STRATASCAN

# Geophysical Survey Report

## Barkby Hall, Leicestershire

October 2005

Job no. 2062


**Richard Smalley BA (Hons)**


REGISTERED · ORGANISATION · IFA

| | |
|---|---|
| **Document Title:** | **Barkby Hall, Leicestershire** |
| **Client:** | **University of Leicester Archaeological Services** |
| **Stratascan Job No:** | **J2062** |
| **Techniques:** | **Detailed magnetic survey (gradiometry)**<br>**Resistance survey** |
| **National Grid Ref:** | **SK 635 098** |

| | |
|---|---|
| **Field Team:** | **Luke Brown**<br>**Daniel Pavett** |
| **Project Manager:** | **Simon Stowe BSc (Hons)** |
| **Report written by:** | **Richard Smalley BA (Hons)** |
| **CAD illustration by:** | **Richard Smalley BA (Hons)** |
| **Checked by:** | **Simon Stowe BSc (Hons)** |


Stratascan Ltd.

Vineyard House
Upper Hook Road
Upton upon Severn
WR8 0SA

Tel: 01684 592266
Fax: 01684 594142
Email: ppb@stratascan.co.uk
www.stratascan.co.uk

LIST OF FIGURES

## 1 SUMMARY OF RESULTS

A magnetometry and resistivity survey carried out over 1.3ha of grassland at Barkby Hall, Leicestershire was successful in locating a number of anomalies that may represent former garden features. A concentration of high resistance anomalies to the north of the survey area may indicate the presence of rubble or structural remains from former outbuildings.

## 2 INTRODUCTION

### 2.1 Background synopsis

Stratascan were commissioned by University of Leicester Archaeological Services (ULAS) to undertake a geophysical survey of an area of grassland and lawn at Barkby Hall.

### 2.2 Site location

The site is located at Barkby Hall, which is in Barkby, Leicestershire.
OS ref. SK 635 098.

### 2.3 Description of site

The survey area comprises of approximately 1.3 ha of grassland that slopes gently towards the south. The underlying geology is Boulder Clay and Moraine Drift (British Geological Survey South Sheet, First Edition Quarternary, 1977). The overlying soils are known as Ragdale soils which are a type of Pelo-stagnogley soil. These consist of slowly permeable, seasonally waterlogged, clayey and fine and loamy over clayey soils (Soil Survey of England and Wales, Sheet 3 Midland and Western England).

### 2.4 Site history and archaeological potential

No specific details were available to Stratascan.

### 2.5 Survey objectives

The objective of the survey was to locate any anomalies that may represent garden features or outbuildings within the survey area.

### 2.6 Survey methods

Detailed magnetometry and resistivity surveys were carried out across the site in order to assess the area with complementary techniques. More information regarding these techniques is included in the Methodology section below.

# 3 METHODOLOGY

## 3.1 Date of fieldwork

The fieldwork was carried out over 3 days from 4th to the 6th October 2005 when the weather was dry.

## 3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information.

## 3.3 Description of techniques and equipment configurations

### 3.3.1 Magnetometer

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The gradiometer consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements giving a strong response to deep anomalies.

### 3.3.2 Resistance Meter

This method relies on the relative inability of soils (and objects within the soil) to conduct an electrical current, which is passed through them. As resistivity is linked to moisture content, and therefore porosity, hard dense features such as rock will give a relatively high resistivity response, while features such as a ditch which retains moisture give a relatively low response.

The resistance meter used was an RM15 manufactured by Geoscan Research incorporating a mobile Twin Probe Array. The Twin Probes are separated by 0.5m and the associated remote probes were positioned approximately 15m outside the grid. The instrument uses an automatic data logger, which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation.

Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used through-out.

## 3.4 Sampling interval, depth of scan, resolution and data capture

### 3.4.1 Sampling interval

*Magnetometer*
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

*Resistivity*
Readings were taken at 1.0m centres along traverses 1.0m apart. This equates to 900 sampling points in a full 30m x 30m grid. All traverses were surveyed in a “zigzag” mode.

### 3.4.2 Depth of scan and resolution

*Magnetometer*
The Grad 601 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. The collection of data at 0.5m centres provides an appropriate methodology balancing cost and time with resolution.

*Resistivity*
The 0.5m probe spacing of a twin probe array has a typical depth of penetration of 0.5m to 1.0m The collection of data at 1m centres with a 0.5m probe spacing provides an appropriate methodology balancing cost and time with resolution.

