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GEOPHYSICAL SURVEYS AT NORTON GROVE, NORTON, NORTH YORKSHIRE

Archaeological Survey Division

Archive 219

GEOPHYSICAL SURVEYS AT NORTON GROVE, NORTON, NORTH YORKSHIRE

A PROGRAMME OF RESEARCH CARRIED OUT
ON BEHALF OF

NORTH YORKSHIRE COUNTY COUNCIL

By

GeoQuest Associates

INTRODUCTION

This report presents the results of a geophysical survey of two areas to be affected by a proposed link road to the Norton Grove Industrial Estate at Norton in North Yorkshire (Figure 1). The research was carried out on behalf of The Highways and Transportation Department of North Yorkshire County Council.

The geophysical survey was conducted by GeoQuest Associates using methods agreed through discussion with D. Hanson of North Yorkshire County Council. Survey was judged desirable to test for the archaeological potential indicated by proximity to the 'Three Dykes' earthwork though to represent a prehistoric boundary. This report describes the methods used for the evaluation and presents geophysical and archaeological interpretations of the findings.

GEOLOGY, TOPOGRAPHY AND LANDUSE

The proposed road links the Norton Grove Industrial Estate with Scarborough Road at a point south of Quarry Farm (Figure 1). The planned route traverses arable field 4480 south of the Priorpot Beck and pasture field 3100 containing scrub, which jointly total 3.3ha. Both areas are approximately level with no rock outcrops. Field 3100 forms part of the Norton Grove Stud Farm.

The solid geology in the study area comprises Upper Jurassic Kimmeridge and Ampthill Clays which are presumably obscured by deposits of drift. The mean elevation is approximately 25m O.D..

THE GEOPHYSICAL SURVEY

Geophysical surveying provides a rapid method for the detection of subsoil features within archaeological landscapes. Two methods are most frequently used. *Geomagnetic* surveying employs a portable magnetometer to detect small perturbations in the Earth's magnetic field caused by changes in soil magnetic susceptibility or permanent magnetisation. The *resistivity* method, on the other hand, maps differences in soil electrical resistance which mainly reflect variations in water content.

The primary aim of the geophysical survey at Norton was to prospect for evidence of prehistoric and later activity along the route of the proposed link road. Such evidence might comprise ditched enclosures, pits and timber buildings and associated features, such as field systems and areas of manufacture. These archaeological remains should be characterised by significant contrasts in magnetic susceptibility or permanent magnetisation which, under favourable conditions, will give rise to measurable geomagnetic anomalies. It was therefore considered that magnetic area survey would be a suitable technique for the site evaluation.

Measurements of vertical geomagnetic field gradient were made over a regular grid using a Geoscan FM36 fluxgate gradiometer with ST1 sample trigger in the areas marked yellow in Figure 1. A zig-zag traverse scheme was employed and data were logged in units of 20x20m at 1.0x0.5m intervals. Positional errors in the geophysical survey were constrained to within 1m. Appendix A provides further information about the techniques employed.

The geophysical results were processed into grey-scale images showing the residual geomagnetic anomalies and these are shown in Figure 2. Appendix B describes the computer processing of the field data in more detail.

DISCUSSION

General

The two survey areas are characterised by moderately intense geomagnetic anomalies with the strongest disturbances being detected in the pasture field north of the Priorpot Beck. The southern field contains a dense scatter of ferrous litter which appear as small and intense magnetic dipoles. This debris may have obscured more subtle geophysical anomalies of possible archaeological interest.

As a first stage in the interpretation, the geomagnetic map has been classified into characteristic styles of geophysical terrain as follows:

1 Significant regions of anomalously *high magnetic field gradient* which might be associated with high susceptibility, soil-filled structures such as *pits or ditches.*

2 Areas of anomalously *low magnetic field gradient*, corresponding to features of low magnetic susceptibility, such as *concentrations of rubble.*

3 Scattered *dipolar anomalies* (paired positive-negative) whose most probable source are objects or deposits with very high susceptibility, such as the *ferrous litter* referred to above or *fired features in the subsoil.*

A geophysical interpretation is presented in Figure 3 which includes a key defining the colour used for each class of anomaly.

Interpretation

Figure 4 presents a physical interpretation of the geomagnetic survey data. The following features have been identified:

Northern Area

1 A set of intense magnetic dipoles provide evidence that a metal pipe traverses this area in an ENE direction before branching NW and SE to run parallel to the line of trees shown in Figure 1.

