THAMES VALLEY

SERVICES

Land adjacent to Littlemore Hospital, Littlemore, Oxford

Geophysical (magnetometer) survey

by Marta Buzcek and Tim Dawson

Site Code: LLO12/12

(SP 5320 0261)

Land adjacent to Littlemore Hospital, Littlemore, Oxford

Geophysical Survey (Magnetic) Report

For Donnington Health Trust

by Marta Buczek and Tim Dawson

Thames Valley Archaeological Services Ltd

Site Code LLO 12/12

January 2013

Summary

Site name: Land adjacent to Littlemore Hospital, Littlemore, Oxford

Grid reference: SP 5320 0261

Site activity: Magnetometer survey

Date and duration of project: 8th - 9th January 2013

Project manager: Steve Ford

Site supervisor: Tim Dawson

Site code: LLO 12/12

Area of site: 3.71ha

Summary of results: Several features of archaeological interest were identified by the survey. These include a probable banjo enclosure, possibly within a landscape divided into larger rectangular enclosures, and several patches of possible thermoremnance caused by burning events in the past.

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✓ 11.11.12
	Andrew Mundin✓ 11.1.12

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Land adjacent to Littlemore Hospital, Littlemore, Oxford
A Geophysical Survey (Magnetic)

by Marta Buczek and Tim Dawson

Report 12/12b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at a plot of land adjacent to Littlemore Hospital, Littlemore, Oxford (SP 5320 0261) (Fig. 1). The work was commissioned by Mr Tom Smailes of Kemp & Kemp Property Consultants, Elms Court, Botley, Oxford, OX2 9LP, on behalf of Donnington Health Trust, Trust Office, 7 Groombridge Place, Donnington, Newbury, RG14 2JQ.

A planning application (12/02848/OUT) has been submitted for the subject for the development of up to 140 residential units together with 258 car parking spaces, 356 cycle parking spaces, landscaping and open space. A desk-based assessment was prepared (Ford 2012) and a geophysical survey recommended on the basis of its conclusions by the City Council Archaeologist.

This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012), and the City's policies on archaeology. The field investigation was carried out according to a brief provided by Mr David Radford, Archaeologist at Oxford City Council (Radford 2012). The fieldwork was undertaken by Marta Buczek and Tim Dawson on 8th - 9th January 2013 and the site code is LLO 12/12.

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 southern side of Oxford and to the west of Littlemore. It is currently one large parcel of land, of 3.71ha, bordered by a railway line to the north and the A4074 dual carriageway to the west (Fig. 1). The rear clinic buildings of Littlemore Hospital are just beyond the southern boundary of the site. The field displays a slight fall of slope towards the road in the west, and a more pronounced slope in the southern corner of the field. A 2m wide open ditch and associated bank runs parallel to the road on its western boundary. The highest points of the site are the centre and the eastern corners, at a height of 70m above Ordnance Datum. The underlying geology is Beckley Sand with the Thames floodplain to the west (BGS 1994).

The site is covered by long uneven grass with several patches of thick undergrowth (Plates 1 and 2). The northern boundary, which consists primarily of a metal post-and-wire fence, was relatively free of undergrowth except for at its eastern end where brambles grew thickly. The southern edge of the site was also heavily overgrown along its entire length. These factors had the effect of reducing the regularity of the survey walking and were by no means idea survey conditions. The ground beneath the growth was firm and the weather dry for both days of the survey.

Site history and archaeological background

The site lies within the archaeologically rich Thames Valley but at some distance from the historic Saxon and medieval centre of Oxford City and also some distance from medieval Littlemore itself. The site does, however lie within a broad zone of land within and around the southern and eastern suburbs of Oxford notable for the presence of a Roman pottery industry (Radford and Beckley 2011). Several kiln sites are known relatively close to the study area at Rose Hill, Cowley, Blackbird Leys and Littlemore itself and are a part of a major centre of production in the middle and later parts of the Roman period. The output was traded widely across southern England (Henig and Booth 2000; Young 2000; Booth *et al*. 2007; Radford 2012).

