

**GEOPHYSICAL SURVEY OF PROPOSED
WASTEWOD PROCESSING PLANT,
POLLINGTON AIRFIELD, NORTH
YORKSHIRE & EAST RIDING OF
YORKSHIRE: Phase 2**

HFA Site Code: PAF 2008
Grid Ref.: SE 6017 2089 (approximate centre)

A programme of research carried out on behalf of

Humber Field Archaeology

by

GeoQuest Associates



SUMMARY

A second phase of archaeological geophysical survey has been carried out on the site of a proposed waste wood processing plant at the former Pollington Airfield (R.A.F. Snaith). Three rectangular sample blocks, totalling 5ha, were mapped using a fluxgate magnetometer on arable land south of Heck and Pollington Lane. Data were again logged at 0.25m intervals, along traverses spaced 1.0m apart in order to detect subsoil anomalies in magnetic susceptibility as an indicator of archaeological features. The geophysical character of the area was found to be similar to that previously explored; namely extremely weak geomagnetic anomalies, implying relatively homogenous soils with low susceptibilities. Nevertheless, a complex pattern of linear and rectilinear features has been detected in the eastern half of the study area, which are consistent with ditched enclosures and trackways. Three sites which may contain structural remains have also been tentatively identified.

1 INTRODUCTION

- 1.1 This report describes the results of a second phase of geophysical survey over farmland on part of the former Pollington Airfield (R.A.F. Snaith), in North Yorkshire and the East Riding of Yorkshire (Figure 1), where it is proposed to develop a biomass waste wood processing facility. The first phase of investigation mapped a total of 13.14ha in 5 sample blocks north of Heck and Pollington Lane. In the present study a further 3 sample blocks have been surveyed in a single arable field situated between this lane and the Knottingley and Goole Canal.
- 1.2 This project contributes to an archaeological assessment being carried out by Humber Field Archaeology for Dalkia Bioenergy Ltd through their consultants *ethical partnership*. Fieldwork was carried out by GeoQuest Associates from 24th to 27th November 2009, at which time the field bore a 5cm tall cereal crop. Further details of the archaeological context of the study area were given in our previous report.

2 THE GEOPHYSICAL SURVEY

- 2.1 Setting out details for Areas 6 and 7 are defined in Figure 1 and Appendix A, while the baseline origin (E) for Area 8 was a concrete fence post 36.6m from the straining post in the northeast field corner. This baseline was then oriented towards a point 2m from the eastern field boundary, as delineated by a set of concrete posts. It is important to note that the positions of sample blocks shown in Figures 1 to 4 are approximate: the exact coordinates of features detected by the survey must be established in relation to the positions of the fixed points defined in Figure 1 and Appendix A, several of which lie outside the study area and are not depicted on the Ordnance Survey.
- 2.2 Measurements of vertical geomagnetic field gradient were again recorded using a Geoscan FM36 fluxgate gradiometer with 0.05nT/m resolution. A zig-zag traverse scheme was employed and data were logged in grid units of 20x20m at 1.0x0.25m intervals, thus providing 1600 measurements per grid. Geophysical readings were once more downloaded on-site into a portable graphics computer for quality checks and initial processing. These data were subsequently transferred to a laboratory computer for final processing, interpretation and archiving using GeoQuest's *InSite* software.
- 2.3 Geomagnetic readings in each sample block were processed into a continuous-tone, grey-scale images which were low-pass filtered to remove speckle, thus enhancing the appearance of anomalies of possible archaeological interest. These results are shown in Figure 2 along with a scale which shows positive magnetic anomalies as dark grey and negative magnetic anomalies as light grey. Further details of the data processing procedures are given in Appendix B.
- 2.4 An archaeological interpretation of the geophysical survey is presented in Figures 3 and 4. A key defines the colours and fill styles used in these drawings, while feature codes **f1** and **f2**, etc, are included in Figure 4 for reference in the discussion below.

3 INTERPRETATION

General

- 3.1 Magnetic anomalies in each of the sample blocks were found to be extremely weak, consistent with topsoil and subsoil layers having low and uniform magnetic susceptibility. Topsoils were also found to contain a very low concentration of ferrous litter and burnt material, as evidenced by the near-absence of small magnetic dipoles which are characteristic of such materials. In both regards, the new study areas are similar to those sampled in the previous investigation on land north of Heck and Pollington Lane.

Area 6

- 3.2 **f1:** A single, intense magnetic dipole has been detected in the northern quarter of this block with no associated geophysical features. The absence of a clear north-south oriented polarisation in this anomaly suggests that the source is a randomly-oriented fragment of iron or fired material, such as brick, rather than an *in situ* fired structure, such as a kiln or hearth. This is the only significant geophysical anomaly detected in Area 6.

