ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Apex Architectural Planning Ltd

Land at High Grange
Bishop Auckland
County Durham

geophysical survey

report 3485
July 2014

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 the proposed development of land at High Grange, Bishop Auckland, County Durham. The works comprised the detailed geomagnetic survey of a single area measuring 2.1 hectares (ha).

1.2 The works were commissioned by Apex Architectural Planning Ltd and conducted by Archaeological Services Durham University.

Results

1.3 Pits and ditches of possible archaeological origin were detected. Some of the ditches appear to form an enclosure with possible internal features in the southern part of the field.

1.4 Weak positive magnetic lineations across the PDA probably reflect former ploughing, possibly ridge and furrow cultivation.

1.5 A modern service was detected in the west of the PDA.

2. Project background

Location (Figure 1)

2.1 The proposed development area (PDA) is located on land at High Grange, Bishop Auckland, County Durham (NGR centre: NZ 17469 31756). Approximately 2.1ha of detailed geomagnetic survey was conducted in a single pasture field. To the south is the A689 road, to the west is residential housing and to the north and east are further pasture fields.

Development proposal

2.2 It is proposed to develop the site for housing.

Objective

2.3 The principal aim of the survey was to assess the nature and extent of any sub-surface features of potential archaeological significance within the PDA, 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 survey has been undertaken in accordance with instructions from the client and national standards and guidance (see para. 5.1 below).

Dates

2.5 Fieldwork was undertaken on 2nd July 2014. This report was prepared for July 2014.

Personnel

2.6 Fieldwork was conducted by Andrew Platell and Nathan Thomas (supervisor). The geophysical data processing and report preparation was by Nathan Thomas, with illustrations by David Graham. The report was edited by Duncan Hale. The project was managed by Daniel Still.

Archive/OASIS

2.7 The site code is **BHG14**, for **B**ishop Auckland**, H**igh **G**range 20**14**. 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 **archaeol3-183209**.

3. Historical and archaeological background

3.1 There are no known heritage assets within the PDA and no previous archaeological works are recorded within the PDA.

3.2 Beechburn Grange lies approximately 250m west of the PDA. The house and its outbuildings date to the 18th and 19th centuries and are listed Grade II.

3.3 Beechburn Mill, approximately 600m north-west of the PDA, is a post-medieval water-powered corn mill on Beechburn Beck. The wheel was of the undershot type. It was fed by a mill race from a dam 260m upslope. It is shown on a map of 1761 and the 1st Edition Ordnance Survey map.

3.4 The medieval village of Hunwick lies 1.5km north-east of the PDA. It has two rows of houses arranged around the village green.

3.5 It is likely that the PDA was used for agricultural purposes during the medieval and post-medieval periods, however, it is possible that an archaeological resource relating to earlier periods may be present within the PDA.

4. Landuse, topography and geology

4.1 At the time of survey the PDA comprised a single pasture field under short grass. It was bounded on all sides by post and wire fences and mature hedgerows. A metal feed trough was located near the northern corner of the field and a small plastic trough was located near the southern corner.

4.2 The PDA occupied a gentle south-west facing slope with elevations falling from 120m OD in the north-east to 111m OD in the south-west.

4.3 The bedrock geology of the PDA comprises mudstone, siltstone and sandstone of the Permian Lower Coal Measures. This is overlain by Devensian glacial till (BGS 2014).

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* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013).

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, it was considered possible 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) could also be present.

5.4 Given the anticipated shallowness of targets and the 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 the survey area and related to the Ordnance Survey National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

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 a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. The greyscale image and interpretations are presented in Figures 2-4; the trace plot is provided in Figure 5. In the greyscale image, 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 the geomagnetic data:

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
de-stagger	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 plan is provided. 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 sediment-filled structures

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

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Except where stated otherwise, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Discrete positive magnetic anomalies have been detected in the west of the PDA. The anomalies may reflect former pits or areas of industrial activity.

5.14 Several linear positive magnetic anomalies have also been detected. These are likely to reflect former ditches within the PDA. The anomalies do not correspond to any former field boundaries depicted on historic mapping. Some of these probable ditches appear to form an enclosure in the southern part of the field, with smaller internal anomalies perhaps reflecting the remains of a rectilinear feature.

5.15 Broadly north-east to south-west aligned, parallel, weak positive magnetic anomalies have been detected across the PDA. These are likely to reflect former ridge and furrow cultivation.

5.16 Strong dipolar magnetic anomalies have been detected around the edges of the area. These correspond to the metal fencing bounding the field. This is particularly strong along the western edge of the PDA.

