ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
The Northumberland Estates

Windy Edge
North of Alnmouth Road
Alnwick
Northumberland

geophysical survey

report 2697
October 2011

Durham University

Contents

Figures

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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 at Windy Edge, north of Alnmouth Road, Alnwick, Northumberland. The works comprised geomagnetic survey of ten areas within the 25ha proposed development area.

1.2 The works were commissioned by The Northumberland Estates and conducted by Archaeological Services Durham University.

Results

1.3 Former ridge and furrow cultivation was detected in all areas with the exception of Areas 1, 3 and 8. Ridge and furrow is present in parts of Areas 4, 4a and 5 as upstanding earthworks.

1.4 Former field boundaries were detected in Areas 2, 4 and 8. A former track shown on historic maps was identified in Areas 1 and 2.

1.5 Possible soil-filled ditches were identified in Areas 1, 3 and 9.

1.6 Land drains were identified in Areas 1, 3 and 6 and modern service pipes in Areas 3, 4 and 7.

1.7 The Geat Whin Sill has been detected across parts of Areas 3, 5, 6 and 8.

2. Project background

Location (Figure 1)

2.1 The proposed development area was located at Windy Edge, north of Alnmouth Road, Alnwick, Northumberland (NGR centre: NU 20173 13008). Ten surveys were conducted across ten land parcels totalling 25ha in size. The proposed development area is irregular in plan and is bounded to the west by housing estates, to the north by a sewage works and a meander of the River Aln, to the south are properties along Alnmouth Road and the eastern edge of the site is bounded by the A1 road and agricultural land beyond.

Development proposal

2.2 The development proposal is for landscaping, construction of residential properties and installation of roads and services.

Objective

2.3 The principal aim of the surveys 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 relation to the development.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from the client and in line with national standards and guidelines (see 5.1 below).

Dates

2.5 Fieldwork was undertaken between 13th June and 8th September 2011. This report was prepared for 6th October 2011.

Personnel

2.6 Fieldwork was conducted by Thomas Fitton, David Graham, Duncan Hale, Natallie Swann and Richie Villis. The geophysical data were processed by Duncan Hale, Natalie Swann and Richie Villis. This report was prepared by Natalie Swann and Richie Villis, with illustrations by David Graham and Janine Watson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **AWE11**, for **A**lnwick **W**indy **E**dge 20**11**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University 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 **archaeol3-104502**.

3. Historical and archaeological background

Previous archaeological works

3.1 An archaeological desk-based assessment was conducted (Archaeological Services 2011). The results of that report are summarised here.

3.2 There is no direct evidence for prehistoric activity within the proposed development area but the presence of activity in the vicinity indicates that an as yet unidentified resource has the potential to exist.

3.3 There are no indications that the remains of settlement dating to the Roman, medieval or post-medieval periods survive within the site.

3.4 Ridge and furrow earthworks of probable medieval date survive over the south-western part of the site.

3.5 There is the potential for palaeoenvironmental deposits to survive in the floodplain associated with former meanders of the river.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised two fields of arable land and eight fields of pasture. It was not possible to collect data in part of Area 1 due to dense, tall vegetation.

4.2 The proposed development area slopes steeply down from 60m OD in the south to approximately 25m OD in the north, on the floodplain of the River Aln.

4.3 The underlying solid geology of the area comprises the Great Whin Sill (small areas recorded near the sewage plant) with Carboniferous Tyne Limestone Formation and Alston formation elsewhere. There are glaciao-fluvial deposits in the west part of the site and till in the east. Along the river banks are areas of alluvium.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2010); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (draft 2nd edition, Schmidt & Ernenwein 2011).

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 suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on 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, based on the desk-based assessment, 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 Given the anticipated shallowness of targets and the predominantly non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique 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.

Field methods

5.5 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system with real-time correction.

5.6 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 nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m grid unit.

5.7 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

5.8 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 (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; the trace plots are provided in Figure 6. 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.

