Archaeological Services
University of Durham

Whitby Business Park, Whitby, North Yorkshire

geophysical survey

on behalf of
National Grid Wireless

Report 1376
December 2005

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/archaeologicalservices

Whitby Business Park, Whitby, North Yorkshire

geophysical survey

Report 1376

December 2005

Archaeological Services Durham University

on behalf of

National Grid Wireless

Altrincham Business Park, George Richards Way, Altrincham, Chesire, WA15 5GL

Contents

1. Summary

The project

1.1 This report presents the results of a geophysical survey which was conducted on land to the north of Whitby Business Park, one of the locations under consideration for the proposed replacement of the East Cliff broadcast tower at Whitby, North Yorkshire.

1.2 The works were commissioned by National Grid Wireless, and conducted by Archaeological Services.

Results

1.3 Evidence of ridge and furrow cultivation, which can date from the medieval period to the late 19th century, has been found within the study area. The anomalies reflecting ridge and furrow cultivation can sometimes obscure features from earlier periods.

1.4 No other features of archaeological significance were detected.

2. Project background

Location, landuse and geology (Figure 1)

2.1 The proposed development area is located to the north of Whitby Business Park, off Stainsacre Lane, Whitby, North Yorkshire and lies within North York Moors National Park.

2.2 The study area measured 1ha and comprised open pasture bounded by fields on all sides, with a beck surrounded by dense undergrowth to the north. The area is predominantly level at an elevation of *c*.60m O.D.

2.3 The underlying geology comprises alternate layers of sandstone and Carboniferous shale. This is overlain with glacial deposits consisting mainly of boulder clay.

Development proposal

2.4 The development proposal comprises the possibility of relocating the East Cliff broadcast tower to a location near Whitby Business Park, due to the erosion of the headland.

Objective

2.5 The principal aim of the survey was to determine the nature and extent of any sub-surface features of potential archaeological significance.

Brief

2.6 The project brief required a survey of up to 1ha to be undertaken at the study area.

Dates

2.7 Fieldwork was carried out on the 13th December 2005. This report was prepared on the 14th December 2005.

Personnel

2.8 Fieldwork was conducted by Martin Railton and Sam Roberts. This report was prepared by Sam Roberts, with illustrations by Martin Railton. The Project Manager was Duncan Hale.

Archive

2.9 The site code is **WBP05**, for **W**hitby **B**usiness **P**ark 20**05**. The paper and data archive is currently held by Archaeological Services University of Durham. It is anticipated that the data archive will be transferred to the North York Moors National Park Sites and Monuments Record and the North Yorkshire Historic Environment Record upon the completion of the proposed development.

3. Archaeological and historical background

3.1 There are no scheduled sites within 1km of the site, and few listed buildings or sites of historic or archaeological interest. A desk-based assessment evaluating the nature, extent and significance of any surviving archaeological features within the study area (Archaeological Services 2005) concluded that there was a low potential for the presence of any archaeological resource; however if any resource were to be present, the undeveloped nature of the site would lead to a high potential for the resource to survive in good condition.

4. Geophysical survey

Standards

4.1 The surveys and reporting were conducted in accordance with English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (2002); and the Archaeology Data Service (2001) *Geophysical data in archaeology: A guide to good practice*.

Technique selection

4.2 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 resistivity, 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.

4.3 In this instance it was considered possible that cut features, such as ditches and pits, may 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.

4.4 Given the shallowness of the 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 a hand-held magnetometer to detect and record minute perturbations, or 'anomalies', in the vertical component (i.e. gradient) of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

4.5 A survey area totalling 1ha was laid out using a 30m grid. The survey grid was tied-in to known, mapped, Ordnance Survey points using a Leica GS50 global positioning system (GPS).

4.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601 fluxgate gradiometers with automatic datalogging facilities. 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.

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

Data processing

4.8 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 data. The greyscale images and interpretations are presented in Figures 2-4; the trace plot is 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.

4.9 The following basic processing functions have been applied to the dataset:

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 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 and so create a smoother appearance to the data. In this instance the gradiometer data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types (Figure 3)

4.10 A colour-coded geophysical interpretation plans is provided for the survey area. 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.
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 (Figure 4)

4.11 A colour-coded archaeological interpretation plan has been provided for the survey area.

4.12 Linear positive and negative magnetic anomalies reflecting ridge and furrow cultivation are present across the survey area. The ridge and furrow remains are on a northwest-southeast alignment with furrows spaced approximately 5m apart.

4.13 A linear dipolar magnetic anomaly along the southern edge of the survey area reflects a wire fence marking the field boundary.

