Archaeological Services
University of Durham

Street House Farm, Loftus, Cleveland

Phase 2 geophysical survey

on behalf of
Stephen Sherlock & Tees Archaeology

Report 1745
October 2007

Archaeological Services
Durham University
South Road
Durham DH1 3LE
Tel: 0191 334 1121
Fax: 0191 334 1126
archaeological.services@durham.ac.uk
www.durham.ac.uk/archaeological.services

Street House Farm, Loftus, Cleveland

Phase 2 geophysical survey

Report 1745

October 2007

Archaeological Services Durham University

on behalf of

Stephen Sherlock
Elm Lea, Malton Road, York YO3 9LT

and

Tees Archaeology
Hartlepool Borough Council, Sir William Gray House, Clarence Road, Hartlepool TS24 8BT

Contents

1. Summary

The project

1.1 This report presents the results of a second stage of geophysical survey conducted on land at Street House Farm, near Loftus in Cleveland. The works comprised a fluxgate gradiometer survey of one hectare, to the immediate south of the 2007 excavation and earlier investigations.

1.2 The works were undertaken on behalf of Stephen Sherlock and Tees Archaeology.

Results

1.3 The survey has revealed a complex of soil-filled ditches and enclosures, almost certainly reflecting more than one phase of activity.

1.4 These archaeological features appear to continue beyond the limit of the survey in every direction suggesting the extent of the settlement has not yet been determined.

1.5 Traces of medieval ridge and furrow cultivation have also been detected.

2. Project background

Location (Figure 1)

2.1 The study area is located at Street House Farm, Loftus, Cleveland (NGR: centre NZ 7396 1943). The survey area includes part of the 2004 excavation and lies to the immediate south of the 2007 excavation. A geophysical survey undertaken in 2005 and excavations from 2005/6 lie just to the north.

Objective

2.2 The principal objective of the survey was to assess the nature and extent of sub-surface archaeological features to the south of those previously recorded, as part of an ongoing survey and excavation project directed by Stephen Sherlock. It was anticipated that the site would continue to the south of the main enclosure, which had been the focus of much of the work to date. The results of the survey would inform and assist the research strategy for future fieldwork.

Project brief

2.3 The survey was undertaken in accordance with instructions provided by Stephen Sherlock.

Dates

2.4 Fieldwork was undertaken on 14th September 2007. This report was prepared between 17th September and 3rd October 2007.

Personnel

2.5 Fieldwork was conducted by Richie Villis (Supervisor) and Janet Beveridge. This report was prepared by Duncan Hale, with illustrations by Janine Wilson and Dr David Webster. The Project Manager was Duncan Hale.

Archive/OASIS

2.6 The survey site code is **SHF07**, for **S**treet **H**ouse **F**arm 20**07**. The survey archive will be supplied on CD to Steve Sherlock for deposition with the project archive in due course. Archaeological Services is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is **archaeol3-32128**.

3. Archaeological and historical background

3.1 The principal feature investigated at the site so far is a rectilinear ditched enclosure, originally identified through aerial photography and then dated to the late Iron Age after excavations in 2004 (Sherlock in prep.). Much of the enclosure is evident in our 2005 geophysical survey (Archaeological Services 2005). The 2004 and subsequent excavations have revealed a multi-phased sequence of re-cut enclosure ditch containing, amongst other things, ring-ditches associated with roundhouses and evidence for salt-working, beginning in the 4th/3rd centuries BC and continuing until the 4th century AD. In the

Anglo-Saxon period the site was used for a substantial cemetery (Sherlock in prep.).

4. Landuse, topography and geology

4.1 A cereal crop had been harvested prior to survey. Stacks of bales were present along part of the western side of the field, which prevented survey in that area. A spoilheap from the 2007 excavation, near the northern limit of the survey, is evident in the plots as a small unsurveyed area.

4.2 The survey area lies at a mean elevation of about 170m OD, with the western side (where the enclosure is sited) being predominantly level before sloping down to about 165m in the east of the field.