2 Several stone or concrete culverts appear to be situated adjacent to the pipe as indicated by compact, negative magnetic anomalies. These are marked by the hatched circles in Figure 4.

3 Some evidence for a further set of tile pipes or drains is seen in the form of positive magnetic lineations in the SE quadrant of this survey area which appear to radiate from one of the 'culverts' proposed above. Alternatively, however, these anomalies may represent ditches of archaeological interest.

4 Probable headlands and disturbance due to pipelaying have been detected along the northern margins of this survey area.

5 Several pits and small ditches, of possible archaeological interest, have been detected and are marked in Figure 4.

Southern Area

7 As described above, this area is characterised by a dense scatter of ferrous litter as evidenced by the numerous small magnetic dipoles. This is almost certainly a result of intense mechanised cultivation.

8 Several diffuse, positive anomalies traverse this area and probably reflect geological features or the topography of the rockhead.

9 When the data are displayed on a high resolution monitor the area is seen to be patterned by polygons on a length scale of 2-10m; these probably reflect periglacial features in the subsoil. However, several of these anomalies have geometries suggestive of archaeological features (eg. those extracted in Figure 4) and hence further investigation to clarify their nature may be advisable.

10 A headland, in the form of low susceptibility stoney material has been detected along the western boundary of this field.

CONFIDENCE RATINGS

The percentage levels of confidence which we assign to the features interpreted from the geophysical survey data are as follows:

Headlands: Most 70%.

Geological features: 60%.
Metal pipes: 95%.
Tile drains 60% or **ditches** 40% (Northern Area)
Periglacial features: 70%.

SUMMARY AND CONCLUSIONS

The results of this research can be summarised as follows:

1 Geomagnetic anomalies in the study area were moderately intense, reflecting reasonable susceptibility contrasts between subsoil features and their surroundings. The geophysical data in the southern survey area were degraded by the effects of surface iron contamination.

2 A metal pipe, drains and culverts are present in the northern study area. No services were detected in the southern area.

3 Stoney headlands and disturbance due to pipelaying appear to be present along the field margins.

4 The southern area appears to be characterised by soil polygons of periglacial origin. However, several of these features have geometries suggestive of archaeological features and hence further investigation to verify their nature may be advisable.

5 No additional features of archaeological interest were detected by the geophysical survey.

Credits *Field survey*: C. Lambert, D. Watson
Report: M.J. Noel, C. Lambert
Date: 19/6/94

FIGURE 1

Map showing the location of the area surveyed at Norton (yellow). Digitised from the 1:2500 OS sheet (not all buildings are shown). Position of the proposed road is marked in blue.