Area 7

- 3.3 **f2 & f3:** A set of very weak and diffuse positive magnetic lineations have been mapped in the northern and eastern parts of this 100m square sample block. The general trend of feature **f2** towards the adjoining canal suggests that the source may be a tile land drain, with feature **f3** being a feeder drain. However, when these anomalies are seen in the context of those detected in adjoining Area 8, it seems more likely that they comprise part of an extensive network of silted ditches associated with enclosure and settlement in this area. Owing to the weakness of the geophysical anomalies, it is possible that further ditches exist but are undetected owing to very low magnetic susceptibility contrasts in the subsoil.

Area 8

- 3.4 This area has been found to contain a complex pattern of rectilinear magnetic anomalies of a style similar to those seen in the Phase 1 sample blocks north of Heck and Pollington Lane, where excavation indicated that they relate to a system of Romano-British enclosures and a road. The present data set provides good evidence to suggest that a similar pattern of land use continues south into the north-eastern corner of the Phase 2 study area. The wavelengths of the geophysical anomalies (1-2m) indicate that the target features may be at depths of more than 1m.
- 3.5 **f4:** A pair of parallel, positive linear anomalies enter the sample block and can be traced for a distance of about 60m along a bearing south-west. The spacing of about 10m and style of these anomalies suggests the presence of a double-ditched roadway, which clearly continues north-east beyond the area investigated.
- 3.6 **f5:** Another set of parallel linear anomalies has been found trending south-west into the sample area, consistent with a second road or possibly part of a network of land drains. Unfortunately, these anomalies are close to the detection limit of the geophysical method used and hence their full extent cannot be characterised.

f3	Ditch	■	■	■	■	■	■	■	■	■	■	■
f4	Ditched roadway	■	■	■	■	■	■	■	■	■	■	■
f5	Ditched roadway	■	■	■	■	■	■	■	■	■	■	■
f6	Ditched roadway	■	■	■	■	■	■	■	■	■	■	■
f7	Ditched enclosure	■	■	■	■	■	■	■	■	■	■	■
f8, f9, f10	Structural remains	■	■	■	■	■	■	■	■	■	■	■

6 CREDITS

Survey & Report: M. J. Noel PhD, FRAS
 Date: 30th November 2009

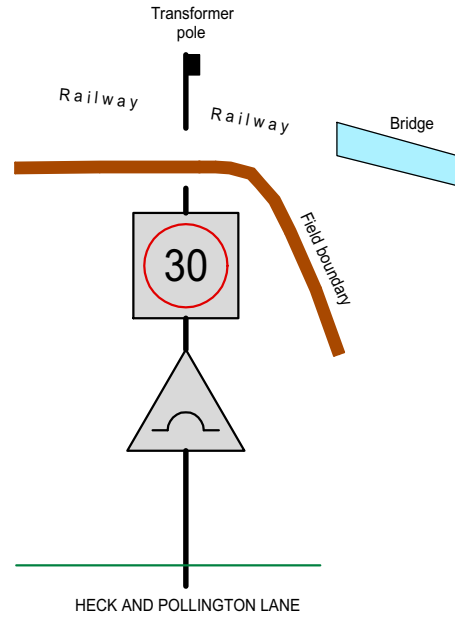
Note: Whilst every effort has been taken in the preparation and submission of this report in order to provide as complete an assessment as possible within the terms of the brief, GeoQuest Associates cannot accept any responsibility for consequences arising as a result of unknown and undiscovered sites or artefacts.

