



WYAS  
**Archaeological  
Services**

**Forest Works Factory**

**Boothorpe**

**Leicestershire**

Geophysical Survey

Report no. 3034  
October 2017

**Client:** Silkstone Environmental Ltd



# **Forest Works Factory, Boothorpe, Leicestershire**

## **Geophysical Survey**

### *Summary*

*A geophysical (magnetometer) survey, covering approximately 5 hectares, was undertaken on land to the north of Boothorpe Road, Boothorpe, Leicestershire. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected geological and agricultural anomalies, along with ferrous and magnetic disturbance, across the site. Overall the archaeological potential of the site is deemed to be low.*



## Report Information

Client: Silkstone Environmental Ltd  
 Address: 7 Hall Annex, Thorncliffe Park, Chapeltown, Sheffield, S35 2PH  
 Report Type: Geophysical Survey  
 Location: Boothorpe  
 County: Leicestershire  
 Grid Reference: SK 32146 17819  
 Period(s) of activity: Modern  
 Report Number: 3034  
 Project Number: 6744  
 Site Code: FWF17  
 OASIS ID: Archaeol11-299788  
 Date of fieldwork: October 2017  
 Date of report: October 2017  
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 distribution: -----



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## **1 Introduction**

Archaeological Services WYAS (ASWYAS) were commissioned by Silkstone Environmental Ltd to undertake a geophysical (magnetometer) survey on agricultural land to the north of Boothorpe Road, Boothorpe and to the immediate west of the Forest Works Factory on Butt Lane. This is in advance of a possible residential development. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CIfA 2014; David *et al.* 2008). The survey was carried out between the 23rd and 24th October 2017.

### **Site location, topography and land-use**

The site is located approximately 6km to the west of Ashby-de-la-Zouch and approximately 12km to the south-east of Burton upon Trent (see Fig. 1). Ground cover consisted of pasture, with an area of approximately 0.3ha which was unsurveyable in the north. The survey area, totaling approximately 5ha, is centred at SK 32146 17819 and the topography of this site is gently sloping at a height above Ordnance Datum (aOD) of 141m.

### **Soils and geology**

The underlying geology comprises Helsby Sandstone Formation and Pennine Lower Coal Measures with no superficial deposits recorded (BGS 2017). Soils of the area belong to the Bardsey association (713a) consisting of slowly permeable seasonally waterlogged loams over clays and fine silts. (SSEW 1983).

## **2 Archaeological Background**

The following information has been taken from an analysis of the Pastscape website ([www.pastscape.org.uk](http://www.pastscape.org.uk)) using a 1km radius around the centre of the survey area.

Nothing has been located within the survey area, but ridge and furrow earthworks have been recorded to the north and east of the site, based upon air photograph analysis. Similarly some clay, brick and mine workings are recorded to the north of the site along with the associated tramway.

## **3 Aims, Methodology and Presentation**

The main aim of the geophysical survey was to provide additional information on the known archaeology within the area. To achieve this, a magnetometer survey covering all available parts of the PDA was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

### **Magnetometer survey**

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble R6 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1.

### **Reporting**

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows a more detailed site location plan at a scale of 1:2000. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 3 to 5 inclusive at a scale of 1:1250.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

***The figures in this report have been produced following analysis of the data in processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.***

## **4 Results and Discussion (see Figs 3 to 5)**

### **Geological anomalies**

Small discrete low magnitude anomalies have been identified throughout and are thought to be caused by variations in the depth and composition of the soils and the superficial deposits from which they derive.

### **Agricultural anomalies**

Predominantly former field boundaries have been detected, which correspond with those on early cartographic documents.

Some ploughing trends, comparable to those of a former ridge and furrow regime have been detected across the survey area.

### **Ferrous anomalies**

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

## **5 Conclusions**

Magnetic features indicative of former agricultural practices and management have been detected across the survey area. Some geological and ferrous anomaly trends have been identified and recorded. Overall the archaeological potential of the site is considered to be low.