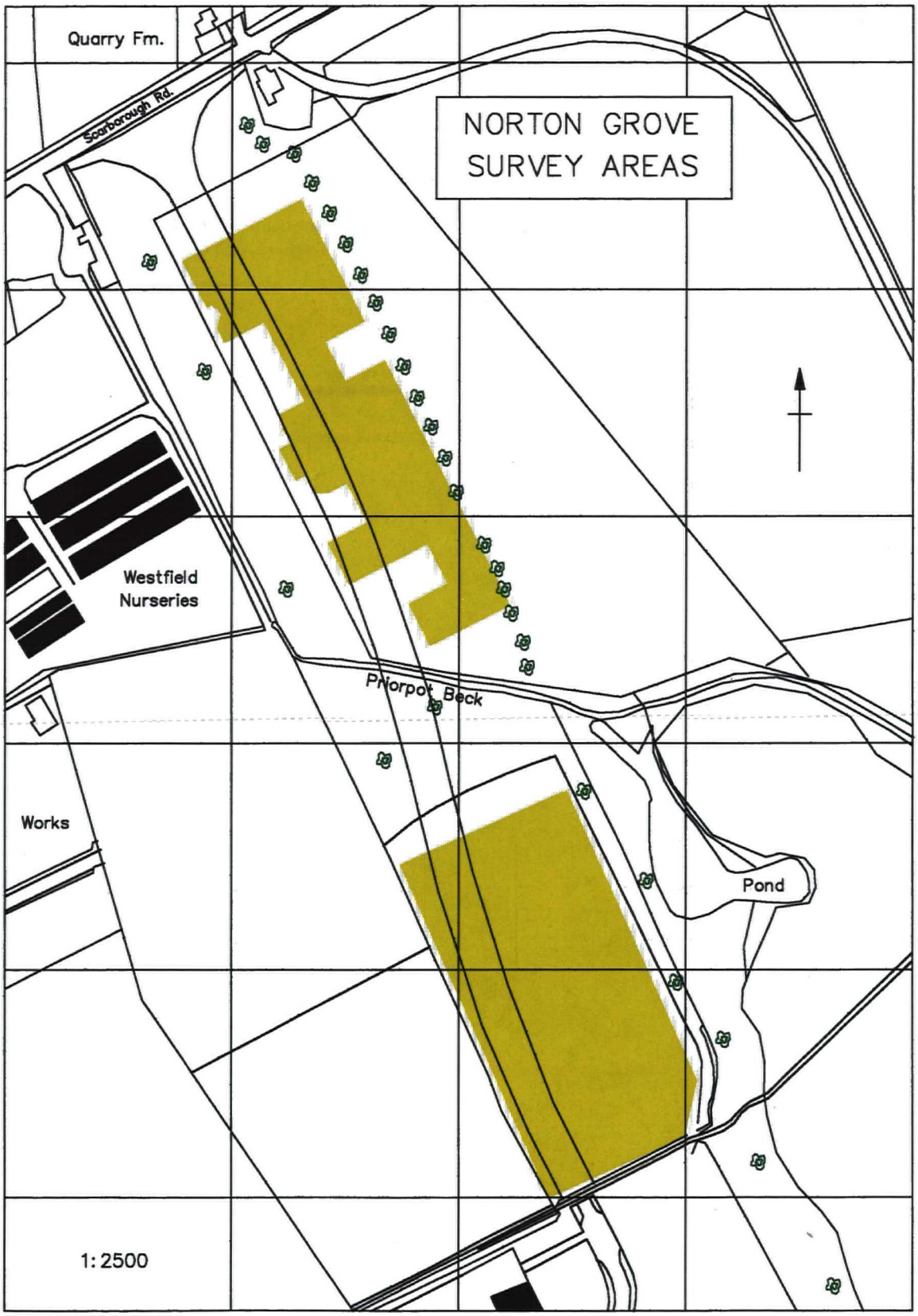
NORTON GROVE
SURVEY AREAS
Quarry Fm.
Scarborough Rd.
Westfield
Nurseries
Priorpot Beck
Works
Pond
1: 2500

FIGURE 2

Results of the geomagnetic surveys at Norton. Refer to the scale below for absolute values.

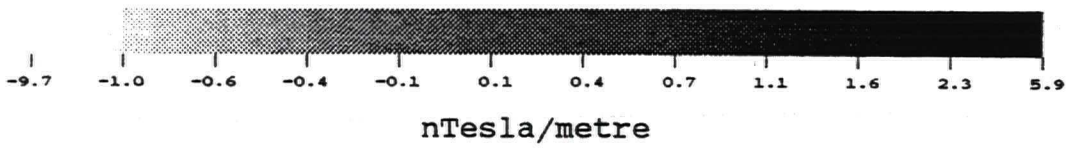

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Figure 2 - large A-scale plan is not included in the scan as too large.

Please refer to the original report for this figure 2.

FIGURE 3

Geophysical interpretation of the survey results obtained at Norton. Refer to the key for an explanation of the symbols used. Solid colour fills signify the most intense anomalies. The trees have been omitted for clarity.

Westfield
Nurseries

Priorpot Beck

Pond

Polygonal
patterning

NORTON GROVE

GEOPHYSICAL
INTERPRETATION

0 50m

1:1000

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KEY

+ve Anomalies

-ve Anomalies

Dipoles

FIGURE 4

An interpretation of the geophysical survey results from Norton. Refer to the key for an explanation of the symbols used. The trees have been omitted for clarity.

NOTES

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ditch?

headland

disturbance due to pipe laying

pipe

pipe

culvert?

culvert?

drains?

Westfield
Nurseries

Priorpot Beck

geological

features

Pond

PATTERNED

GROUND

e.g.

e.g.

e.g.

geological feature

NORTON GROVE

PHYSICAL
INTERPRETATION

0 50m

1:1000

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KEY

Pits/ditches

Stoney

Pipes