

# RED HOUSE FARM, FRESSINGFIELD SUFFOLK

# DETAILED MAGNETOMETER SURVEY



Project Number: 1079

December 2014



# RED HOUSE FARM, FRESSINGFIELD SUFFOLK

# **DETAILED MAGNETOMETER SURVEY**

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Site Code	FSF 076	NGR	TM 254 770
Planning Ref.	ТВС	OASIS	britanni1-194872
Approved By	Matthew Adams	DATE	December 2014



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#### ABSTRACT

In November 2014 Britannia Archaeology Ltd undertook a detailed fluxgate gradiometer survey over 1.8 hectares of land at Red House Farm, Fressingfield, Suffolk, in one field given over to pasture, ahead of the construction of a residential development. A fairly narrow range of anomalies were recorded during the survey, some of which may have an archaeological derivation.

The most common anomalies recorded within the dataset were isolated dipolar responses that indicate the presence of ferrous material within the upper soil horizon probably introduced during the manuring process.

Areas of magnetic disturbance were recorded predominantly around the sites periphery caused by ferrous material present within the field boundaries.

Seven discontinuous narrow positive linear trends recorded running parallel with the long axis of the field are likely to relate to previous agricultural practices.

One thermoremnant response is indicative of an area of burning, potentially an oven, hearth, furnace or kiln of possible archaeological or equally modern origin.

Four linear trends that form parallel and perpendicular mutually respecting enclosures have also been recorded. They predate the 1885 Ordnance Survey map and are on a slightly different alignment to the current boundary arrangement.



# **1.0 INTRODUCTION**

On Tuesday 25<sup>th</sup> November 2014, Britannia Archaeology Ltd (BA) undertook a detailed fluxgate gradiometer survey over *c*.1.8ha of land at Red House Farm, Fressingfield, Suffolk (NGR TM 254 770) on one agricultural field in advance of a proposed residential development (Figure 1).

This survey was commissioned by Mr Michael Pickstock on behalf of the landowner Mr George Barrett in response to a design brief issued by Suffolk County Council Archaeology Service/Conservation Team (SCCAS/CT), (Brudenell. M, dated 24/10/2014). The weather was dry and overcast following a prolonged period of precipitation.

# 2.0 SITE DESCRIPTION

The site is located to the west of the village of Fressingfield; it is bounded to the north by New Street and lies to the west of Priory Crescent. Fences and Hedgerows border the 1.8 hectare field to the north, south, east and west.

Bedrock geology is described as Norwich Crag Formation Sand; sedimentary bedrock formed approximately 0 to 5 million years ago in the Quaternary and Neogene Periods when the local environment was dominated by shallow seas depositing mud, silt, sand and gravel (BGS, 2014).

Superficial geology is described as Lowestoft Formation Diamicton, formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by ice age conditions when glaciers scoured the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS 2014).

#### Site Visit 11<sup>th</sup> November 2014

A site visit was undertaken by the author on the 11<sup>th</sup> November 2014 to assess the suitability of the site for survey and to carry out a risk assessment. Some hay bales were present that were subsequently removed prior to the start of the survey, a cart was present along the south-eastern boundary. No other hazards were noted.





Site shot, looking south-east

DP2



Site shot looking north.

# 3.0 PLANNING POLICIES

The geophysical survey was carried out on the recommendation of the county council (SCCAS/CT), following guidance laid down by the *National Planning and Policy Framework* (NPPF, DCLD 2012) which replaced *Planning Policy Statement 5: Planning for the Historic Environment* (PPS5, DCLG 2010) in March 2012. The relevant local planning policy is the *Mid Suffolk District Local Plan;* (1998) which is due to be replaced with the *Mid Suffolk District Local Development Framework* in the near future.



#### 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 Mid Suffolk Local Plan (1998).

The local plan for Mid Suffolk deals with development on archaeological sites in policy HB14, this states the following:

- Where there is an overriding case for preservation, planning permission for development that would affect an archaeological site or setting will be refused.
- Having taking archaeological advice, the district planning authority may decide that development can take place subject to either satisfactory measures to preserve the archaeological remains in situ or for the site to be excavated and the findings recorded. In appropriate cases the district planning authority will expect a legally binding agreement to be concluded or will impose a planning agreement to be concluded or will impose a planning condition requiring the developer to make appropriate and satisfactory provision for the excavation and recording of the archaeological remains.

In section 2.2.3 of the Local Plan the Heritage and Listed Building objectives are:-



- to maintain or enhance the quality of Mid Suffolk's heritage, particularly through safeguarding its Conservation Areas and Listed Buildings;
- to protect ancient monuments and their settings;
- to give protection to parks and gardens of historic or landscape importance;
- to control change in ways that will protect the character of towns and villages and their setting;
- to give protection to archaeological sites and to ensure they are properly investigated and recorded if such sites are disturbed by development.

