THAMES VALLEY

ARCHAEOLOGICAL

SERVICES

Land off Brougton Road, Crouch Hill, Banbury, Oxfordshire

Geophysical Survey (Magnetic)

by Kyle Beaverstock and Andrew Mundin

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 Mundin

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.

Report edited/checked by: Steve Ford✓ 15.09.16

Thames Valley Archaeological Services Ltd, 47–49 De Beauvoir Road, Reading RG1 5NR
Tel. (0118) 926 0552; Fax (0118) 926 0553; email **tvas@tvas.co.uk;** *website: www.tvas.co.uk*

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 recoded 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

BGS, 1982, *British Geological Survey*, 1:50000, Sheet 201, Solid and Drift Edition, Keyworth

Dawson, M and Gailey S, 2013, Land off Broughton Road, Banbury, Oxfordshire, an archaeological desk-based assessment, CgMs consulting, Newark

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage, Portsmouth (2nd edn)

CI*f*A, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading

CI*f*A, 2011, *Standard and Guidance: for archaeological geophysical survey*, Reading

CI*f*A, 2014, *Standard and Guidance: for archaeological geophysical survey*, Reading

NPPF, 2012, *National Planning Policy Framework*, Dept Communities and Local Government, London

APPENDIX 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.1

Name: Broughton Road, Banbury
Location:
MapRef:

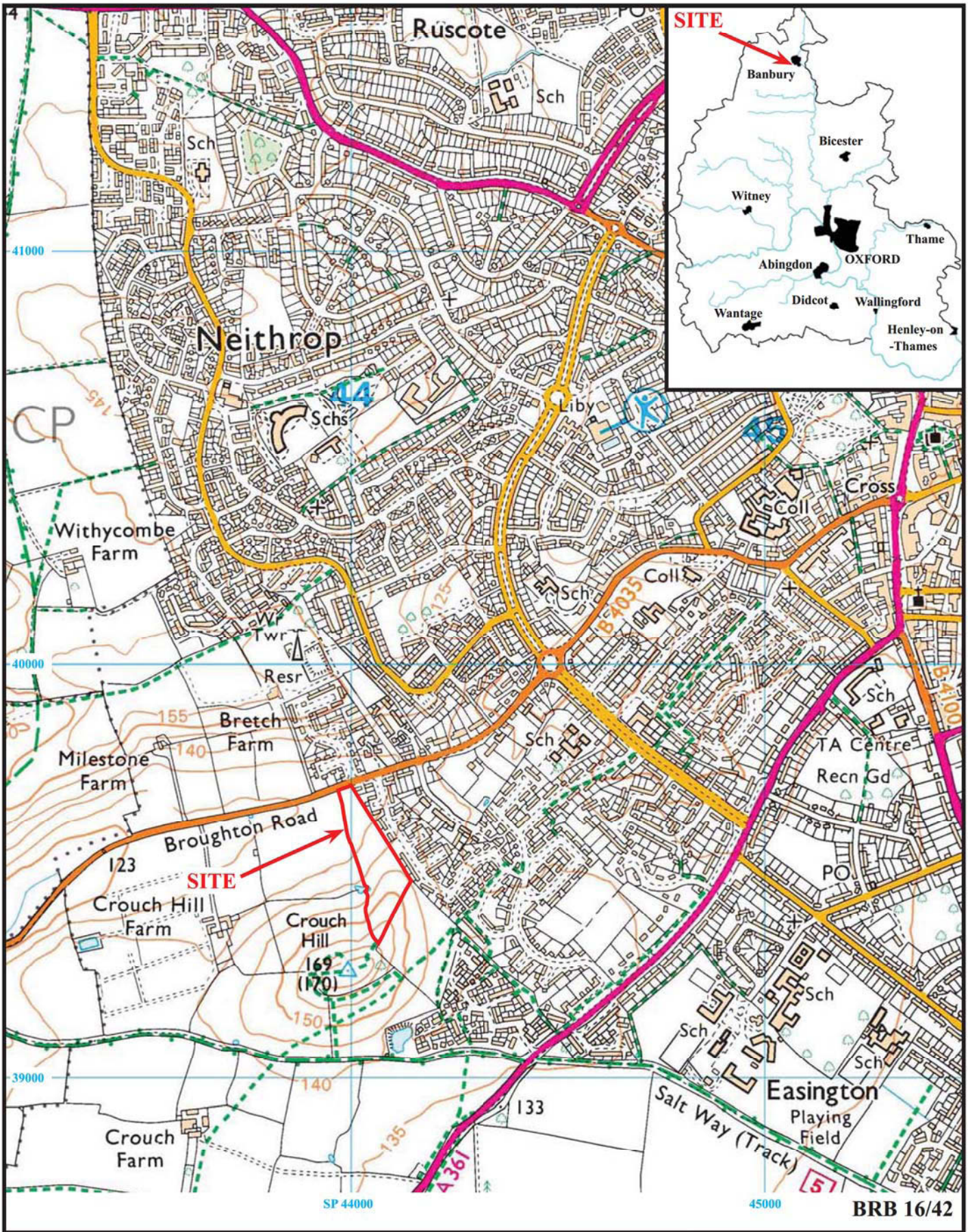
Site Totals: ()
Composite Area: 0 ha
Surveyed Area: 0 ha

