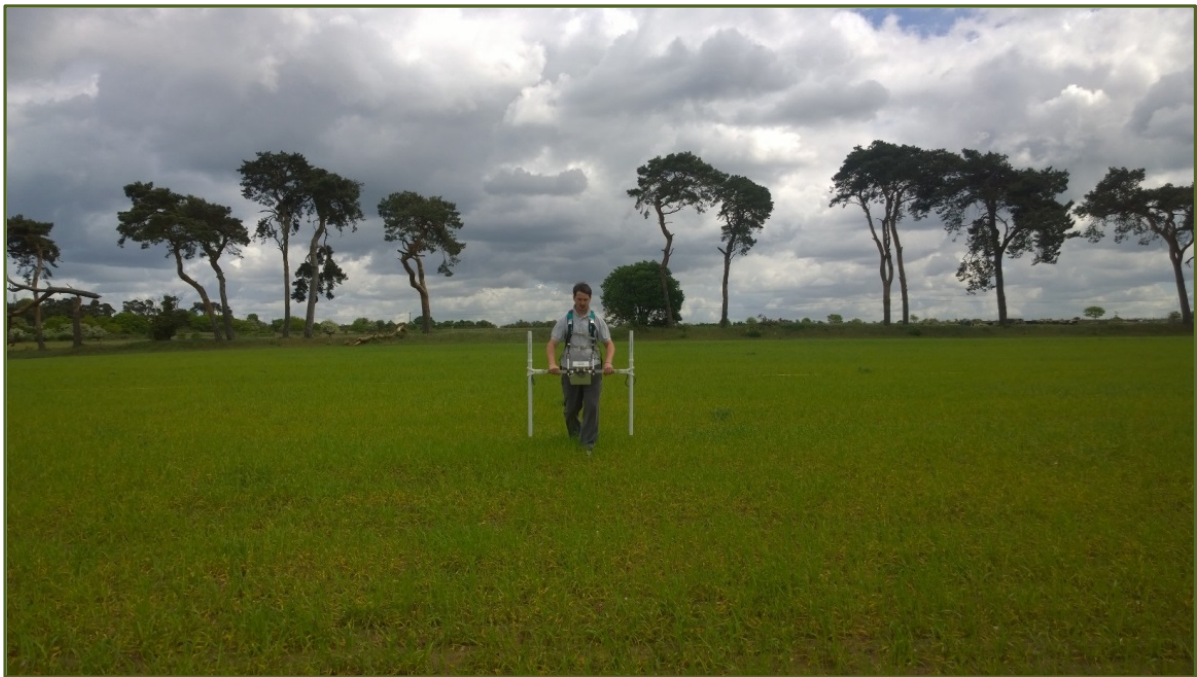




LAND SOUTH OF BROOM ROAD, LAKENHEATH, SUFFOLK

DETAILED MAGNETOMETER SURVEY



Report Number: 1056

May 2014



LAND SOUTH OF BROOM ROAD, LAKENHEATH, SUFFOLK

DETAILED MAGNETOMETER SURVEY

Prepared for:
Andrew Tester
Suffolk County Council Archaeological Service
Field Team
Ford House
Shire Hall
Bury St Edmunds
IP33 1RX

By:
Timothy Schofield HND BSc PifA

Britannia Archaeology Ltd
**115 Osprey Drive,
Stowmarket, Suffolk
IP14 5UX**

T: 01449 763034

info@britannia-archaeology.com

www.britannia-archaeology.com

Registered in England and Wales: 7874460

May 2014

Site Code	LKH 368	NGR	TL 722 821
Planning Ref.	-	OASIS	britanni1-179143
Approved By	Martin Brook	DATE	May 2014



The material contained within this report was prepared for an individual client and solely for the benefit of that client and the contents should not be relied upon by any third party. Britannia Archaeology Ltd will not be held liable for any loss or damage, direct, indirect or consequential, through misuse of, or actions based on the material contained within by any third party.

The results and interpretation of the report cannot be considered an absolute representation of the archaeological or any other remains. In the case of geophysical surveys the data collected, and subsequent interpretation is a representation of anomalies recorded by the survey instrument. Britannia Archaeology Ltd will not be held liable for any errors of fact supplied by a third party, or guarantee the proper maintenance of the survey stations.



CONTENTS

	Abstract	Page 5
1.0	Introduction	Page 6
2.0	Site Description	Page 6
3.0	Planning Policies	Page 7
4.0	Archaeological Background	Page 8
5.0	Project Aims	Page 10
6.0	Methodology	Page 10
7.0	Results and Discussion	Page 12
8.0	Conclusion	Page 13
9.0	Project Archive and Deposition	Page 13
10.0	Acknowledgements	Page 13
	Bibliography	Page 14
Appendix 1	Metadata Sheets	Page 15
Appendix 2	Technical Details	Page 19
Appendix 3	OASIS Form	Page 21
Figure 1	Grid, Referencing Information & Site Location Plan	1:2500
Figure 2	Raw Magnetometer Greyscale Plot	1:2000
Figure 3	Processed Magnetometer Greyscale Plot	1:2000
Figure 4	Processed Magnetometer XY Trace Plot	1:2000
Figure 5	Interpretation Plot of Magnetometer Anomalies	1:2000



ABSTRACT

Detailed fluxgate gradiometer survey was undertaken by Britannia Archaeology Ltd over one agricultural field (c.5.89 hectares) on the 6th - 8th May 2014. Despite the sites high potential for encountering remains of a prehistoric origin, only a relatively narrow range of anomalies were recorded, of which only a few have a potential archaeological derivation.