SETTING OUT DETAILS

A, B, C & D refer to the labels shown in Figure 1

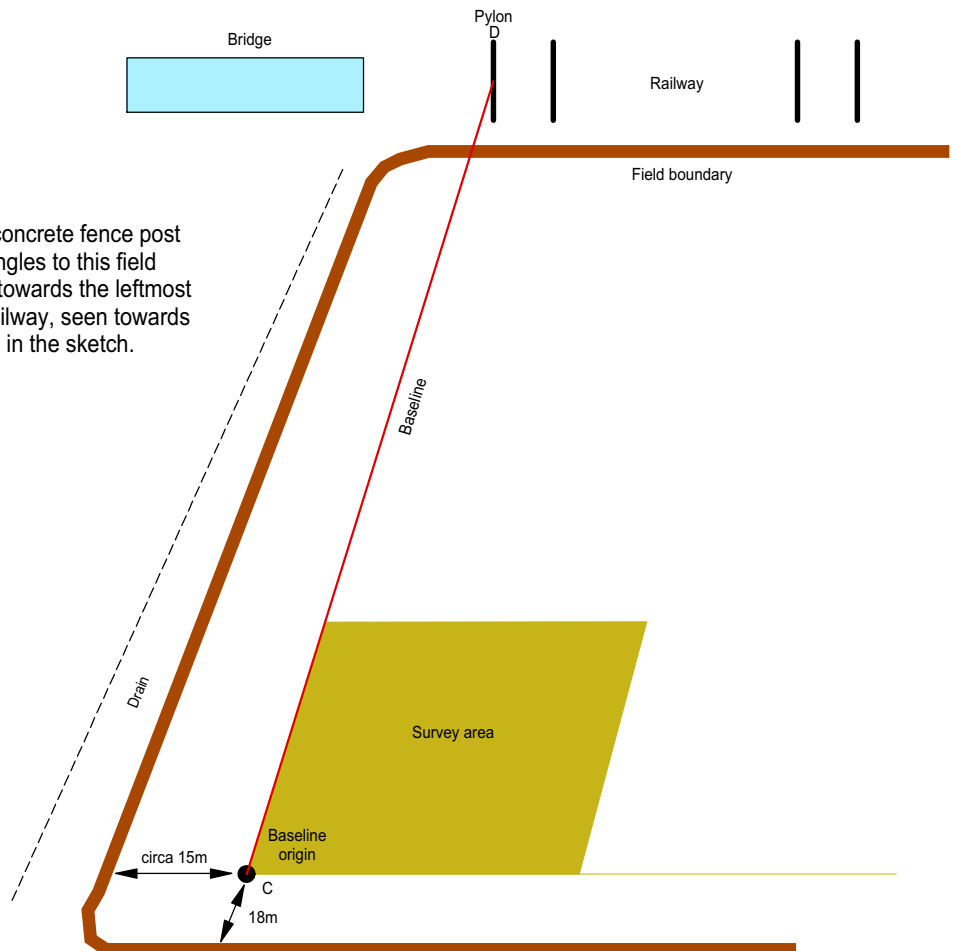
AREA 6

Baseline origin (A) is the pole of a road sign on south side of Heck and Pollington Lane, bearing 30mph and bridge warning notices. The baseline is then oriented towards a transformer pole (B) on the railway which is seen immediately left of the blue railway bridge, as in the sketched view here.



AREA 7

Baseline origin (C) is 18m from the first concrete fence post NE from the south field corner, at right angles to this field boundary. The baseline is then oriented towards the leftmost pylon (D) carrying powerlines over the railway, seen towards the right of the railway bridge, as defined in the sketch.



APPENDIX B

DATA PROCESSING

PROCESSING THE SURVEY DATA

The geophysical images contained in this report were prepared within Microsoft Windows® using the InSite® program published by GeoQuest Associates. Geophysical images were then placed onto a map which was digitised from the Ordnance Survey, edited and then plotted using a computer aided drafting (CAD) system and colour inkjet printer.

Data were downloaded from the meter to a portable computer in the field for storage, visualisation and quality control (QC) assessment. These data were then transferred to a laboratory computer for final processing, printing and archiving.

A number of process steps have been applied to the geophysical data obtained during the survey and those which have been used are linked to the main flow path by arrows. Steps were applied in the order shown and are designed to reduce artifacts in the data and enhance geophysical features of archaeological interest. The following sections describe each step in more detail.

REMOVE STRIPING

Reduces a data artifact comprising alternating changes in level in readings logged along zig-zag traverses. This artifact is common in fluxgate magnetometer data. InSite uses a proprietary algorithm to reduce this error.

INFILL SMALL BLANK AREAS

Fills isolated blank data cells with the mean of near-neighbours or a suitable approximation entered manually. Small blank areas will have been logged if it was not possible to obtain a geophysical reading over, for example, a manhole cover in the case of a resistivity survey.

REMOVE SPIKES

Replaces isolated, anomalously high or low values with the mean of near neighbours or a suitable approximation entered manually. 'Spike' readings are commonly associated with ferrous litter or poor electrical contact in the case of geomagnetic and resistivity data, respectively.

REDUCE WALK HARMONICS

Reduces a regular oscillation in traverse data caused by walking movements of the operator during a geomagnetic survey. InSite employs a fast Fourier transform to determine the optimum amplitude and phase of the walk-induced harmonic which is then subtracted from each traverse.

REDUCE SHEAR ARTIFACTS

Corrects for apparent shear in geomagnetic anomalies surveyed by zig-zag traversing in a geomagnetic survey. The shearing effect arises from the interaction of the operator+magnetometer with the geomagnetic field and also from the lag in the instrument response to changes in the field. InSite uses a proprietary algorithm to reduce this error.

CORRECT FOR METER DRIFT

Corrects for a linear drift in the meter calibration with time. Such drift is a common problem with fluxgate magnetometers, particularly during periods of rapid air temperature change. InSite uses least-squares regression on the mean of data along each traverse to estimate the change in calibration level across each grid. This gradient is then removed from the data.

ADJUST GRID MEAN LEVELS

Adjusts for differences in the mean level in data grids due to changes in instrument calibration (fluxgate magnetometer survey) or alteration in remote electrode spacing (resistivity survey).