4.3 The underlying solid geology comprises Jurassic Upper Lias strata, which are overlain by boulder clay and morainic drift.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation* (David 1995); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, it was considered likely that cut features, such as ditches and pits, might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting each of the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record minute anomalies in the vertical component of the Earth's

magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 The survey area had been marked on the ground by the client (Figure 2). A 20m grid was established across the area and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system (GPS) providing sub-metre accuracy.

5.6 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.

5.7 Data were downloaded on-site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.8 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale and interpretations are presented in Figure 2, together with the results of the 2005 survey; both trace plots are provided in Appendix I. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to the data:

zero mean grid	sets the background mean of each grid to zero; for removing grid edge discontinuities.
destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
despike	locates and suppresses random iron spikes in gradiometer data.
interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided. Two types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic

	susceptibility soil-filled structures such as pits and ditches.
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

Interpretation: features

5.11 A colour-coded archaeological interpretation plan is provided. Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter and/or by burning.

5.12 Further to the results of the 2005 survey, the second phase of survey has recorded the southern corner of the main ditched enclosure together with an associated complex of rectilinear and curvilinear positive magnetic anomalies to the south. These anomalies almost certainly reflect the remains of ditches, which define further enclosures and trackways, and appear to continue beyond the limit of the survey in every direction. More than one phase of activity appears to be represented.

5.13 In the western part of the survey these enclosures lie on a principal north-south axis with possible entrances to the east. Areas of enhanced magnetic susceptibility have been recorded in each enclosure, perhaps indicating intensive use of those areas, though not necessarily occupation as such since roundhouse ring-ditches have not been identified.

5.14 A number of smaller ditched features have been detected immediately south-east of the main enclosure.

5.15 A prominent east-west lineation immediately south of these corresponds to a former field boundary.

5.16 A series of very weak, parallel positive magnetic anomalies oriented broadly east-west throughout the area almost certainly reflects traces of former ridge and furrow cultivation.

5.17 A scatter of small, discrete dipolar magnetic anomalies was detected across the survey area. These anomalies often reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and as such have little or no archaeological significance. However, excavation has demonstrated that a number of these anomalies in the 2005 survey area will almost certainly have reflected ferrous items within some of the many graves that turned out to be present on the site, while others corresponded to hearths.

6. Conclusions

6.1 A second fluxgate gradiometer survey has been undertaken at Street House Farm as part of an ongoing survey and excavation project directed by Stephen Sherlock.

6.2 The survey has revealed a complex of ditched enclosures to the south of the main ditched enclosure previously investigated. The features appear to continue beyond the limit of the survey in every direction, indicating the extent of the settlement has not yet been determined. The anomalies detected almost certainly reflect more than one phase of activity.

6.3 Traces of medieval ridge and furrow cultivation and a former field boundary have also been detected.

7. Sources

David, A, 1995 *Geophysical survey in archaeological field evaluation*, Research and Professional Services Guideline **1**, English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

