ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Nathaniel Lichfield & Partners
for
Northumbrian Land Ltd

White House
Stokesley
North Yorkshire

geophysical surveys

report 2610
March 2011

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at White House Farm, Stokesley, North Yorkshire. The works comprised geomagnetic survey of two fields totalling approximately ten hectares.

1.2 The works were commissioned by Nathaniel Lichfield & Partners for Northumbrian Land Ltd and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled ditch features were identified in both areas. Some of these appear to form parts of enclosures and could possibly pre-date the former ridge and furrow cultivation.

1.4 Discrete anomalies which may reflect soil-filled pit features have also been detected.

1.5 Former ridge and furrow cultivation has been identified in both survey areas.

1.6 The course of a former river or stream, including a possible ox-bow lake, has been identified in Area A. Part of this feature may account for the apparent cropmarked enclosure detailed by an HER record.

1.7 Former field boundaries have been identified in Area A.

1.8 A possible former cowhouse has been identified in Area A.

1.9 A possible former pond has been identified in the north of Area A.

1.10 Probable services have been detected in Area A.

2. Project background

Location (Figure 1)

2.1 The site is located on fields immediately west of Stokesley, North Yorkshire (NGR centre: NZ 5169 0854). It is roughly rectangular in plan, and covers an area of approximately 10.5 ha. To the east is a housing estate; to the west is Crab Tree Farm; agricultural fields form the northern boundary and the Stokesley to Hutton Rudby road forms the southern boundary. The buildings of White House Farm to the south are included in the proposed development area but excluded from survey.

Development proposal

2.2 It is proposed to develop the fields to the north of the road for housing, with a recreational open space at the northern end. White House Farm is to be redeveloped for commercial use.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the survey area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from the client and with current national standards and guidance (see para. 5.1 below).

Dates

2.5 Fieldwork was undertaken between 7th and 9th February 2011. This report was prepared for 2nd March 2011.

Personnel

2.6 Fieldwork was conducted by Andy Platell and Richie Villis (Supervisor). The geophysical data were processed by Richie Villis. This report was prepared by Richie Villis, with illustrations by Janine Watson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **SWH11**, for **S**tokesley **W**hite **H**ouse 20**11**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University 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 **archaeol3-94579**.

3. Historical and archaeological background

3.1 An archaeological desk-based assessment has been undertaken for the proposed development area (Archaeological Services 2010). The following summarises the assessment's conclusions.

3.2 No archaeological resource has been identified which requires preservation *in situ*. There are no historic or statutorily protected buildings in the vicinity of the site. The

structures on site are of 19th- and 20th-century date. There are no Scheduled Ancient Monuments on or in the near vicinity of the site.

3.3 An enclosure of assumed Iron Age date is present immediately to the north of the proposed development area. A second such enclosure is recorded by the HER directly on the site. However, this latter HER entry is questionable and may arise from an incorrect grid reference. A range of material, dating from the Neolithic to the Saxon periods, has also been recovered by fieldwalking in the vicinity of the proposed development area. Therefore, whatever the true nature of the questionable HER record, there is potential for remains of prehistoric to Saxon dates to be present in the proposed development area.

3.4 The area lies beyond the edge of the medieval settlement of Stokesley, and it is probable that the area was utilised in the medieval and post-medieval periods as agricultural land. Evidence relating to this, in the form of ridge and furrow cultivation and field boundaries, may survive.

3.5 Map evidence shows that the area has remained as undeveloped farmland since at least the middle of the 19th century. Significant archaeological remains of a recent date are therefore unlikely to be present.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised two arable fields and a working farm. Geophysical survey was conducted in both arable fields totalling *c*. 10ha. The larger, eastern field is referred to as Area A; the smaller, western field as Area B.

4.2 The proposed development area lies on gently sloping ground between the Rivers Leven and Tame, with an elevation of 65m to 70m OD.

4.3 The underlying solid geology of the area comprises Triassic strata of the Mercia Mudstone Group, which are overlain by Devensian glacial deposits; these are overlain by post-glacial river terrace and alluvial deposits.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Draft Standard and Guidance for archaeological geophysical survey* (2010); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (draft 2nd edition, Schmidt & Ernenwein 2010).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic

susceptibility survey. Some techniques are more suitable than others in particular situations, depending on 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, based on desktop and cropmark evidence, 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 the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record 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 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system with real-time correction.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m 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 (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to each dataset:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities

destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
despike	locates and suppresses 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 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 Colour-coded geophysical interpretations are provided. Three 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
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
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

General comments

5.11 Colour-coded archaeological interpretations are provided.

5.12 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 ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Series of parallel, alternate, positive and negative magnetic anomalies which almost certainly reflect former ridge and furrow cultivation have been detected aligned north-south across both areas.