5.9 The following basic processing functions have been applied to each dataset:

clip	clips 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
destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
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 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plans is provided. 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

General comments

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. 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.

Area 1

5.13 Three broad and diffuse irregular-shaped positive magnetic anomalies were detected in the north of this area, which could reflect soil-filled features such as ditches but may be a result of near-surface geological variation.

5.14 A concentration of dipolar anomalies detected on the south edge of the area probably reflects a former track shown on historic maps and an adjacent service pipe (clearly detected in Area 3).

5.15 A series of linear positive magnetic anomalies aligned north-west/south-east were detected across the survey area; these almost certainly reflect the modern plough regime.

5.16 A linear negative magnetic anomaly was detected aligned broadly east-west, which may reflect a land drain.

Area 2

5.17 A concentration of dipolar magnetic anomalies in the north-east corner of this area may be associated with the former track shown on historic maps and detected in Area 1.

5.18 A linear negative magnetic anomaly aligned approximately north-south on the east edge of the survey area and a positive magnetic anomaly aligned north-east/south-

west towards the south edge of the survey area correspond to former field boundaries shown on historic maps.

5.19 A series of broad alternate positive and negative magnetic anomalies were detected aligned approximately north-south. These anomalies almost certainly reflect former ridge and furrow cultivation.

5.20 Two parallel positive magnetic anomalies towards the east edge of the survey area reflect an existing earthen track.

5.21 The rectilinear arrangement of dipolar magnetic anomalies detected in the north part of this area reflects existing fences.

Area 3

5.22 Broad and intense dipolar magnetic anomalies have been detected in the east of this area. These almost certainly reflect the underlying Great Whin Sill.

5.23 Two weak curvilinear positive magnetic anomalies have been detected in this area, which could possibly reflect the remains of soil-filled ditch features.

5.24 Several strong linear positive magnetic anomalies were detected across the survey area. These probably reflect fired clay drains associated with a system of land drainage.

5.25 The strong dipolar magnetic anomaly, aligned broadly north-east/south-west in the north-west corner of the area, almost certainly reflects a service pipe.

5.26 A series of linear positive magnetic anomalies have also been detected in the north-western part of the survey. These are likely to reflect a system of water pipes, as evidenced by two large brick inspection chambers noted on the ground.

5.27 Narrow, parallel, weak negative magnetic anomalies detected north-west/south-east across the area are likely to reflect the modern ploughing regime.

Area 4

5.28 Two series of alternate linear positive and negative magnetic anomalies were detected in this area; these anomalies correspond to upstanding ridge and furrow cultivation. The first series, in the north of the area, is aligned approximately north-south, the second series north-west/south-east. They are separated by headlands aligned east-west which were associated with a former field boundary shown on historic maps.

5.29 A strong positive magnetic anomaly situated between the headlands corresponds to the remains of a small stone structure noted on the ground.

5.30 A linear positive magnetic anomaly aligned approximately north-south on the western edge of the survey area corresponds to a former field boundary shown on historic maps of the site.

5.31 A linear positive magnetic anomaly detected in the eastern part of this area and aligned north-west/south-east, curving south-west at its south end reflects an existing earthen track.

5.32 A sinuous chain of intense dipolar anomalies was recorded following a contour across the survey area. This almost certainly reflects a modern service pipe.

Area 4a

5.33 A series of alternate parallel positive and negative magnetic anomalies aligned north-west/south-east was detected in this area; these anomalies reflect upstanding ridge and furrow earthworks and are a continuation of the features from Area 4.

5.34 A concentration of dipolar magnetic anomalies was detected in the centre of this area; this is likely to reflect recent ground disturbance.

5.35 The dipolar magnetic anomaly along the south edge of this area reflects a wire fence.

Area 5

5.36 Broad and intense dipolar magnetic anomalies were detected across most of this area; these almost certainly reflect a continuation of the underlying Great Whin Sill, also detected in Area 3.