### 3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily downloaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

## 3.5 Processing, presentation of results and interpretation

### 3.5.1 Processing

*Magnetometer*

Processing is performed using specialist software known as *Geoplot 3*. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed magnetometer data used in this report:

| | |
|---|---|
| *Zero mean grid* | *Threshold = 0.25 std. dev.* |
| *Zero mean traverse* | *Least mean square fit = off* |
| *Despike* | *X radius = 1 Y radius = 1* |
| | *Threshold = 3 std. dev.* |
| | *Spike replacement = mean* |

*Resistivity*

The processing was carried out using specialist software known as *Geoplot 3* and involved the 'despiking' of high contact resistance readings and the passing of the data though a high pass filter. This has the effect of removing the larger variations in the data often associated with geological features. The nett effect is aimed at enhancing the archaeological or man-made anomalies contained in the data.

The following schedule shows the processing carried out on the processed resistance plots.

| | |
|---|---|
| *Despike* | *X radius = 1* |
| | *Y radius = 1* |
| | *Spike replacement* |
| *High pass filter* | *X radius = 10* |
| | *Y radius = 10* |
| | *Weighting = Gaussian* |

### 3.5.2 Presentation of results and interpretation

*Resistivity*

The presentation of the data for the site involves a printout of the raw data as a grey scale plot (Figure 3), together with a grey scale plot of the processed data (Figure 4). Anomalies have been identified and plotted onto the ‘Abstraction and Interpretation of Anomalies’ drawing (Figure 5).

*Magnetometer*

The presentation of the data for the survey involves a printout of the raw data both as grey scale (Figure 6) and trace plots (Figure 7 and 8), together with a grey scale plot of the processed data (Figure 9). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 10).

# 4 RESULTS

## 4.1 Resistivity

The resistance data is dominated by both high and low area anomalies. The high resistance area anomalies are concentrated to the north of the survey area and may be of archaeological origin. The roughly rectangular shape of high resistance in the northern area may represent buried rubble or structural remains of a former building. Further investigation of this anomaly would be required in order to identify the origin of this feature. The high resistance area anomalies hatched in orange on Figure 5 have been interpreted as being related to root systems due to their close proximity to trees.

The low resistance area anomalies have been subdivided into two categories. Those hatched in blue on Figure 5 are of uncertain origin, however they may be indicative of landscaping. Those hatched in cyan may be of geological or pedological origin, perhaps as a result of waterlogging from the nearby brook.

High resistance linear anomalies representing possible structural remains or compacted ground are evident across the site. Two low resistance linear anomalies are present running north – south down the centre of the survey area. These are likely to be caused by cut features of possible archaeological origin. A low resistance curvilinear anomaly is present on the eastern edge of the site.

## 4.2 Magnetometry

Positive linear anomalies are present across the survey area within the magnetometry data. These indicate the presence of cut features such as ditches that may be of archaeological origin. A number of these positive linear anomalies have an associated negative linear anomaly. These features may suggest a form of bank and ditch arrangement.

Discrete positive anomalies are evident across the survey area. These may be of archaeological origin and have been interpreted as pits, possibly relating to the position of former trees.

The areas of magnetic interference to the west of the survey area are a result of the metal fence and the path that divides the survey area in two. Metal fences surrounding the trees within the survey area have also caused some localised patches of magnetic interference. Several positive anomalies with associated negative responses, known as bipolar anomalies, are evident across the site. These are likely to be associated with buried ferrous objects. A modern service runs approximately north – south on the western edge of the survey area.

### 4.3 Combined Interpretation

Figure 11 shows the combined interpretation of the magnetometer and resistance data. Anomalies with similar characteristics and close proximity to each other have been grouped together in order to represent a feature. Therefore a positive linear anomaly from gradiometry data and a low resistance linear anomaly from the resistance data sharing the same position have been grouped together to represent a ditch like feature.

The combined interpretation shows good correlation between the two survey techniques. A bank and ditch arrangement running approximately north-south through the survey area is clear in both the resistance and magnetometer data.

Evidence for structural remains is concentrated in the northern most section of the survey area in the form of a high resistance area and linear anomalies. However, these types of feature coincide with the ditch anomalies picked up by the gradiometer, which may indicate that landscaping has taken place. Further investigation is necessary in order to ascertain the nature of these features.

## 5 CONCLUSION

Both survey techniques were successful in locating a number of anomalies that may represent former garden features and outbuildings.

Areas of low resistance and low resistance linear anomalies along with the positive and negative linear anomalies within the magnetometer data suggest that some form of landscaping has taken place within the survey area in the past. Areas of high resistance and high resistance linear anomalies may represent the structural remains of former outbuildings. Further investigation is required in order to ascertain the origin of these features.

Other anomalies of possible archaeological interest include discrete positive anomalies. These are evident across the survey area and may indicate the presence of possible pit features. These pits may relate to the position of former trees within the garden area.