ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
The Brigantia Archaeological Practice
for
JFS and Associates

# Clapham Lodge
# Leeming
# North Yorkshire

## geophysical survey

report 3024
November 2012

Durham University

## Contents



## Figures




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# 1. Summary

## The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at Clapham Lodge, Leeming, North Yorkshire. The works comprised the geomagnetic survey of approximately 1.1ha of pasture.

1.2 The works were commissioned by The Brigantia Archaeological Practice for JFS and Associates and conducted by Archaeological Services Durham University.

## Results

1.3 No features of likely archaeological significance have been identified in the survey.

1.4 Traces of a former plough regime were identified in Area 1.

1.5 A modern service was detected in Area 1.

1.6 A possible spread of rubble or other near-surface debris was identified in Area 2.

# 2. Project background

### Location (Figure 1)

2.1 The survey area was located at Clapham Lodge, Leeming, in Exelby Leeming and Newton parish, Hambleton district, North Yorkshire (NGR centre: SE 29970 88570). Two surveys totalling approximately 1.1ha were conducted in two land parcels. To the north and east was Leeming airfield, to the west the Roman Road of Dere Street and to the south farmland.

### Development proposal

2.2 The development proposal is for an anaerobic digester site.

### 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, 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 guidance (see para. 5.1 below).

### Dates

2.5 Fieldwork was undertaken on the 19th October 2012. This report was prepared for 14th November 2012.

### Personnel

2.6 Fieldwork was conducted by Nathan Thomas and Richie Villis (Supervisor). The geophysical data were processed by Duncan Hale. This report was prepared by Natalie Swann, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

### Archive/OASIS

2.7 The site code is **LBC12**, for **L**eeming **B**ar **C**lapham Lodge 20**12**. 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 **archaeol3-137359**.

# 3. Historical and archaeological background

3.1 The proposed development area lies within an area of potential archaeological significance. The course of Dere Street Roman Road runs to the west of the site on the line of the old A1 road.

3.2 Previous geophysical surveys undertaken around Leeming Bar for the A1 Dishforth to Barton Improvement detected widespread evidence for ridge and furrow cultivation and former field systems (Archaeological Services 2005 & 2006).

# 4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised two fields of pasture surrounded by metal security fencing for the airfield.

4.2 The area was predominantly level with a mean elevation of approximately 33m OD.

4.3 The underlying solid geology of the area comprises Permian and Triassic strata of the Sherwood Sandstone Group, which are overlain by Devensian till deposits.

# 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 *Guide to Good Practice: Geophysical Data in Archaeology* (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 previous work in the area, 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 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 related to known, mapped Ordnance Survey (OS) points and the 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 continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. 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 |
| *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 soil-filled structures such as pits and ditches |
| *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.

### Area 1

5.12 A series of weak parallel positive magnetic anomalies was detected aligned approximately north-west/south-east. These anomalies almost certainly reflect a former plough regime.

5.13 A chain of dipolar magnetic anomalies was detected aligned approximately north-south, which almost certainly reflects a ferrous pipe.

5.14 The intense dipolar magnetic anomalies detected along the southern edge of the survey area reflect the adjacent security fence along the field boundary.

5.15 The only other anomalies detected here are small, discrete dipolar magnetic anomalies. These almost certainly reflect near-surface ferrous/fired items, such as horseshoes and brick fragments.

**Area 2**

5.16 Intense dipolar magnetic anomalies were detected across this area reflecting near-surface ferrous and/or fired debris, and possibly indicating a spread of rubble across this part of the site.

## 6. Conclusions

6.1 Approximately 1.1ha of geomagnetic survey was undertaken at Clapham Lodge, Leeming, North Yorkshire, prior to proposed development.