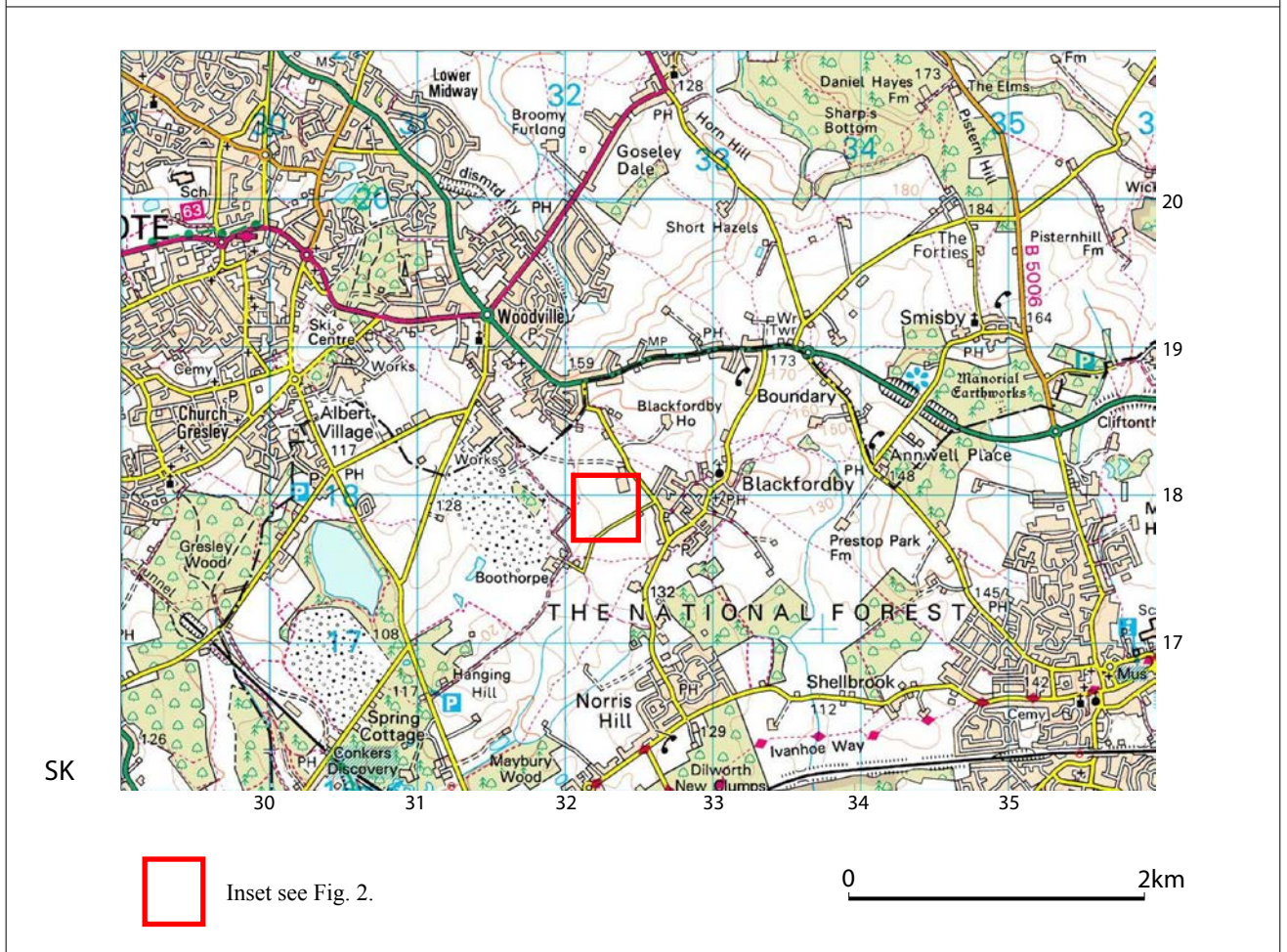
