GEOPHYSICAL SURVEYS ON AREAS OF PROPOSED DEVELOPMENT AT HAMPSTHWAITE, NORTH YORKSHIRE

A programme of research carried out on behalf of

Nidderdale Quality Foods Ltd

by

GeoQuest Associates

1 INTRODUCTION

1.1 A geophysical site investigation has been carried out on two areas of land northeast of the Abattoir in Hampsthwaite village, North Yorkshire (Figure 1). A total of about 1.31ha was examined with the aim of providing information concerning the likely character and extent of subsoil archaeological features.

1.2 The research was carried out by GeoQuest Associates on behalf of Nidderdale Quality Foods Ltd, following instructions from Kevin J. Cale, Archaeological Consultant. Results of the geophysical surveys will be used to inform a programme of further research (which may include evaluation by trial trenching) aimed at characterising any subsoil archaeological features. Thereafter, it is proposed to redevelop the site for housing.

1.3 Figure 1 shows the location of the survey areas on a map digitised from a 1:500 scale plan drafted by Malcolm Tempest Ltd, architects. The geophysical surveys took place on 11th and 12th October 2000.

Grids 426160 458900

2 SITE DESCRIPTION

2.1 The archaeological interest in the study area centres on the conjecture that it may straddle the line of Watling Street (a Roman Road) on its route between Ilkley and Aldborough (*Isurium*). The presence of this structure signals the potential for associated features of Roman date being present in the immediate vicinity.

2.2 Following discussions between Kevin J. Cale and Gail Falkingham (Heritage Unit, North Yorkshire County Council), two areas of potential archaeological interest were selected for geophysical survey:

Area A

The southern third of a field of pasture, located immediately NE of the abattoir. Low earthworks of ridge and furrow are visible in this field, together with a bank and ditch, oriented NNE-SSW in the southern corner of the field. An ephemeral pond was present at the time of survey within the marsh shown in Figure 1. Area A occupies the lower of 2 river terraces, which are separated by a height difference of about 3m.

Area B

A small grassed paddock of trapezoidal plan, located SE of a car parking area. Well-preserved ridge and furrow was visible in this area which is positioned on the higher river terrace. Two caravans were parked close to the northern fenceline in this area.

2.3 The solid geology underlying the site consists of Namurian (Carboniferous) sandstone. These strata are almost certainly overlain by fluvial deposits which probably consist of gravels, silts and clay. The local rock types and drift are likely to have a moderate magnetic susceptibility, favouring use of archaeological geomagnetic survey, while the timing of the survey (late summer) is generally considered to favour the maximum amplitude of soil resistivity anomalies.

3 THE GEOPHYSICAL SURVEYS

Field Methods

3.1 Measurements of vertical geomagnetic field gradient were recorded using a Geoscan FM36 fluxgate gradiometer over all accessible parts of both study areas. A zig-zag traverse scheme was employed and data were logged in grid units of 20x20m at 1.0x0.5m intervals, thus providing 800 measurements per grid. Appendix A provides further information about this technique.

3.2 Soil electrical resistance values were measured over a similar area using a Geoscan RM15 meter operating in 'twin-electrode' configuration, with 0.5m spacing of the mobile electrodes. Again, data were logged at 1.0x0.5m gridded intervals. Appendix B describes the principles underlying this survey technique.

3.3 Data were downloaded on-site into an IBM Thinkpad computer for processing, printing and storage. These data were subsequently transferred to a laboratory computer for further processing, interpretation and archiving.

Data Processing

3.4 The GeoQuest **InSite®** software was used to process the geophysical data and to produce continuous tone grey-scale and colour images at a scale of 1:1000. These results are shown in Figures 2-5. A convention is used that shows positive magnetic and resistance anomalies as dark grey/purple and negative anomalies as light grey/red. The drawings include keys which relate the colour scales to anomaly values in nano Tesla per metre and Ohms.

3.5 The following basic processing steps were applied to the data:

Removal of striping artifacts in the geomagnetic images caused by alternating changes in level between zig-zag traverses.

Removal of Random 'Spikes' present in the data due to small ferrous objects or fired stone on or near the ground surface (magnetic survey), or poor electrical contact with the soil (resistivity survey). This process replaces spikes with the mean of near-neighbours.

DeShear corrects for apparent shear in strong geomagnetic anomalies surveyed by zig-zag traversing.