6.2 No features of likely archaeological significance have been identified in the survey.

6.3 Traces of a former plough regime were identified in Area 1.

6.4 A modern service was detected in Area 1.

6.5 A possible spread of rubble or other near-surface debris was identified in Area 2.

## 7. Sources

Archaeological Services 2005 *A1(T) Dishforth to Barton Improvement, North Yorkshire: geophysical surveys Vols I-III*, unpublished report **1121** for AMEC, Archaeological Services Durham University

Archaeological Services 2006 *A1(T) Dishforth to Barton Improvement, North Yorkshire: Phase 2 geophysical surveys*, unpublished report **1368** for AMEC, 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 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

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

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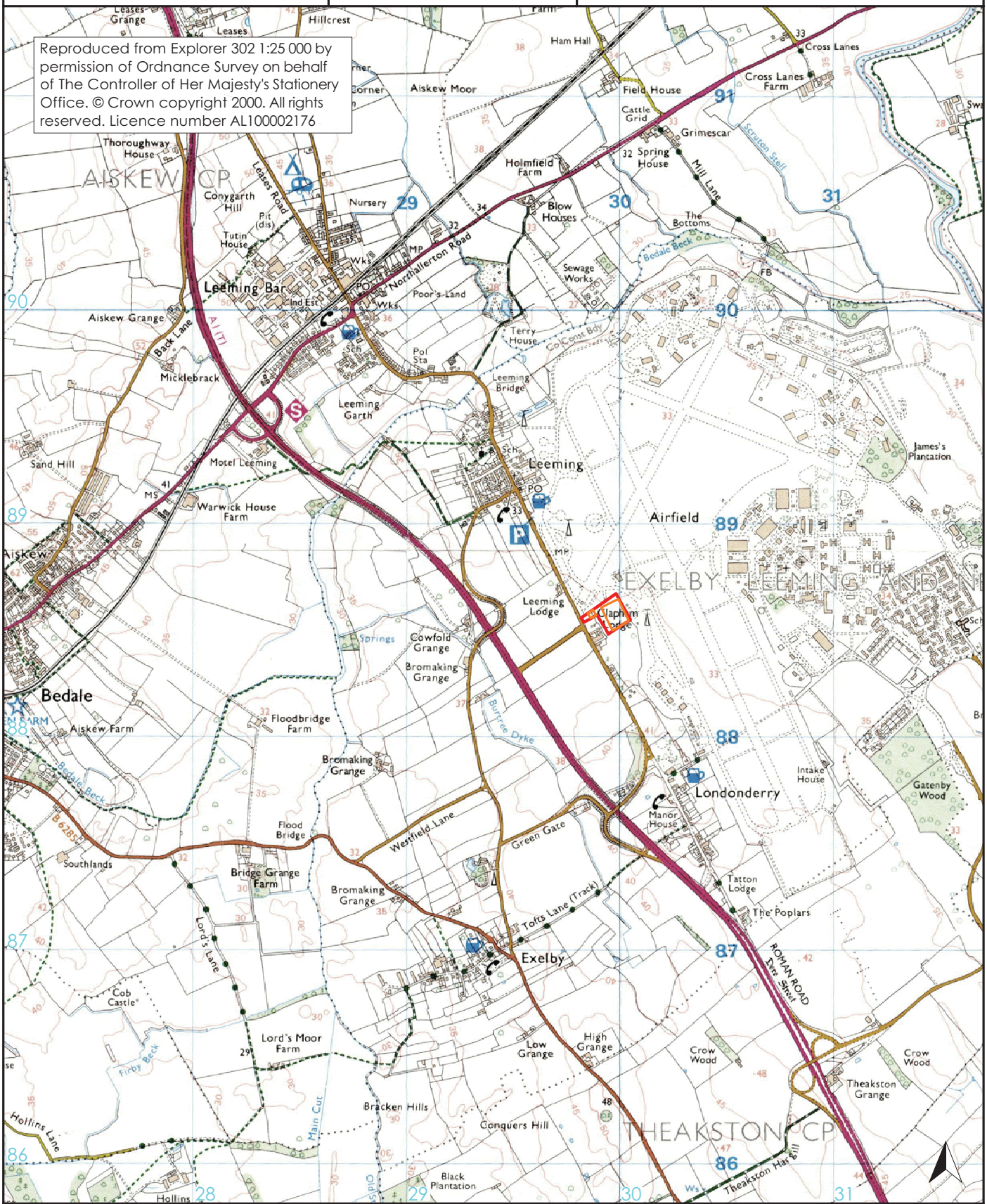
Figure 1: Site location






