Archaeological Services
University of Durham

Land north of Norwich Common, Wymondham, Norfolk

geophysical survey

on behalf of
CgMs Consulting

Report 1907
April 2008

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1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development on land north of Norwich Common, Wymondham, Norfolk. The works comprised a geomagnetic survey of approximately 13ha.

1.2 The works were commissioned by CgMs Consulting and conducted by Archaeological Services Durham University.

Results

1.3 Several former field boundaries and an infilled pond have been detected in the survey area; these all correspond to features marked on Ordnance Survey maps up to 1957.

1.4 A probable former roadside ditch has been detected near the western boundary of the survey area.

1.5 Occasional very weak anomalies elsewhere could possibly reflect remains of other ditch and pit features.

1.6 Two herring-bone arrangements of land drains were detected in the eastern half of the survey area.

2. Project background

Location (Figure 1)

2.1 The study area was located on land to the north of Norwich Common, Wymondham, Norfolk (NGR centre: TG 1290 0320). The field was approximately 12.6ha in size and was bounded on its eastern and western sides by roads, to the south by houses and to the north by a large hedgerow and dyke.

Development proposal

2.2 A proposal has been put forward for a housing development which will retain open areas to its fringes.

Objective

2.3 The principal aim of the survey was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development 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 advance of development.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from CgMs Consulting and a Written Scheme of Investigation (WSI) provided by Archaeological Services and approved by the Head of Archaeological Planning at Norfolk Landscape Archaeology, Norfolk Museums & Archaeology Service.

Dates

2.5 Fieldwork was undertaken between 14th and 18th April 2008. This report was prepared between 21st and 28th April 2008.

Personnel

2.6 Fieldwork was conducted by Graeme Attwood (Supervisor), Edward Davies and Richie Villis. This report was prepared by Graeme Attwood and Duncan Hale, the Project Manager, with illustrations by David Graham.

Archive/OASIS

2.7 The site code is **WNC08**, for **W**ymondham**, N**orwich **C**ommon 20**08**. The survey archive will be supplied on CD to CgMs Consulting 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 **archaeol3-41382**.

3. Archaeological and historical background

3.1 An assessment of the archaeological and historical potential of the survey area has been undertaken by CgMs Consulting (Gailey 2008).

3.2 Based on known find-spots, previous archaeological investigations and other available evidence the site was regarded as having low archaeological potential for the Palaeolithic, Mesolithic and Neolithic periods; moderate potential for the Bronze Age; moderate to good for the Iron Age; good for the Roman period and low potential for all subsequent periods.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised a single arable field which was predominantly level with a mean elevation of 45m OD.

4.2 The underlying solid geology of the area comprises Chalk which is overlain by Boulder Clay.

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 2nd edition* (David forthcoming); 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 survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a variety of complementary techniques such as magnetometry, earth 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.

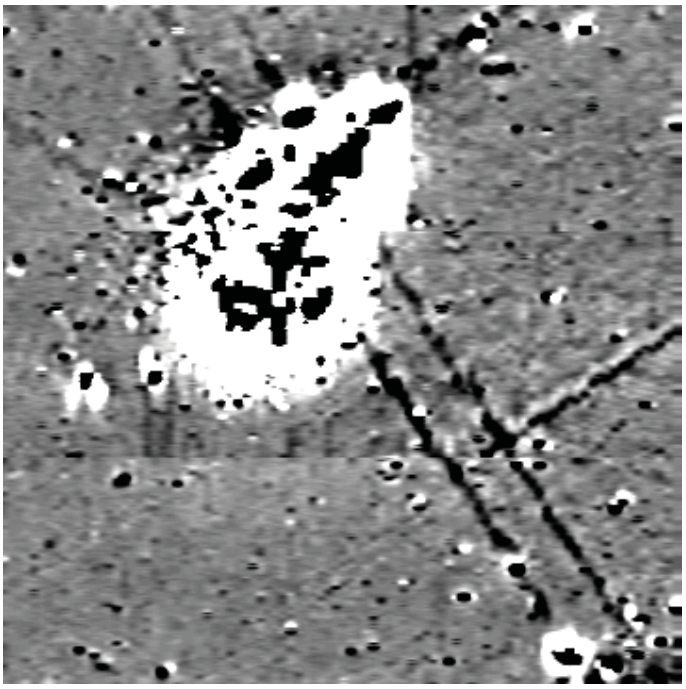
5.3 In this instance, it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Boulder Clay is variable in nature and it is understood that in some parts of East Anglia this has previously provided a poor response to geomagnetic survey. However, given the anticipated nature and depth of targets and the non-igneous geological environment of the study area, it was considered appropriate to try a geomagnetic technique, fluxgate gradiometry, for detecting each of the types of feature mentioned above. Fluxgate gradiometry 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.