COMPOSITE
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

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)

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

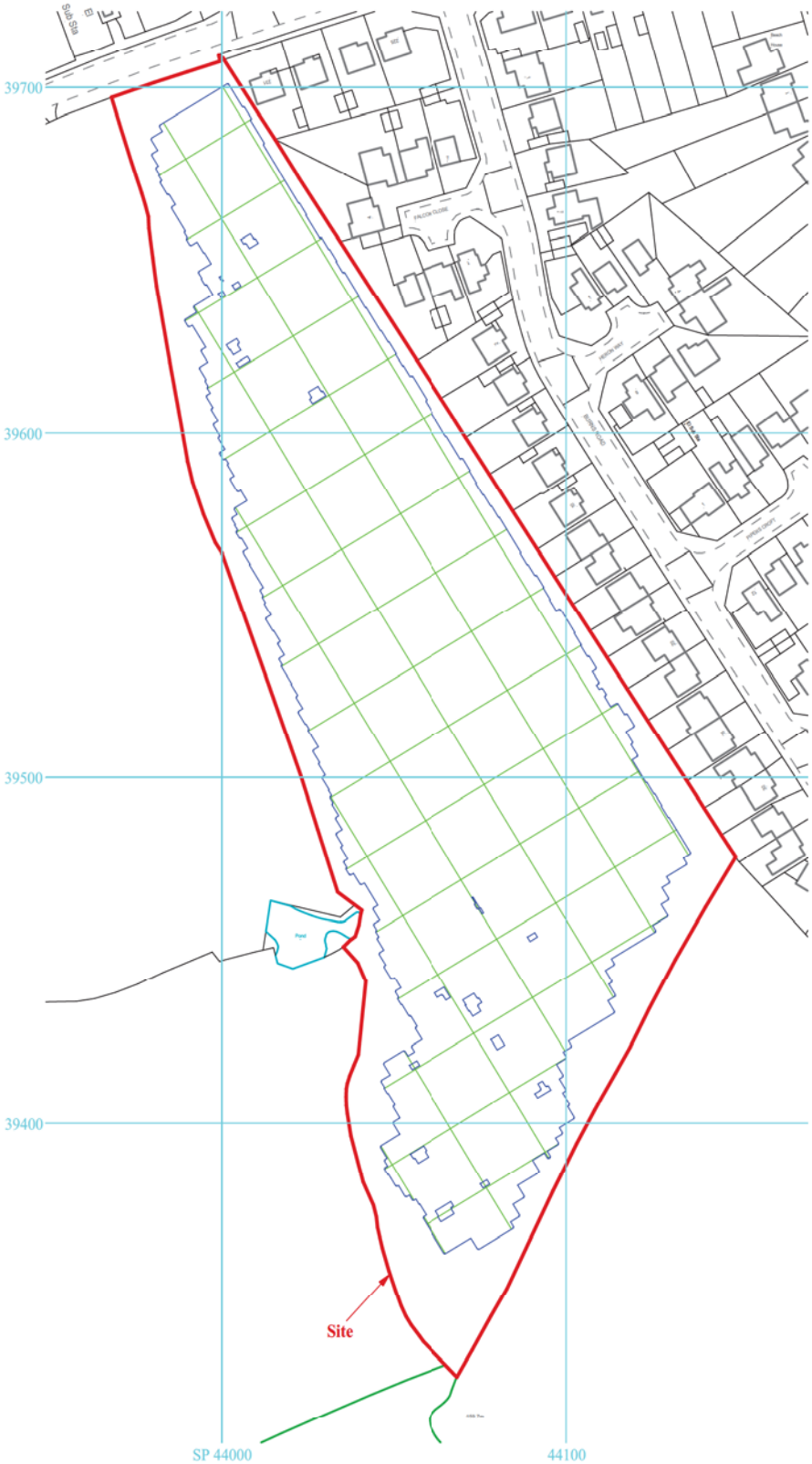
Source Grids: 81
1 Col:0 Row:14 grids\80.xgd
2 Col:0 Row:15 grids\81.xgd
3 Col:1 Row:13 grids\76.xgd
4 Col:1 Row:14 grids\77.xgd
5 Col:1 Row:15 grids\78.xgd
6 Col:1 Row:16 grids\79.xgd
7 Col:2 Row:10 grids\69.xgd
8 Col:2 Row:11 grids\70.xgd
9 Col:2 Row:12 grids\71.xgd
10 Col:2 Row:13 grids\72.xgd
11 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
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



