

ARCHAEOLOGICAL
SERVICES
DURHAM UNIVERSITY

on behalf of
The Lanchester Partnership
(Friends of *Longovicium*)

Land west and south of *Longovicium*
Lanchester
County Durham

geophysical survey

report 3472
July 2014

Contents

1.	Summary	1
2.	Project background	2
3.	Historical and archaeological background	3
4.	Landuse, topography and geology	3
5.	Geophysical survey	4
6.	Conclusions	7
7.	Sources	8

Appendix: English Heritage Geophysical Survey Database Questionnaire

Figures

Figure 1:	Site location
Figure 2:	Geophysical survey overview
Figure 3:	Geophysical survey
Figure 4:	Geophysical interpretation
Figure 5:	Archaeological interpretation
Figure 6:	Trace plots of geomagnetic data

1. Summary

The project

- 1.1 This report presents the results of geophysical surveys conducted on land to the west and south of the Roman fort of *Longovicium*, south-west of Lanchester, County Durham. The works comprised geomagnetic survey of four areas totalling 3.5 hectares (ha).
- 1.2 The works were commissioned by The Lanchester Partnership (Friends of *Longovicium*) and conducted by Archaeological Services Durham University.

Results

- 1.3 Two substantial ditches were detected along the western side of the fort (Area 1). A causewayed entrance is apparent in the outer ditch, together with the possible remains of a roadside ditch heading west. Among several other ditches in the north of Area 1 are the probable remains of at least one enclosure. Discrete anomalies could reflect former pits and possibly hearths or ovens.
- 1.4 The extent of the former reservoir in Area 2 has been clearly defined by the survey. The reservoir may have been at least partly filled with building rubble. The remains of a probable second reservoir have also been detected just to the west.
- 1.5 Many anomalies to the south of the reservoirs appear to reflect ditched enclosures or plots to both sides of former roads. Some anomalies are better defined than others, but there are possibly some structural remains present here also.
- 1.6 Occasional further ditches, pits and possible small structural remains have been detected in Areas 3 and 4. The most prominent anomaly here is almost certainly associated with a road heading south-east from the fort to join Dere Street.

2. Project background

Location (Figure 1)

- 2.1 The study area comprised land to the west and south of the Roman fort of *Longovicium*, south-west of the town of Lanchester in County Durham (NGR fort centre: NZ 15945 46898). The surveys extended the existing coverage by surveying an 'L-shaped' area to the immediate west of the fort and to the south of previous surveys. The fort and its surroundings are a Scheduled Ancient Monument (SAM, Asset UID 100236).
- 2.2 Four areas totalling 3.5ha were surveyed: Area 1 was located to the immediate west of the fort, bounded to the north by the B6296 road (Cadger Bank); Area 2 was located south of Area 1, near the south-west corner of the fort; Areas 3 and 4 were located approximately 100m south of the fort. The locations of these, and previous geophysical surveys, are shown in Figure 2.

Objective

- 2.3 Previous surveys have focussed on the fort itself and the *vicus* along the Roman road of Dere Street to the north, east and south-east of the fort. The principal aim of the present surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance which extend west and south of the fort, including the site of the presumed 'Roman reservoir' outside the south-west corner of the fort.

Methods statement

- 2.4 The surveys have been undertaken in accordance with instructions from the client, with survey proposals and a methods statement provided by Archaeological Services Durham University, and with national standards and guidance (see para. 5.1 below).
- 2.5 Since the survey areas lie within the Scheduled Monument the surveys were undertaken in accordance with a licence granted by English Heritage under Section 42 of the Ancient Monuments and Areas Act 1979 (as amended by the National Heritage Act 1983).

Dates

- 2.6 Fieldwork was undertaken on 18th March 2014. This report was prepared for July 2014.

Personnel

- 2.7 Fieldwork was conducted by Duncan Hale (Senior Archaeologist) and Jonathan Dye (Project Archaeologist). Geophysical data processing and report preparation was by Duncan Hale (the project manager) with illustrations by Janine Watson.

