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ARCHAEOLOGICAL

S E R V I C E S

**Land off Broughton Road, Crouch Hill,
Banbury, Oxfordshire**

Geophysical Survey (Magnetic)

by Kyle Beaverstock and Andrew Muddin

Site Code: BRB 16/42

(SP 4406 3971)

Land off Broughton Road, Crouch Hill, Banbury, Oxfordshire

Geophysical Survey (Magnetic) Report

For CALA Homes Ltd

by Kyle Beaverstock and Andrew Mordin

Thames Valley Archaeological Services Ltd

Site Code BRB 16/42

September 2016

Summary

Site name: Land off Broughton Road, Crouch Hill, Banbury, Oxfordshire

Grid reference: SP 44066 39511

Site activity: Magnetometer survey

Date and duration of project: 10th - 11th of August 2016

Project Coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: BRB 16/42

Area of site: 2.8ha of which 2.1ha surveyed

Summary of results: A modest quantity of magnetic anomalies have been identified from the survey. Some have been identified as being possibly of archaeological and historic agricultural origin. The agricultural features appear to represent ridge and furrow on the lower part of the site in the north. The other anomalies are linear and may represent ditches and gullies

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

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Report edited/checked by: Steve Ford✓ 15.09.16
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Land off Broughton Road, Crouch Hill, Banbury, Oxfordshire A Geophysical Survey (Magnetic)

by Kyle Beaverstock and Andrew MUNDIN

Report 16/42

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Broughton Road, Banbury, Oxfordshire (SP 44066 39511) (Fig. 1). The work was commissioned by Miss Ruth Henderson of CALA Homes (Midlands) Ltd. CALA House, Arleston Way, Solihull, B90 4LH.

Outline planning consent (13/01528/OUT) has been gained from Cherwell District Council for a housing development on a 2.8ha parcel of land at Broughton Rd, Banbury, Oxfordshire (SP 4407 3948). This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012), and the District's policies on archaeology. The archaeological potential of the site has been detailed in a desktop study (Dawson and Gaily 2013). The field investigation was carried out to a specification approved by Mr Richard Oram, Planning Archaeologist for Oxfordshire County Archaeological Services. The fieldwork was undertaken by Kyle Beaverstock and Michael Johnson and the site code is BRB 16/42. The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located on the SW edge of modern Banbury, immediately adjacent to Crouch Hill (Fig.1). The land is currently disused arable land, with grass coverage and occasional small shrubs (Pl.1 and 2). The topography of the land raises substantially in the south, as the site raises towards the top of Crouch Hill off the south western corner of the survey. The underlying geology is Upper Lias (clay) (BGS 1982).

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution. A grid plan was drawn up to cover the entire

proposal site area but the presence of encroaching undergrowth on the boundaries of the field reduced the area available to survey, especially in the south, east and north west field corners. Occasional obstructions were present on the site consisting of small trees and shrubs dispersed all over the field, which were left as 2m wide unsurveyed areas.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both English Heritage (2008) and the Chartered Institute *for* Archaeologists (2002, 2011, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two fluxgates mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	Effect
e.g. Clip from -3.00 to 3.00 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: y doubled	Increases the resolution of the readings in the y axis, enhancing the shape of anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
Search & Replace: from: ± 30 nT to: ± 1000 nT with: dummy	Removes extreme values resulting from magnetic interference caused by near-by ferromagnetic objects.
Range match (area: top 90, left 0, bottom 149, right 359) to top edge	Equalises the range of values between areas surveyed by different operatives, correcting for differences in setup.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

Once processed, the results are presented as a greyscale plot shown in relation to the site (Fig. 3), followed by a second plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.6.1 Brighton and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

A range of magnetic anomalies were recorded across the survey area (Fig. 4), although the eastern edge of the site is dominated by a pipeline [Fig 5: 8] running NNW to SSE. The magnetic anomalies of possible archaeological origin are recognisable as positive variations in the site's general background magnetic field. The positive anomalies usually represent buried cut features such as ditches or pits whereas negative anomalies are indicative of earthen banks, or thickened or disturbed subsoil.