5.17 A chain of intense magnetic anomalies aligned north-west/south-east in the west of the field almost certainly reflects a service pipe.

5.18 A large and strong dipolar magnetic anomaly has been detected in the northern corner of the PDA. This corresponds to a metal animal feeder.

5.19 Small, discrete dipolar magnetic anomalies have been detected across the PDA. 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.

6. Conclusions

6.1 Approximately 2.1 ha of detailed geomagnetic survey was undertaken on land at High Grange, Bishop Auckland, prior to proposed development.

6.2 Pits and ditches of possible archaeological origin were detected. Some of the ditches appear to form an enclosure with possible internal features in the southern part of the field.

6.3 Weak positive magnetic lineations across the PDA probably reflect former ploughing, possibly ridge and furrow cultivation.

6.4 A modern service was detected in the west of the PDA.

7. Sources

BGS 2014 online *Geology of Britain viewer* available from: http://mapapps.bgs.ac.uk/geologyofbritain/home.html accessed 27th June 2014

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 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

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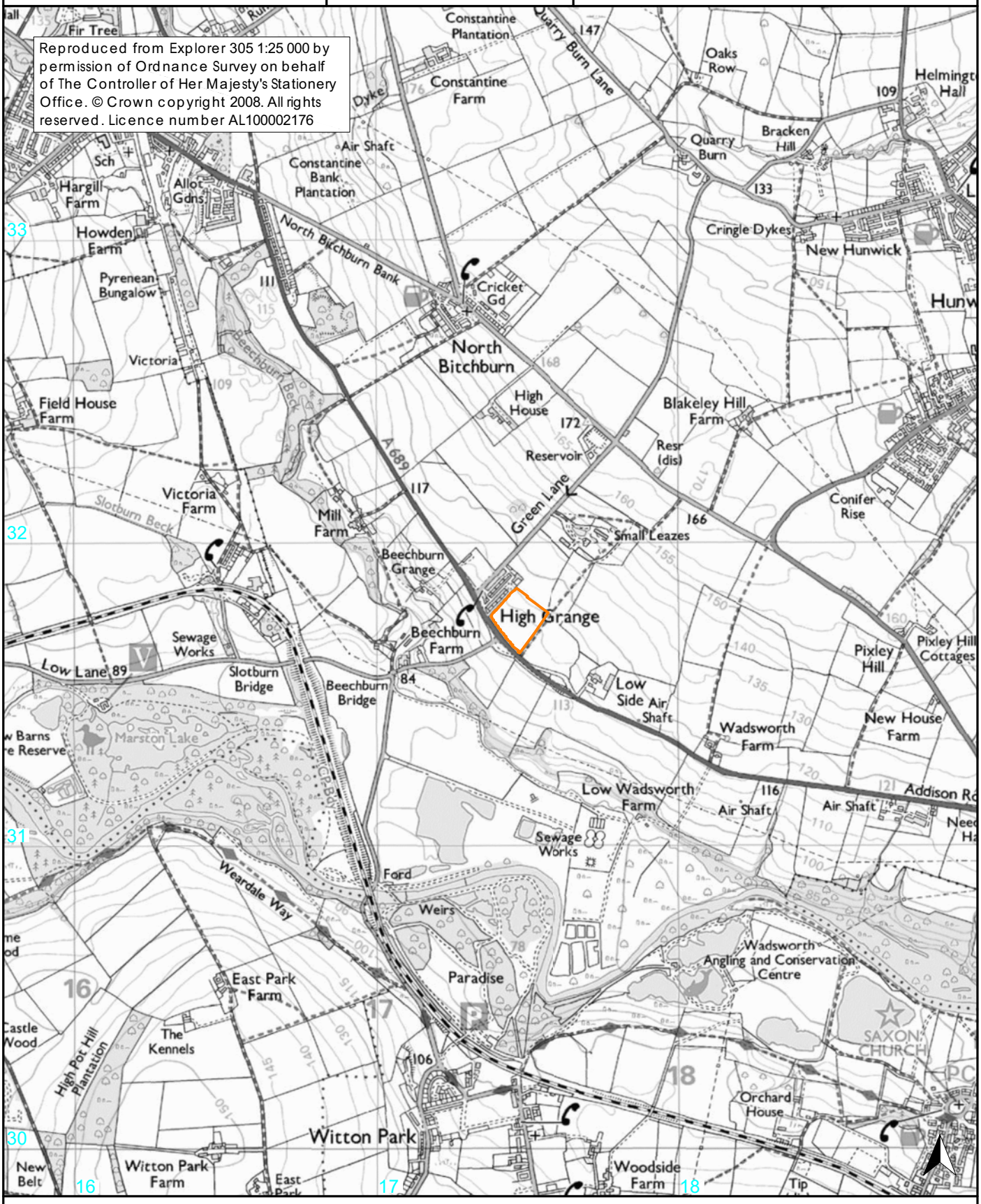
Figure 1: Site location