5.14 Small, discrete dipolar magnetic anomalies have been detected in both of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

Area A

5.15 A rectilinear, positive magnetic anomaly, which almost certainly reflects a soil-filled ditch feature, has been detected in the south of the area. This could possibly pre-date the ridge and furrow in this area.

5.16 Two linear, weak positive magnetic anomalies have been detected aligned obliquely to ridge and furrow, which abuts these features. These almost certainly reflect headlands associated with the former ridge and furrow cultivation.

5.17 A sinuous and diffuse curvilinear positive magnetic anomaly detected across the north-western and central parts of the survey area almost certainly reflects the former course of a river or stream. Part of this feature may account for the cropmarks interpreted as an enclosure by the HER, as discussed in the detailed desk-based assessment (Archaeological Services 2010).

5.18 The river course meanders and forms an ox-bow lake. There is prehistoric and Romano-British evidence of ritual activity associated with rivers, such as the discovery of a Roman jug in nearby Eller Beck, and the recovery of a Bronze Age sword from an ox-bow lake at Houghall in Durham. Given the proximity of finds in the area, this natural feature could have been used in ritual activities during these periods.

5.19 A linear, weak positive magnetic anomaly has been detected aligned broadly north-west/south-east in the area of the former river channel. This may reflect a soil-filled ditch or be another part of the former water course.

5.20 A rectilinear positive magnetic anomaly has been detected at the north-west corner of this area. This may reflect a soil-filled ditch feature of archaeological origin, or may also be related to the former river course.

5.21 North of the water course the ridge and furrow is not as clear, but has still been detected as parallel, alternate, positive and negative anomalies. This could be attributed to the change in superficial geology.

5.22 A number of other linear, positive magnetic anomalies which may reflect soil-filled ditch features have been detected.

5.23 A group of diffuse positive magnetic anomalies has been detected in the north of the area. These may represent soil-filled pit features, or possibly a former pond. The north of the site was wetter and boggier than the south.

5.24 Two discontinuous chains of small dipolar magnetic anomalies, aligned north-south and east-west, have been detected in this area. These correspond to the location of former field boundaries as shown by the Ordnance Survey maps dated 1938 and 1966.

5.25 The large dipolar anomaly detected in the central part of the survey area, on the line of a former field boundary, may reflect the remains of a former cowhouse, which the farmer indicated was in this area at the time of the survey.

5.26 Three chains of intense dipolar magnetic anomalies detected in the south of the area may reflect services. Two inspection chamber covers were noted on the ground near the south-eastern boundary of the field.

5.27 The high concentration of dipolar magnetic anomalies along the southern boundary of the field reflects large amounts of ferrous waste, such as old bikes and shopping trolleys, noted on the ground.

5.28 Similarly, the area of large and strong dipolar magnetic anomalies detected in the south-west corner of the area reflects the position of ferrous and fired waste, such as corrugated iron sheeting and brick rubble noted on the ground.

5.29 The east-west aligned, strong dipolar magnetic anomaly detected near the southern end of the site corresponds to the position of a ferrous field boundary.

Area B

5.30 A rectilinear positive magnetic anomaly has been detected in the south-west of this area. This almost certainly reflects a soil-filled ditch feature, which appears to form two sides of an enclosure. The former ridge and furrow cultivation in this area may overlie this feature.

5.31 A strong positive magnetic anomaly has also been detected in the south-west corner of this area, within the area of the enclosure but not necessarily contemporary with it. This cross-shaped feature appears to be at least partly enclosed by a narrow soil-filled ditch or series of small pits.

5.32 The dipolar magnetic anomalies detected along the south and east edges of this survey area reflect the adjacent ferrous fence.

5.33 One of the discrete dipolar magnetic anomalies detected at the west edge of the survey area reflects the position of a telegraph pole.

6. Conclusions

6.1 Approximately ten hectares of geomagnetic survey was undertaken at White House Farm prior to residential development.

6.2 Probable soil-filled ditch features were identified in both areas, some of which appear to form parts of enclosures. These could pre-date the former ridge and furrow cultivation.

6.3 Discrete features which may reflect soil-filled pit features have also been detected.

6.4 Former ridge and furrow cultivation has been identified in both survey areas.

6.5 The course of a former river or stream, including a possible ox-bow lake, has been identified in Area A. Part of this feature may account for an apparent cropmarked enclosure detailed by an HER record.