At the south end of the field a weak positive anomaly [1] runs south to north for approximately 30m but is partially obscured by overgrowth along the western edge of the field. Further north another weak positive anomaly [2] was noted it runs east to west for approximately 10m and may be related to anomaly [3]. Anomaly [3], is a positive linear anomaly running east to west for approx. 14m before turning south for 12m. It is likely that this anomaly continues as anomaly [4] which is slightly segmented but continues south for approx 60m.

Weak positive anomaly [5] is a possible linear running south-west to north-east for 18m with a second linear to its north [6] running south-east to north-west for 18m. These linears may also be related and all may represent several phases of agricultural activity (field systems).

The negative anomaly in the north [7] is most likely more recent agricultural activity (ridge and furrow) and [9] represents ferro-magnetic debris, most likely derived from modern soil make up.

Conclusion

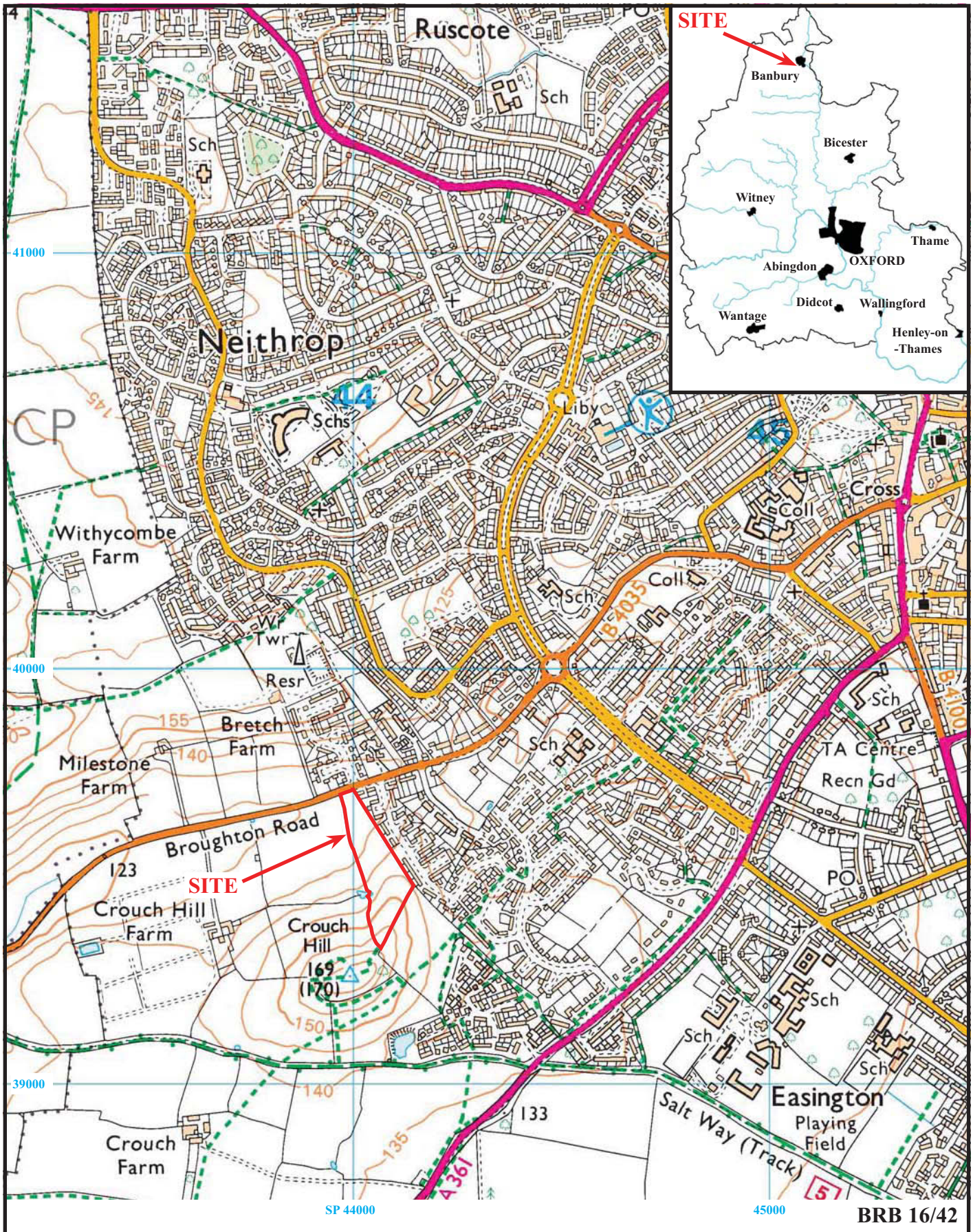
A modest quantity of magnetic anomalies have been identified from the survey and some have been interpreted as being of archaeological and historic agricultural origin. The agricultural features represent parallel striping for furrow bases on a NNW-SSE axis on or near the lower part of the site in the north. A possible corner of a rectilinear field boundary and a few other linear anomalies seem to be the only other features that may be of archaeological origin