Survey strategy

5.5 In the first instance the gradiometer technique was used over a test area located over known former field boundaries and a pond, as shown on early OS maps. As the technique clearly detected these known features, as well as several previously unrecorded features (see image below), it demonstrated its efficacy at detecting features of potential archaeological significance, and so was continued across the remainder of the study area.



Results of initial test survey (not to scale)

Field methods

5.6 A 30m grid was established across the survey area and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system (GPS) with real-time correction providing sub-metre accuracy.

5.7 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 set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

5.8 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

5.9 Geoplot v.3 software was used to process the geophysical data and to produce both a continuous tone greyscale image and a trace plot of the raw (unfiltered) data. The greyscale image and interpretations are presented in Figure 2; the trace plot is provided in Figure 3. In the greyscale image, 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.

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

clip	clips, or limits 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.
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 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.11 A colour-coded geophysical interpretation plan is provided in Figure 2. 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

5.12 A colour-coded archaeological interpretation plan is provided in Figure 2.

5.13 Small, discrete dipolar magnetic anomalies have been detected across the survey area. 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.

5.14 Several linear positive magnetic anomalies have been detected within the survey area. Of these, one aligned north-west/south-east and two aligned north-east/south-west correspond to former field boundaries shown on Ordnance Survey (OS) maps of the site up to 1957. Additional linear positive magnetic anomalies, which almost certainly reflect former ditches or drains, converge on a former pond, also marked on early OS maps. The pond is evident in the survey as a large concentration of dipolar magnetic anomalies, which almost certainly reflect the ferrous and/or fired nature of the material used to backfill the pond.

5.15 A number of other extremely weak positive magnetic anomalies could possibly reflect truncated remains of ditch and pit features. A row of small, discrete positive magnetic anomalies near the south-eastern corner could reflect a row of large post-holes or small pits.

5.16 Several series of parallel, evenly-spaced magnetic anomalies have been detected across the eastern half of the survey area; some of these appear to feed into other linear anomalies, and all almost certainly reflect land drains.

5.17 A positive magnetic anomaly which is aligned parallel to the road at the western boundary of the survey area may represent an earlier roadside ditch which has since been backfilled. Parts of this ditch appear to have been backfilled with large amounts of ferrous or fired material, detected as dipolar magnetic anomalies.

5.18 Dipolar magnetic anomalies have been detected along the southern boundary of the survey area; these reflect the ferrous nature of items within the gardens that back on to the survey area. Large, intense dipolar magnetic anomalies in the south-eastern corner of the site reflect adjacent lamp-posts.

6. Conclusions

6.1 A geomagnetic survey was undertaken over a proposed development site on land to the north of Norwich Common in Wymondham, Norfolk.

6.2 Several former field boundaries and an infilled pond have been detected in the survey area; these all correspond to features marked on Ordnance Survey maps up to 1957.

6.3 A probable former roadside ditch has been detected near the western boundary of the survey area.

6.4 Occasional very weak anomalies elsewhere could possibly reflect remains of other ditch and pit features.

6.5 Two herring-bone arrangements of land drains were detected in the eastern half of the survey area.

7. Sources

David, A, forthcoming *Geophysical survey in archaeological field evaluation, 2nd edition,* 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

Gailey, S, 2008 *Land at Site B north Norwich Common, Wymondham, Norfolk; archaeological desk-based assessment,* unpublished report by CgMs Consulting

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

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Figure 1
Location of the survey area