Fieldwork at Oxford Science Park, to the southeast of the study area, identified an early/middle Saxon settlement south of Littlemore Brook (Moore 2001; Booth *et al*. 2007) which is the earliest Saxon evidence within the Oxford City boundaries (Dodd 2003). A desk-based assessment has been produced for this site (Ford 2012) which also notes topographical attraction of such a Thames terrace site for prehistoric settlement.

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 30m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 3600 sampling points across a full 30m × 30m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution. The initial grid plan was drawn up using the Ordnance Survey map of the site with the origin of the grid in the field's southern corner and the southern boundary as the base line. This had to be altered however due to the presence of a large 2m wide ditch and associated bank along the field's western edge and the density of the undergrowth along the southern boundary. The grid used in the survey (Fig. 2), therefore, was further north and east of the one originally planned.

Additional undergrowth resulted in the reduction of the grid at the site's eastern end and along part of the northern boundary.

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 set out by both English Heritage (2008) and the Institute for Archaeologists (2002).

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 fast yet detailed survey 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 seem 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 GeoXH 6000 handheld GPS system with sub-decimetre 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 ArcheoSurveyorLite 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**
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.
Clip from -2.00 to 2.00 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.

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.7.22.01, 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 ArcheoSurveyorLite in 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 rotated to orientate it to north and combined with grid and site plans 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 survey shows a small number of discrete anomalies which are believed to be archaeological in origin, such as pits, as well as linear anomalies which may represent cut features such as ditches, most likely of archaeological origin.

Two linear features **[Fig. 4: 1, 2]** with strong magnetic signatures are located in the western and northern part of the surveying area and represent ditch-type anomalies, probably archaeological in origin. Of these anomalies, one **[1]** is roughly aligned north-south and forms a wide curve to the northeast at its northern end. It is intersected by a second, slightly curved, irregular linear anomaly **[2]** which is aligned southwest-northeast, approximately at right-angles to the first. It is unclear as to whether they are contemporary but if so they appear

to form the junction of three enclosures. A third linear **[3]** anomaly appears to strike out in a north-westerly direction from the curve of **[1]**.

The magnetic survey has revealed the outline of what appears to be a banjo enclosure **[4]**, so named for its shape: slightly bulbous in plan with a long entrance (access route or drove-way) to the south. Another anomaly adjoining the possible entrance to the west may be a further feature of the enclosure. The survey shows a number of stronger localised magnetic responses within the enclosure **[5]** which may represent fired structures such as ovens or natural occurring depressions or solution hollows, caused by water based silting infilling faults in the underlying geology.

Two weak positive, linear anomalies, one aligned roughly east-west in the west of the field **[6]** and the other north-south in the eastern end of the field **[7],** are possibly of archaeological origin and may represent ditch-type features.

A series of three negative anomalies occur in northern-western corner of the site **[8]** may indicate built-up areas of ground, possibly of archaeological origin, although this is an uncertain conclusion.

Several large positive anomalies surrounded by an associated negative response (dipolar) are plotted in the central **[9]**, southern **[10]** and eastern **[11]** parts of the survey area and most likely represent buried ferrous objects.

A scatter of bipolar anomalies, those that consist of both positive and negative responses, which appear to be aligned with magnetic north can be seen scattered across the northern half of the field **[12]**. Because of their magnetic orientation these can be interpreted as possible thermoremnant features, i.e. ground or objects that have been burnt *in situ* realigning their magnetic fields to that of the Earth. Due to their sizes, roughly 2-2.5m across these patches may represent the remains of subterranean kiln structures.

Several magnetic spikes can be identified across the whole field; these appear to be relatively sparse scatters of ferromagnetic objects, either archaeological or modern in origin. The main concentration of these appears to be in northern-western part of the field.

The survey was affected by magnetic disturbance along the northern and south-eastern boundaries of the site. This is most likely caused by the nearby metal fences which bordered the area on these sides. These disturbances may mask any features of possible archaeological origin in nearby areas.

Conclusion

The survey has successfully identified several features that are likely to be of archaeological origin in addition to areas of possible thermoremnance. Of particular note is the probable banjo enclosure apparently within another larger square enclosure. Other anomalies identified include those caused by nearby metal objects or/and services such as buried metal objects or wire fences. The latter anomalies may have had a masking effect on any underlying archaeological features.