References

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- CI/A, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading
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- CI/A, 2014, *Standard and Guidance: for archaeological geophysical survey*, Reading
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APPENDIX 1. Survey and data information

<p>Programme: Name: TerraSurveyor Version: 3.0.25.1</p> <p>Name: Broughton Road, Banbury Location: MapRef:</p> <p>Site Totals: () Composite Area: 0 ha Surveyed Area: 0 ha</p> <p>COMPOSITE Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing. Dummy Value: 2047.5</p> <p>Dimensions Composite Size (readings): 640 x 680 Survey Size (meters): 160 m x 340 m Grid Size: 20 m x 20 m X Interval: 0.25 m Y Interval: 0.5 m (surveyed @ 1 m)</p> <p>Stats Max: 2.20 Min: -1.80 Std Dev: 1.28 Mean: 0.06 Median: 0.02 Composite Area: 5.44 ha Surveyed Area: 2.0507 ha</p> <p>Source Grids: 81 1 Col:0 Row:14 grids\80.xgd 2 Col:0 Row:15 grids\81.xgd 3 Col:1 Row:13 grids\76.xgd 4 Col:1 Row:14 grids\77.xgd 5 Col:1 Row:15 grids\78.xgd 6 Col:1 Row:16 grids\79.xgd 7 Col:2 Row:10 grids\69.xgd 8 Col:2 Row:11 grids\70.xgd 9 Col:2 Row:12 grids\71.xgd 10 Col:2 Row:13 grids\72.xgd 11 Col:2 Row:14 grids\73.xgd 12 Col:2 Row:15 grids\74.xgd 13 Col:2 Row:16 grids\75.xgd 14 Col:3 Row:5 grids\57.xgd 15 Col:3 Row:6 grids\58.xgd 16 Col:3 Row:7 grids\59.xgd 17 Col:3 Row:8 grids\60.xgd 18 Col:3 Row:9 grids\61.xgd 19 Col:3 Row:10 grids\62.xgd 20 Col:3 Row:11 grids\63.xgd 21 Col:3 Row:12 grids\64.xgd 22 Col:3 Row:13 grids\65.xgd 23 Col:3 Row:14 grids\66.xgd 24 Col:3 Row:15 grids\67.xgd 25 Col:3 Row:16 grids\68.xgd 26 Col:4 Row:3 grids\45.xgd 27 Col:4 Row:4 grids\46.xgd 28 Col:4 Row:5 