#### 4.0 ARCHAEOLOGICAL BACKGROUND

The proposed development lies close to a small stream in a location that is topographically favourable for early occupation of all periods. There are no recorded heritage assets on the Suffolk Historic Environment Record and this area has not been subject to previous systematic investigation. The scale of the proposed development is such that there is a high potential for the discovery of unknown important features and deposits of archaeological interest. The building of the scout hut, a residential development and other infrastructure would cause significant ground disturbance that has the potential to damage or destroy any below ground heritage assets that might exist at the site.

#### 5.0 PROJECT AIMS

A non-intrusive field survey by geophysical prospection was required of the area to determine the extent and significance of subsurface anomalies, followed by a possible subsequent trial trench evaluation, the aims and objectives are laid out as follows in Section 3 of the brief:

3.1 A geophysical survey is required over the application site to enable the archaeological resource, both in quality and extent, to be provisionally examined.

#### 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 signature was relatively low across the site and a suitable zero station was located with relative ease.



# 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 surveyors noted a degree of sensor drift during the first few grids as the sensors warmed up, this caused the characteristic parallel traverse 'striping' that is present within the raw dataset (Figure 2).

#### 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 within 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  $\pm 0.1$ m employing a Leica Viva Glonnass 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 mid-day 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 deviations;Display Clipping:+/- 3 standard deviations.



Processed Data:

De-stripe:Median Sensors;Data Clipping:1.00 standard deviations;Display Clipping:+/- 3 standard deviations.

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 v2.5.16.0 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 v2.5.16.0. 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 did not position any reference stations within the field. Three geo-referenced virtual survey stations are presented in Figure 2 that can be used to relocate the anomalies recorded and position any subsequent trial trenches.

# 7.0 **RESULTS & DISCUSSION (Figure 5)**

The most common anomalies recorded within the dataset were isolated dipolar ('iron spike') responses (yellow hatched circles) that indicate the presence of ferrous material within the upper soil horizon. They are evenly distributed throughout the survey area and therefore have probably been introduced into the topsoil through the manuring process.

Areas of magnetic disturbance (yellow hatching) have been recorded predominantly around the sites periphery. These readings relate to the presence of ferrous material within the boundaries and also include a cart and a partially dis-used service terminal box located near to the south-eastern border.

Seven discontinuous narrow positive linear trends (green lines) are likely to relate to previous agricultural practices. They are aligned parallel with the long axis of the field orientated north-west to south-east.

One thermoremnant response (magenta hatching) has been recorded within the southeastern half of the field. It is likely to relate to an area of burning, potentially an oven, hearth, furnace or kiln that could have an archaeological origin; equally this anomaly could derive from a modern fire event.



Four linear trends (orange hatching) orientated north-west to south-east before turning perpendicular through a ninety degree corner have further been recorded. The four linears respect each other forming two distinct enclosures. No field boundaries are present on any of the Ordnance Survey (OS) maps; therefore they are likely to be older than at least the earliest OS map dated 1885. All four of the anomalies are on a slightly different alignment and also do not respect the current boundary arrangement.

# 8.0 CONCLUSION

This geophysical survey was successful in locating a fairly narrow range of anomalies, some of which have a potential archaeological origin. It would be prudent to further investigate the anomalies that are indicative of remnant enclosures, to ascertain a derivation. The thermo-remnant response is also worthy of archaeological study by targeted trial trenching. The narrow positive linear trends that have been ascribed an agricultural origin would also benefit from further investigation to evaluate this hypothesis. Areas that appear void of anomalies should also be ground tested to assess whether any archaeological features remain unrecorded due to poor clarity between a features backfill and the magnetic signature of the natural superficial geology.

# 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 Michael Pickstock and Mr George Barrett for commissioning the project and arranging site access, and to Dr Matthew Brudenell of Suffolk County Council Archaeological Service/Conservation Team for his advice throughout.



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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 - <u>www.bgs.ac.uk/opengeoscience/home.html?Accordion2=1#maps</u>



APPENDIX 1 METADATA SHEETS

#### **Raw Data**

Filename	Fress1R.xcp
Description	
Instrument Type	Grad 601-2 (Gradiometer)
Units	nT
Surveyed by	TPS/DPM on 11/25/2014
Assembled by	TPS on 11/25/2014
Direction of 1st Traverse	45 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	400 x 220
Survey Size (meters)	100.00m x 220.00 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	6.11
Min	-5.15
Std Dev	1.77
Mean	0.61
Median	0.64
Composite Area	2.20 ha
Surveyed Area	1.39 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

#### **Processed Data**

Г		
Filename	Fress1P.xcp	
Description		
Instrument Type	Grad 601-2 (Gradiometer)	
Units	nT	
Surveyed by	TPS/DPM on 11/25/2014	
Assembled by	TPS on 11/25/2014	
Direction of 1st Traverse	45 deg	
Collection Method	ZigZag	
Sensors	2 @ 1.00 m spacing.	
Dummy Value	32702.00	
Dimensions		
Composite Size (readings)	400 x 220	
Survey Size (meters)	100.00m x 220.00 m	
Grid Size	20.00 m x 20.00 m	
X Interval	0.25 m	
Y Interval	1.00 m	
Stats		
Max	5.38	
Min	-5.75	
Std Dev	1.59	
Mean	-0.06	
Median	-0.01	
Composite Area	2.20 ha	
Surveyed Area	1.39 ha	
Program		
Name	ArcheoSurveyor	
Version	2.5.16.0	



