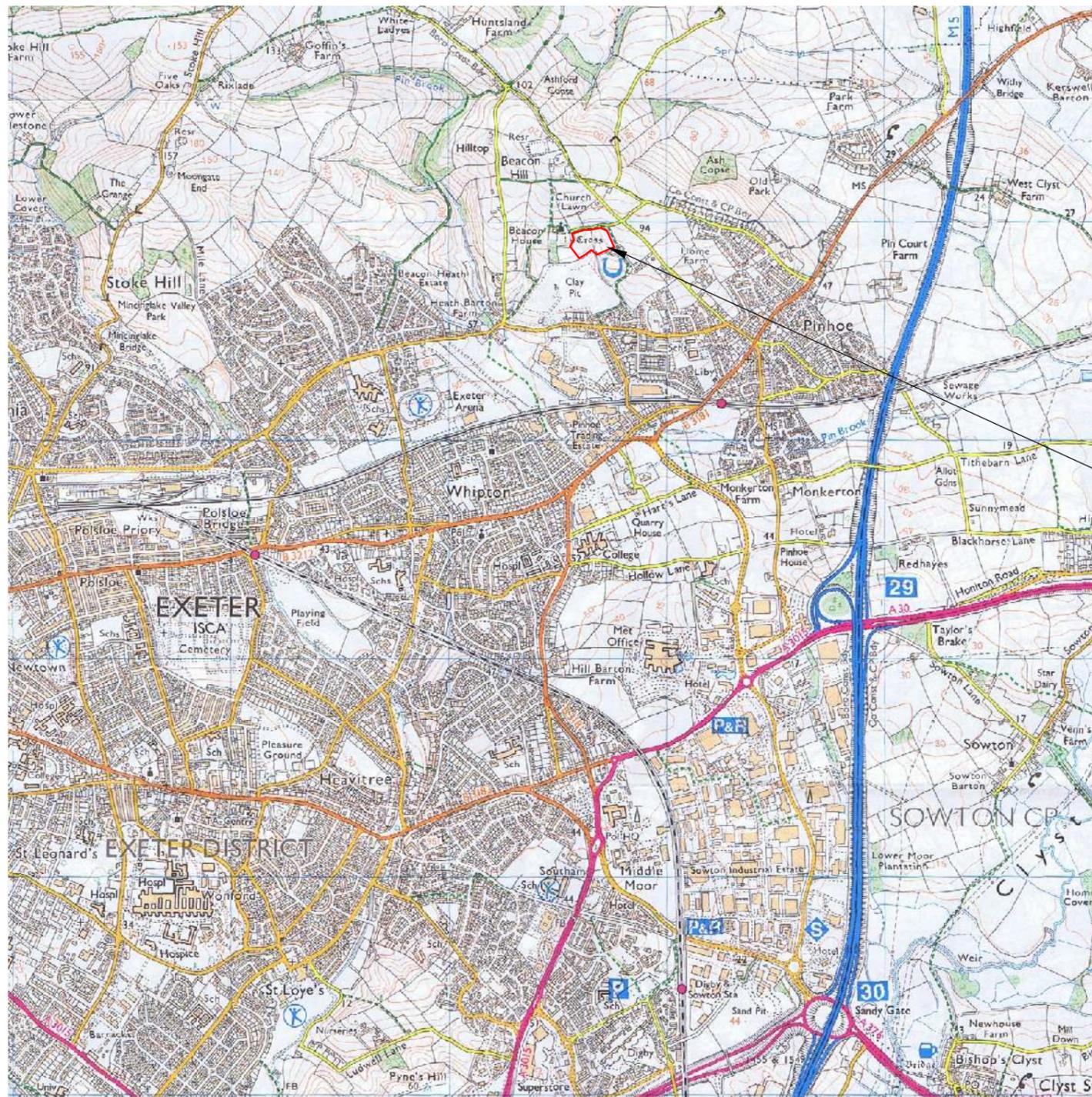
● Survey location

Site centred on OS NGR
SX 956 949

SCALE 1:25 000



SCALE TRUE AT 10



Survey location

**Geophysical Survey
Pinhoe Quarry
Exeter**

Referencing information

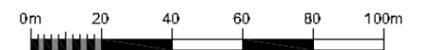
Grid coordinates based on Ordnance Survey
OSGB36 datum
Grids set out using RTK GPS with Topcon
TopNet correction data RTCMv2 format
OSTN02 transformation