6.6 Former field boundaries have been identified in Area A.

6.7 A possible former cowhouse has been identified in Area A.

6.8 A possible former pond has been identified in the north of Area A.

6.9 Probable services have been detected in area A.

7. Sources

Archaeological Services 2010 *White House, Stokesley, North Yorkshire: archaeological desk-based assessment*. Unpublished report **2556**, Archaeological Services Durham University

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

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

IfA 2010 *Draft Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2010 (draft) *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

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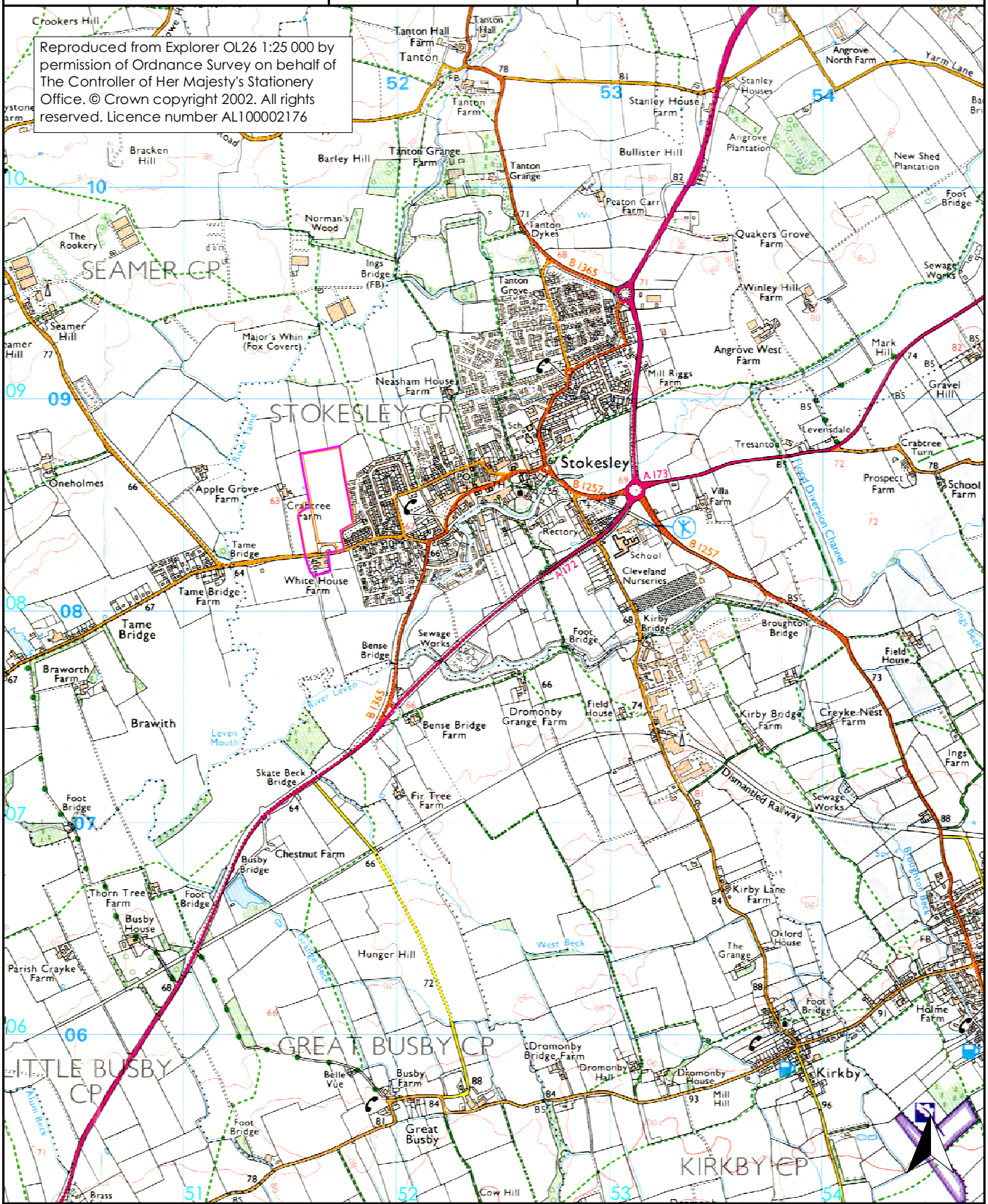
Figure 1: Site location



site location

0 1km
scale 1:25 000 for A4 plot

Area A

Area B

088
087
086
085
084
083
516
517
518

proposed development area

magnetic survey

-3 nT 3

0 50m

scale 1:1000 for A2 plot

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Figure 2: Geophysical surveys

Area A

Area B

088
087
086
085
084
083
516
517
518

proposed development area
magnetic survey
dipolar magnetic anomaly
positive magnetic anomaly
negative magnetic anomaly

0 50m
scale 1:1000 for A2 plot

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Figure 3: Geophysical interpretations

Area A

Area B

? former pond

088
087
086
085
084
083
516
517
518

proposed development area
magnetic survey
soil-filled feature
palaeo-channel / river course
service pipe
ridge and furrow
former field boundary
telegraph pole
inspection cover
former cowhouse

0 50m
scale 1:1000 for A2 plot

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Figure 4: Archaeological interpretations

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Figure 5:
Trace plots of geomagnetic data

Area A

32.90nT/cm

0 50m
scale 1:1000

Area B

22.00nT/cm

0 50m
scale 1:1000