INTERPOLATE AND COMBINE

Combines grids to form an array of regularly-spaced data on a square mesh. InSite uses bilinear interpolation to accomplish this.

LOW PASS FILTER

If this process task is indicated then a 3x3 or 5x5 boxcar filter has been used to smooth the data and reduce noise or 'speckle' seen in the original image.

HIGH PASS FILTER

If this process task is indicated then a 3x3 or 5x5 filter, with appropriate coefficients, has been used to pass short-wavelength information into the resulting image.

EDGE DETECT FILTER

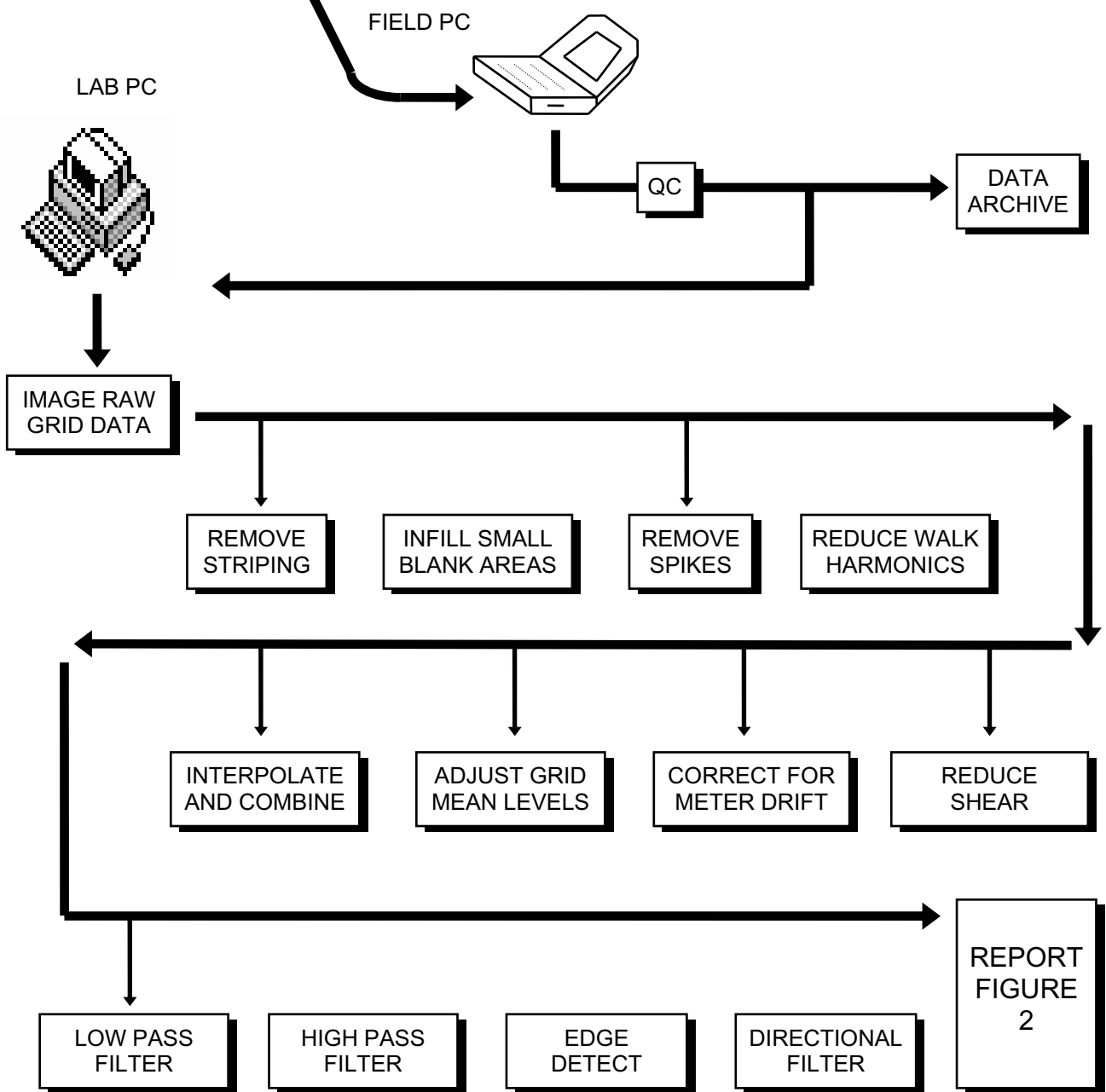
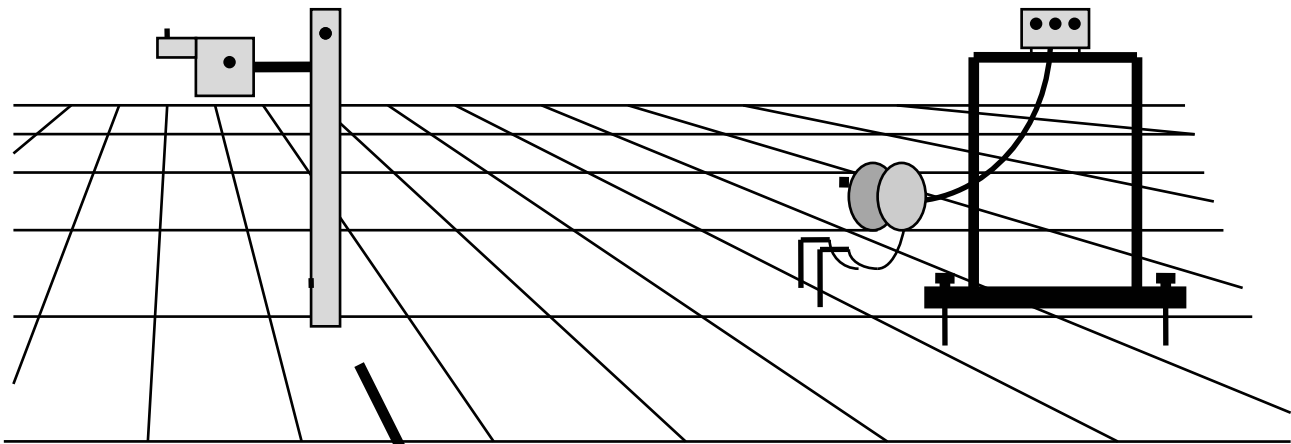
Signifies that a Sobel, Laplace or other specialised filter has been applied to enhance significant lateral transitions in the geophysical image.

