

**T H A M E S      V A L L E Y**

**ARCHAEOLOGICAL**

**S E R V I C E S**

**Land at Old Gloucester Road, Hayden,  
Cheltenham, Gloucestershire**

**Geophysical Survey (Magnetic)**

**by Kyle Beaverstock**

**Site Code: OGC17/92**

**(SO 9148 2426)**

# **Land at Old Gloucester Road, Hayden, Cheltenham, Gloucestershire**

## **Geophysical Survey (Magnetic) Report**

**For Finch Investment Limited**

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code OGC 17/92

**May 2017**

## Summary

**Site name:** Land at Old Gloucester Road, Hayden, Cheltenham, Gloucestershire

**Grid reference:** SO 9148 2426

**Site activity:** Magnetometer survey

**Date and duration of project:** 8th - 11th May 2017

**Project manager:** Steve Ford

**Site supervisor:** Kyle Beaverstock

**Site code:** OGC17/92

**Area of site:** c. 3.1ha

**Summary of results:** The survey was completed across the majority of the site area but was only able to locate magnetic anomalies relating to previous ridge and furrow agricultural activity. A series of strong magnetic anomalies along the north-eastern indicates the presence of a buried service.

**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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[www.tvas.co.uk/reports/reports.asp](http://www.tvas.co.uk/reports/reports.asp).*

Report edited/checked by: Steve Ford✓ 25.05.17 Tim Dawson✓ 25.05.17
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# Land at Old Gloucester Road, Hayden, Cheltenham, Gloucestershire A Geophysical Survey (Magnetic)

by Kyle Beaverstock

**Report 17/92**

## **Introduction**

This report documents the results of a geophysical survey (magnetic) carried out at Old Gloucester Road, Hayden, Cheltenham, Gloucestershire (Fig. 1). The work was commissioned by Mr Daniel Bray of Ecus Ltd. Eastlands II, London Road, Basingstoke, Hampshire, RG21 4AW on behalf of Finch Investment Ltd.

Planning consent is to be sought from Gloucestershire County Council to develop a parcel of land on the north side of Old Gloucester Road, Cheltenham, Gloucestershire (SO 9151 2426) (Fig. 1). The site occupies an area of 3.14ha. This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012) and County's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock and Jamie Williams between the 8th and 11th of May and the site code is OGC 17/92.

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 northern side of Old Gloucester Road between the dispersed hamlet of Hayden and the western suburbs of Cheltenham, which lie just a few hundred metres to the east (Fig. 1). It consists of two irregularly-shaped fields, both of which were under pasture at the time of the survey (Pl. 1-2), and an overgrown paddock which was not available for survey. The two pasture fields are divided by a post-and-wire fence. The site is bordered to the south by Old Gloucester Road (B4634), to the west by a house and garden, to the north-west by a track and the north-east by a stream. Topographically, the site is at a height of 35m above Ordnance Datum and slopes downhill from south-west to the stream in the north-east. The underlying geology is recorded as Charmouth Mudstone Formation (BGS 1988). Conditions during the survey were dry and sunny.

## **Site history and archaeological background**

The archaeological potential of the site has been highlighted in a desk-based assessment (Bray 2017). In summary this derives from its location within an area of the Forest of Dean, an area noted for its production of iron since Iron Age times. Numerous sites and finds of various periods are recorded for the wider study area,

much of it mining associated but with relatively little recorded for the site itself. However, previous fieldwork to the north included evidence of middle Saxon iron production (Pine *et al.* 2010) .

## **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. The majority of the area was surveyed without issue however, there was a fence running south-west to north-east and some overgrowth and trees around the edge of the site prevented a small amount from being surveyed.

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.

<b>Process</b>	<b>Effect</b>
Clip from -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: <i>y</i> doubled	Increases the resolution of the readings in the <i>y</i> 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.
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. 3) with the processed data then presented as a second figure (Fig. 4), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 5). 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 2.18.2 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

Magnetic anomalies were recorded across a large proportion of the site area (Figs. 3 and 4). The majority of these most likely indicate ridge and furrow farming [Fig 5: 1], these are represented by a series of parallel positive linear anomalies and negative linear anomalies running south-west to north-east with a single linear anomaly connecting them in a north-west to south-easterly direction. There was also a strong dipolar linear anomaly [2] running north-east to the south-west along the north-eastern boundary of the site which represents a high pressure gas main (Bray pers. comm.). The post-and-wire fence which separates the two survey fields created an area of magnetic disturbance along this boundary, as did the fences around the perimeter of the field. These strong readings may obscure weaker ones resulting from buried features. A large number of strong magnetic spikes were detected across the whole site, these most likely represent ferrous objects or debris from agricultural activity.