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Appendix 1. Survey and data information

Raw data
COMPOSITE
Filename: 20130109.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: Marta Buczek, Tim Dawson on 09/01/2013
Assembled by: Tim Dawson on 09/01/2013
Direction of 1st Traverse: 315 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32000

Dimensions
Composite Size (readings): 840 x 240
Survey Size (meters): 210 m x 240 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 100.00
Min: -100.00
Std Dev: 6.97
Mean: -0.51
Median: -0.25
Composite Area: 5.04 ha
Surveyed Area: 2.988 ha

PROGRAMME
Name: ArcheoSurveyor
Version: 2.5.19.6

Source Grids: 41
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2 Col:0 Row:1 grids\08.xgd
3 Col:0 Row:2 grids\15.xgd
4 Col:0 Row:3 grids\21.xgd
5 Col:0 Row:4 grids\27.xgd
6 Col:0 Row:5 grids\32.xgd
7 Col:0 Row:6 grids\36.xgd
8 Col:0 Row:7 grids\40.xgd
9 Col:1 Row:0 grids\02.xgd
10 Col:1 Row:1 grids\09.xgd
11 Col:1 Row:2 grids\16.xgd
12 Col:1 Row:3 grids\22.xgd
13 Col:1 Row:4 grids\28.xgd
14 Col:1 Row:5 grids\33.xgd
15 Col:1 Row:6 grids\37.xgd
16 Col:1 Row:7 grids\41.xgd
17 Col:2 Row:0 grids\03.xgd
18 Col:2 Row:1 grids\10.xgd
19 Col:2 Row:2 grids\17.xgd
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21 Col:2 Row:4 grids\29.xgd
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26 Col:3 Row:2 grids\18.xgd
27 Col:3 Row:3 grids\24.xgd
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29 Col:3 Row:5 grids\35.xgd
30 Col:3 Row:6 grids\39.xgd
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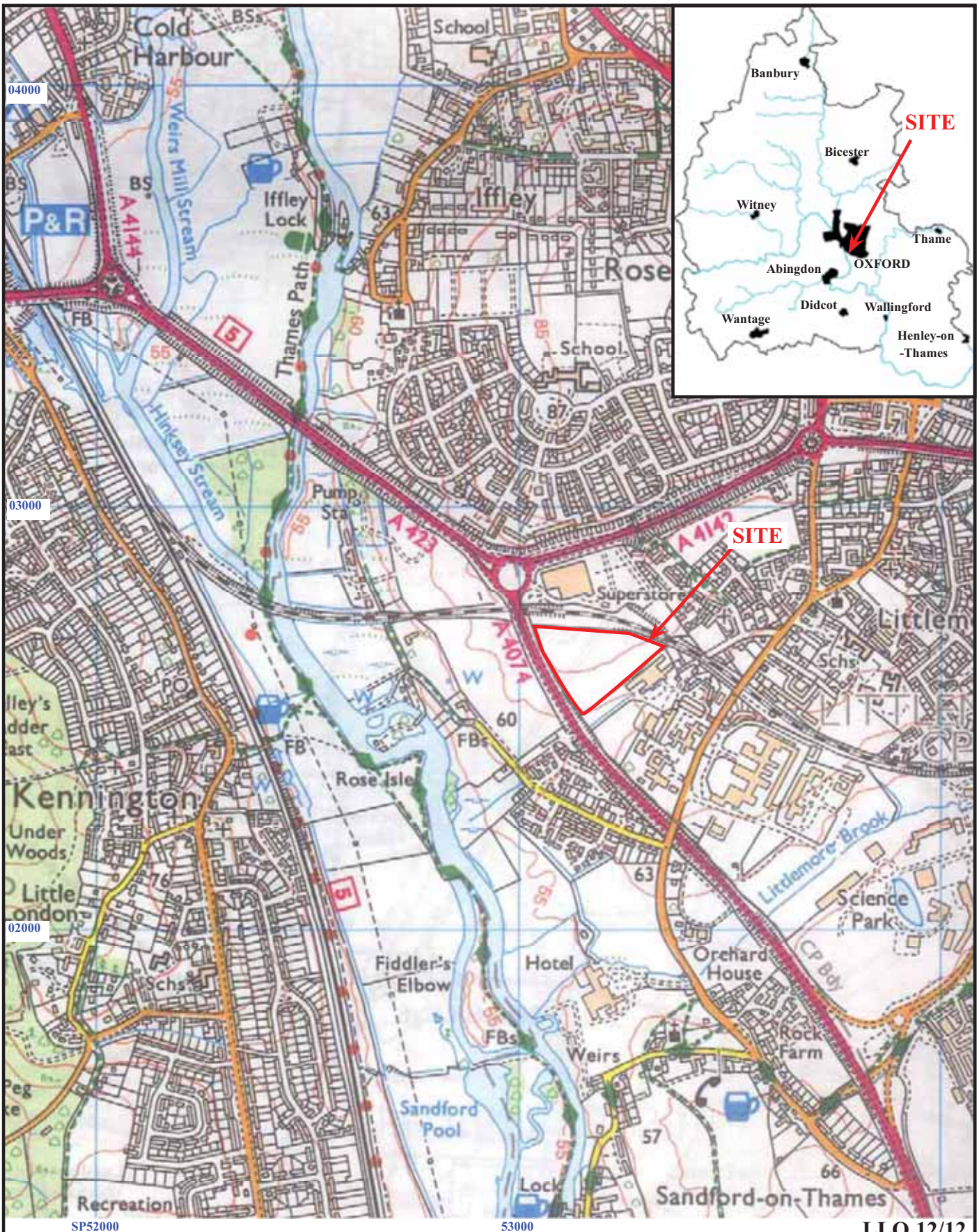
32 Col:4 Row:1 grids\12.xgd
33 Col:4 Row:2 grids\19.xgd
34 Col:4 Row:3 grids\25.xgd
35 Col:4 Row:4 grids\31.xgd
36 Col:5 Row:0 grids\06.xgd
37 Col:5 Row:1 grids\13.xgd
38 Col:5 Row:2 grids\20.xgd
39 Col:5 Row:3 grids\26.xgd
40 Col:6 Row:0 grids\07.xgd
41 Col:6 Row:1 grids\14.xgd