4.14 The only other anomalies detected are small, discrete, dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and fired debris, such as horseshoes and brick fragments and fencing wire.

5. Conclusions

5.1 Geophysical surveys have been carried out over land to the north of Whitby Business Park, Whitby, North Yorkshire.

5.2 Evidence of ridge and furrow cultivation, which can date from the medieval period to the late 19th century (Taylor 1975), has been detected throughout the study area. The anomalies reflecting ridge and furrow cultivation can sometimes obscure features from earlier periods.

5.3 No other features of archaeological significance have been detected.

6. Sources

Archaeological Services 2005 *Replacement of the East Cliff broadcast tower, Whitby, North Yorkshire* unpublished report **1348** for National Grid Wireless, Archaeological Services Durham University

Archaeology Data Service 2001 *Geophysical data in archaeology: A guide to good practice* Arts and Humanities Data Service

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

Institute of Field Archaeologists 2002 *The use of geophysical techniques in archaeological evaluations* IFA Technical Paper **6**

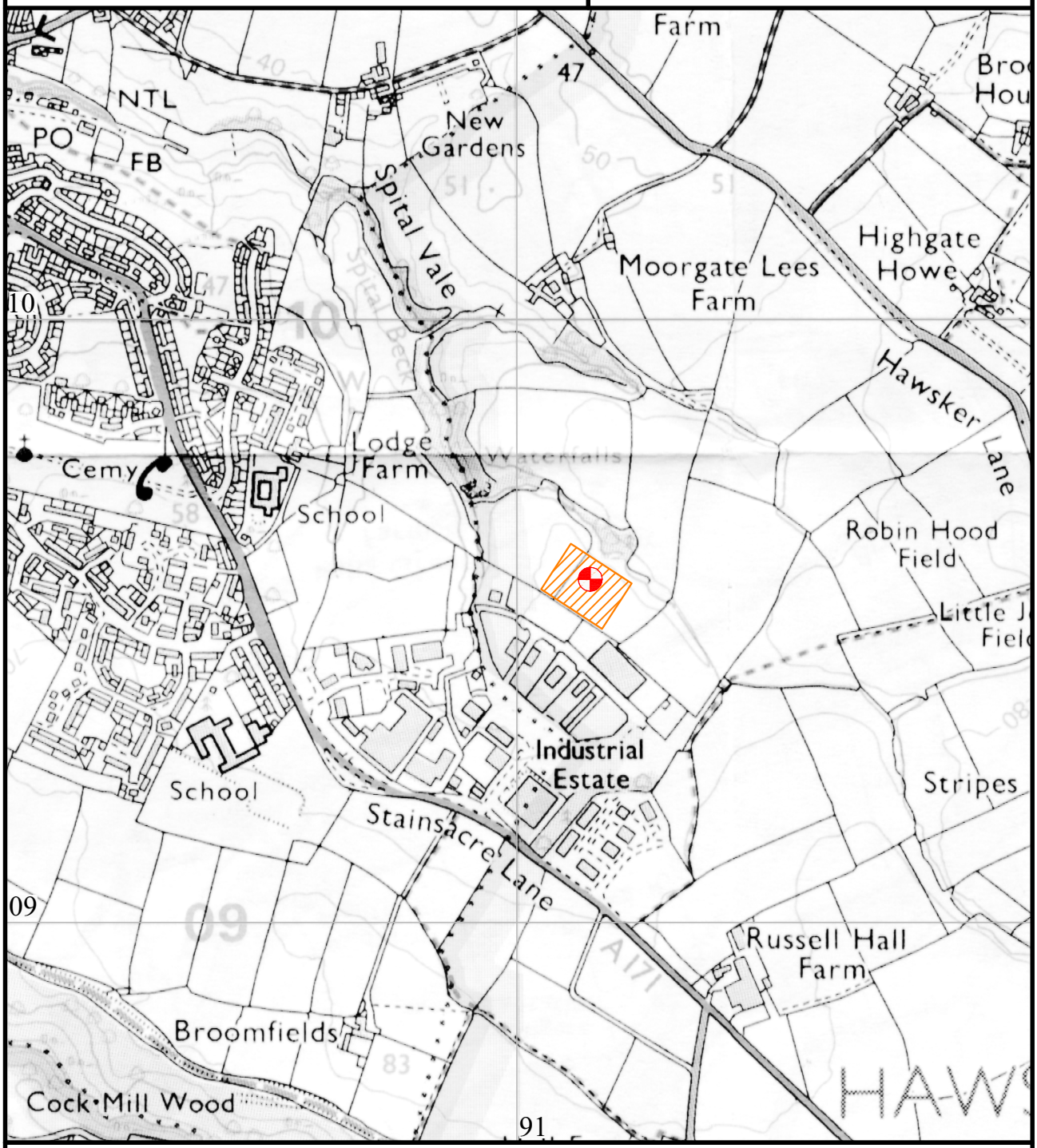
Taylor, C 1975 *Fields in the English landscape* Aldine Press, London