Isolated dipolar responses were most numerous and probably relate to the introduction of modern ferrous cultural debris into the topsoil. Fourteen areas of magnetic disturbance were recorded, some of which were caused by ferrous material on the boundary, two electric pylons and magnetic material probably associated with a demolished abattoir.

A series of weak positive linear trends indicative of agricultural strip fields or periglacial 'patterned ground' geological surface features were recorded in the south-eastern half of the plot.

Sixteen positive discrete anomalies were recorded throughout the dataset that are indicative of archaeological rubbish pits, however a modern or geological derivation cannot be ruled out.

One positive curvilinear anomaly indicative of a potential ring ditch has been recorded to the north of the demolished abattoir, it may be of archaeological significance however a modern origin cannot be ruled out.

Further targeted trial trenching to ground- test the hypotheses given in this report would be prudent.



1.0 INTRODUCTION

On the 6th - 8th May 2014 Britannia Archaeology Ltd (BA) undertook a detailed fluxgate gradiometer survey over 5.89 hectares of one agricultural field in advance of a proposed residential development on land south of Broom Road, Lakenheath, Suffolk (NGR TL 722 821).

The survey was commissioned by Andrew Tester of Suffolk County Council Archaeological Service Field Team in response to a design brief issued by Suffolk County Council Archaeology Service/Conservation Team (SCCAS/CT), (Brudenell. M, dated 28/03/2014).

2.0 SITE DESCRIPTION

The site is located approximately 500m south-west of the medieval core of the village of Lakenheath, on the edge of the modern settlement and in the Forest Heath District of Suffolk. It lies south of Broom Road and is bounded to the west by residential development, to the north by Broom Road and an existing housing development and to the east by agricultural fields and a nature reserve on Maidcross Hill which is the site of a sandy warren described as an important remnant of the Brecks Heath (Natural England). The nature reserve falls within the Breckland SSSI, but the site itself does not.

The site is a roughly rectangular parcel of land covering 5.89ha at a height of between 15 and 18.5m AOD, sloping down in a south-westerly direction. It comprises the majority of a larger field currently used for agriculture that also extends further to the west.

The underlying bedrock comprises chalk described as Holywell Nodular Chalk Formation and New Pit Chalk Formation. The superficial geology varies across the site and is described as a mixture of Croxton sand and gravel deposits and also 'Head' (clay, silt, sand and gravel) deposits. Both were formed in the Quaternary period under glacial and sub-aerial slope conditions (BGS 2014).

2.1 *Site visit*

A site visit was undertaken by Matthew Adams on the 30th April 2014 to assess the ground conditions and to carry out a risk assessment. It was found to be suitable for survey with only one overhead power cable (DP1) worthy of note, present in the northern half of the field. A new crop had been sown and had grown to a height measuring less than 10cm which did not affect the survey.

DP1



Taken from the north-eastern corner, looking south-west.

3.0 PLANNING POLICIES

3.1 *National Planning Policy Framework (NPPF, DCLG March 2012)*

The NPPF recognises that 'heritage assets' are an irreplaceable resource and planning authorities should conserve them in a manner appropriate to their significance when considering development. It requires developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. The key areas for consideration are:

- The significance of the heritage asset and its setting in relation to the proposed development;
- The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance;
- Significance (of the heritage asset) can be harmed or lost through alteration or destruction, or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification;
- Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred;
- Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.



3.2 Forest Heath Local Plan, (Policy 8.20, 1995)

Forest Heath's local plan development plan was adopted in 1995 and has undergone some revision since. A Core Strategy was released in 2010 and an updated assessment of their Heritage Policy is pending. The Council's position on heritage assets is summarised as follows:

- The District Council will seek provision to be made for the evaluation of archaeological sites of unknown importance and areas of high potential prior to the determination of development proposals. Where nationally or locally important sites, whether scheduled or not, and their settings, are effected by proposed development, there will be a presumption in favour of their preservation. On sites where there is no overriding case for preservation, development will not normally be permitted unless agreement has been reached to provide either for their preservation or for their recording and, where desirable, their excavation prior to development.

4.0 ARCHAEOLOGICAL BACKGROUND

The following archaeological background utilises data from the Suffolk Historic Environment Record, Suffolk Record Office, English Heritage PastScape (www.pastscape.org.uk) and the Archaeological Data Service (www.ads.ahds.ac.uk) (ADS).

There are no Scheduled Ancient Monuments, Designated Heritage Assets, Non-Designated Heritage Assets or Conservation Areas within the development area. However unknown Non-Designated Heritage Assets may exist on site.

No known archaeological work has been undertaken within the area, however a number of sites have been recorded on air photographs and isolated findspots are present within a 1km search radius centred on the proposed development.

Significant Lower Palaeolithic deposits have been noted during 19th century gravel workings located 350m north-east at Maidscross Hill (LKH 036). These contained numerous worked flint hand axes and flint artefact scatters associated with hominid migration routes along the Bytham River which flowed through this area before the Anglian Glaciation (approx. 500,000BC).

Later prehistoric sites are relatively well represented in a 1km radius around the centre of the site.