grids\47.xgd 29 Col:4 Row:6 grids\48.xgd 30 Col:4 Row:7 grids\49.xgd 31 Col:4 Row:8 grids\50.xgd 32 Col:4 Row:9 grids\51.xgd 33 Col:4 Row:10 grids\52.xgd 34 Col:4 Row:11 grids\53.xgd</p>	35 Col:4 Row:12 grids\54.xgd 36 Col:4 Row:13 grids\55.xgd 37 Col:4 Row:14 grids\56.xgd 38 Col:5 Row:0 grids\30.xgd 39 Col:5 Row:1 grids\31.xgd 40 Col:5 Row:2 grids\32.xgd 41 Col:5 Row:3 grids\33.xgd 42 Col:5 Row:4 grids\34.xgd 43 Col:5 Row:5 grids\35.xgd 44 Col:5 Row:6 grids\36.xgd 45 Col:5 Row:7 grids\37.xgd 46 Col:5 Row:8 grids\38.xgd 47 Col:5 Row:9 grids\39.xgd 48 Col:5 Row:10 grids\40.xgd 49 Col:5 Row:11 grids\41.xgd 50 Col:5 Row:12 grids\42.xgd 51 Col:5 Row:13 grids\43.xgd 52 Col:5 Row:14 grids\44.xgd 53 Col:6 Row:0 grids\15.xgd 54 Col:6 Row:1 grids\16.xgd 55 Col:6 Row:2 grids\17.xgd 56 Col:6 Row:3 grids\18.xgd 57 Col:6 Row:4 grids\19.xgd 58 Col:6 Row:5 grids\20.xgd 59 Col:6 Row:6 grids\21.xgd 60 Col:6 Row:7 grids\22.xgd 61 Col:6 Row:8 grids\23.xgd 62 Col:6 Row:9 grids\24.xgd 63 Col:6 Row:10 grids\25.xgd 64 Col:6 Row:11 grids\26.xgd 65 Col:6 Row:12 grids\27.xgd 66 Col:6 Row:13 grids\28.xgd 67 Col:6 Row:14 grids\29.xgd 68 Col:7 Row:0 grids\01.xgd 69 Col:7 Row:1 grids\02.xgd 70 Col:7 Row:2 grids\03.xgd 71 Col:7 Row:3 grids\04.xgd 72 Col:7 Row:4 grids\05.xgd 73 Col:7 Row:5 grids\06.xgd 74 Col:7 Row:6 grids\07.xgd 75 Col:7 Row:7 grids\08.xgd 76 Col:7 Row:8 grids\09.xgd 77 Col:7 Row:9 grids\10.xgd 78 Col:7 Row:10 grids\11.xgd 79 Col:7 Row:11 grids\12.xgd 80 Col:7 Row:12 grids\13.xgd 81 Col:7 Row:13 grids\14.xgd
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**Land at Broughton Road, Crouch Hill,
Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)**
Figure 1. Location of site within Banbury and Oxfordshire