Archaeological Services
University of Durham

Whitby Business Park,
Whitby, North Yorkshire
geophysical survey

Report 1376
Figure 1
Location of the geophysical survey area and the proposed development site

on behalf of
National Grid Wireless

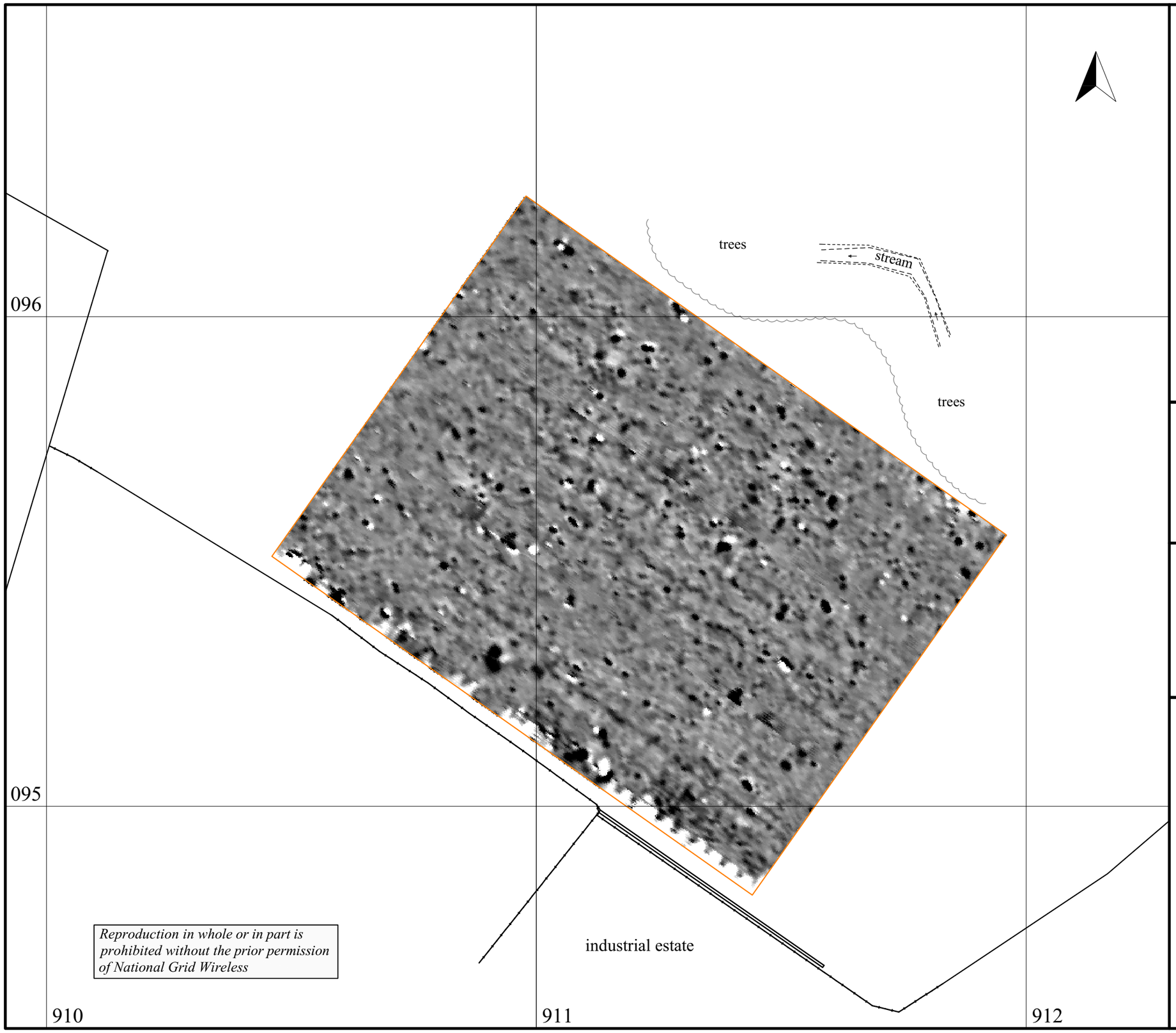


proposed site

survey area

0 500m

scale 1:10 000 - for A4 plot



Archaeological Services
University of Durham

