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S E R V I C E S

**Land at Hanwell Fields,
Banbury, Oxfordshire**

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: HRB21/169

(SP 4469 4253)

Land at Hanwell Fields, Banbury, Oxfordshire

Geophysical Survey (Magnetic) Report

For Manor Oak Homes Ltd

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code HRB 21/169

October 2021

Summary

Site name: Land at Hanwell Fields, Banbury, Oxfordshire

Grid reference: SP 4469 4253

Site activity: Magnetometer survey

Date and duration of project: 24th September 2021

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: HFB21/169

Area of site: c.3.32ha

Summary of results: A small number of magnetic anomalies of potential archaeological interest were detected by the geophysical survey. These include a penannular positive linear anomaly and two positive linear anomalies which may indicate the presence of buried archaeological features.

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✓ 15.10.21 Tim Dawson✓ 15.10.21
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Land at Hanwell Fields, Banbury, Oxfordshire A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 21/169b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Hanwell Fields, Banbury (SP 4469 4253) (Fig. 1). The work was commissioned Mr William Main of Manor Oak Homes Limited, 21 The Point, Market Harborough, Leicestershire LE16 7NU.

Planning permission is to be sought from Cherwell District Council for a residential development on a parcel of land at Hanwell Fields. As such, a geophysical survey has been requested to inform the application. This is in accordance with the *National Planning Policy Framework* (NPPF 2019) and the District's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock on the 24th of September 2021 and the site code is HRB21/169.

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

Location, topography and geology

The 3.32ha site is located on the northern edge of Banbury, on the north side of Duke's Meadow Drive. The site is a sub-triangular parcel of land that is sloped from 130m above Ordnance Datum (aOD) in the north-west to 108m aOD in the south-east. The site is currently under grass and shrubs and is not being utilised. The underlying geology is stated as Middle Lias Silts and Clays in the west and Lower Lias Mainly Clay in the east (BGS 1982).

Site history and archaeological background

The archaeological background has been highlighted in a desktop study (Tabor 2021). To summarise, the archaeological potential stems from a number of prehistoric sites discovered in the area including Neolithic, Bronze Age and Iron Age sites as well as a number of Palaeolithic finds. There is also some evidence of Roman activity in the area. A geophysical survey and excavations to the west of the site revealed a number of broadly prehistoric features (Bray and Dawson 2015, McNicol-Norbury 2015a and b).

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating north to south zig-zag orientation across the survey area. A small amount of ferrous debris in the eastern part of the site caused some interference. Conditions were dry and bright.

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 European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 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 two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10

mounted at the rear of the cart. 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.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses 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
Clip from -1.65 to 1.69 nT	Enhance the contrast of the image to improve the appearance of possible archaeological 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.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

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 2.18.15 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

The geophysical survey recorded a range of magnetic anomalies across the whole site area (Figs. 2 and 3). The most striking of these are a number of parallel positive linear anomalies [Fig. 4: 1] which run east to west across the entire site. These are regularly spaced between 5m and 10m apart and most likely represent the furrows of a ridge and furrow farming system of medieval or post-medieval date. Across the centre, the north-west and in the south-western parts of the site are areas of magnetic debris [2]. These are represented by positive and negative responses with a high amplitude scattered across a large area and are most likely caused by ferrous debris, some of which could be seen on the surface of the field. Along the southern boundary and in the east of the site are areas of regular magnetic disturbance [3], most likely caused by fencing along the site boundary.

In the south-west corner of the site is a curved positive linear anomaly [4]. This penannular feature is orientated to the south-east and has a diameter of c.8m and possibly represents a ring ditch. To the north-east of this is a weak positive linear anomaly [5] which runs from the south-west to the north-east across the centre of the site for 100m. To the north-east is a stronger positive linear anomaly [6] orientated from the north-west to the south-east and running for c.36m. These positive linear anomalies may represent field boundaries of unknown date.

Conclusion

Whilst a significant number of anomalies were revealed by the geophysical survey, the majority appear to be agricultural in origin with some evidence of magnetic debris most likely due to the ferrous objects that could be seen on the surface. There were however some of potential archaeological interest: two positive linear anomalies, most likely field boundaries, and in the south-eastern corner a potential ring ditch. These anomalies suggest the potential for some prehistoric features to be present.