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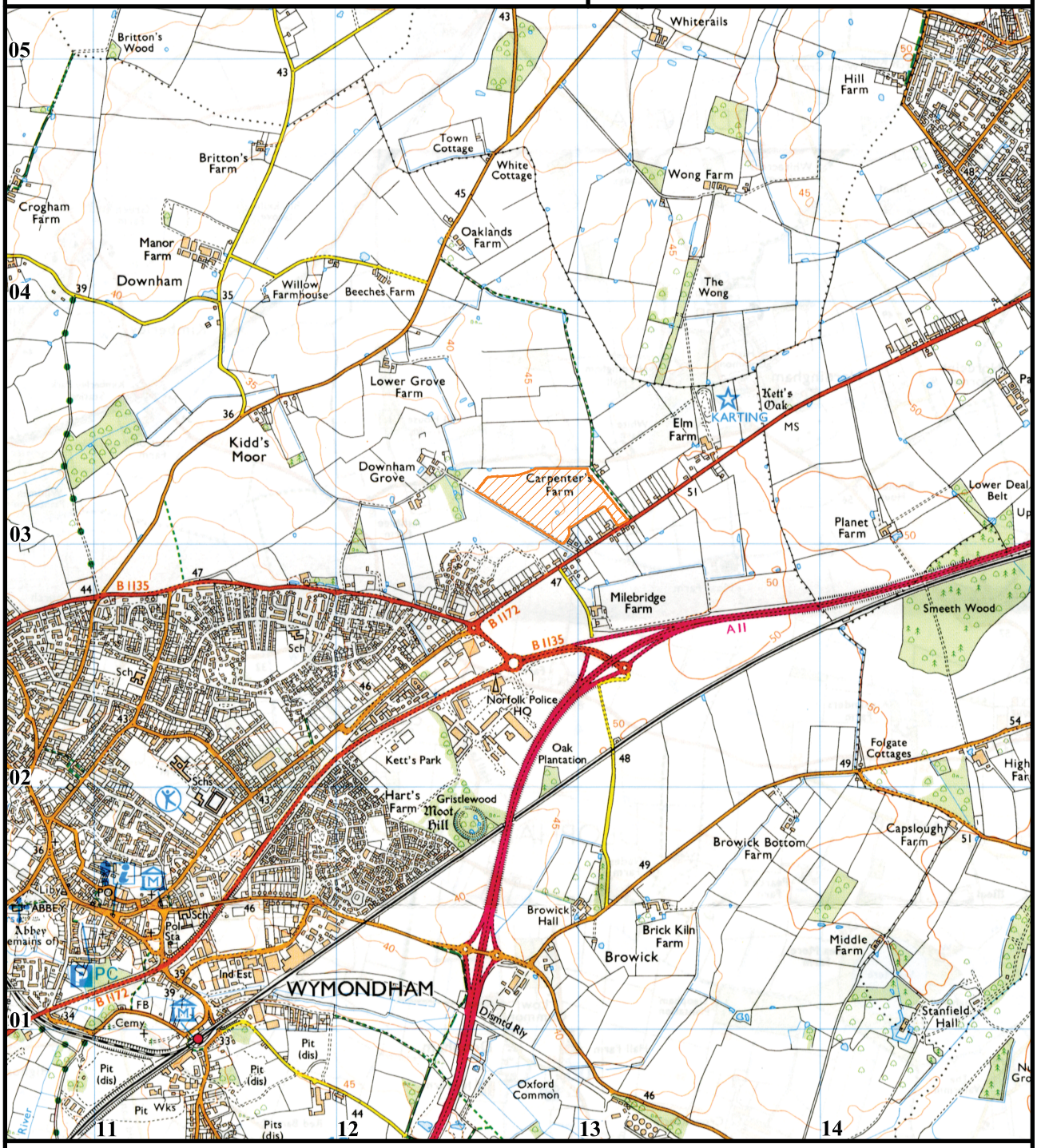

survey area

0 1km

scale 1:25 000 - for A4 plot

a

b

c

033 032 031 030

126 127 128 129 130 131 132

Pond
Drain
Farm
Track
The Old Oak
SKIPPING BLOCK ROW
48.5m
Garage
BM 48.81m
B 1172
St Edmund's
El Sub Sta
47.2m
COMMON

former field boundary
infilled pond

a) Geophysical survey

outline of survey area

3.00
2.50
2.00
1.50
1.00
0.50
0
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

b) Geophysical interpretation

positive magnetic anomalies
negative magnetic anomalies
dipolar magnetic anomalies

c) Archaeological interpretation

soil-filled features
land drain
probable land drain

0 50m
scale 1:1000 - for A0 plot

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Figure 2

Geophysical survey and interpretations

Figure 3: Trace plot of geophysical data