DIRECTIONAL FILTER

This filter is equivalent to illuminating the data from one direction to produce a pseudo-relief image. Directional filtering is usually employed to aid the identification of subtle anomalies in resistivity data. This filter highlights features trending at right angles to the direction of illumination.

NOTE

GeoQuest Associates can supply the geophysical images presented in this report in a variety of digital formats for visualisation on microcomputers running Microsoft Windows. These formats include the TIF, BMP and PCX standards.



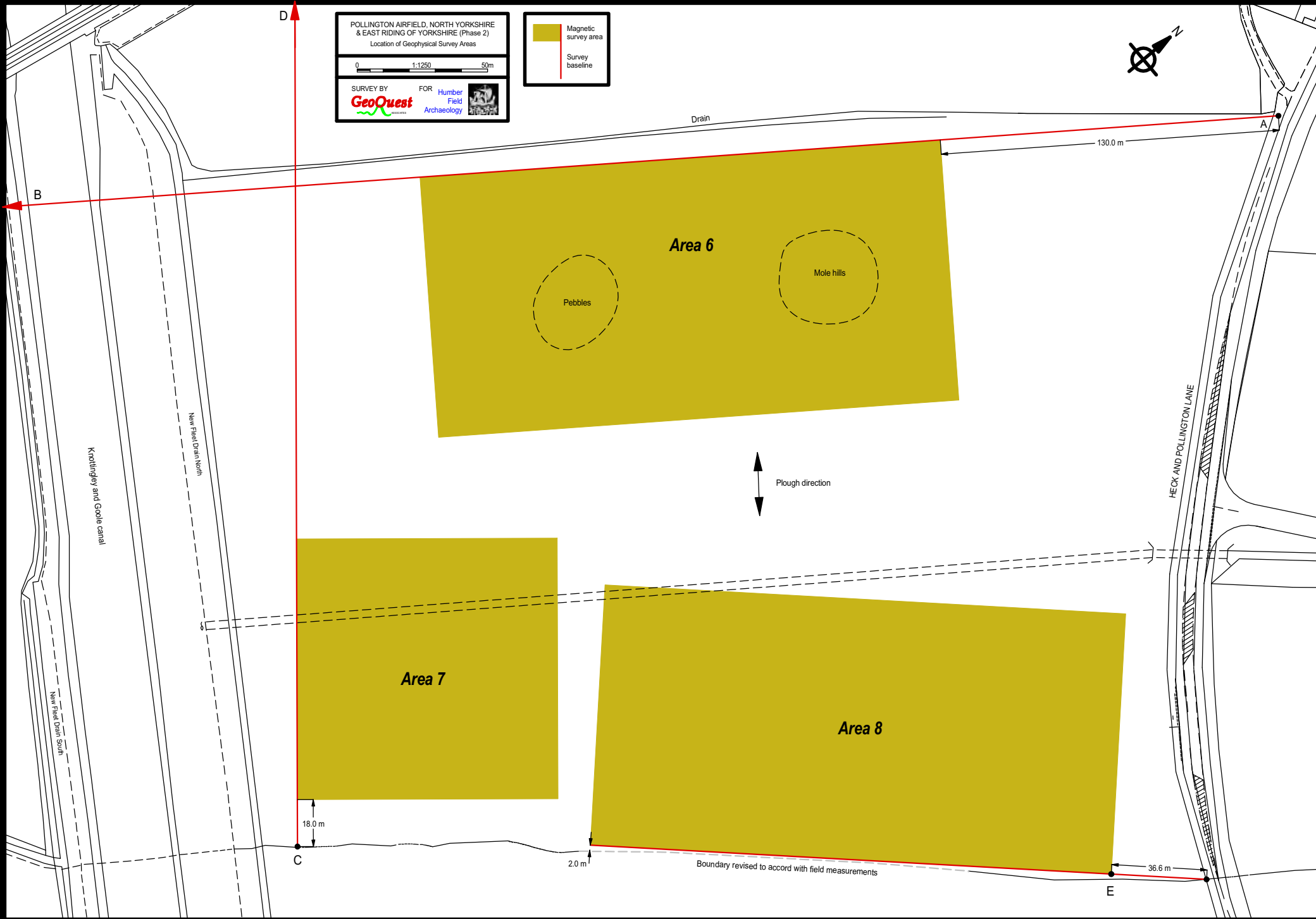
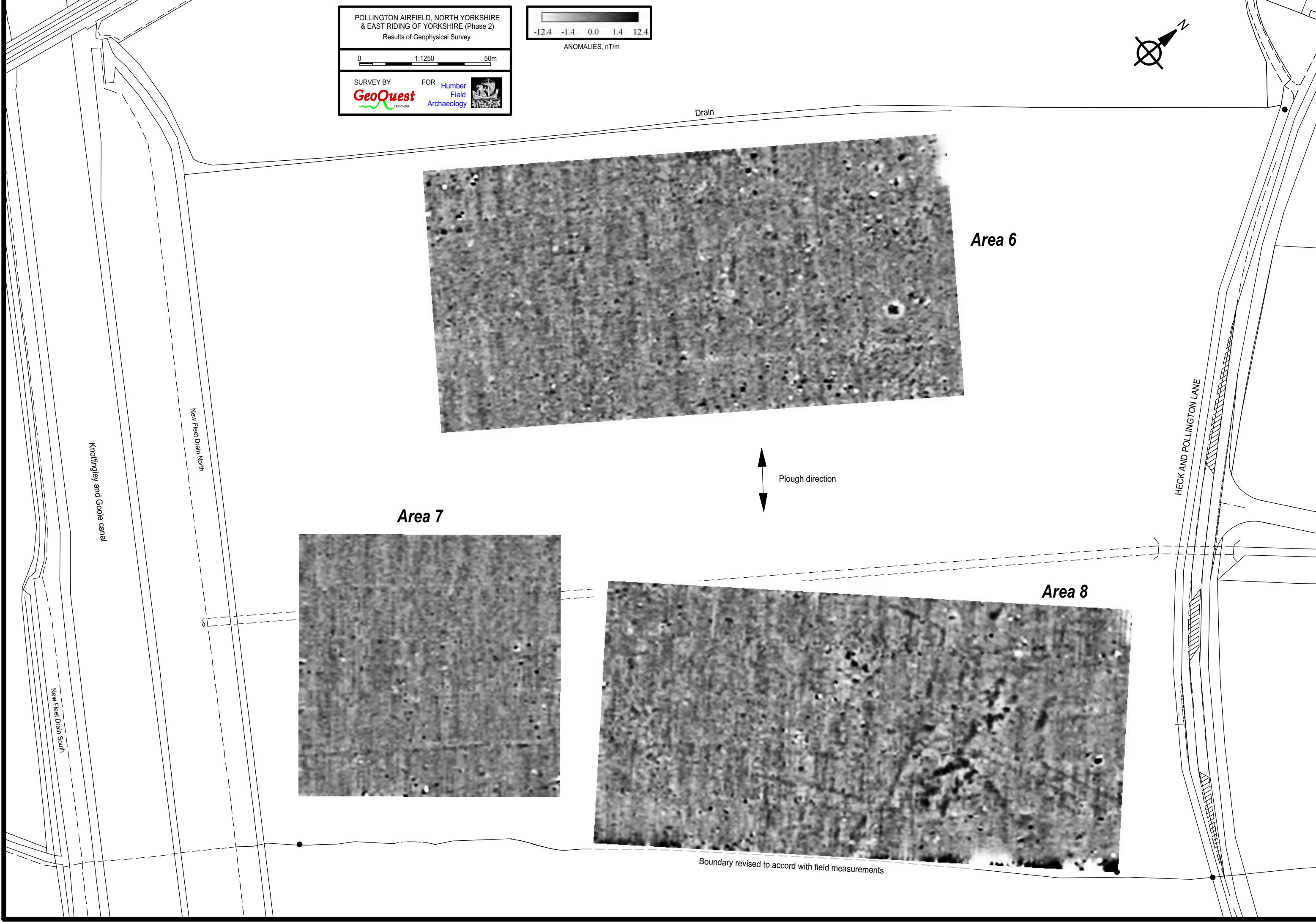
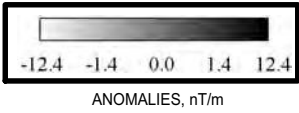