Processed data
Stats
Max: 2.00
Min: -2.00
Std Dev: 0.74
Mean: 0.00
Median: 0.01

Processes: 7
1 Base Layer
2 DeStripe Median Sensors: All
3 Despike Threshold: 1 Window size: 3x3
4 Clip from -2.00 to 2.00 nT
5 Range Match (Area: Top 90, Left 0, Bottom 149, Right 119) to Right edge
6 Edge Match (Area: Top 180, Left 240, Bottom 209, Right 359) to Left edge
7 Clip from -2.00 to 2.00 nT



LLO 12/12

Land adjacent to Littlemore Hospital, Littlemore, Oxford, 2013

Geophysical Survey (magnetic)

Figure 1. Location of site within Littlemore and Oxfordshire.

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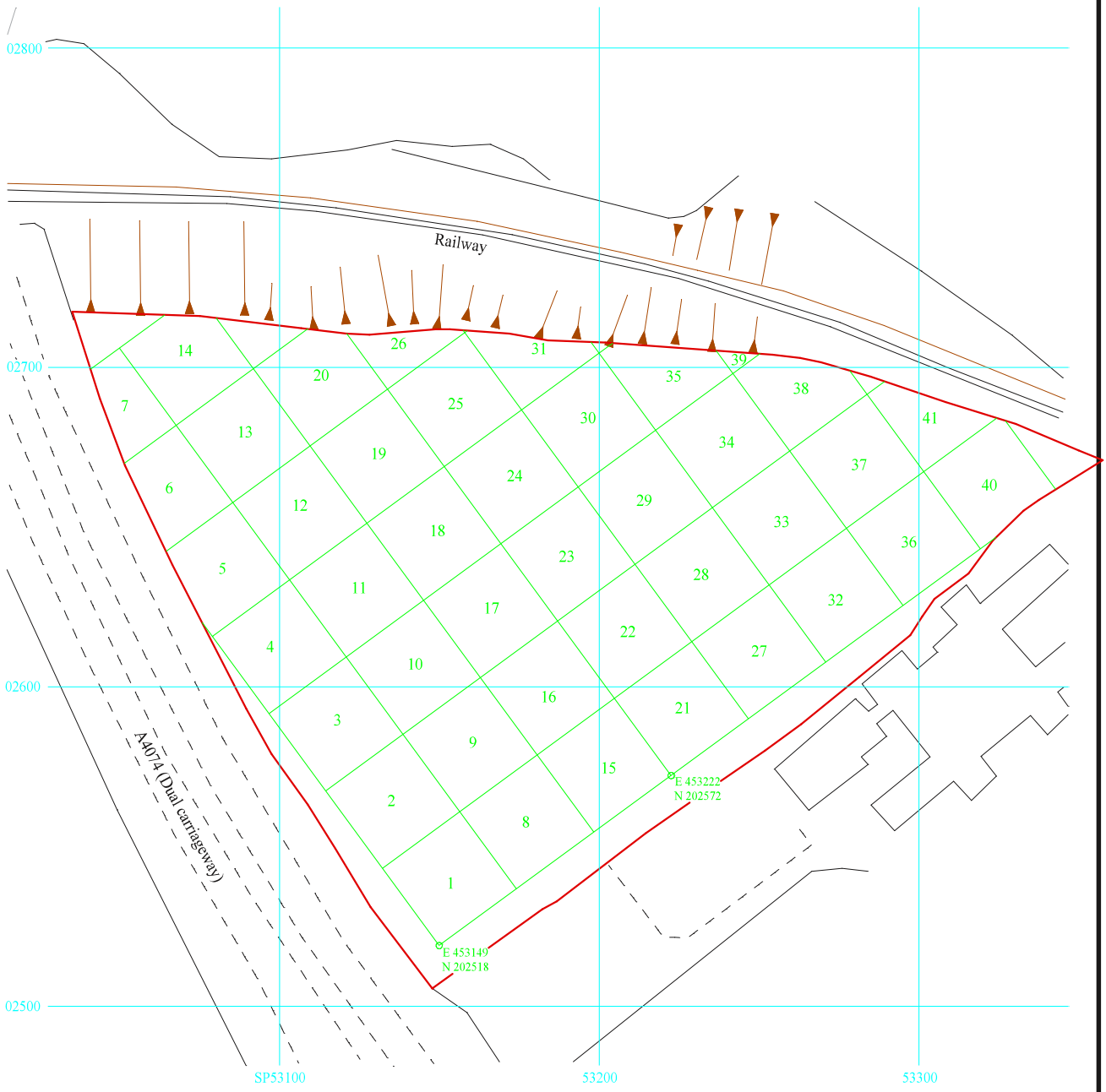

LLO 12/12b

N

Land adjacent to Littlemore Hospital, Littlemore, Oxford, 2013
Geophysical Survey (Magnetic)