Land at Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)

Figure 1. Location of site within Banbury and Oxfordshire

THAMES VALLEY ARCHAEOLOGICAL SERVICES



BRB 16/42

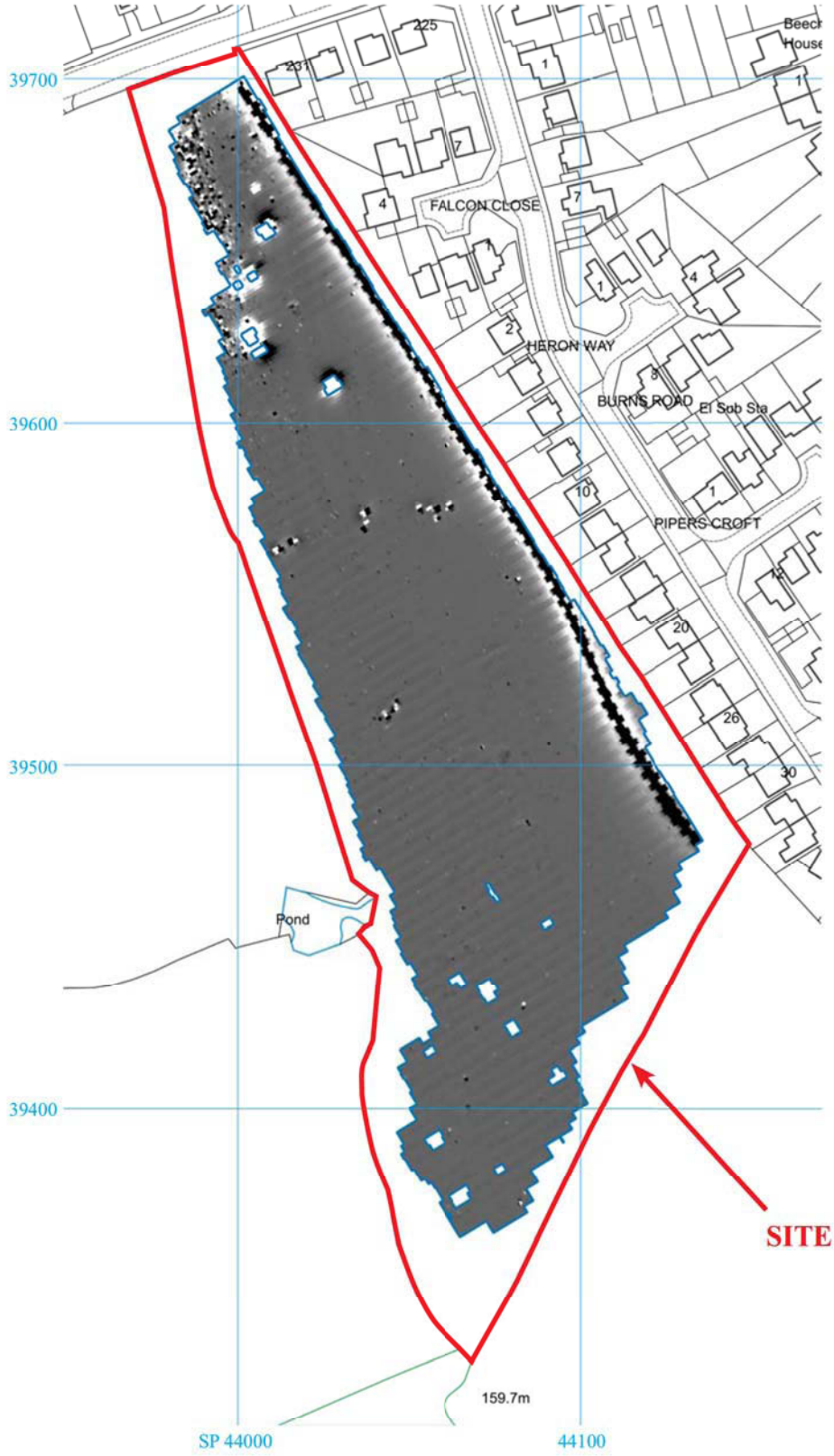
N

Land at Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016 Geophysical Survey (Magnetic)

Figure 2. Survey grid layout.

0 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES



BRB 16/42

N

Land at Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)

Figure 3. Plot of raw gradiometer data.