site location

survey outline

0 1km

scale 1:25 000 for A4 plot

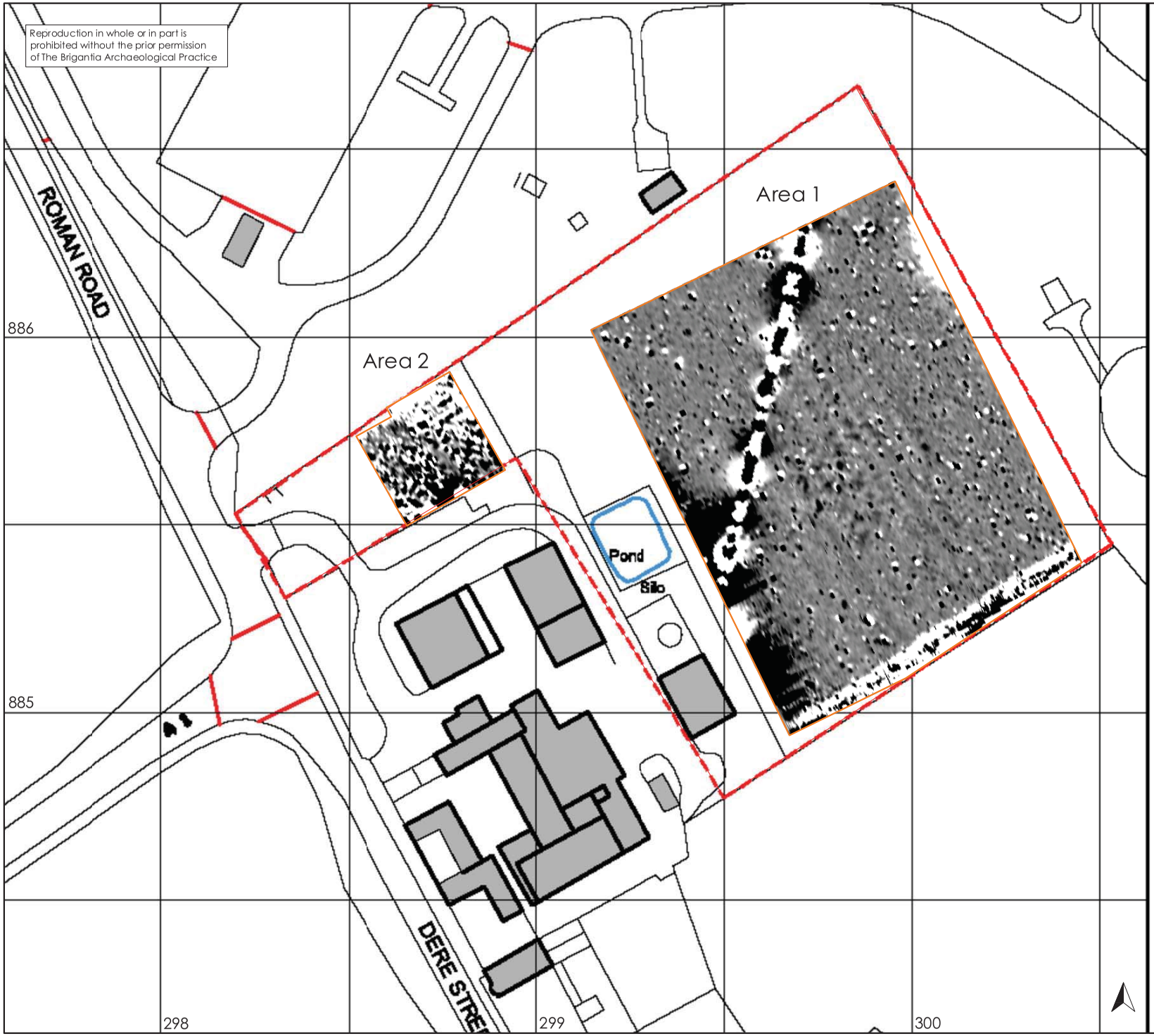



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Figure 2: Geophysical survey