site location

0 800m
scale 1:17 500 for A4 plot

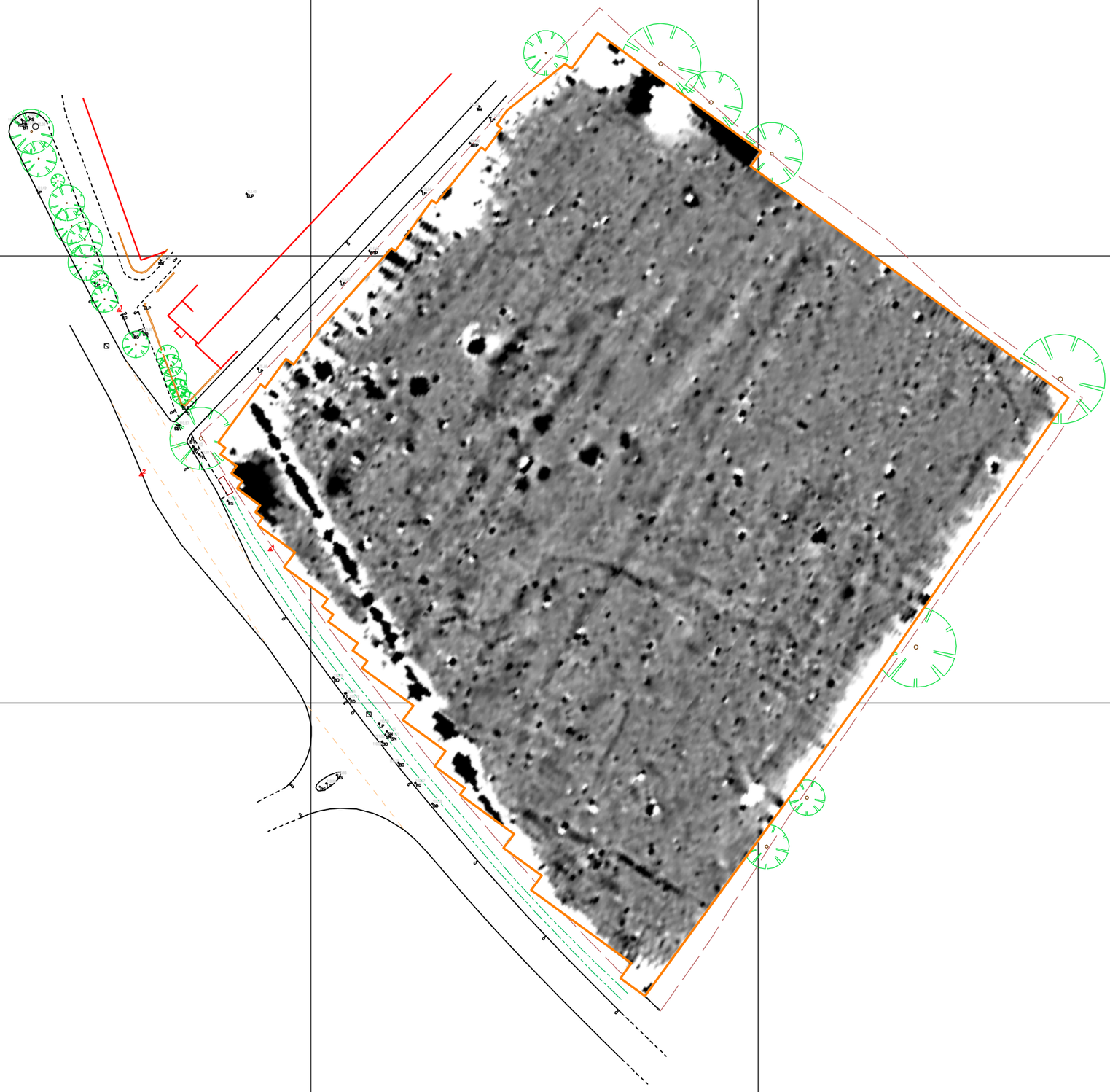


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Figure 2: Geophysical survey