Correction for drift in magnetometer and resistance meter calibration with time.

Adjustment of grid mean values to achieve an optimum match along the lines of contact between data grids (both data sets).

Interpolation of the data, using a bilinear function, to generate a regular mesh of values at 0.25 x 0.25m intervals.

3.6 The geophysical images were printed on a Hewlett Packard HP650C Designjet plotter with 256 grey shades and 600 dpi resolution. A sigmoid function was used to map the data to printed tones since this provides a measure of contrast equalisation. Appendix C provides more information about data processing and itemises the algorithms that were applied to produce the grey-scale and colour geophysical images.

3.7 In Figure 5 the soil resistance data are shown after processing with a directional filter which emphasises subtle trends in the readings by appearing to illuminate the data map. This form of presentation is particularly useful when attempting to extract edges and linear trends in the geophysical data.

Key to Figure 6

3.8 A number of significant anomalies have been detected in both data sets and these are presented on a 1:1000 geophysical interpretation plan using coded colours and patterns (Figure 6). The following types of anomaly have been distinguished:

Green Significant regions of anomalously high or positive magnetic field gradient which might be associated with high susceptibility, soil-filled structures such as pits, and the silted furrows of medieval ridge and furrow.

Red Strong dipolar magnetic anomalies (paired negative-positive) which may reflect dumps of material with very high susceptibility and sites of bonfires. Smaller examples are almost certainly due to near-surface ferrous litter and have been ignored in the subsequent archaeological interpretation.

Brown Areas of anomalously high soil electrical resistance. In archaeological contexts, such regions are generally associated with buried wall footings, areas of more stoney ground and underground chambers.

Orange Regions where the instrument has recorded a relatively low electrical resistance, indicating a greater abundance of soil moisture. Archaeological examples might include ditches, pits and infilled ponds.

3.9 An archaeological interpretation plan at 1:1000 is presented in Figure 7 which includes feature codes **f1**, **f2**, etc, to assist in the discussion below.

4 INTERPRETATION

Area A

4.1 The most distinctive feature in the geomagnetic survey data comprises two sets of regularly-spaced lineations, NE of the marshy area, which provide good evidence for two medieval fields of ridge and furrow (**f1** & **f2**). These fields are separated by a 5-8m wide band of low magnetic susceptibility material which can be interpreted as either a stoney headland or a road composed of gravel or stone (**f3**). The geophysical data indicate that the headland or road is oriented N-S, with a possible bend which alters the bearing towards the NW. In the resistivity data set (Figures 4 & 5) the headland/road has not been detected, suggesting that the water content of this feature was similar to that of the surrounding subsoil at the time of survey.

4.2 Two compact positive magnetic anomalies have been detected close to the NW limit of this survey area. These anomalies may indicate the existence of soil-filled pits or recent areas of burning.

4.3 A band of intense magnetic dipoles, about 5m wide, has been detected along the axis of the bank and ditch feature in the SE quarter of this survey area. These anomalies are consistent with a linear deposit of ferrous debris such as might be expected along a former fenceline or farm track (**f4** & solid black line in Figure 7).

4.4 Within the extreme SE corner of Area A the geomagnetic survey has mapped a set of 3 parallel, positive magnetic lineations, spaced about 3.5m apart, which are consistent with silted ditches or the furrows of medieval ridge and furrow (**f6**). A correlation with similar features in Area B supports the latter hypothesis.

4.5 A weak and diffuse, curvilinear positive magnetic anomaly has been detected at right angles (and possibly crossing) furrow feature **f6** described above. This anomaly probably reflects the remains of a shallow ditch or a trackway (**f5**) of different date to the ridge and furrow.

Area B

4.6 A set of intense magnetic lineations correlates with the earthwork remains of ridge and furrow seen in this area (**f7**).