FIGURE 1

POLLINGTON AIRFIELD, NORTH YORKSHIRE
& EAST RIDING OF YORKSHIRE (Phase 2)
Results of Geophysical Survey

0 1:1250 50m

SURVEY BY **GeoQuest** FOR **Humber Field Archaeology**



Drain

Area 6

Area 7

Plough direction

Area 8

HECK AND POLLINGTON LANE

Boundary revised to accord with field measurements

FIGURE 2

POLLINGTON AIRFIELD, NORTH YORKSHIRE & EAST RIDING OF YORKSHIRE (Phase 2)
Archaeological Interpretation

0 1:1250 50m

SURVEY BY **GeoQuest** FOR **Humber Field Archaeology**

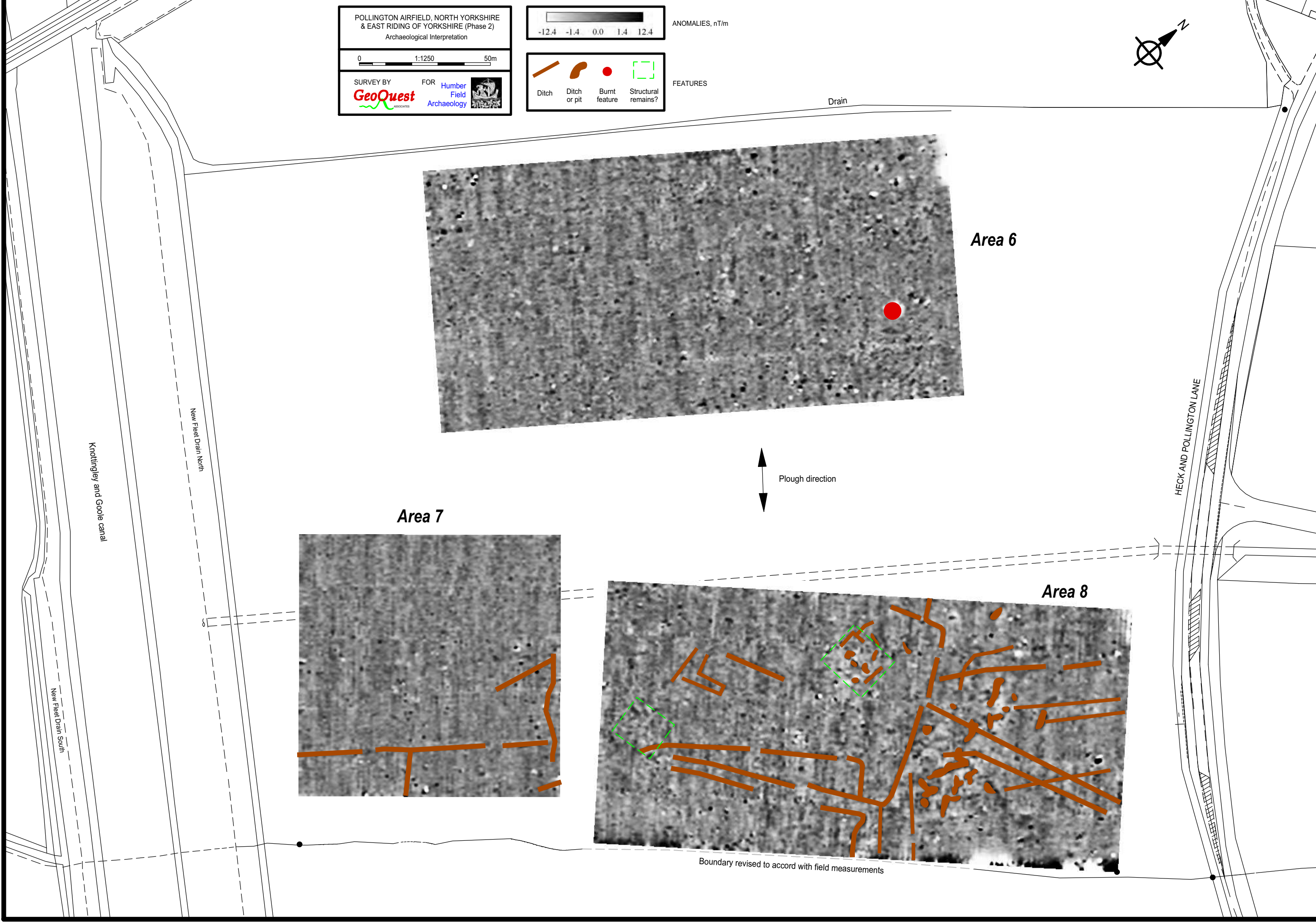
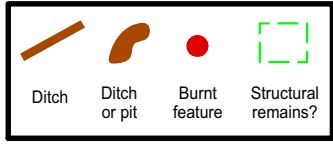
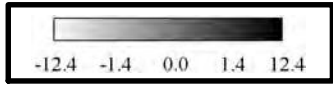