0m 100m

+100 nT

-100 nT

THAMES VALLEY ARCHAEOLOGICAL SERVICES

BRB 16/42

N

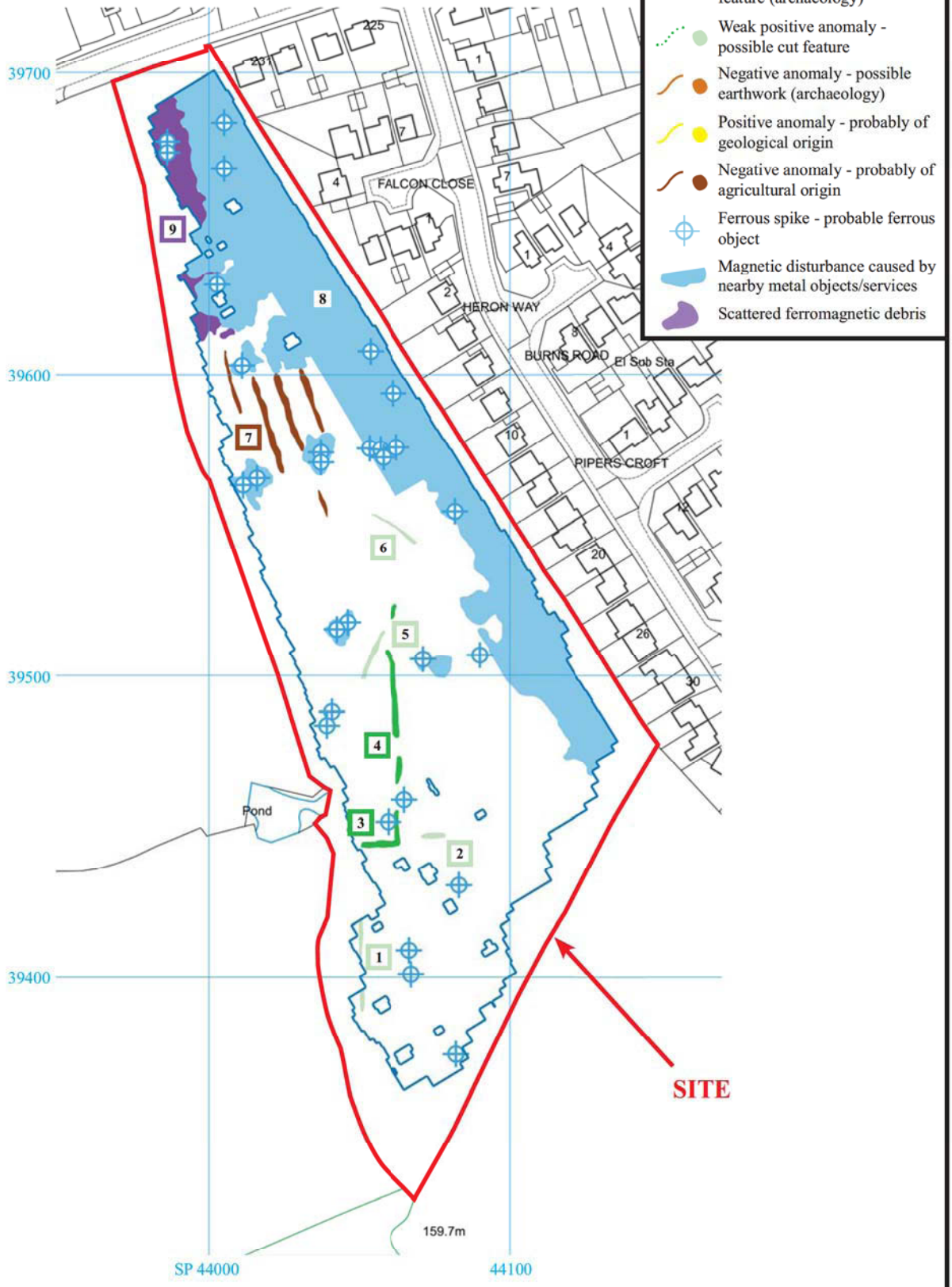
Land at Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)

Figure 4. Plot of minimally processed gradiometer data.

0m 100m

+2.2 nT
-1.8 nT

THAMES VALLEY ARCHAEOLOGICAL SERVICES



BRB 16/42

N

Land at Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)
Figure 5. Interpretation plot.

0m 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES

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

Plate 2. Site looking north west.

BRB 16/42

Land off Broughton Road, Crouch Hill, Banbury, Oxfordshire, 2016
Geophysical Survey (Magnetic)
Plates 1 - 2.

THAMES VALLEY ARCHAEOLOGICAL SERVICES

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

Thames Valley Archaeological Services Ltd,
47-49 De Beauvoir Road, Reading,
Berkshire, RG1 5NR

Tel: 0118 9260552
Fax: 0118 9260553
Email: tvas@tvas.co.uk
Web: www.tvas.co.uk