Mesolithic finds (LKH 127) have been recorded 1.1km to the north-east where a section cut through sand dunes on Lakenheath Warren in 1931 revealed microliths and worked flint. Five records dating to the Neolithic period are also noted and four of these (LKH 003, LKH 004, LKH 013 and LKH 044) relate to findspots located in two fields, around 1km to the north-east of the site. Neolithic Grooved Ware (LKH 013) and a single barbed, hollow base type arrowhead (LKH 003) were found as part of a larger multi-



period finds scatter. A polished greenstone axe (LKH 004) and a leaf-shaped arrow head (LKH 044) were found at Roman field which is also described as a multi-period site. This concentration suggests a possible focus of activity in this direction along the northern edge of the Fen.

Bronze Age pottery comprising 400 sherds of Beaker pottery (LKH 013) has been recovered to the north-east in the same location as the earlier Neolithic Groove ware.

Three further Bronze Age entries (LKH 041, LKH 048 & LKH 128) record find spots located to the north and north-east, in the same fields as the earlier Neolithic finds. The closest was located 600m to the north and comprised a barbed and tanged arrowhead and half a javelin head (LKH 048).

The remains of a possible Bronze Age round barrow (LKH 042) are also noted 500m north-east. This has been later associated with a medieval stone cross that stood on top, but is no longer extant.

The search results show a steady increase of activity into the Iron Age period with 11 records noted within the search area (LKH 014, LKH 020, LKH 029, LKH 041, LKH 076, LKH 108, LKH 156, LKH 181, LKH 202, LKH 211 and LKH 269). Two distinct areas of activity can be identified with significant finds and features recorded to the north and north-east, as with previous periods however the south-western Breckland/Fen boundary also seems to have been well used.

Five locations lying around 150 – 500m to the west (LKH 076, LKH 156, LKH 181, LKH 202 and LKH269), have provided evidence of Iron Age activity along the Fen Edge. Most notable is a burnt mound (LKH 156) containing a scatter of burnt flints, just inside the fenland area. A pit was also recorded close-by during an evaluation at Eriswell Drive (LKH 269) on the Breckland side of the margin, suggesting more substantial activity in the south-western area than just the finds scatters (LKH 076, LKH 181 and LKH 202) located to the north-west of the assessment site.

Romano-British activity in Lakenheath is focused in two areas. Dense activity is recorded over 1km to the north-east and finds and features have been noted 350m to the east. A Roman ditch was found adjacent to the High Street (LKH 076) and several finds (LKH 181) were also recovered at Bell meadow 800m north-east of the site.

Anglo-Saxon activity is well represented in the wider area with the famous warrior burial excavated at Lakenheath Airbase in 1996 lying 2km south. Five records (LKH 103, LKH 104, LKH 202 and LKH 315) are located within 300m – 1km north-west, west and south of site, and are once again located along the Fen Edge similar to the Roman and prehistoric records. The most notable record (LKH 315) relates to a long-maintained property boundary 700m west and in the modern settlement, which may be indicative of the early origins of the medieval and post-medieval settlement. Monitoring work at Anchor Lane (LKH 202 and LKH 322) also revealed middle to late Anglo-Saxon features. A Saxon bronze disc brooch with interlace ornamentation was also recovered 350m to the south.



The medieval core of Lakenheath is recorded in the SHER (LKH 254) and contains numerous medieval finds, sites and surviving buildings, its site lies approximately 300m to the north-west. Documentary evidence reveals Lakenheath to have been a significant settlement during the medieval period with a small port linked to the River Little Ouse located somewhere on the Fen edge to the west. Several other medieval find spots (LKH 057, LKH 103 and LKH Misc) are located nearby, with a medieval banked rabbit warren (LKH 174) also recorded 550m to the east.

Numerous post-medieval and modern finds, features and buildings are located around the site, with the focus to the north-west. The most significant for this development is the site of a windmill (LKH 131) located 130m to the west. Documentary sources detailing land division prior to enclosure in the early 19th century suggest that the site was part of land set-aside for local agriculture. It formed part of a three field rotation system where by each field was subdivided into furlongs and strips and the populous farmed two fields per year leaving the third fallow. The site comprised a segment of 'field three' which was made up of the land south of Broom Road.

Given the above, the predominant archaeological potential is for anomalies indicative of medieval and post-medieval agricultural field systems, although those associated with Roman and Saxon occupation are also possible.

5.0 PROJECT AIMS

A non-intrusive field survey by geophysical prospection is required of the development to determine the extent and significance of subsurface anomalies.

6.0 METHODOLOGY

6.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that the background magnetic susceptibility was relatively low, and therefore it was relatively simple to locate a suitable zero station.

6.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three to five grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument; this same point was used to zero the sensors throughout the survey providing a common zero point. The weather was changeable over the three days, with overcast conditions interspersed with long periods of sunshine on the first day causing sensor drift, and the characteristic parallel traverse 'striping' in the raw dataset (Figure 2) that is particularly prevalent in the eastern half of the dataset. Followed by overcast conditions on the second day and periods of rain on the final day.



6.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on 20 x 20m grids.

6.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of ± 0.1 m employing a Leica Viva Glonass Smart Rover GS08 real time kinetic (RTK) survey system. Data were converted to the National Grid Transformation OSTN02 and the instrument was regularly tested using stations with known ETRS89 coordinates. The grids were positioned on a north-west to south-east alignment (Figure 1).

6.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the amount of field boundary magnetic disturbance, which slightly reduced the area available.

6.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 2 and 3). An XY trace plot of the processed data has also been included (Figure 4).

The raw data is presented with no processing, and was clipped to produce a uniform greyscale plot, processed data schedules are also displayed below.