References

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- CI/A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading
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- Tabor, R, 2021, 'Land at Hanwell Fields, Banbury, Oxfordshire, A desktop study', Thames Valley Archaeological Services unpubl rep 21/169, Reading

Appendix 1. Survey and data information

Programme:

Name: TerraSurveyor
Version: 3.0.25.0

Raw data

Filename: HRB21-169 RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 444565.076310632, 242597.541342639 m
Southeast corner: 444609.666310632, 242465.071342639 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 44.6 m x 132 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 14863, Recorded: 14863

Stats

Max: 107.13
Min: -108.93
Std Dev: 11.81
Mean: -2.64
Median: -1.19
Composite Area: 0.59068 ha
Surveyed Area: 0.49361 ha

Filename: HRB21-169 B RAW.xcp

Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 444599.486677795, 242615.964686142 m
Southeast corner: 444753.926677795, 242463.864686142 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 154 m x 152 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 55903, Recorded: 55903

Stats

Max: 107.23
Min: -109.74
Std Dev: 10.07
Mean: -0.96
Median: -0.67
Composite Area: 2.349 ha
Surveyed Area: 1.8532 ha

Filename: HRB21-169 C RAW.xcp

Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 444749.234025149, 242624.950751553 m
Southeast corner: 444811.114025149, 242518.740751553 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions

Survey Size (meters): 61.9 m x 106 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 15407, Recorded: 15407

Stats

Max: 106.92
Min: -109.72
Std Dev: 7.32
Mean: 0.13
Median: -0.37
Composite Area: 0.65723 ha
Surveyed Area: 0.50403 ha

Processed data

Filename: HRB21-169.xcp

Stats
Max: 1.66
Min: -1.65
Std Dev: 0.80
Mean: -0.03
Median: 0.00
Composite Area: 0.59068 ha
Surveyed Area: 0.49106 ha

GPS based Process

- 1 Base Layer.
- 2 Unit Conversion Layer (Lat/Long to UTM).
- 3 DeStripe Median Traverse:
- 4 Clip from -1.50 to 1.50
- 5 DeStagger by: 50.00cm, Shift Positions

Filename: HRB21-169 B.xcp

Stats
Max: 1.66
Min: -1.65
Std Dev: 0.70
Mean: 0.00
Median: 0.00
Composite Area: 2.349 ha
Surveyed Area: 1.8449 ha