0 50m
scale 1:1000 for A3 plot

magnetic survey

-5 nT 5

318

317

174

175

176

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Figure 3: Geophysical interpretation

0 50m
scale 1:1000 for A3 plot

magnetic survey

dipolar magnetic anomaly

positive magnetic anomaly

318

317

174

175

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Figure 4: Archaeological interpretation

0 50m
scale 1:1000 for A3 plot

- magnetic survey
- possible soil-filled archaeological feature
- service pipe
- trough
- possible ridge and furrow

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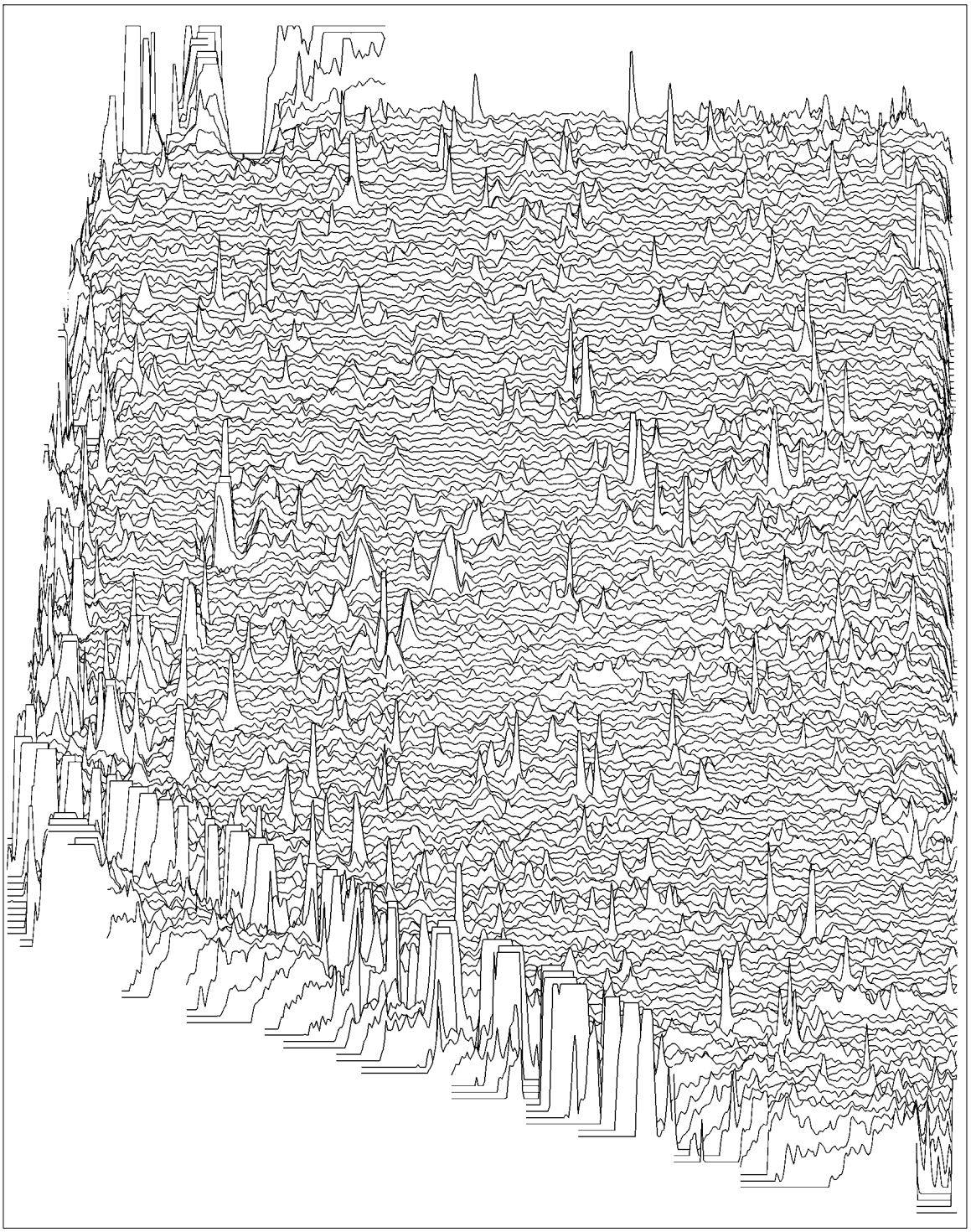
Figure 5: Trace plot of geomagnetic data

19.90nT/cm



0 50m
scale 1:1000 for A4 plot