Figure 2. Grid layout

0 100m

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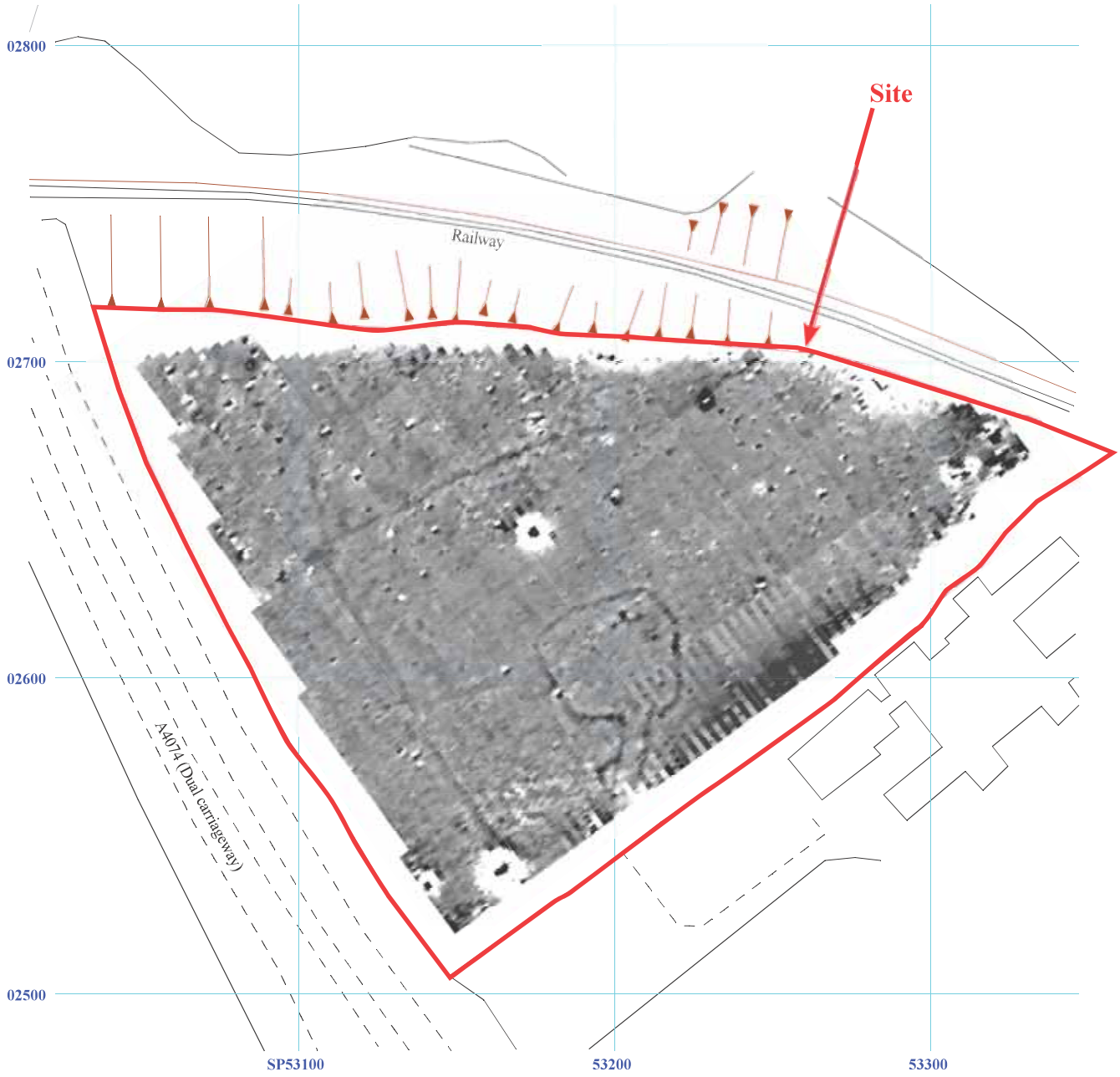

LLO 12/12b

N

Land adjacent to Littlemore Hospital, Littlemore, Oxford, 2013
Geophysical Survey (Magnetic)

Figure 3. Plot of minimally processed gradiometer data.