0 50m
scale 1:1000 for A3 plot

site boundary

magnetic survey

-5 nT 5


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North Yorkshire

geophysical survey
report 3024

Figure 3: Geophysical interpretation

0 50m
scale 1:1000 for A3 plot

- site boundary
- magnetic survey
- dipolar magnetic anomaly
- positive magnetic anomaly

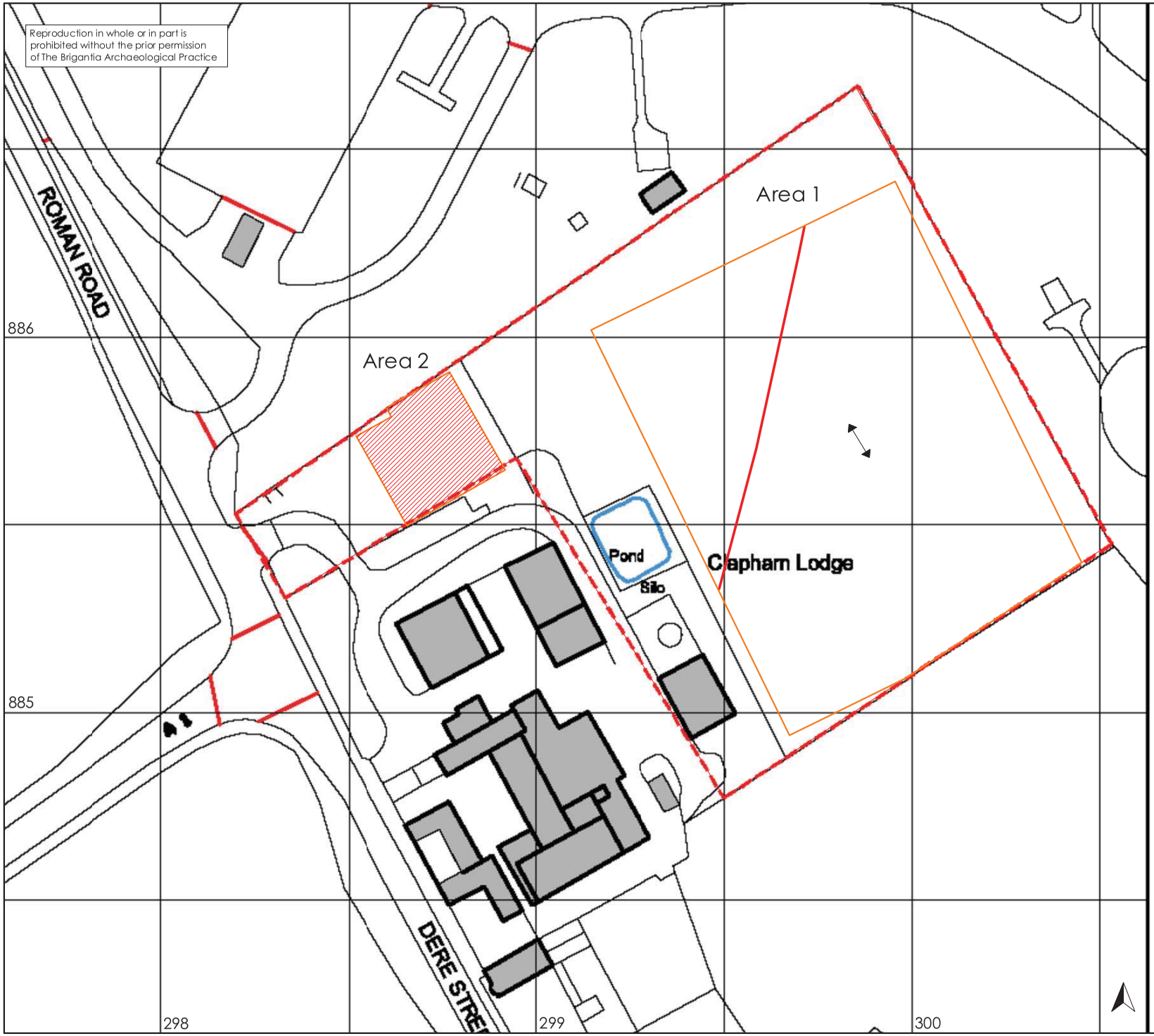