GPS based Process

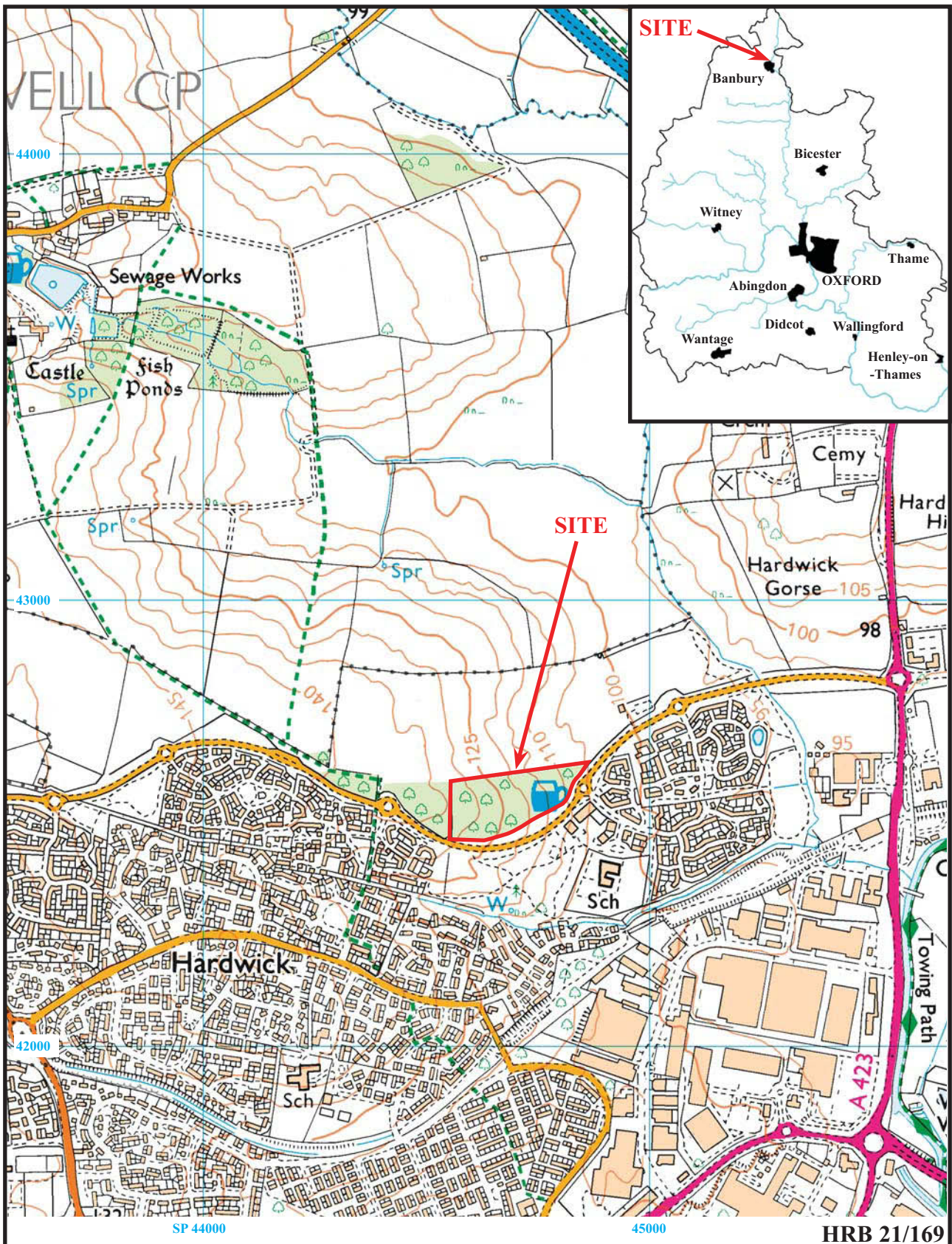
- 1 Base Layer.
- 2 Unit Conversion Layer (Lat/Long to UTM).
- 3 DeStripe Median Traverse:
- 4 Clip from -1.50 to 1.50
- 5 DeStagger by: 50.00cm, Shift Positions

Filename: HRB21-169 C.xcp

Stats
Max: 1.66
Min: -1.65
Std Dev: 0.64
Mean: 0.03
Median: 0.02
Composite Area: 0.65723 ha
Surveyed Area: 0.50212 ha

GPS based Process

- 1 Base Layer.
- 2 Unit Conversion Layer (Lat/Long to UTM).
- 3 DeStripe Median Traverse:
- 4 Clip from -1.50 to 1.50
- 5 DeStagger by: 20.00cm, Shift Positions



**Land at Hanwell Fields, Banbury,
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Geophysical Survey (Magnetic)**

Figure 1. Location of site within Banbury and Oxfordshire.