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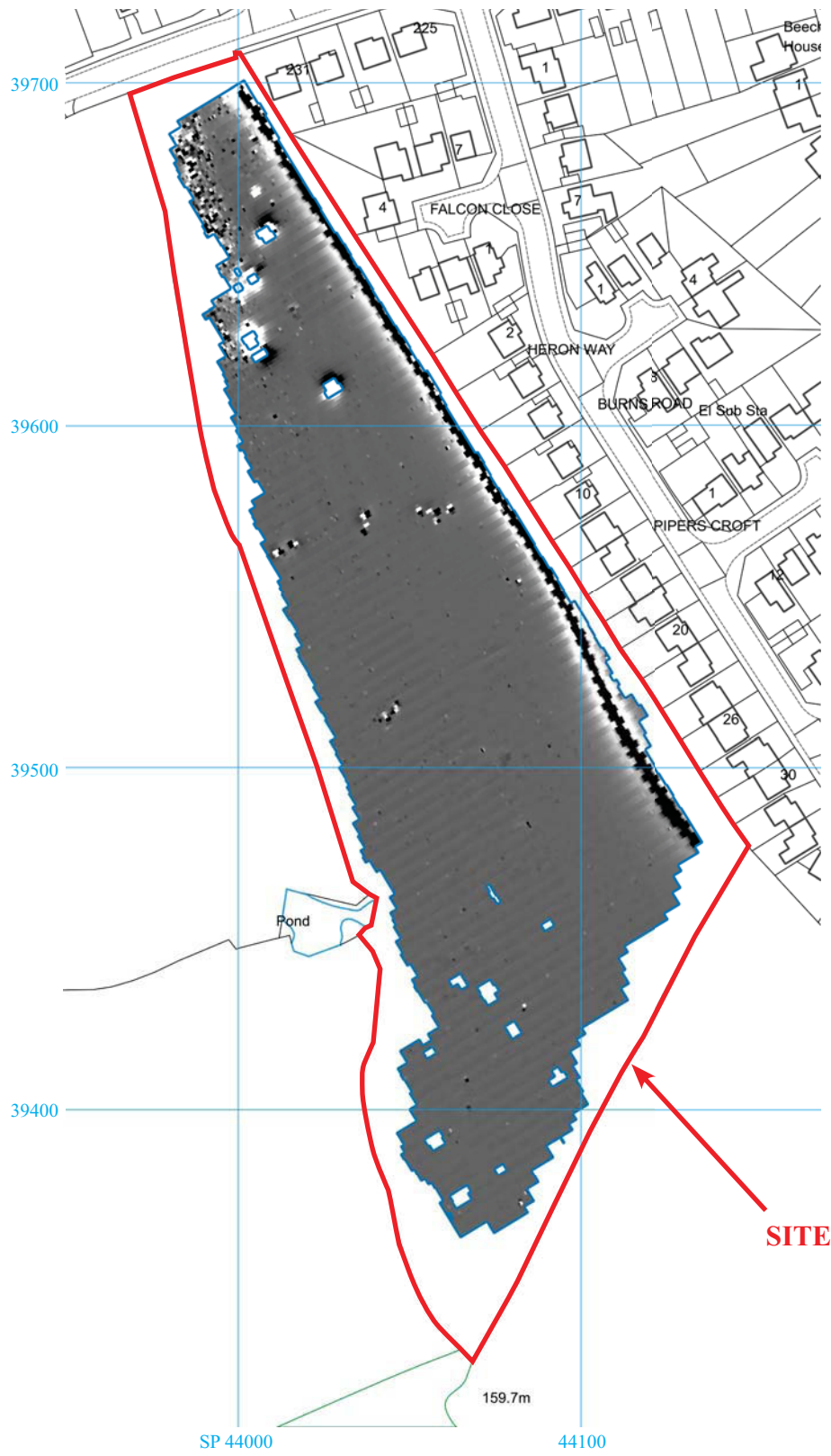
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Figure 2. Survey grid layout.



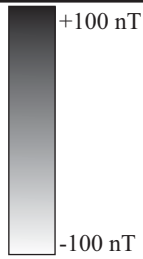
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Figure 3. Plot of raw gradiometer data.