4.7 No further features of archaeological or geotechnical interest have been detected in either Area A or Area B.

5 SUMMARY AND CONCLUSIONS

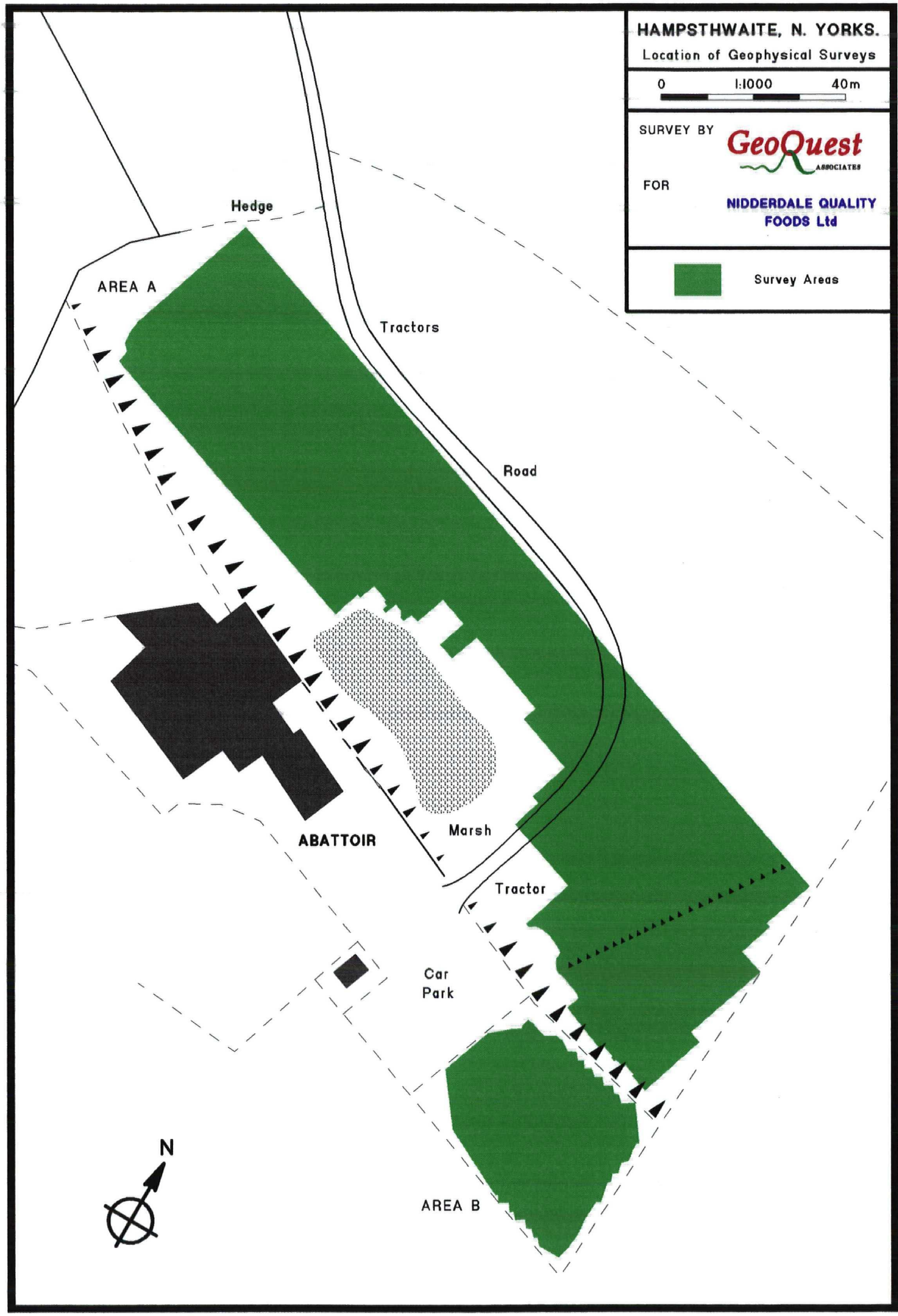
5.1 Detailed geophysical surveys has been carried out on two areas of land adjoining the abattoir in the village of Hampsthwaite, North Yorkshire. The aim of the surveys was to identify features of archaeological interest and thus contribute to a programme of site investigation prior to a possible redevelopment for housing.

5.2 The survey results provide good evidence for two sets of ridge and furrow in Area A separated by a headland or road containing more stoney material. A third system of ridge and furrow, with much narrower spacing, has also been detected in the small paddock of Area B. A field boundary marked by ferrous debris appears to cross the medieval ridge and furrow in the southern part of Area A.

5.3 A scheme of trial trenching may be advisable in order to test the archaeological character of features inferred from the geophysical surveys.