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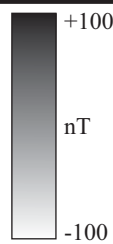
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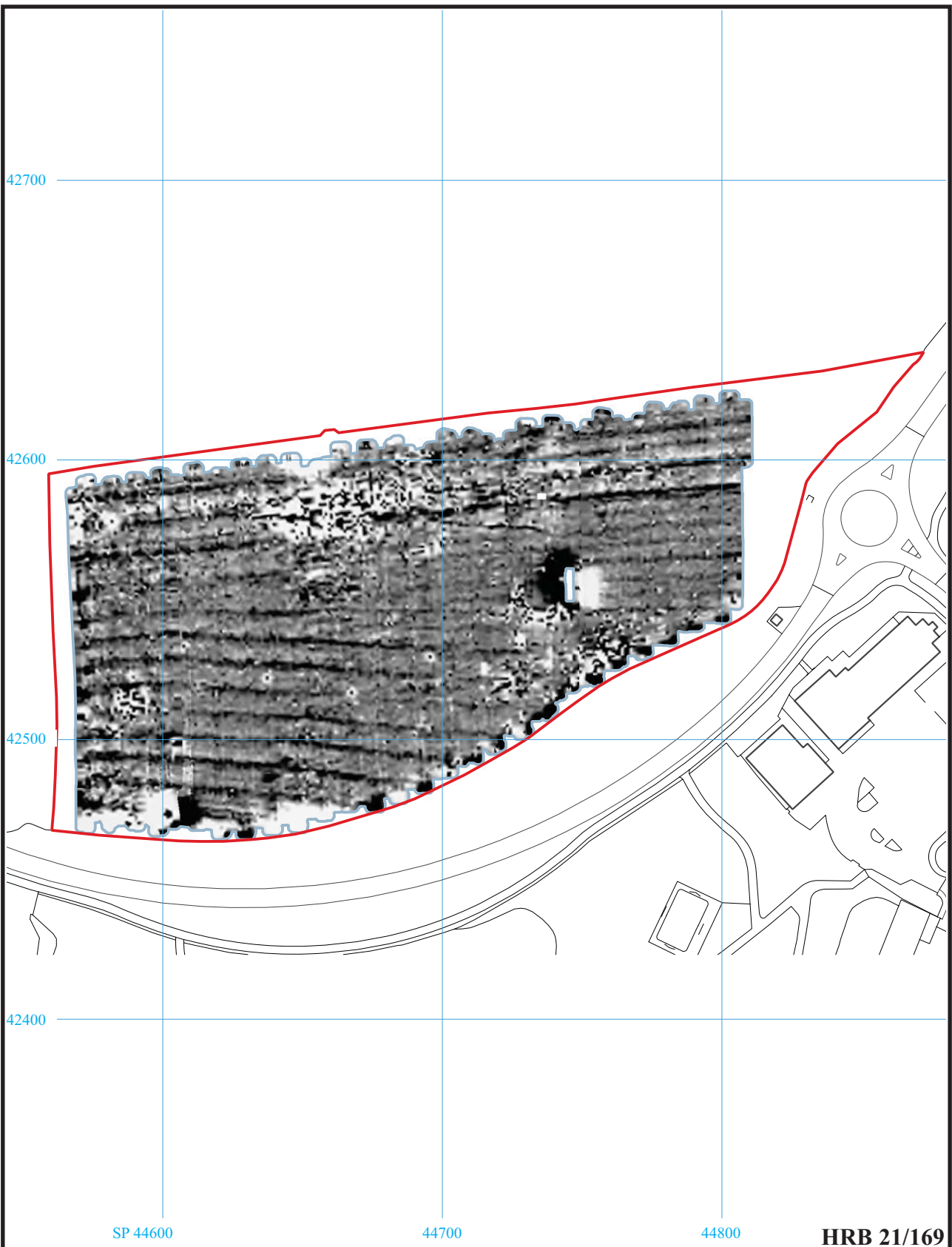


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Geophysical Survey (Magnetic)
Figure 2. Plot of raw gradiometer data.