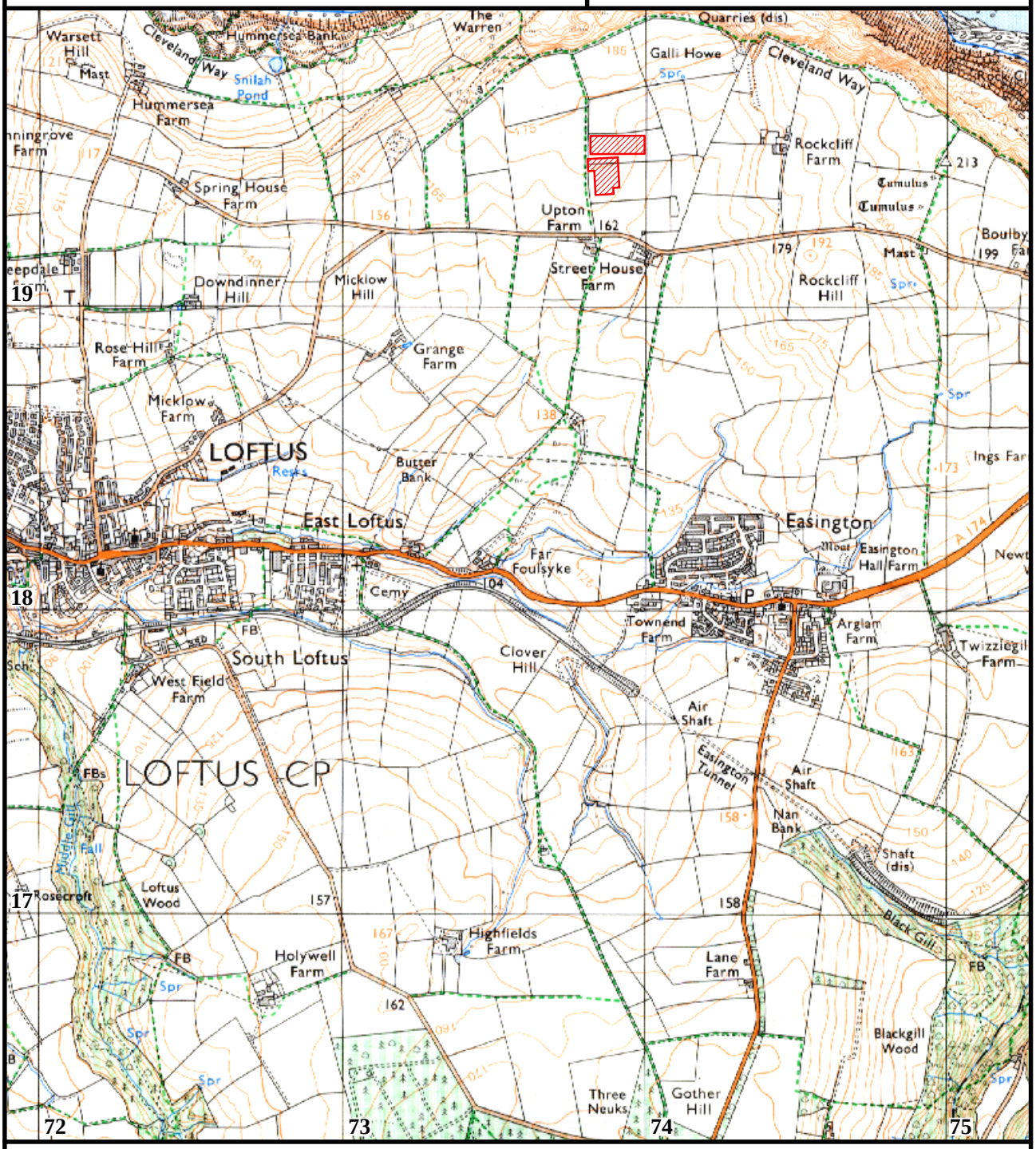
Archaeological Services
University of Durham