SITE

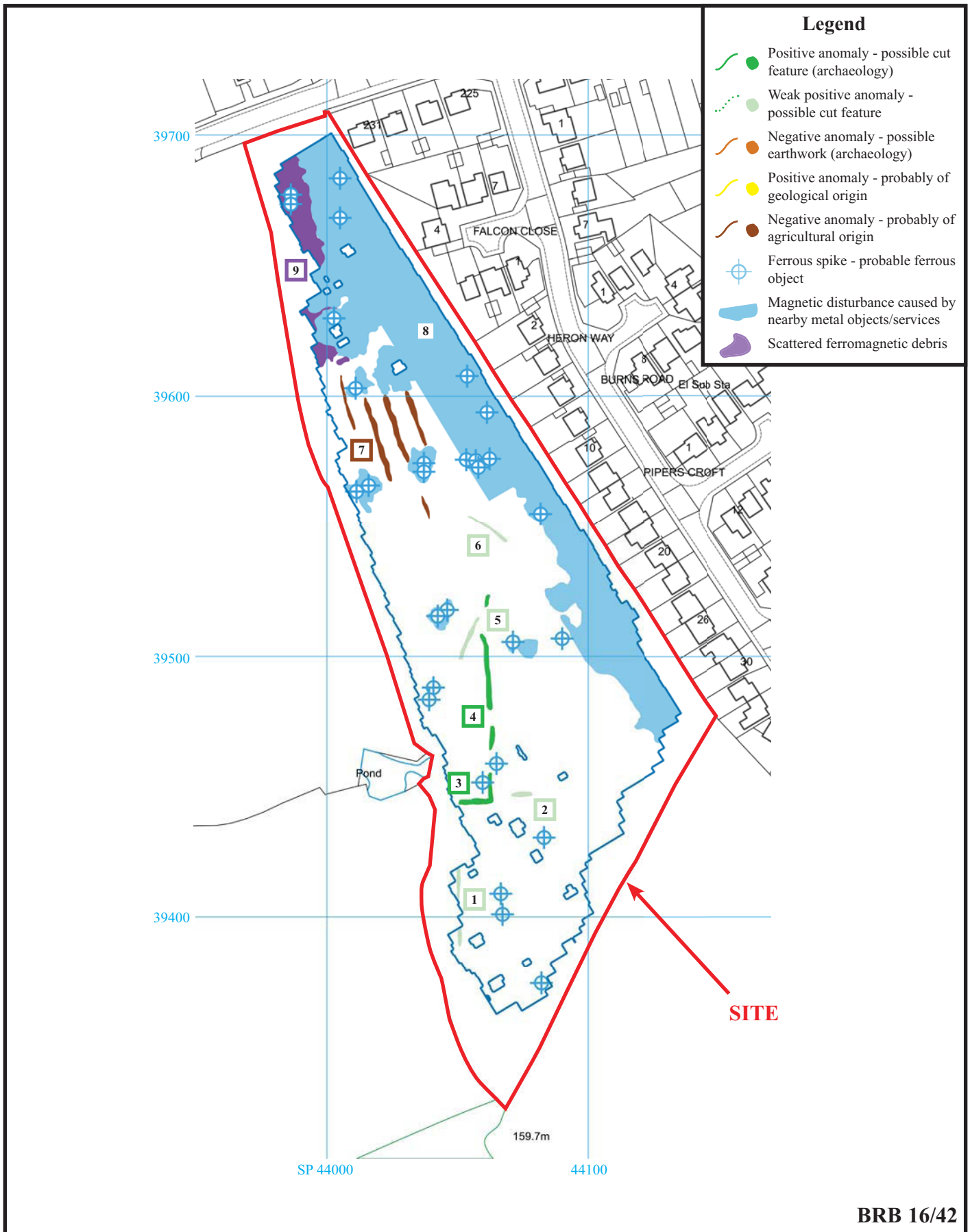
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Figure 4. Plot of minimally processed gradiometer data.





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Figure 5. Interpretation plot.

0m 100m



Plate 1. Northern end of the surveyed field, looking south east towards Crouch Hill.



Plate 2. Site looking north west.