## Conclusion

The survey was completed across the majority of the site area but was only able to locate magnetic anomalies relating to previous ridge and furrow agricultural activity. The paddock in the western corner of the site was inaccessible for the survey. A series of strong magnetic anomalies along the north-eastern indicates the presence of a buried high-pressure gas main.

## References

- BGS, 1988, *British Geological Survey*, 1:50,000, Sheet 216, Solid and Drift Edition, Keyworth
- Bray, D, 2017, 'Old Gloucester Road, Cheltenham – Historic Environment Desk-Based Assessment', ECUS unpublished report 9337, Charlfield
- CI/A, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading
- CI/A, 2011, *Standard and Guidance: for archaeological geophysical survey*, Reading
- CI/A, 2014, *Standard and Guidance: for archaeological geophysical survey*, Reading
- English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage, Portsmouth (2nd edn)
- NPPF, 2012, *National Planning Policy Framework*, Dept Communities and Local Government, London

## Appendix 1. Survey and data information

### Programme:

Name: TerraSurveyor  
Version: 3.0.29.3

### Raw data

Survey corner coordinates (X/Y):  
Northwest corner: 391633.41, 224179.23 m  
Southeast corner: 391813.41, 223899.23 m  
Direction of 1st Traverse: 241.46568 deg  
Collection Method: ZigZag  
Sensors: 2 @ 1.00 m spacing.  
Dummy Value: 2047.5

### Dimensions

Composite Size (readings): 720 x 280  
Survey Size (meters): 180 m x 280 m  
Grid Size: 20 m x 20 m  
X Interval: 0.25 m  
Y Interval: 1 m

### Stats

Max: 96.61  
Min: -100.00  
Std Dev: 25.61  
Mean: -2.69  
Median: -0.35  
Composite Area: 5.04 ha  
Surveyed Area: 2.6197 ha

### Source Grids: 84

1 Col:0 Row:0 grids\76.xgd  
2 Col:0 Row:1 grids\77.xgd  
3 Col:0 Row:2 grids\78.xgd  
4 Col:0 Row:3 grids\79.xgd  
5 Col:0 Row:4 grids\80.xgd  
6 Col:0 Row:5 grids\81.xgd  
7 Col:0 Row:6 grids\82.xgd  
8 Col:0 Row:7 grids\83.xgd  
9 Col:0 Row:8 grids\84.xgd  
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84 Col:7 Row:10 grids\15.xgd