5.37 A series of linear positive magnetic anomalies aligned approximately north-south in the north-west corner of the survey area reflects former ridge and furrow cultivation. Upstanding remains were noted in the southern corner of the survey area.

Area 6

5.38 An area of dipolar magnetic anomalies in the north-east of this area almost certainly reflects a continuation of the same igneous geology detected in Areas 3 and 5, the Great Whin Sill.

5.39 A series of linear and rectilinear positive magnetic anomalies were detected across the survey area, similar in nature to those detected in Area 3. These almost certainly reflect clay land drains.

Area 7

5.40 A series of parallel positive magnetic anomalies aligned north-west/south-east was detected across this area; these anomalies are likely to reflect former ridge and furrow cultivation and are a continuation of the features detected in Area 4.

5.41 A chain of dipolar magnetic anomalies was detected aligned north-west/south-east; this is likely to reflect a modern service and is a continuation of an anomaly detected in Area 4.

Area 8

5.42 An area of dipolar magnetic anomalies was detected along the north edge of this survey area. These anomalies almost certainly reflect a continuation of the underlying Great Whin Sill, also detected in Areas 3, 5 and 6.

5.43 Within the geological band two linear positive magnetic anomalies were detected, one aligned north-west/south-east and the other north-east/south-west; these are likely to reflect former field boundaries shown on historic maps.

5.44 A further linear positive magnetic anomaly aligned north-west/south-east was detected across the central part of this survey area, which also corresponds to a former field boundary shown on historic maps.

5.45 A series of parallel positive magnetic anomalies aligned approximately north-west/south-east was detected across the south-west of the survey area; these anomalies are likely to reflect former ploughing.

Area 9

5.46 A series of parallel positive magnetic anomalies was detected across this area. These anomalies may reflect former ridge and furrow cultivation.

5.47 A linear positive magnetic anomaly was detected on a different alignment to the former ploughing. This anomaly may reflect a soil-filled feature such as a ditch or a former field boundary not shown on the historic maps.

6. Conclusions

6.1 Geomagnetic survey was undertaken over a proposed development area at Windy Edge, Alnwick, Northumberland.

6.2 Former ridge and furrow cultivation was detected in all areas with the exception of Areas 1, 3 and 8. Ridge and furrow is present in parts of Areas 4, 4a and 5 as upstanding earthworks.

6.3 Former field boundaries were detected in Areas 2, 4 and 8. A former track shown on historic maps was identified in Areas 1 and 2.

6.4 Possible soil-filled ditches were identified in Areas 1, 3 and 9.

6.5 Land drains were identified in Areas 1, 3 and 6 and modern service pipes in Areas 3, 4 and 7.

6.6 The Geat Whin Sill has been detected across parts of Areas 3, 5, 6 and 8.

7. Sources

Archaeological Services 2011 *Windy Edge, north of Alnmouth Road, Alnwick, Northumberland: archaeological desk based assessment.* Unpublished report **2623**, Archaeological Services Durham University

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2010 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2011 (draft) *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