6 CREDITS

Survey: M. J. Noel PhD, FRAS and M. Johnstone BA
Report: M. J. Noel
Date: 19th October 2000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SURVEY BY
GeoQuest
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FOR
NIDDERDALE QUALITY FOODS Ltd
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Tractors
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ABATTOIR
Marsh
Tractor
Car Park
AREA B
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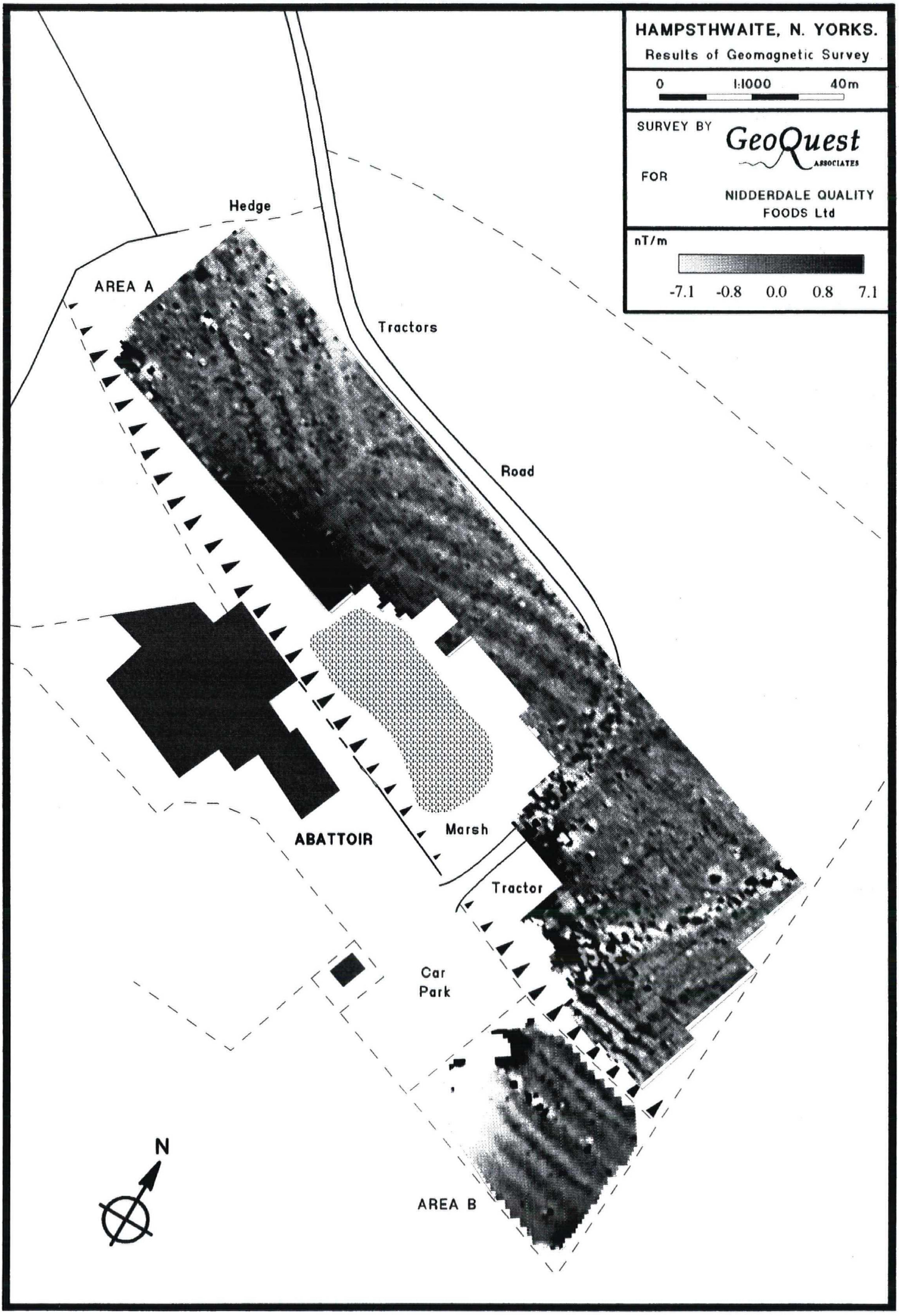
FIGURE 1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AREA A
Tractors
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ABATTOIR
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Car Park
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FIGURE 2