Raw Data:

Data Clipping: 1.00 standard deviation.
Display Clipping: +/- 3 standard deviations.

Processed Data:

De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre value=mean, replace with = mean;
De-stripe: Median Traverse: All;
Data Clipping: 1.00 standard deviation;
Display Clipping: +/- 3 standard deviations.

Grid number 45 was *not* used.

An interpretation plan characterising the anomalies recorded can be found at Figure 5, drawing together the evidence collated from both greyscale and XY trace plots (Figures



2, 3 and 4). All figures are tied into the National Grid and printed at an appropriate scale.

6.7 Software

Raw data were downloaded using DW Consulting's Archeosurveyor v2.0 and will be stored in this format as raw data. The software used to process the data and produce the composites was also DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. Interpretation plots were then produced using AutoCAD.

6.8 Grid Restoration

Britannia Archaeology Ltd positioned no reference stations within the field however the grids can be relocated using the geo-referenced stations presented in Figure 1; these coordinates can also enable the accurate targeting of geophysical anomalies.

7.0 RESULTS & DISCUSSION

Isolated dipolar ('iron spike') responses were most numerous throughout the dataset and were probably caused by the introduction of modern ferrous cultural debris into the topsoil through loss, rather than resulting from the presence of buried archaeological artefacts. These responses (yellow hatched circles) seem to be fairly evenly spaced throughout the field with no apparent concentration.

Fourteen areas of magnetic disturbance (yellow/pink hatching) were recorded that vary both in strength and shape. Those present on the sites periphery are caused by the location of ferrous material along the boundary. Two areas of magnetic disturbance (magenta hatching) located in the north-western third of the field demarcate the location of overhead electric pylons. The location of the demolished abattoir buildings have caused areas of magnetic disturbance to be recorded around the rectangular 'dummy readings', present in the centre of the dataset. It is likely that the smaller areas recorded nearby are also related to ferrous material associated with the abattoir. It may be prudent to further target some of these smaller areas to prove this theory.

A series of weak positive linear trends (green lines) have been recorded in the south-eastern half of the plot that are possibly indicative of agricultural strip fields. It is also possible however that they represent geological surface features found in periglacial environments and termed 'patterned ground', in this instance they take the form of stripes or polygons. Subsequent trial trenches could be targeted to test the hypotheses given above.

Sixteen positive discrete anomalies (orange hatching) have been recorded throughout the dataset that are indicative of archaeological rubbish pits, however a modern or geological derivation cannot be ruled out. Further archaeological investigations would be prudent.



One positive curvilinear anomaly (orange hatching) indicative of a potential ring ditch has been recorded to the north of the demolished abattoir. It is however close to the areas of magnetic disturbance and an electric pylon and therefore a modern origin cannot be ruled out. Targeted trenching could be used to further investigate this anomaly.

8.0 CONCLUSION

The site has a relatively low background magnetic susceptibility, due to the nature of the underlying superficial geology, this provided good clarity between the magnetic background and the more magnetically susceptible readings recorded in the anomalies. Despite the high potential for recording anomalies of an archaeological origin, only a small degree of those presented within this report are worthy of further archaeological investigation.

9.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections*, Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

10.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to thank Mr Andrew Tester of Suffolk County Council Archaeological Service Field Team for commissioning the project, and to Dr Mr Matthew Brudenell of Suffolk County Council Archaeological Service/Conservation Team for his advice throughout.



Bibliography

Adams, M. 2014. *Land North of Broom Road, Lakenheath, Suffolk; An Archaeological Desk-Based Assessment*. Britannia Archaeology Ltd.

Ayala, G. *et al.* 2004. *Geoarchaeology; Using Earth Sciences to Understand the Archaeological Record*. English Heritage.

Clark, A. J. 1996. *Seeing Beneath the Soil, Prospecting Methods in Archaeology*. BT Batsford Ltd, London.

David, A. 1995. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines*. No.1. English Heritage.

David, A. *et al.* 2008. *Geophysical Survey In Archaeological Field Evaluation*, Second Edition. English Heritage.

Department for Communities and Local Government, 2012. *National Planning Policy Framework (NPPF)*

Gaffney, C, Gater, J. and Ovenden, S. 2002. *The Use of Geophysical Techniques in Archaeological Evaluations*. IFA Technical Paper No. 6.

Gaffney, C. and Gater, J. 2003. *Revealing the Buried Past, Geophysics for Archaeologists*. Tempus Publishing Ltd.

Gurney, D. 2003. *Standards for Archaeology in the East of England*, East Anglian Archaeology Occasional Paper 14.

Institute for Archaeologists. 2011. *Standard and Guidance for Archaeological Geophysical Survey*.

Linford, N. 2006. Notes from an English Heritage Seminar.

Schmidt, A. 2001. *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service. Oxbow Books.

Whitten, D.G.A. 1978. *The Penguin Dictionary of Geology*. Penguin Books Ltd. London.

Witten, A.J. 2006. *Handbook of Geophysics and Archaeology*. Equinox Publishing Ltd. London.