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Figure 1: Site location

proposed development area

0 1km

scale 1:25 000 for A4 plot

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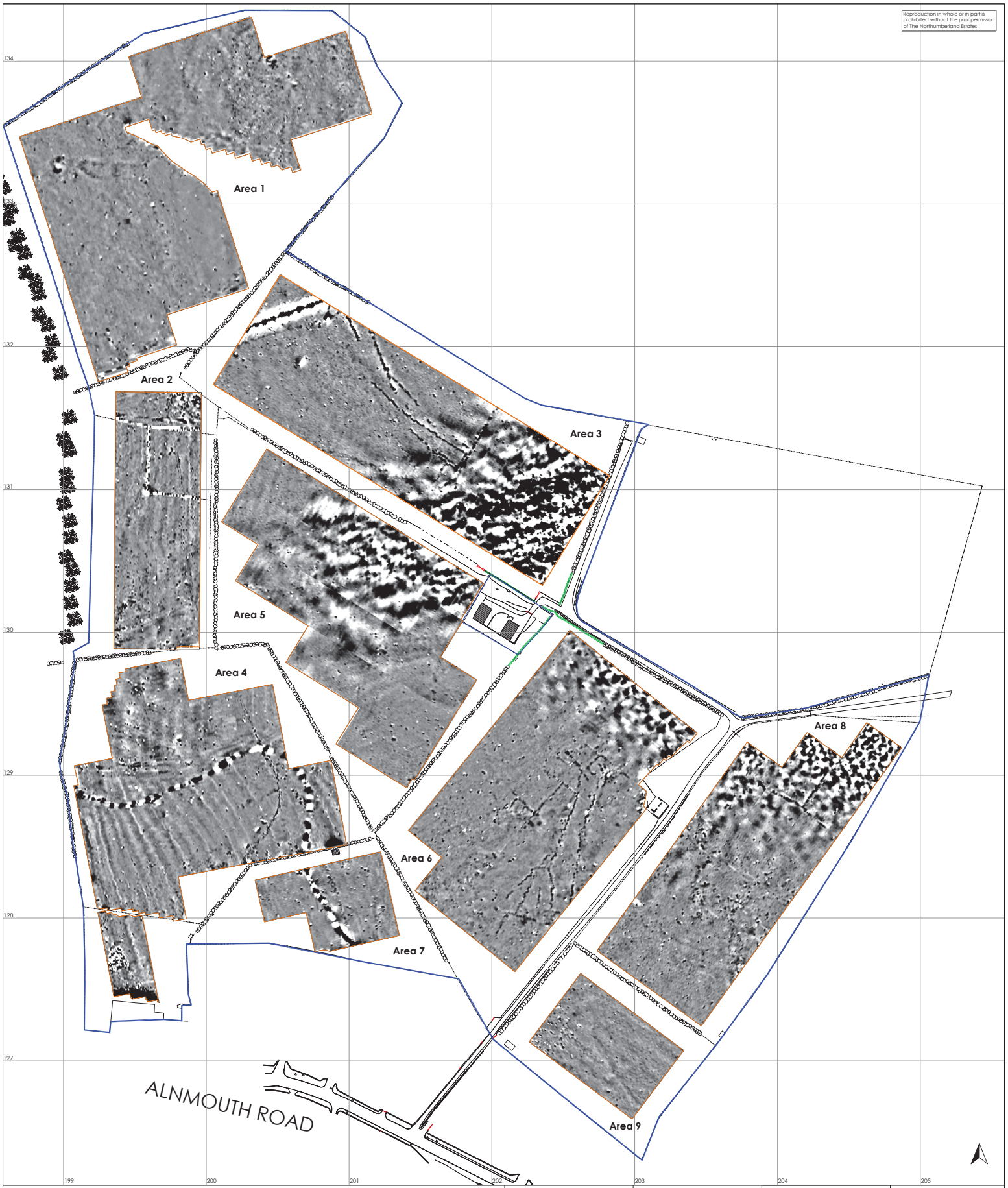
Figure 2: Geophysical survey overview