FIGURE 3

POLLINGTON AIRFIELD, NORTH YORKSHIRE & EAST RIDING OF YORKSHIRE (Phase 2)
Archaeological Interpretation

0 1:1250 50m

SURVEY BY **GeoQuest** FOR **Humber Field Archaeology**

FEATURES

- Ditch (represented by a brown line)
- Ditch or pit (represented by a brown shape)
- Burnt feature (represented by a red dot)
- Structural remains? (represented by a green dashed box)

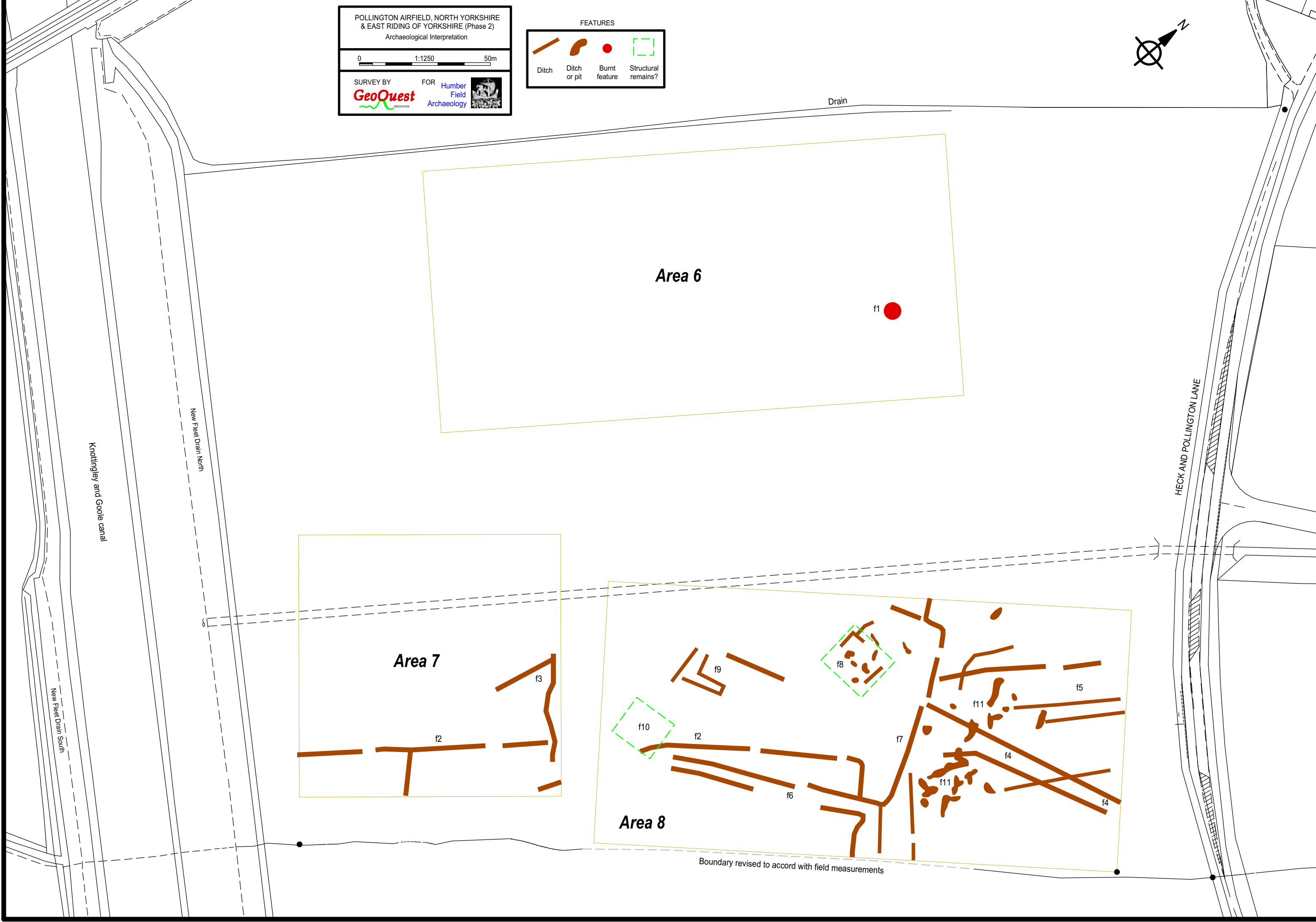


FIGURE 4