Websites

The British Geological Survey, 2013, (Natural Environment Research Council) – Geology of Britain Viewer - www.bgs.ac.uk/opengeoscience/home.html?Accordion2=1#maps



APPENDIX 1 METADATA SHEETS

Raw Data

Filename	LAK 1 Raw.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MB, MCA, TPS on 5/8/2014
Assembled by	TPS on 5/9/2014
Direction of 1st Traverse	45 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	480 x 520
Survey Size (meters)	120.00m x 520.00 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00
Stats	
Max	8.14
Min	-6.94
Std Dev	2.53
Mean	0.71
Median	0.72
Composite Area	6.24 ha
Surveyed Area	4.89 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

Processed Data

Filename	LAK 1 Pro.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MB, MCA, TPS on 5/8/2014
Assembled by	TPSon 5/9/2014
Direction of 1st Traverse	45 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	480 x 520
Survey Size (meters)	120.00m x 520.00 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	5.58
Min	-5.66
Std Dev	1.69
Mean	0.03
Median	0.00
Composite Area	6.24 ha
Surveyed Area	4.89 ha
Program	



Name	ArcheoSurveyor
Version	2.5.16.0

Source Grids: 142	
1	Col:0 Row:0 grids\01.xgd
2	Col:0 Row:1 grids\02.xgd
3	Col:0 Row:2 grids\03.xgd
4	Col:0 Row:3 grids\04.xgd
5	Col:0 Row:4 grids\05.xgd
6	Col:0 Row:5 grids\06.xgd
7	Col:0 Row:6 grids\35.xgd
8	Col:0 Row:7 grids\36.xgd
9	Col:0 Row:8 grids\37.xgd
10	Col:0 Row:9 grids\38.xgd
11	Col:0 Row:10 grids\39.xgd
12	Col:0 Row:11 grids\64.xgd
13	Col:0 Row:12 grids\65.xgd
14	Col:0 Row:13 grids\66.xgd
15	Col:0 Row:14 grids\67.xgd
16	Col:0 Row:15 grids\68.xgd
17	Col:0 Row:16 grids\94.xgd
18	Col:0 Row:17 grids\95.xgd
19	Col:1 Row:0 grids\07.xgd
20	Col:1 Row:1 grids\08.xgd
21	Col:1 Row:2 grids\09.xgd
22	Col:1 Row:3 grids\10.xgd
23	Col:1 Row:4 grids\11.xgd
24	Col:1 Row:5 grids\12.xgd
25	Col:1 Row:6 grids\40.xgd
26	Col:1 Row:7 grids\41.xgd
27	Col:1 Row:8 grids\42.xgd
28	Col:1 Row:9 grids\43.xgd
29	Col:1 Row:10 grids\44.xgd
30	Col:1 Row:11 grids\69.xgd
31	Col:1 Row:12 grids\70.xgd
32	Col:1 Row:13 grids\71.xgd
33	Col:1 Row:14 grids\72.xgd
34	Col:1 Row:15 grids\73.xgd
35	Col:1 Row:16 grids\96.xgd
36	Col:1 Row:17 grids\97.xgd
37	Col:1 Row:18 grids\98.xgd
38	Col:1 Row:19 grids\99.xgd
39	Col:1 Row:20 grids\100.xgd
40	Col:1 Row:21 grids\121.xgd
41	Col:1 Row:22 grids\122.xgd
42	Col:1 Row:23 grids\123.xgd
43	Col:1 Row:24 grids\124.xgd
44	Col:1 Row:25 grids\125.xgd
45	Col:2 Row:0 grids\13.xgd
46	Col:2 Row:1 grids\14.xgd
47	Col:2 Row:2 grids\15.xgd
48	Col:2 Row:3 grids\16.xgd
49	Col:2 Row:4 grids\17.xgd
50	Col:2 Row:5 grids\18.xgd
51	Col:2 Row:6 grids\46.xgd
52	Col:2 Row:7 grids\47.xgd
53	Col:2 Row:8 grids\48.xgd
54	Col:2 Row:9 grids\49.xgd



55	Col:2	Row:10	grids\50.xgd
56	Col:2	Row:11	grids\74.xgd
57	Col:2	Row:12	grids\75.xgd
58	Col:2	Row:13	grids\76.xgd
59	Col:2	Row:14	grids\77.xgd
60	Col:2	Row:15	grids\78.xgd
61	Col:2	Row:16	grids\101.xgd
62	Col:2	Row:17	grids\102.xgd
63	Col:2	Row:18	grids\103.xgd
64	Col:2	Row:19	grids\104.xgd
65	Col:2	Row:20	grids\105.xgd
66	Col:2	Row:21	grids\126.xgd
67	Col:2	Row:22	grids\127.xgd
68	Col:2	Row:23	grids\128.xgd
69	Col:2	Row:24	grids\129.xgd
70	Col:2	Row:25	grids\130.xgd
71	Col:3	Row:0	grids\19.xgd
72	Col:3	Row:1	grids\20.xgd
73	Col:3	Row:2	grids\21.xgd
74	Col:3	Row:3	grids\22.xgd
75	Col:3	Row:4	grids\23.xgd
76	Col:3	Row:5	grids\24.xgd
77	Col:3	Row:6	grids\51.xgd
78	Col:3	Row:7	grids\52.xgd
79	Col:3	Row:8	grids\53.xgd
80	Col:3	Row:10	grids\54.xgd
81	Col:3	Row:11	grids\79.xgd
82	Col:3	Row:12	grids\80.xgd
83	Col:3	Row:13	grids\81.xgd
84	Col:3	Row:14	grids\82.xgd
85	Col:3	Row:15	grids\83.xgd
86	Col:3	Row:16	grids\106.xgd
87	Col:3	Row:17	grids\107.xgd
88	Col:3	Row:18	grids\108.xgd
89	Col:3	Row:19	grids\109.xgd
90	Col:3	Row:20	grids\110.xgd
91	Col:3	Row:21	grids\131.xgd
92	Col:3	Row:22	grids\132.xgd
93	Col:3	Row:23	grids\133.xgd
94	Col:3	Row:24	grids\134.xgd
95	Col:3	Row:25	grids\135.xgd
96	Col:4	Row:1	grids\25.xgd
97	Col:4	Row:2	grids\26.xgd
98	Col:4	Row:3	grids\27.xgd
99	Col:4	Row:4	grids\28.xgd
100	Col:4	Row:5	grids\29.xgd
101	Col:4	Row:6	grids\55.xgd
102	Col:4	Row:7	grids\56.xgd
103	Col:4	Row:8	grids\57.xgd
104	Col:4	Row:10	grids\58.xgd
105	Col:4	Row:11	grids\84.xgd
106	Col:4	Row:12	grids\85.xgd
107	Col:4	Row:13	grids\86.xgd
108	Col:4	Row:14	grids\87.xgd
109	Col:4	Row:15	grids\88.xgd
110	Col:4	Row:16	grids\111.xgd
111	Col:4	Row:17	grids\112.xgd
112	Col:4	Row:18	grids\113.xgd
113	Col:4	Row:19	grids\114.xgd