+2 nT

-2 nT

0m 100m

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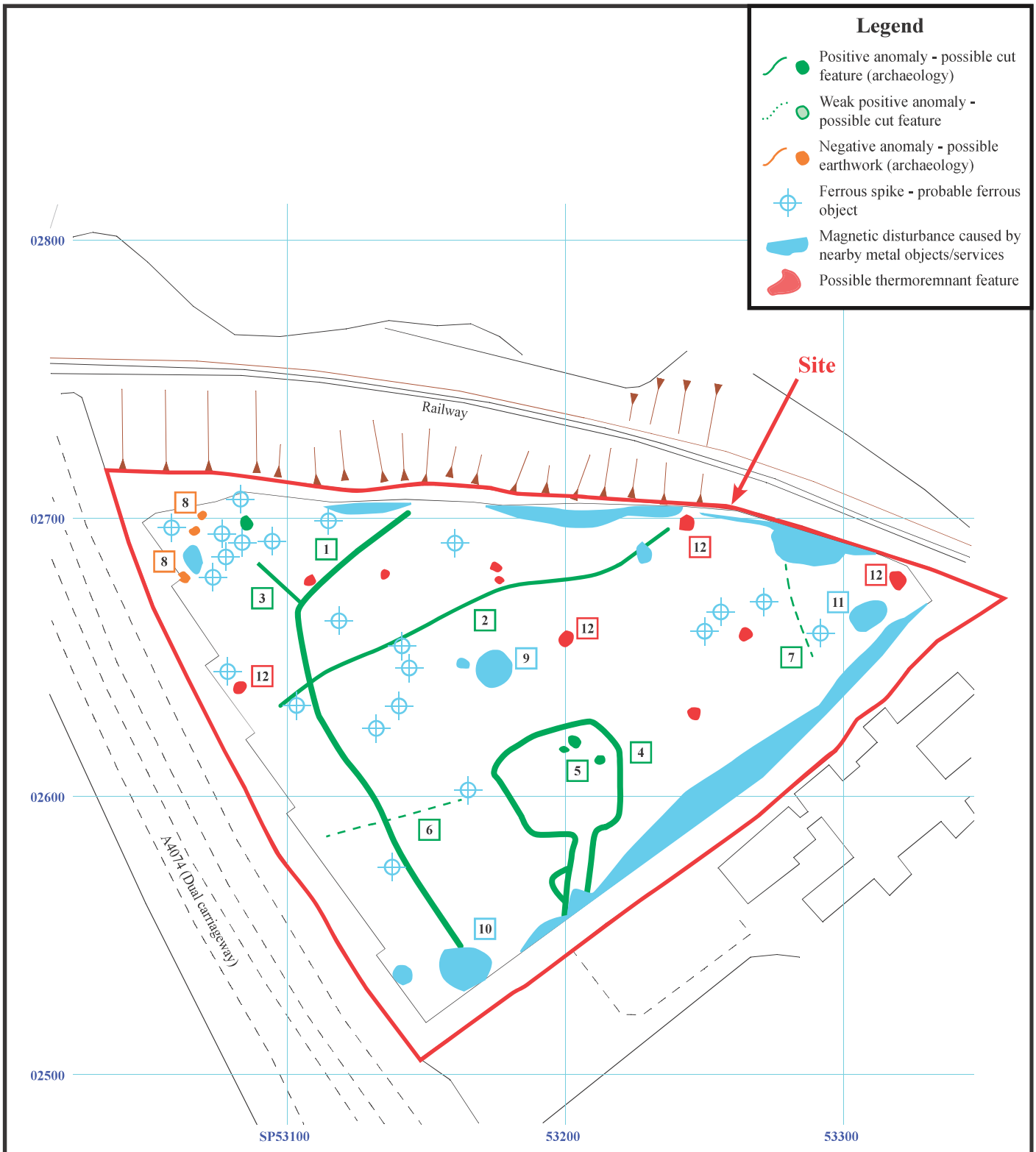

LLO 12/12b

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Land adjacent to Littlemore Hospital, Littlemore, Oxford, 2013
Geophysical Survey (Magnetic)
Figure 4. Interpretation plot.

0m 100m

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Plate 1. General view of the site, looking east.

Plate 2. The north-western corner of the site, looking north.

LLO 12/12b

Land adjacent to Littlemore Hospital, Littlemore, Oxford, 2013
Geophysical Survey (Magnetic)

Plates 1 and 2.

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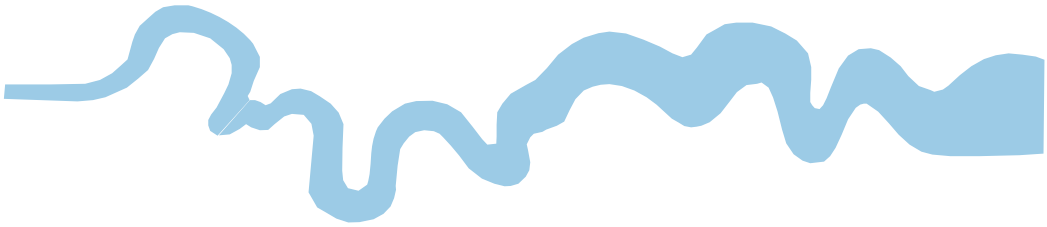
TIME CHART

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