0 150m
scale 1:3000 for A3 plot

proposed development area

magnetic survey

-6 nT 8



magnetic survey

-3 0 3

0 50m
scale 1:1000 for A0 plot

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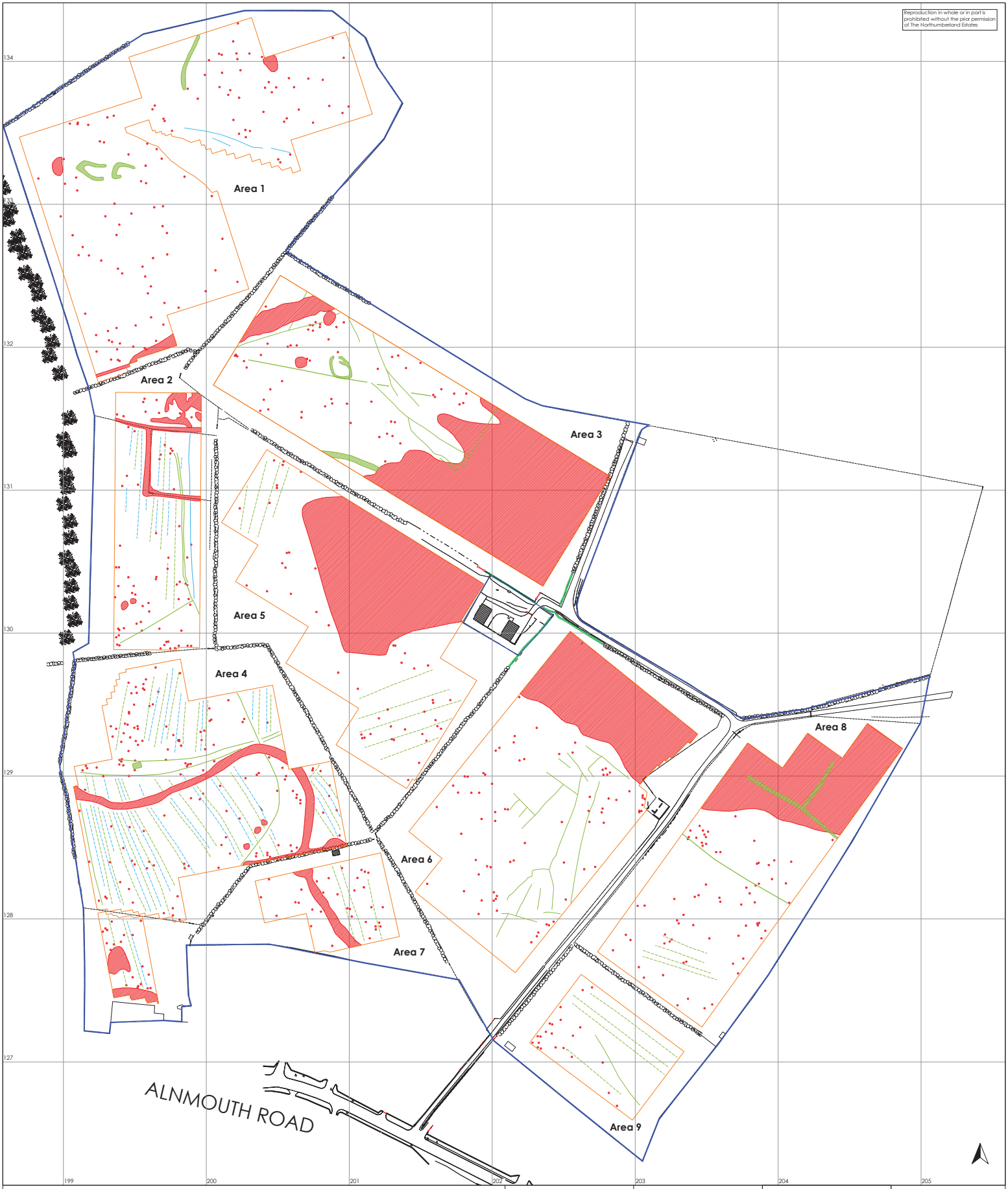
Figure 3: Geophysical survey



magnetic survey
dipolar magnetic anomaly
positive magnetic anomaly
negative magnetic anomaly