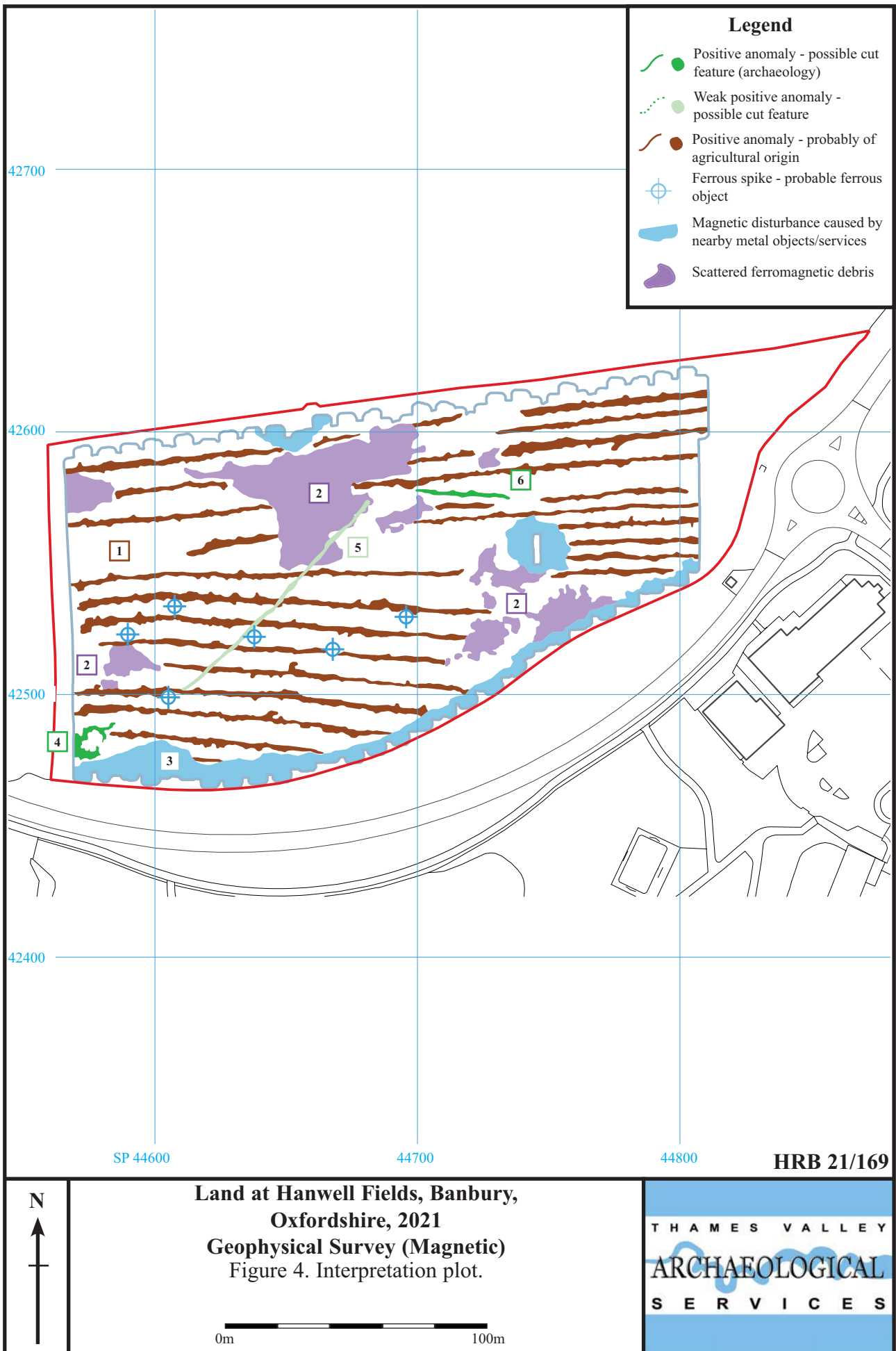


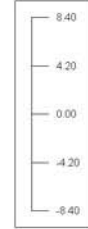
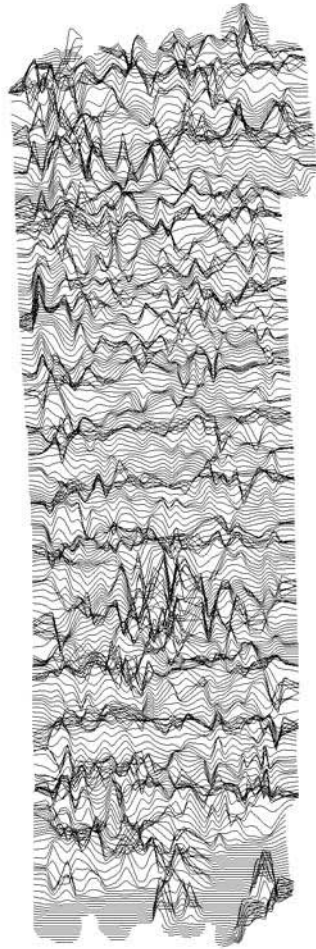
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**Land at Hanwell Fields, Banbury,
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Geophysical Survey (Magnetic)
Figure 3. Plot of processed gradiometer data.