Survey grid size = 30m

— Survey start and traverse direction

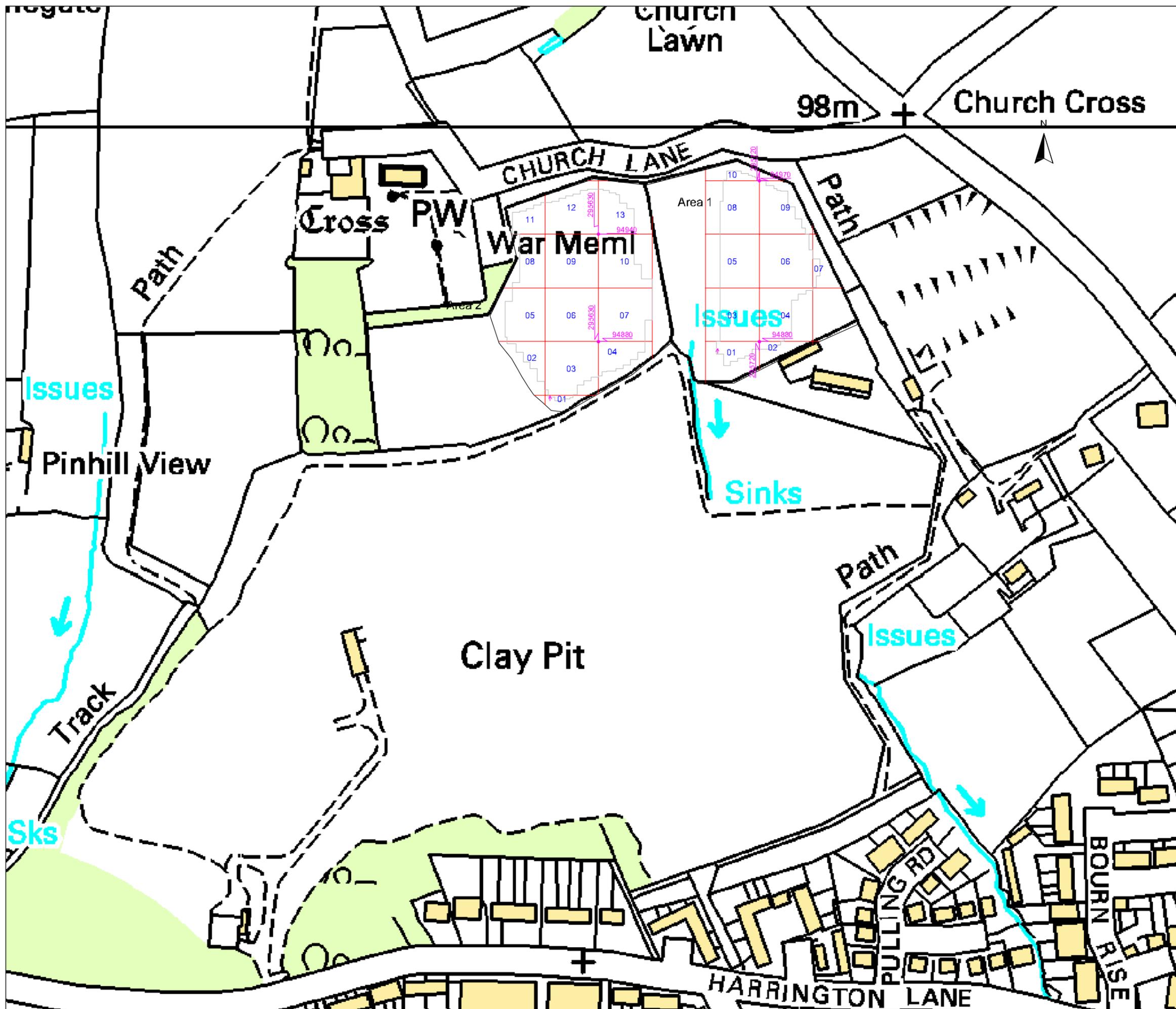
01 Grid reference number and filename

SCALE 1:2000

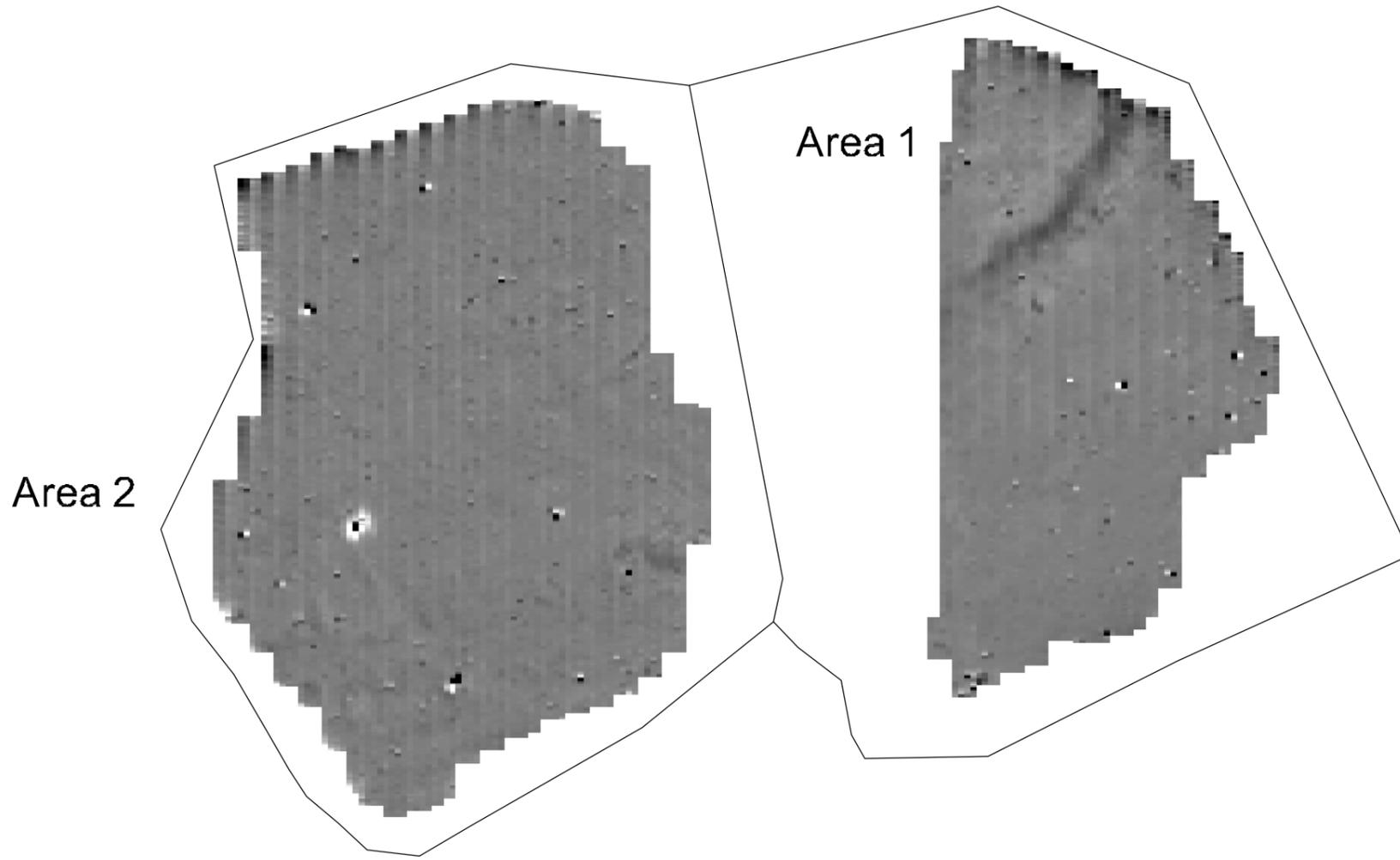


SCALE TRUE AT 0

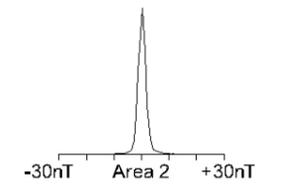
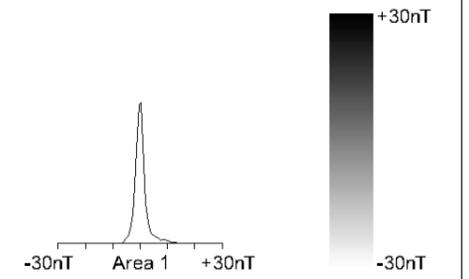
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**Geophysical Survey
Pinhoe Quarry
Exeter**