Street House Farm, Loftus, East Cleveland

geophysical surveys

Report 1745
Figure 1
Survey locations

on behalf of
Stephen Sherlock & Tees Archaeology



Geophysical surveys

0 1km

scale 1:20 000 - for A4 plot

a) Geophysical survey

outline of survey area

8.00
6.83
5.67
4.50
3.33
2.17
1.00
-0.17
-1.33
-2.50
-3.67
-4.83
-6.00 nT

b) Geophysical interpretation

positive magnetic anomalies

dipolar magnetic anomalies

c) Archaeological interpretation

soil-filled features

orientation of ridge and furrow

possible metalwork / hearths

0 40m

scale 1:800 - for A1 plot

on behalf of
Stephen Sherlock & Tees Archaeology

Archaeological Services
University of Durham

Street House Farm, Loftus, East Cleveland

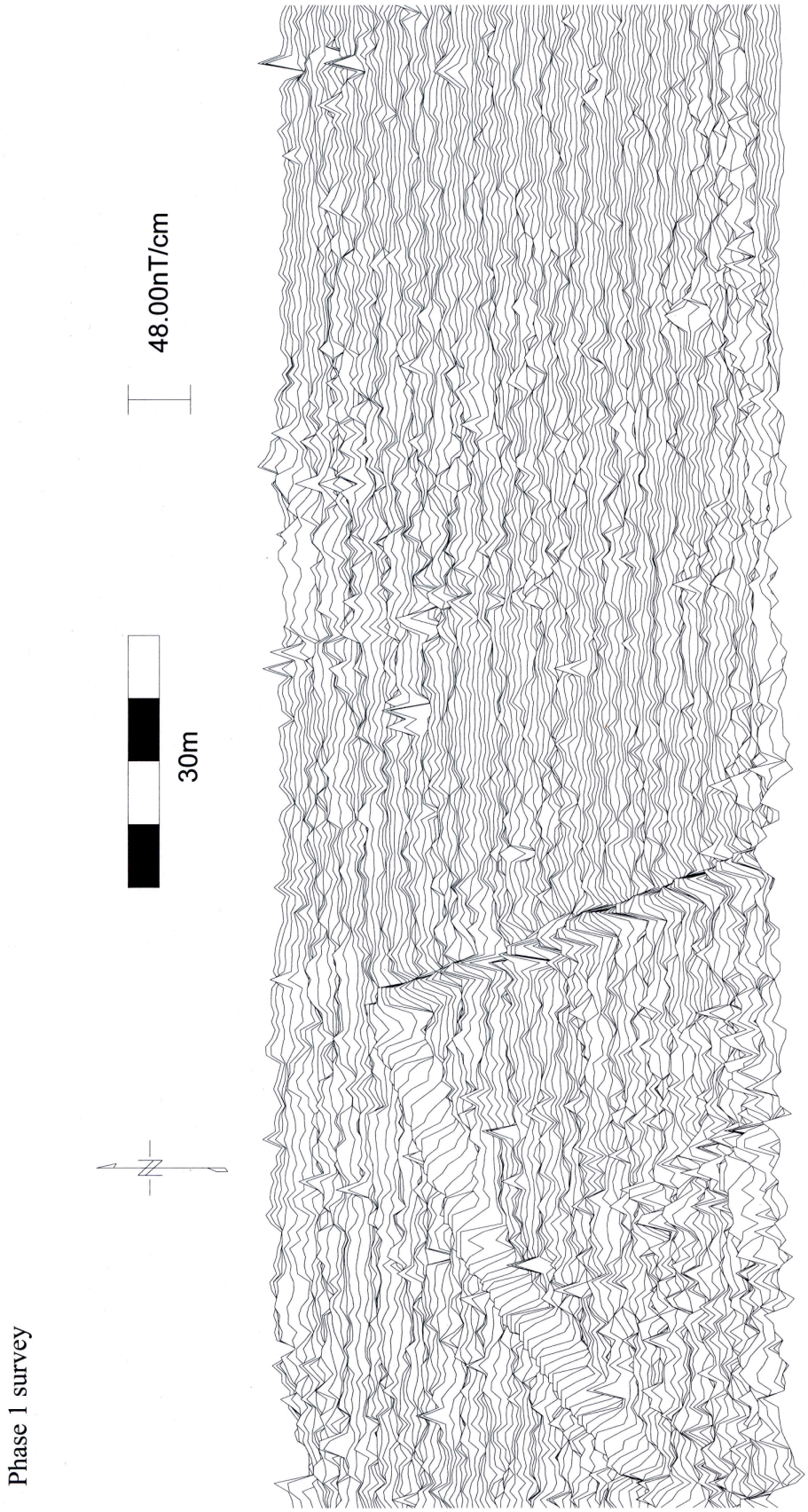
Phase 1 and 2 geophysical surveys

Report 1745

Figure 2

Geophysical surveys, geophysical and archaeological interpretations

Appendix I: Trace plots of geophysical data



Phase 2 survey