114	Col:4	Row:20	grids\115.xgd
115	Col:4	Row:21	grids\136.xgd
116	Col:4	Row:22	grids\137.xgd
117	Col:4	Row:23	grids\138.xgd
118	Col:4	Row:24	grids\139.xgd
119	Col:4	Row:25	grids\140.xgd
120	Col:5	Row:1	grids\30.xgd
121	Col:5	Row:2	grids\31.xgd
122	Col:5	Row:3	grids\32.xgd
123	Col:5	Row:4	grids\33.xgd
124	Col:5	Row:5	grids\34.xgd
125	Col:5	Row:6	grids\59.xgd
126	Col:5	Row:7	grids\60.xgd
127	Col:5	Row:8	grids\61.xgd
128	Col:5	Row:9	grids\62.xgd
129	Col:5	Row:10	grids\63.xgd
130	Col:5	Row:11	grids\89.xgd
131	Col:5	Row:12	grids\90.xgd
132	Col:5	Row:13	grids\91.xgd
133	Col:5	Row:14	grids\92.xgd
134	Col:5	Row:15	grids\93.xgd
135	Col:5	Row:16	grids\116.xgd
136	Col:5	Row:17	grids\117.xgd
137	Col:5	Row:18	grids\118.xgd
138	Col:5	Row:19	grids\119.xgd
139	Col:5	Row:20	grids\120.xgd
140	Col:5	Row:21	grids\141.xgd
141	Col:5	Row:22	grids\142.xgd
142	Col:5	Row:23	grids\143.xgd



APPENDIX 2 – TECHNICAL DETAILS

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.



Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.



APPENDIX 3 – OASIS FORM

OASIS ID: **britannia1-179143**

Project details

Project name Land South of Broom Road, Lakenheath, Suffolk; Detailed Magnetometer Survey.

Short description of the project Detailed fluxgate gradiometer survey was undertaken by Britannia Archaeology Ltd over one agricultural field (c.5.9 hectares) on the 6th - 8th May 2014. Despite the sites high potential for encountering remains of a prehistoric origin, only a relatively narrow range of anomalies were recorded, of which only a few have a potential archaeological derivation. Isolated dipolar responses were most numerous and probably relate to the introduction of modern ferrous cultural debris into the topsoil. Fourteen areas of magnetic disturbance were recorded, some of which were caused by ferrous material on the boundary, two electric pylons and magnetic material probably associated with a demolished abattoir. A series of weak positive linear trends indicative of agricultural strip fields or periglacial 'patterned ground' geological surface features were recorded in the south-eastern half. Sixteen positive discrete anomalies were recorded throughout the dataset that are indicative of archaeological rubbish pits, however a modern or geological derivation cannot be ruled out. One positive curvilinear anomaly indicative of a potential ring ditch has been recorded to the north of the demolished abattoir, it may be of archaeological significance however a modern origin cannot be ruled out. Subsequent targeted trial trenching to ground- test the hypotheses given in this report would be prudent.

Project dates Start: 06-05-2014 End: 08-05-2014

Previous/future work Yes / Yes

Any associated project reference codes P1058 - Contracting Unit No.

Any associated project reference codes R1056 - Contracting Unit No.