### Processed data

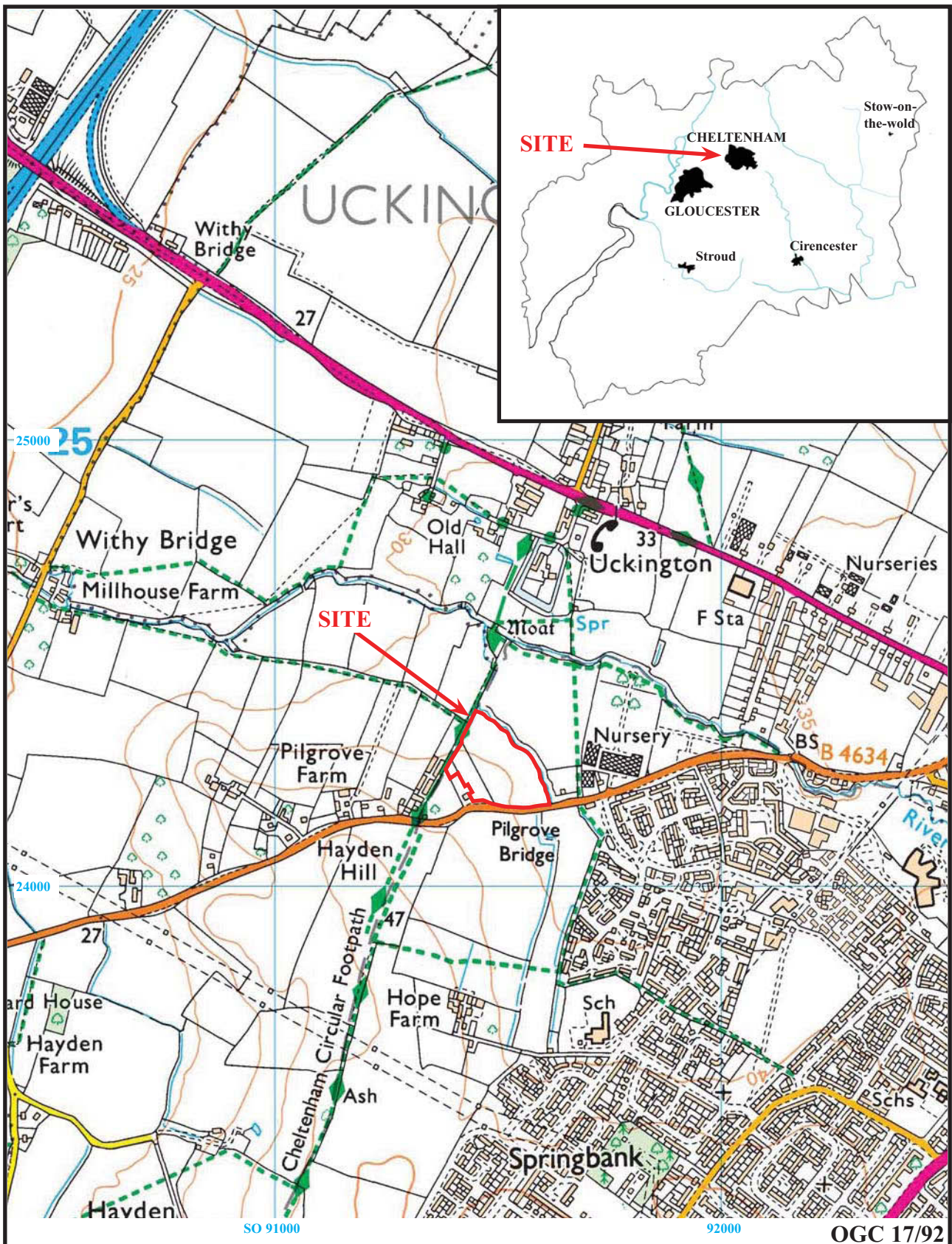
Stats  
Max: 2.20  
Min: -1.80  
Std Dev: 1.38  
Mean: 0.07  
Median: 0.02

### Processes: 6

- 1 Base Layer
- 2 DeStripe Median Sensors: Grids: All
- 3 De Stagger: Grids: All Mode: Both By: -1 intervals
- 4 Despike Threshold: 1 Window size: 3x3
- 5 Interpolate: Y Doubled.
- 6 Clipm -1.80 to 2.20 nT







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Figure 1. Location of site within Hayden and Gloucestershire.

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Figure 2. Survey grid layout.

0 100m



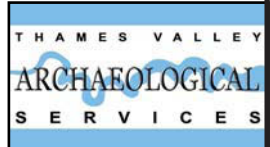
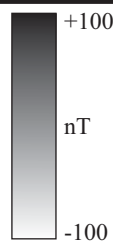
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Figure 3. Plot of raw gradiometer data.



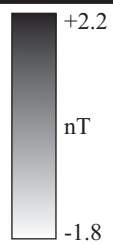


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Figure 4. Plot of minimally processed gradiometer data.