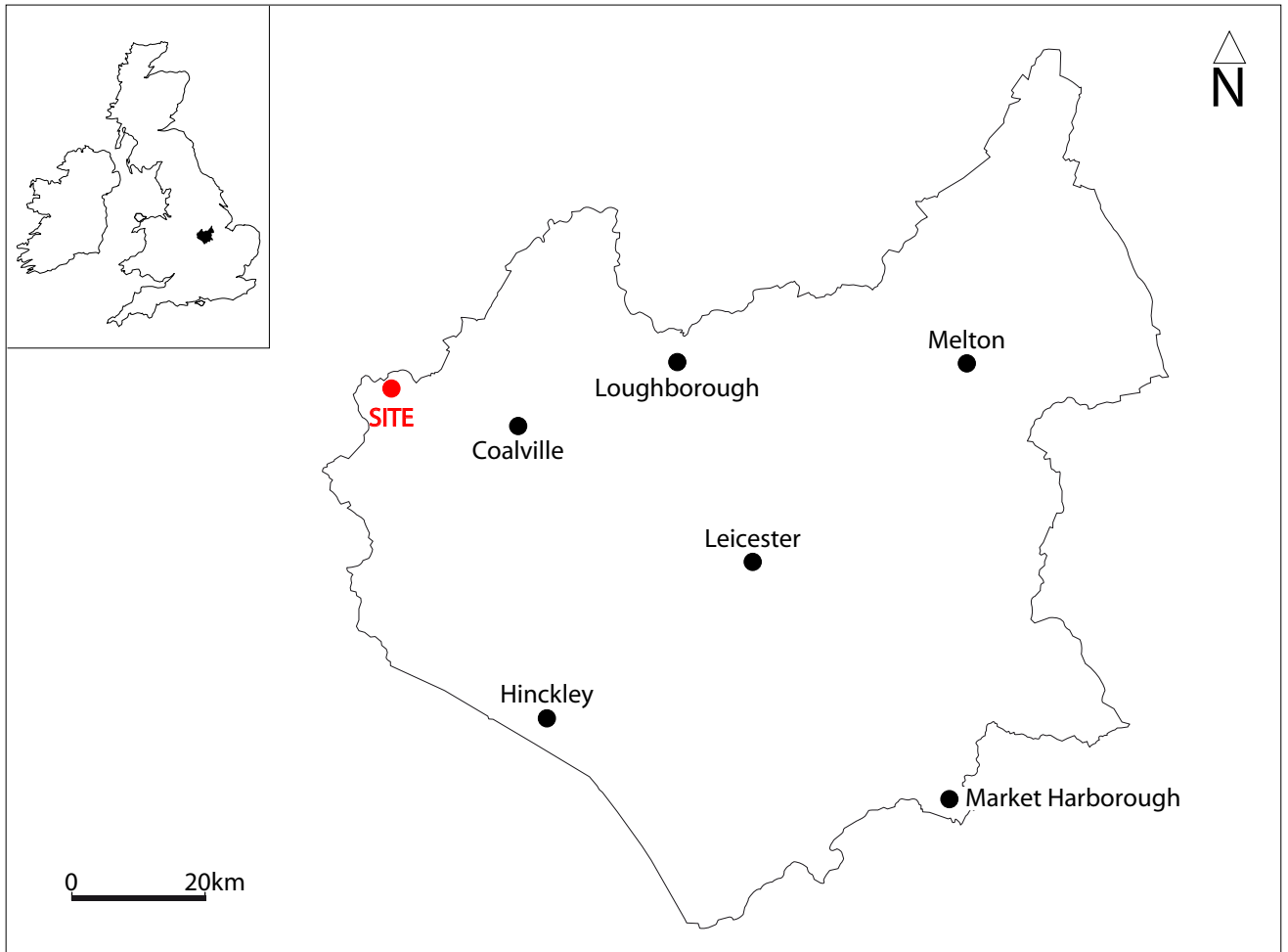