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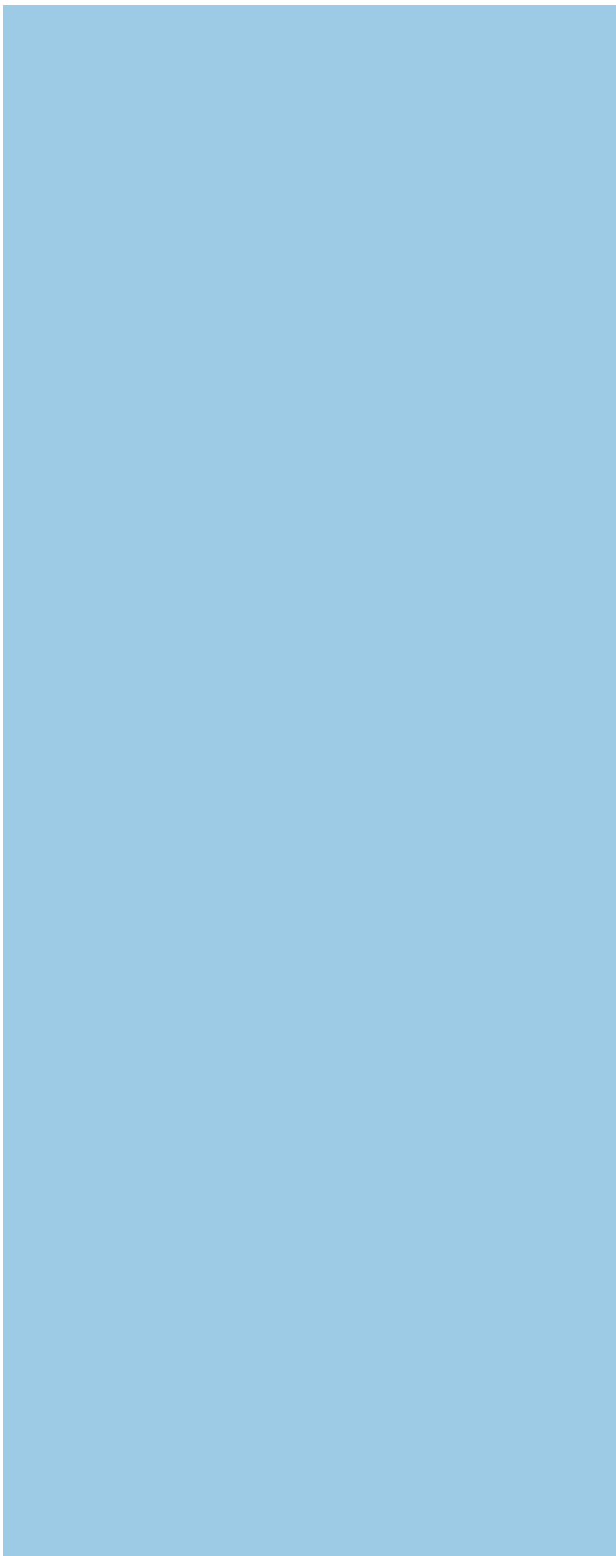
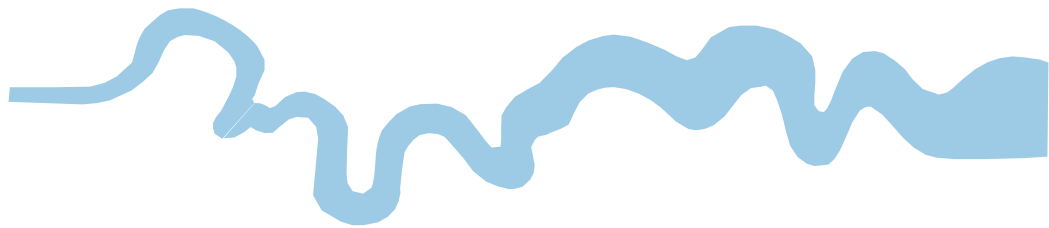
**Land off Broughton Road, Crouch Hill, Banbury,
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Plates 1 - 2.**

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TIME CHART

	Calendar Years
Modern _____	AD 1901
Victorian _____	AD 1837
Post Medieval _____	AD 1500
Medieval _____	AD 1066
Saxon _____	AD 410
Roman _____	AD 43
Iron Age _____	BC/AD 750 BC
Bronze Age: Late -----	1300 BC
Bronze Age: Middle -----	1700 BC
Bronze Age: Early -----	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC





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