Whitby Business Park,
Whitby, North Yorkshire
geophysical survey

Report 1376

Figure 2

Geophysical survey

on behalf of
National Grid Wireless

0 40m

scale 1:800 - for A3 plot

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

Archaeological Services
University of Durham

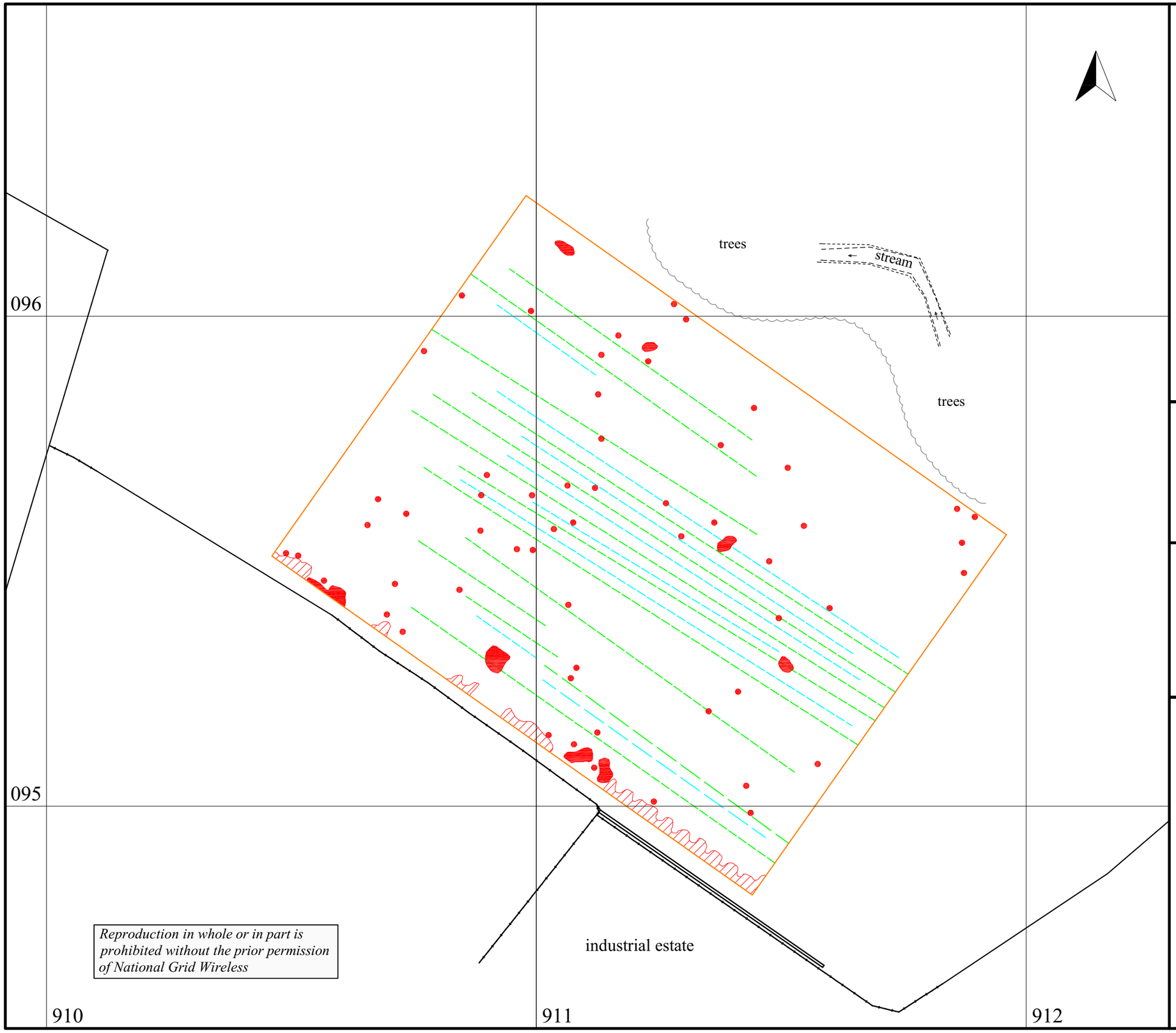
**Whitby Business Park,
Whitby, North Yorkshire
geophysical survey**