Fig. 1. Site location

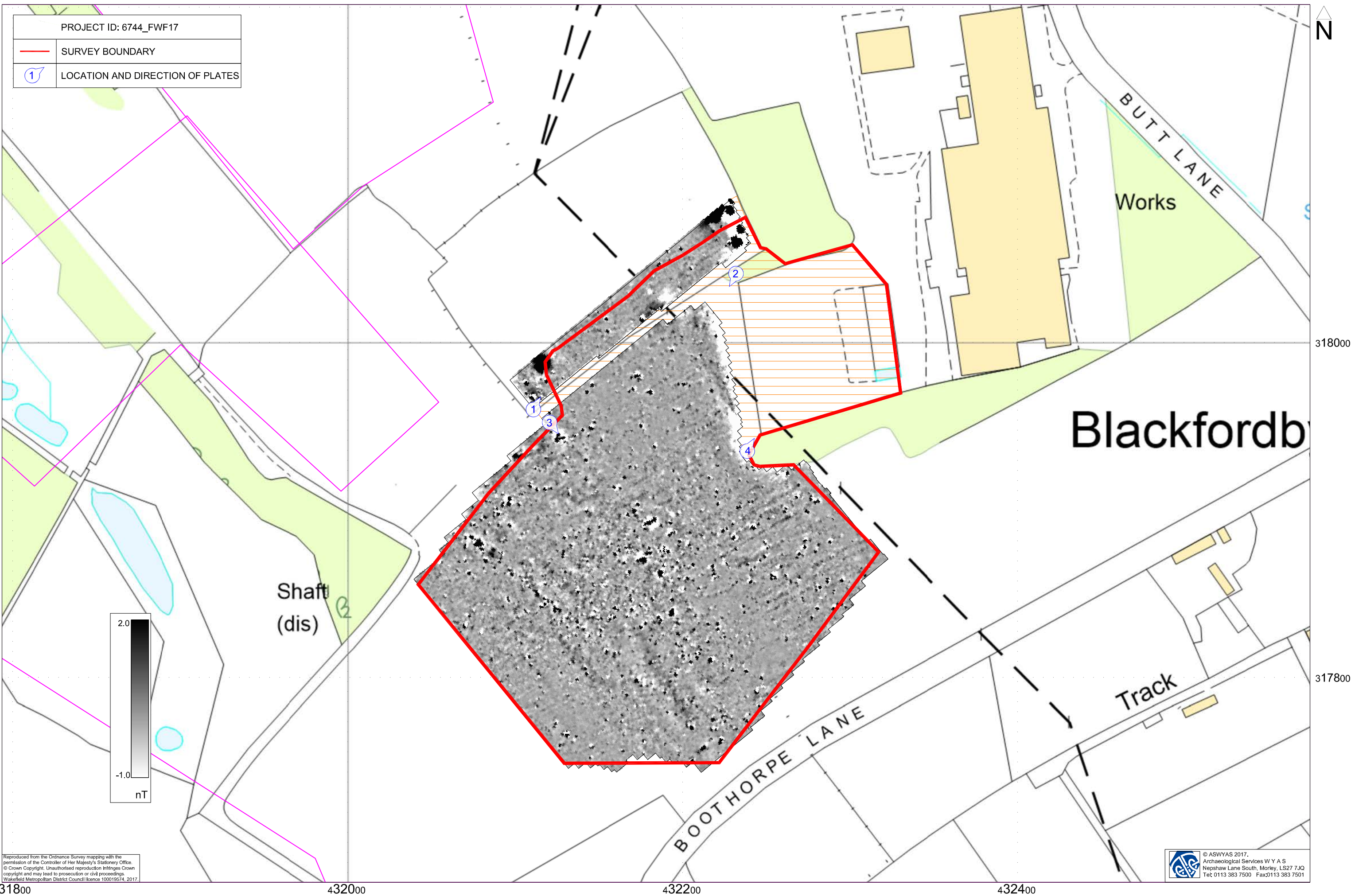


Fig. 2. Survey location showing greyscale magnetometer data (1:2000 @ A3)