Any associated project reference codes LKH 368 - Sitecode

Type of project Field evaluation

Site status None

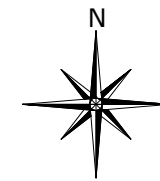
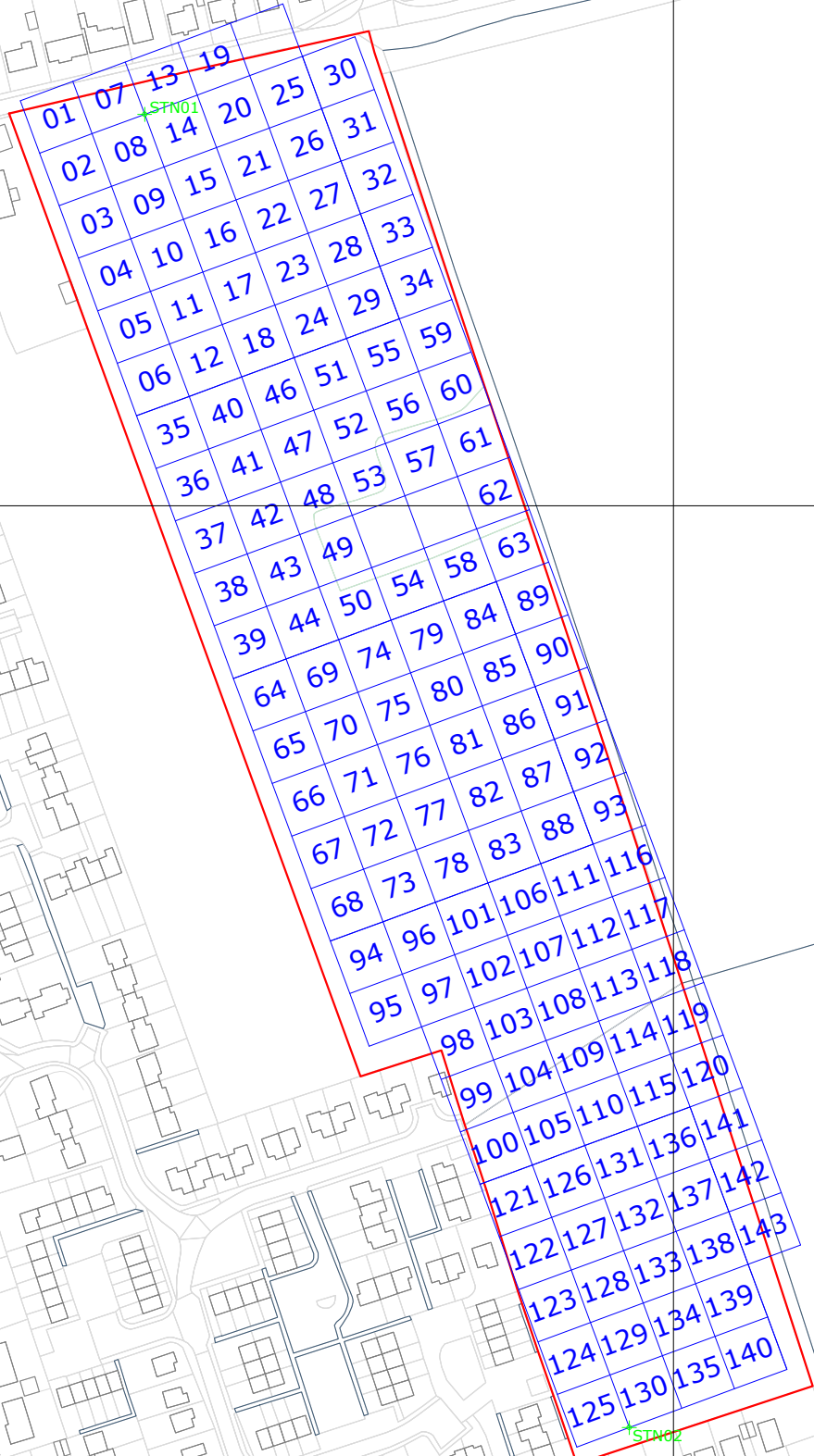
Current Land use Cultivated Land 3 - Operations to a depth more than




	0.25m
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Rural residential
Prompt	Direction from Local Planning Authority - PPS
Position in the planning process	Not known / Not recorded
Solid geology (other)	Holywell Nodular Chalk Formation
Drift geology (other)	Croxton Sand and Gravel, Head Clay Silt Sand and Gravel
Techniques	Magnetometry
Project location	
Country	England
Site location	SUFFOLK FOREST HEATH LAKENHEATH Land South of Broom Road, Lakenheath, Suffolk
Study area	5.89 Hectares
Site coordinates	TL 722 821 52.4093341113 0.531968503938 52 24 33 N 000 31 55 E Point
Height OD / Depth	Min: 15.00m Max: 18.50m
Project creators	
Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Local Planning Authority (with/without advice from County/District Archaeologist)
Project design originator	Matthew Adams
Project director/manager	Timothy Schofield
Project supervisor	Martin Brook
Type of sponsor/funding body	Archaeological Contractor
Name of sponsor/funding body	Suffolk County Council Archaeological Service
Project archives	
Physical Archive Exists?	No
Digital Archive recipient	Suffolk HER
Digital Contents	"Survey"



Digital Media available	"Geophysics", "Images raster / digital photography", "Survey"
Paper Archive recipient	Suffolk HER
Paper Contents	"Survey"
Paper Media available	"Report", "Survey ", "Unpublished Text"
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Land South of Broom Road, Lakenheath, Suffolk; Detailed Magnetometer Survey
Author(s)/Editor(s)	Schofield, T.P
Other bibliographic details	R1056
Date	2014
Issuer or publisher	Britannia Archaeology Ltd
Place of issue or publication	Stowmarket
Description	A4 Bound Report with A3 Fold-out Figures
URL	www.britannia-archaeology.com
Entered by	Tim Schofield (tim@britannia-archaeology.com)
Entered on	16 May 2014