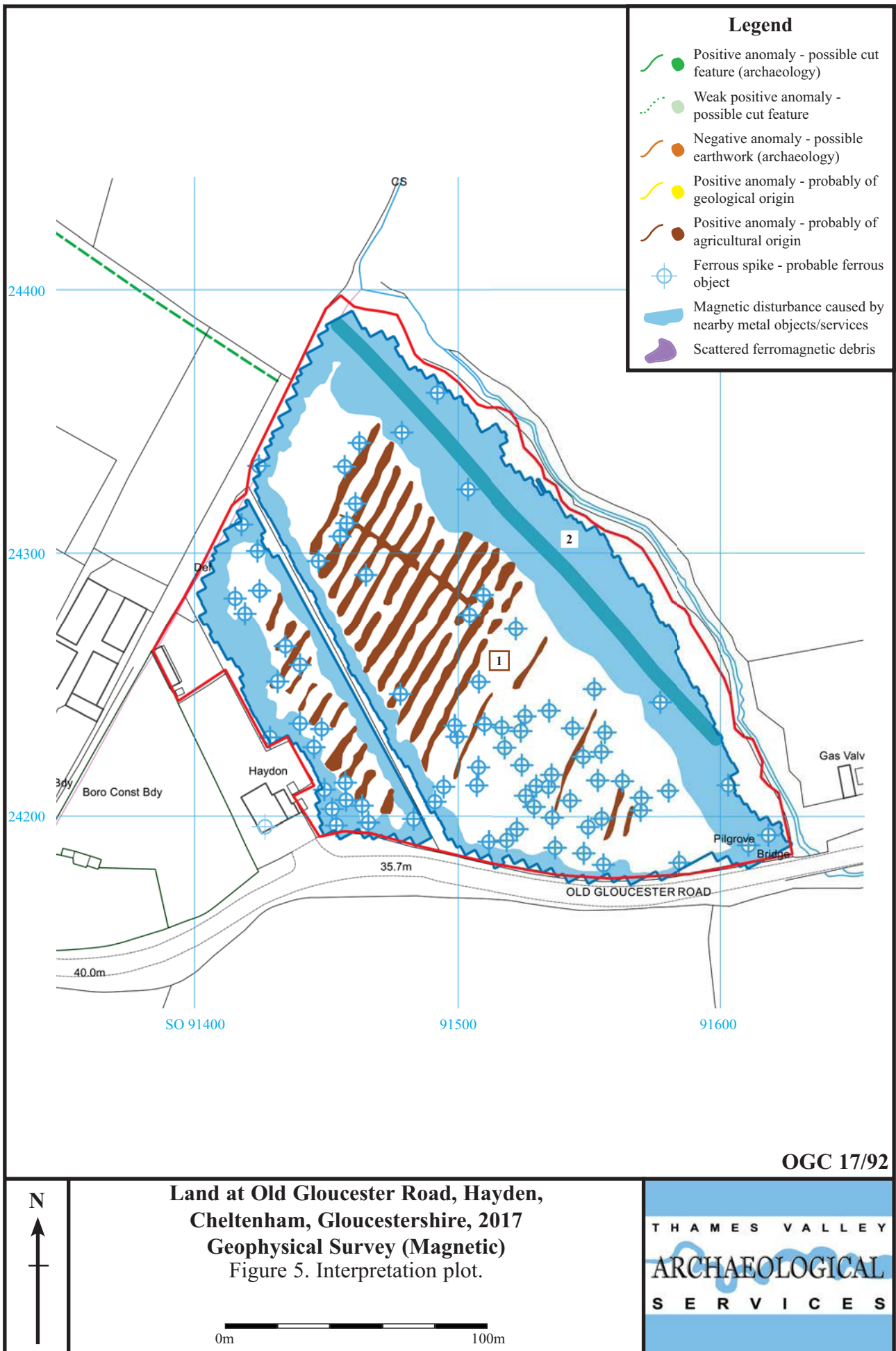






Plate 1. General view of the site, looking north-west from the south-eastern corner.



Plate 2. General view of the site, looking north-west along the dividing fence.

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Plates 1 and 2.

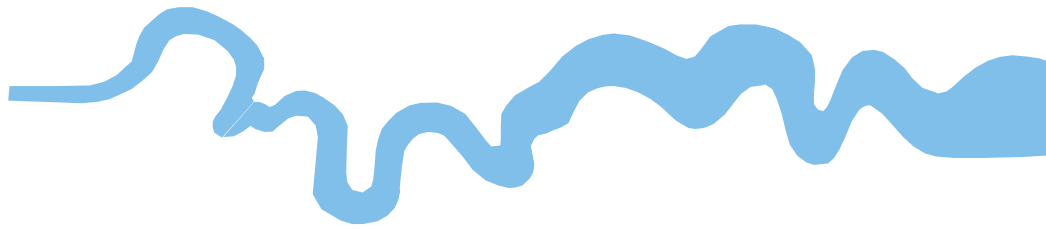
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## TIME CHART

	Calendar Years
Modern _____	AD 1901
Victorian _____	AD 1837
Post Medieval _____	AD 1500
Medieval _____	AD 1066
Saxon _____	AD 410
Roman _____	AD 43 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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