**Greyscale plot of raw
magnetometer data**



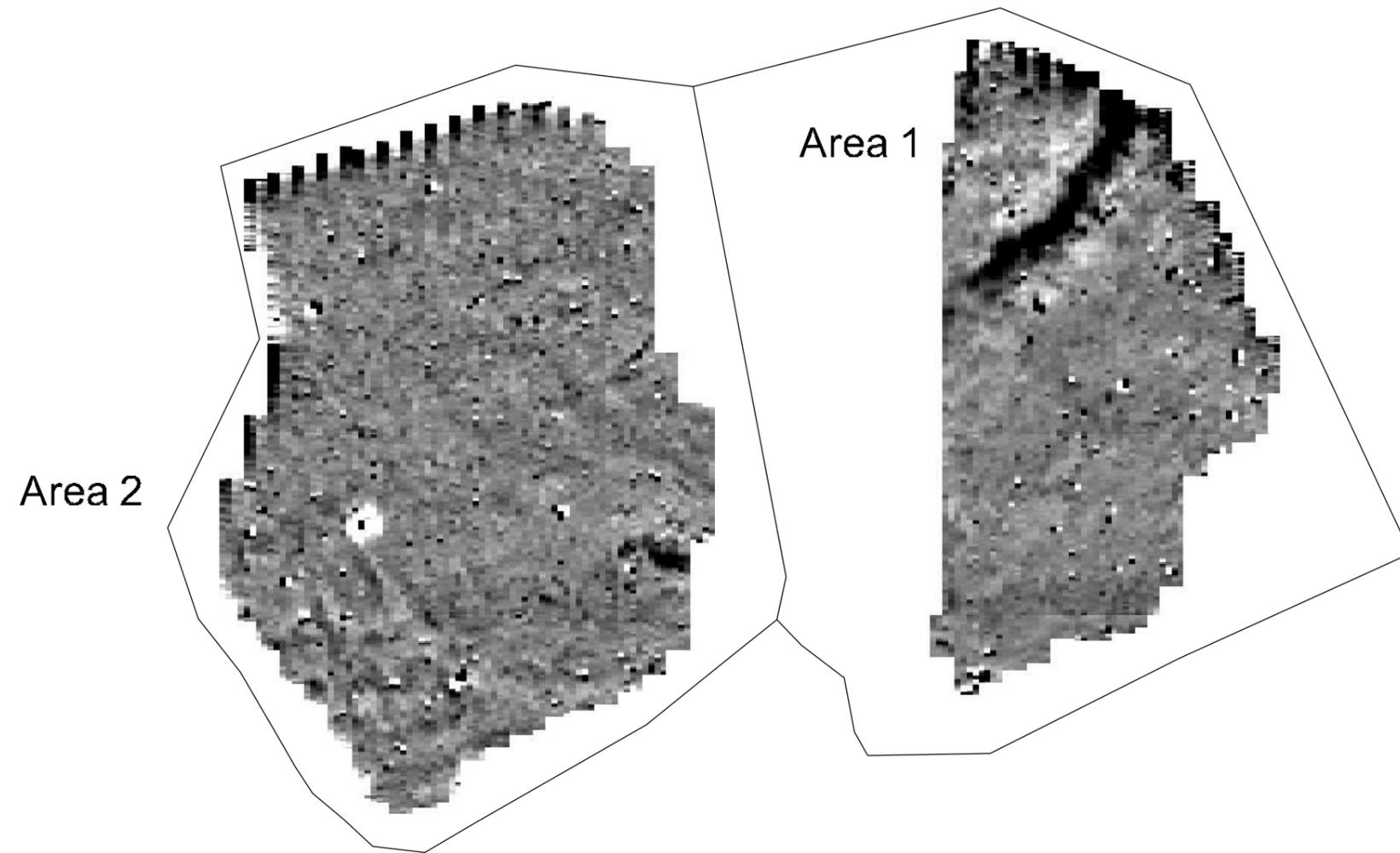
SCALE 1:1000



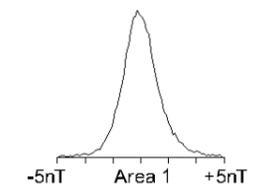
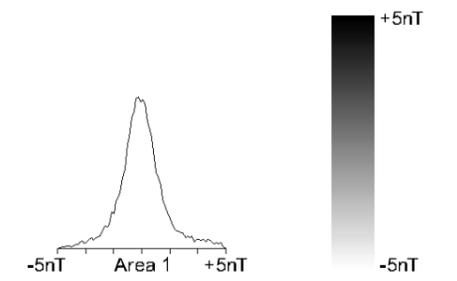
SCALE TRUE AT 0