STATION	EASTING	NORTHING
01	572111.187	282339.822
02	572284.253	281870.729

 Site Boundary

NGR: TL 722 821 REPORT NUMBER: 1056

PROJECT:
LAND SOUTH OF BROOM ROAD,
LAKENHEATH, SUFFOLK



DESCRIPTION:
GRID, REFERENCING INFORMATION
& SITE LOCATION PLAN


BRITANNIA ARCHAEOLOGY LTD



115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

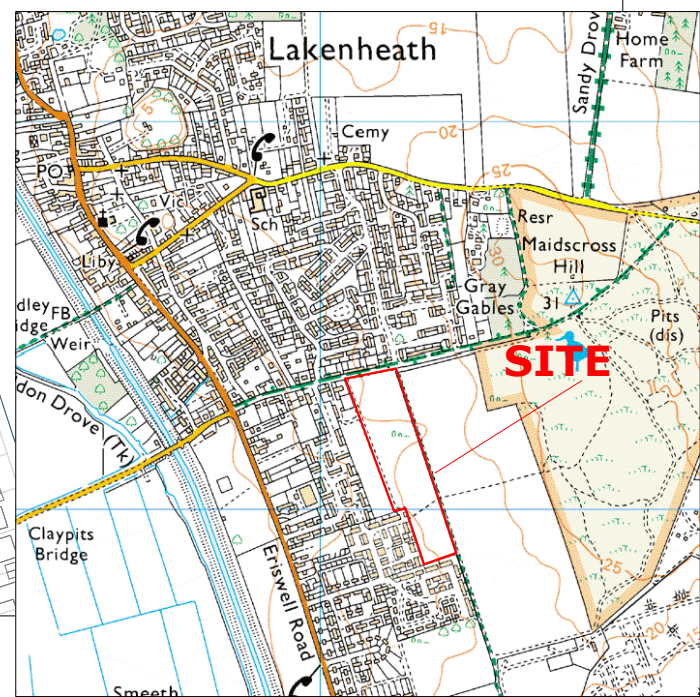
T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

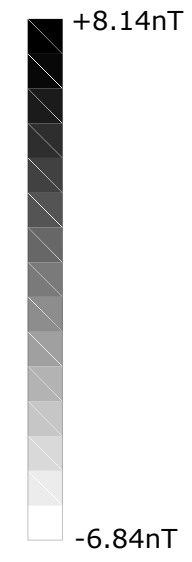
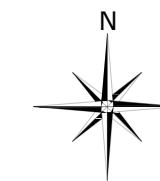
SCALE: 1:2500 0 100m



PLOT: A3 APPROVED: MB VERSION: 01

DATE: MAY 2014 AUTHOR: TPS FIGURE: 01





282200

572300

 Site Boundary

NGR: TL 722 821 REPORT NUMBER: 1056

PROJECT:
LAND SOUTH OF BROOM ROAD,
LAKENHEATH, SUFFOLK

CLIENT:



DESCRIPTION:
RAW MAGNETOMETER
GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD



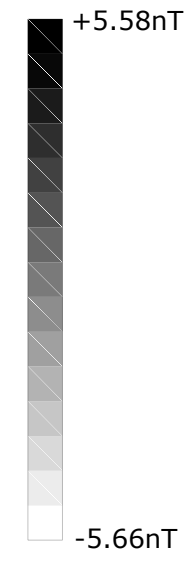
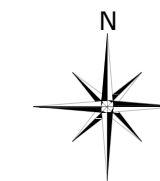
115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:2000  80m

PLOT: A3	APPROVED: MB	VERSION: 01
-------------	-----------------	----------------

DATE: MAY 2014	AUTHOR: TPS	FIGURE: 02
-------------------	----------------	---------------



 Site Boundary

NGR: TL 722 821 REPORT NUMBER: 1056

PROJECT:
LAND SOUTH OF BROOM ROAD,
LAKENHEATH, SUFFOLK

CLIENT:


DESCRIPTION:
PROCESSED MAGNETOMETER
GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD



115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

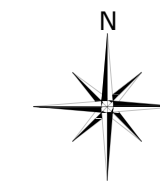
T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:2000 0 80m



PLOT: A3	APPROVED: MB	VERSION: 01
-------------	-----------------	----------------

DATE: MAY 2014	AUTHOR: TPS	FIGURE: 03
-------------------	----------------	---------------



282200

572300

40nT/cm Scale Interval



Site Boundary

NGR: TL 722 821

REPORT NUMBER: 1056

PROJECT:
LAND SOUTH OF BROOM ROAD,
LAKENHEATH, SUFFOLK



DESCRIPTION:
PROCESSED MAGNETOMETER
XY TRACE PLOT

BRITANNIA ARCHAEOLOGY LTD



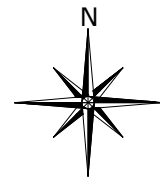
115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:2000

PLOT: A3	APPROVED: MB	VERSION: 01
-------------	-----------------	----------------

DATE: MAY 2014	AUTHOR: TPS	FIGURE: 04
-------------------	----------------	---------------



	Positive Discrete Anomaly, Archaeology?
	Positive Curvilinear Anomaly, Archaeology?
	Weak Positive Linear Trend, Agricultural?
	Electric Pylon
	Area of Magnetic Disturbance
	Isolated Dipolar Response
	Site Boundary

NGR: TL 722 821 REPORT NUMBER: 1056

PROJECT:
LAND SOUTH OF BROOM ROAD,
LAKENHEATH, SUFFOLK

CLIENT:

DESCRIPTION:
INTERPRETATION PLOT OF
MAGNETOMETER ANOMALIES

BRITANNIA ARCHAEOLOGY LTD



115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:2000 0 80m

PLOT: A3	APPROVED: MB	VERSION: 01
-------------	-----------------	----------------

DATE: MAY 2014	AUTHOR: TPS	FIGURE: 05
-------------------	----------------	---------------