Fig. 3. Processed greyscale magnetometer data (1:1250 @ A3)



31800

31780

43220

15.0 nT/cm

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0 30m

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1250 @ A3)



TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
●	MAGNETIC DISTURBANCE	FERROUS MATERIAL
—	LINEAR TREND	AGRICULTURAL
—	LINEAR TREND	FORMER FIELD BOUNDARY
⊕	MAGNETIC ENHANCEMENT	GEOLOGY



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Fig. 5. Interpretation of magnetometer data (1:1250 @ A3)

0 30m



*Plate 1. General view of survey area, looking north-east.*



*Plate 2. General view of survey area, looking south-west.*



*Plate 3. General view of survey area, looking south.*



*Plate 4. Unsurveyable area, looking north-east*

## **Appendix 1: Magnetic survey - technical information**

### **Magnetic Susceptibility and Soil Magnetism**

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

### **Types of Magnetic Anomaly**

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

### *Isolated dipolar anomalies (iron spikes)*

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

### *Areas of magnetic disturbance*

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

### *Linear trend*

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

### *Areas of magnetic enhancement/positive isolated anomalies*

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

### *Linear and curvilinear anomalies*

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

## **Methodology: Gradiometer Survey**

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as *detailed survey* and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.



During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

## **Appendix 2: Survey location information**

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

*Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.*

### **Appendix 3: Geophysical archive**

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS6 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Leicestershire Historic Environment Record).

## **Appendix 4: Oasis form**

# OASIS DATA COLLECTION FORM: England

[List of Projects](#) | [Manage Projects](#) | [Search Projects](#) | [New project](#) | [Change your details](#) | [HER coverage](#) | [Change country](#) | [Log out](#)

## Printable version

**OASIS ID: archaeol11-299788**

### Project details

Project name	Forest Works Factory
Short description of the project	A geophysical (magnetometer) survey, covering approximately 5 hectares, was undertaken on land to the north of Boothorpe Road, Boothorpe, Leicestershire. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected geological and agricultural anomalies, along with ferrous and magnetic disturbance, across the site. Overall the archaeological potential of the site is deemed to be low.
Project dates	Start: 23-10-2017 End: 24-10-2017
Previous/future work	Yes / Not known
Any associated project reference codes	6744 - Sitecode
Any associated project reference codes	6687 - Sitecode
Type of project	Field evaluation
Current Land use	Grassland Heathland 4 - Regularly improved
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology (other)	Pennine Lower Coal Measures
Drift geology	LACUSTRINE CLAYS, SILTS AND SANDS
Techniques	Magnetometry

### Project location

Country	England
Site location	LEICESTERSHIRE NORTH WEST LEICESTERSHIRE ASHBY DE LA ZOUCH Forest Works Factory, Boothorpe
Study area	5 Hectares
Site coordinates	SK 321 178 52.756518087976 -1.52430767608 52 45 23 N 001 31 27 W Point
Height OD / Depth	Min: 141m Max: 141m

### Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Silkstone Environmental
Project design originator	Silkstone Environmental
Project director/manager	E Brunning
Project supervisor	A. Trace

### Project archives

Physical Archive Exists?	No
Digital Archive recipient	Silkstone Environmental
Digital Contents	"Survey"
Digital Media available	"Geophysics", "Images raster / digital photography", "Text"
Paper Archive Exists?	No

### Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Forest Works Factory, Boothorpe
Author(s)/Editor(s)	Sykes, C.
Other bibliographic details	2970
Date	2017
Issuer or publisher	ASWYAS
Place of issue or publication	Leeds
Description	A4 report with A3 figures
Entered by	Emma Brunning (emma.brunning@aswyas.com)
Entered on	1 November 2017

## **Bibliography**

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