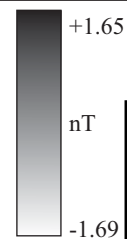


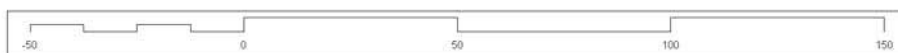
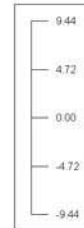
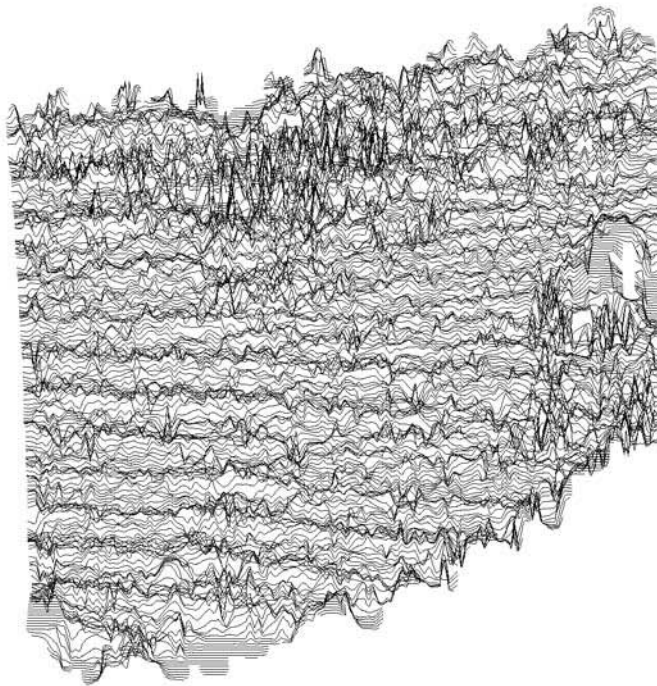


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**Land at Hanwell Fields, Banbury,
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Geophysical Survey (Magnetic)
Figure 5. Plot of processed x-y plot A.

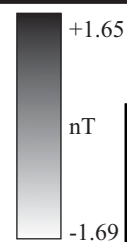


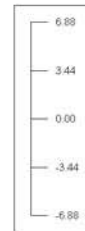
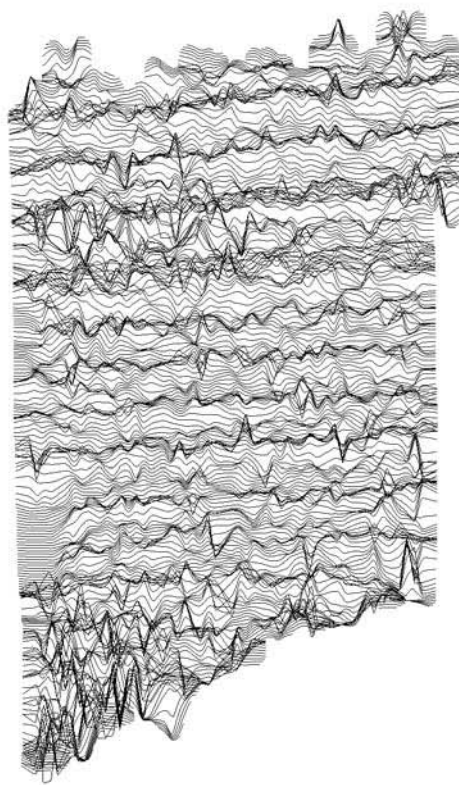


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Figure 6. Plot of processed x-y plot B.





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Geophysical Survey (Magnetic)
Figure 7. Plot of processed x-y plot C.





Plate 1. Western boundary looking south from the north-west.



Plate 2. Northern boundary looking west from the north-east



Plate 3. Central area of the field showing obstruction looking north-east



Plate 4. Eastern area of the field looking east from the centre of the field.

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**Land at Hanwell Fields, Banbury,
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Geophysical Survey (magnetic)
Plates 1 to 4.**

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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 AD 0 BC
Iron Age _____	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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