FIG 03

**Geophysical Survey
Pinhoe Quarry
Exeter**



**Greyscale plot of processed
magnetometer data**



SCALE 1:1000

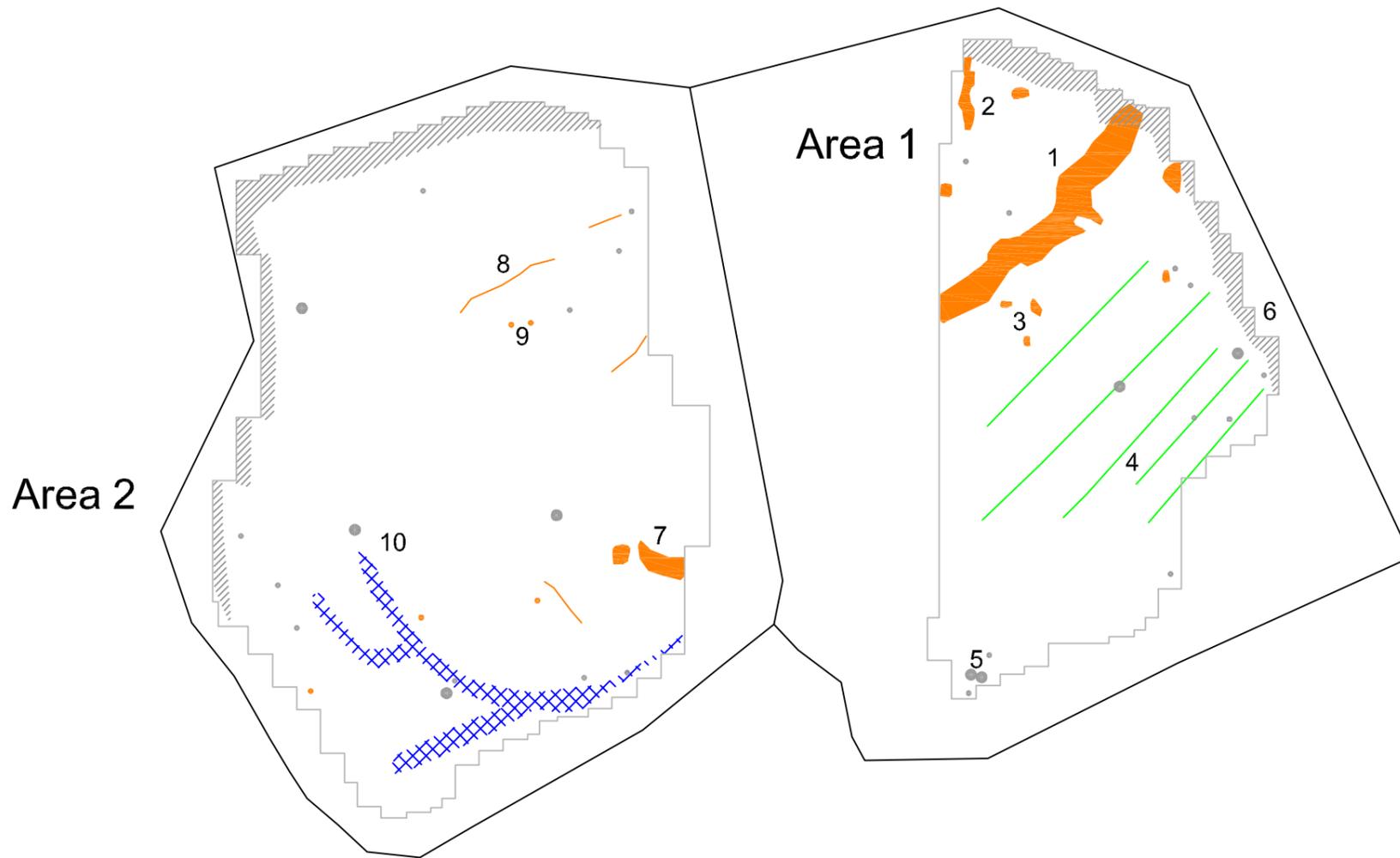


SCALE TRUE AT 0

**Geophysical Survey
Pinhoe Quarry
Exeter**

**Abstraction and interpretation of
magnetometer anomalies**

-  Positive linear anomaly - possible ditch-like feature
-  Linear anomaly - of agricultural origin
-  Negative anomaly - material of low magnetic susceptibility
-  Discrete positive response - possible pit-like feature
-  Magnetic disturbance from ferrous material
-  Strong dipolar anomaly - ferrous object



SCALE 1:1000



SCALE TRUE AT A3