scale 1:1000 for A0 plot

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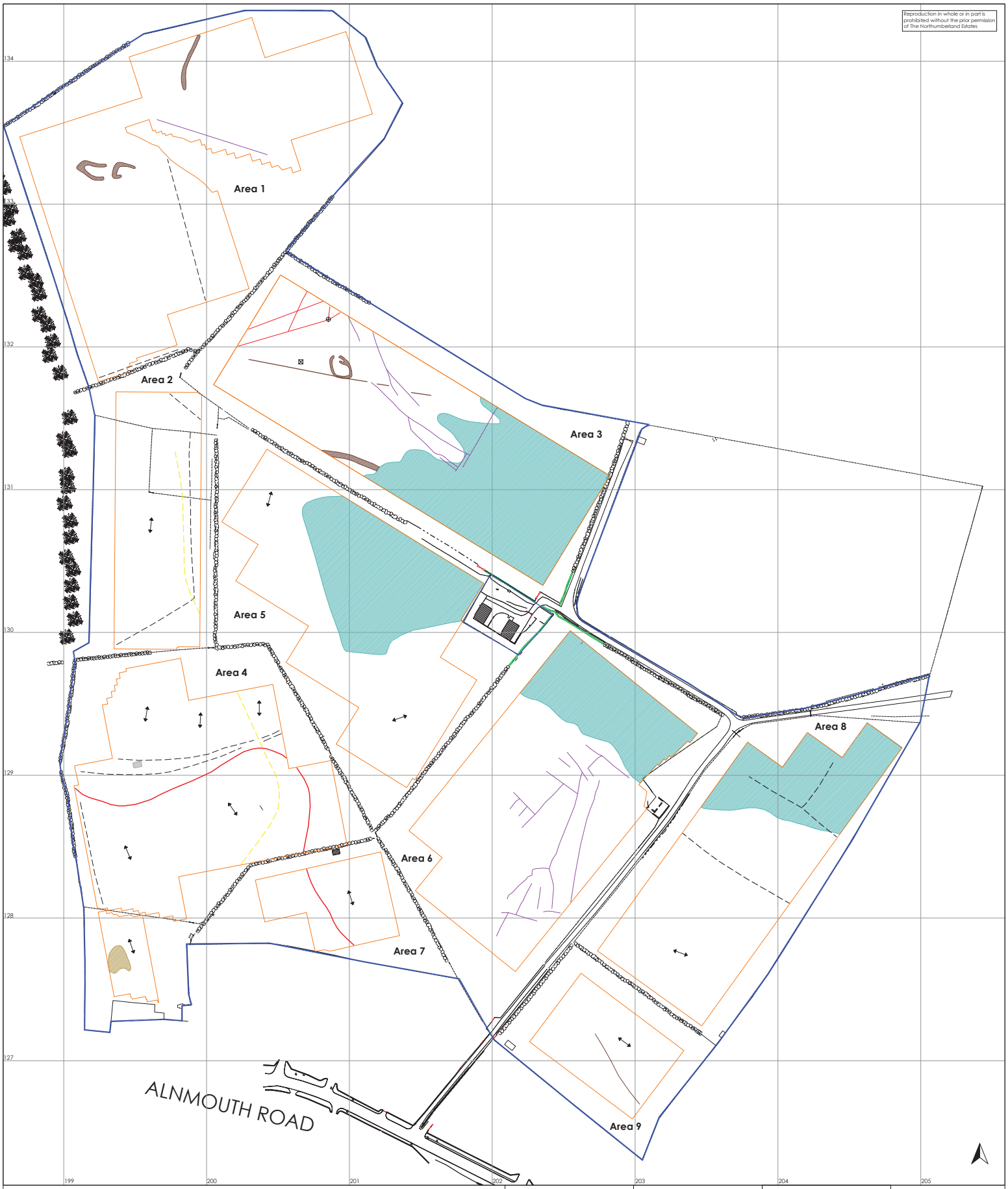
Figure 4: Geophysical interpretation



magnetic survey
soil-filled feature
wall footings
disturbed area
geological feature
service pipe
ridge and furrow
land drain
former field boundary
existing track
telegraph pole
inspection cover

0 50m
scale 1:1000 for A3 plot

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Figure 5: Archaeological interpretation

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Figure 6:
Trace plots of geomagnetic data