Source Grids: 44
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\24.xgd
8 Col:0 Row:7 grids\25.xgd
9 Col:0 Row:8 grids\26.xgd
10 Col:0 Row:9 grids\27.xgd
11 Col:1 Row:0 grids\07.xgd
12 Col:1 Row:1 grids\08.xgd
13 Col:1 Row:2 grids\09.xgd
14 Col:1 Row:3 grids\10.xgd
15 Col:1 Row:4 grids\11.xgd
16 Col:1 Row:5 grids\12.xgd
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23 Col:2 Row:1 grids\14.xgd
24 Col:2 Row:2 grids\15.xgd
25 Col:2 Row:3 grids\16.xgd
26 Col:2 Row:4 grids\17.xgd
27 Col:2 Row:5 grids\18.xgd
28 Col:2 Row:6 grids\33.xgd
29 Col:2 Row:7 grids\34.xgd
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32 Col:3 Row:2 grids\19.xgd
33 Col:3 Row:3 grids\20.xgd
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35 Col:3 Row:5 grids\22.xgd
36 Col:3 Row:6 grids\37.xgd
37 Col:3 Row:7 grids\38.xgd
38 Col:3 Row:8 grids\39.xgd
39 Col:3 Row:9 grids\40.xgd
40 Col:4 Row:5 grids\23.xgd
41 Col:4 Row:6 grids\41.xgd
42 Col:4 Row:7 grids\42.xgd
43 Col:4 Row:8 grids\43.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 are 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: britanni1-194872

Project details	
Project details Project name	Land at Red House Farm, Fressingfield, Suffolk; Detailed Magnetometer
i roject name	
Short description of the project	Survey In November 2014 Britannia Archaeology Ltd undertook a detailed fluxgate gradiometer survey over 1.8 hectares of land at Red House Farm, Fressingfield, Suffolk, in one field given over to pasture, ahead of the construction of a residential development. A fairly narrow range of anomalies were recorded during the survey, some of which may have an archaeological derivation. The most common anomalies recorded within the dataset were isolated dipolar responses that indicate the presence of ferrous material within the upper soil horizon probably introduced during the manuring process. Areas of magnetic disturbance were recorded predominantly around the sites periphery caused by ferrous material present within the field boundaries. Seven discontinuous narrow positive linear trends recorded running parallel with the long axis of the field are likely to relate to previous agricultural practices. One thermoremnant response is indicative of an area of burning, potentially an oven, hearth, furnace or kiln of possible archaeological or equally modern origin. Four linear trends that form parallel and perpendicular mutually respecting enclosures have also been recorded. They predate the 1885 Ordnance Survey map and are on a slightly different alignment to the current boundary arrangement.
Project dates	Start: 25-11-2014 End: 25-11-2014
Previous/future work	No / Yes
Any associated project	P1086 - Contracting Unit No.
reference codes	FSF 076 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 4 - Regularly improved
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Rural residential
Prompt Position in the planning	Direction from Local Planning Authority - PPS Pre-application
process	Tre-application
Solid geology (other)	Norwich Crag Formation Sand
Drift geology (other)	Lowestoft Formation Diamicton
Techniques	Magnetometry
Project location	
Country	
Site location	SUFFOLK MID SUFFOLK FRESSINGFIELD Red House Farm,
Study area	Fressingfield, Suffolk 1.80 Hectares
Site coordinates	TM 254 770 52.3441378031 1.30952501527 52 20 38 N 001 18 34 E Point
Height OD / Depth	Min: 45.00m Max: 45.00m
Project creators	
Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Local Planning Authority (with/without advice from County/District
Project design originator	Archaeologist) Timothy Schofield
Project director/manager	Timothy Scholled
Project supervisor	Timothy Scholield
Type of sponsor/funding body	Landowner
Name of sponsor/funding body	Michael Pickstock and George Barrett
Project archives	
Physical Archive Exists?	
Digital Archive recipient Digital Contents	Suffolk HER
Digital Media available	"Survey" "Geophysics", "Survey"
Paper Archive recipient	Suffolk HER
-	



Paper Contents Paper Media available Project bibliography 1 Publication type Title Author(s)/Editor(s) Other bibliographic details Date Issuer or publisher Place of issue or publication Description URL Entered by Entered on

"Survey" "Report", "Survey ","Unpublished Text" Grey literature (unpublished document/manuscript) Red House Farm, Fressingfield, Suffolk; Detailed Magnetometer Survey Schofield, T. P. R1079 2014 Britannia Archaeology Ltd Stowmarket A4 Bound Report with A3 Fold-out Figures. www.britannia-archaeology.com Tim Schofield (tim@britannia-archaeology.com) 14 January 2015