Report 1376

Figure 3

Geophysical interpretation

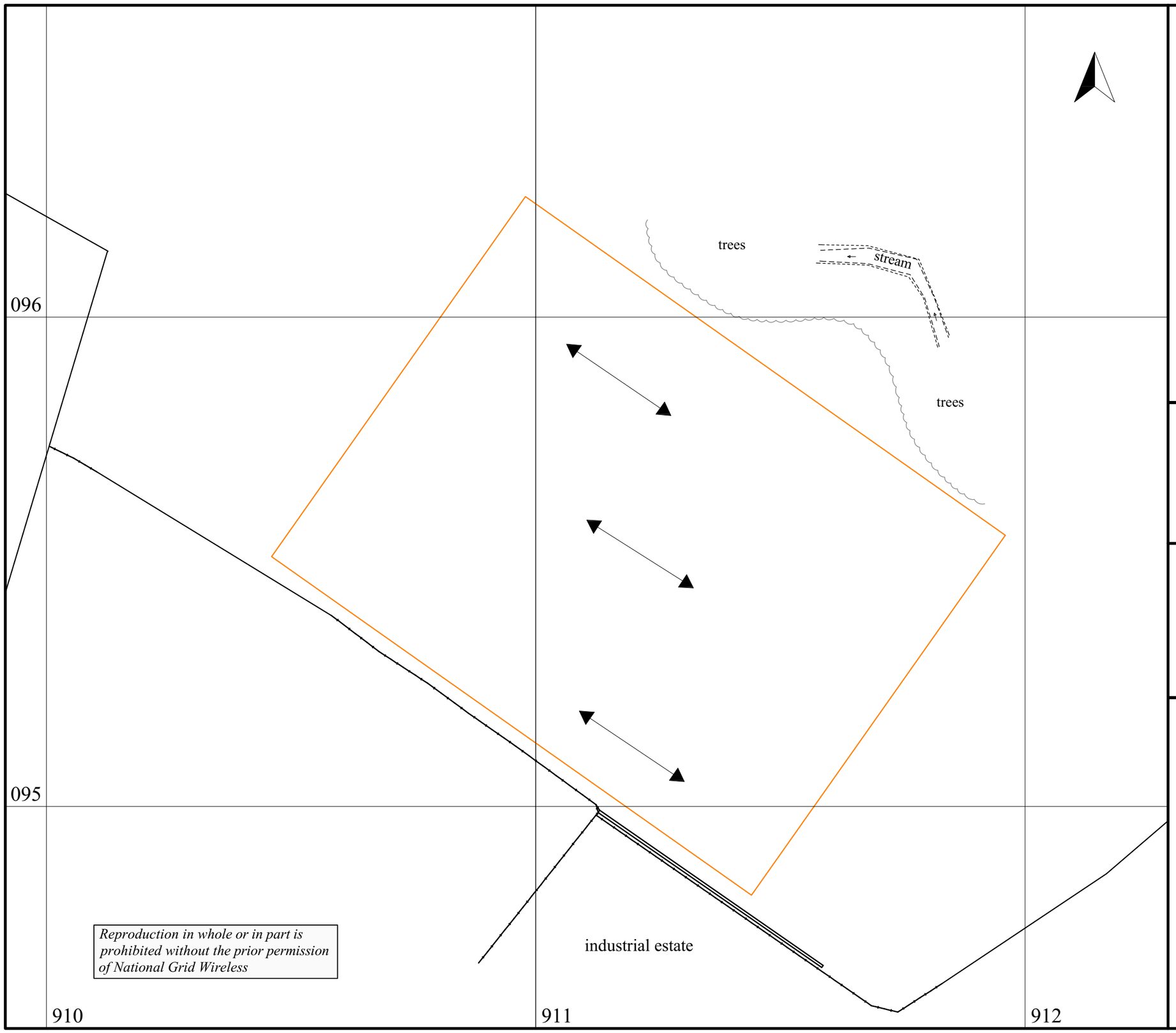
on behalf of
National Grid Wireless



0 40m

scale 1:800 - for A3 plot

- outline of survey area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies



Archaeological Services
University of Durham

**Whitby Business Park,
Whitby, North Yorkshire
geophysical survey**

Report 1376

Figure 4

Archaeological interpretation

on behalf of
National Grid Wireless

0 40m

scale 1:800 - for A3 plot

outline of survey area

orientation of ridge and furrow

Appendix 1: Trace plots of geophysical data

Whitby Business Park, Whitby, North Yorkshire

Trace plot of geomagnetic data

1:750 @ A4