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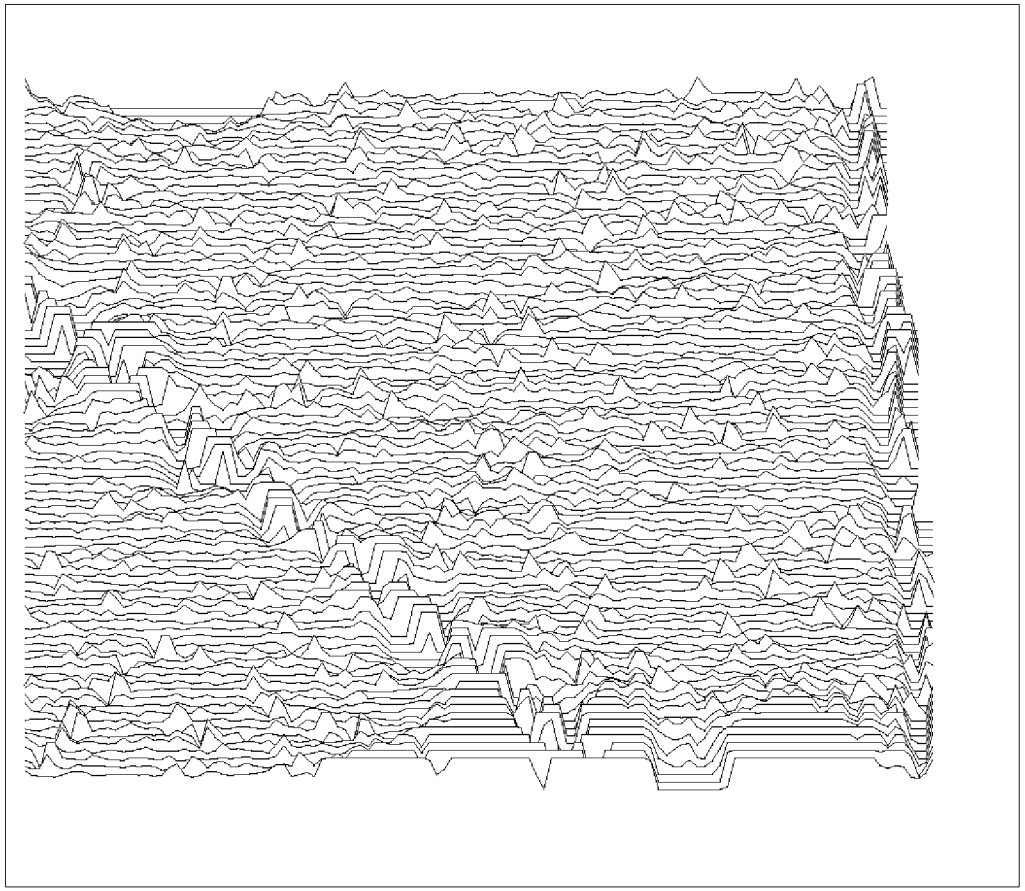
Figure 4: Archaeological interpretation

0 50m
scale 1:1000 for A3 plot

- site boundary
- magnetic survey
- service pipe
- former plough
- ferrous/fired debris

Area 1

24.00nT/cm



Area 2

20.00nT/cm

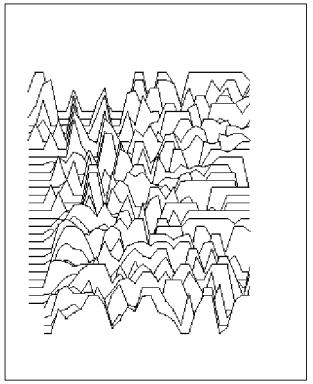


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Figure 5: Trace plots of geomagnetic data

0 50m
scale 1:1000 for A4 plot