Archive/OASIS

- 2.8 The site code is **LWS14**, for *Longovicium* **W**est and **S**outh 2014. The survey archive is retained at Archaeological Services Durham University.
- 2.9 Archaeological Services Durham University is registered with the **Online AccesS** to the Index of archaeological investigationS project (**OASIS**). The OASIS ID number for this project is **archaeol3-184530**.

- 2.10 An English Heritage Geophysical Survey Database Questionnaire has been completed and is included as an Appendix to this report.

Acknowledgements

- 2.11 Archaeological Services is grateful to The Lanchester Partnership, The Friends of *Longovicium*, the landowner Mr Nicholas Greenwell and English Heritage for facilitating this work.

3. Historical and archaeological background

- 3.1 The Roman fort of *Longovicium* was built at around AD150 and covers an area of about 2.3ha. It was rebuilt around AD230 and again in the early 4th century. The fort was a later addition to a chain of defensive forts along the Roman road of Dere Street. Detailed background information has been described elsewhere (for example, Casey *et al.* 1992; The Lanchester Partnership/Friends of *Longovicium* 2007 & 2011).
- 3.2 Previous archaeological work has shown that the interior of the fort could have held up to 1000 soldiers and included barracks, granaries and a *praetorium* or commandant's house, and that there were aqueducts and a cemetery to the west and south-west of the fort (for example, Casey *et al.* 1992; Turner 1990). Elsewhere outside the fort geophysical surveys have shown that there was an extensive *vicus* to the north, east and south-east, along the line of Dere Street (Archaeological Services 2008a, 2008b, 2009, 2013; Cousins 1990; Noel 1991; Payne 1991) and that buildings in the field immediately south of the fort may have included a bath-house and Mithraeum (Cousins 1990; Noel 1991). The locations of previous geophysical surveys are shown in Figure 2. In addition to the above, several small geophysical surveys were undertaken by students at Durham University in the 1990s, with mixed results, in the fields immediately east and south of the fort.

4. Landuse, topography and geology

- 4.1 At the time of fieldwork the survey areas comprised four fields of young cereal bounded by stone walls and wire fences.
- 4.2 Area 1 was predominantly level with a mean elevation of approximately 183m OD. Area 2 occupied a very gentle south-east-facing slope with elevations between 178-183m OD. Areas 3 and 4 occupied the same south-east-facing slope, with elevations ranging from 180m OD in the west to 170m OD in the east.
- 4.3 The underlying solid geology comprises Westphalian mudstone, siltstone and sandstone with coal seams of the Pennine Lower Coal Measures Formation. In Areas 2-4 these strata were overlain by Devensian till.

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, based on previous work, it was considered likely that cut features such as ditches and pits would 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 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 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 the data:

<i>clip</i>	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
<i>zero mean traverse</i>	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
<i>de-stagger</i>	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
<i>interpolate</i>	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. Three types of geomagnetic anomaly have been distinguished in the data:

<i>positive magnetic</i>	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
<i>negative magnetic</i>	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
<i>dipolar magnetic</i>	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 plans is provided.
- 5.12 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.
- 5.13 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 often have little or no

archaeological significance. In this instance, however, it is likely that some of the anomalies will be associated with archaeological materials, features and artefacts. A sample of these anomalies is therefore shown on the interpretation plans.

Area 1

- 5.14 Several linear positive magnetic anomalies have been detected, particularly in the north of the area. One broad, strong anomaly near the eastern edge of the field is oriented parallel to the field wall and the fort; another similar anomaly appears to underlie the field wall. These anomalies almost certainly reflect the infilled remains of ditches around the fort. A causeway is evident across the outer, western, ditch. This is consistent with a road being present here, leaving the fort by the *porta decumana*. A very weak linear positive magnetic anomaly which was detected to the west of the causeway could reflect a drainage ditch along the northern flank of this road, although the apparent association between this anomaly and other perpendicular anomalies may indicate that this is part of a system of enclosure ditches; on the geophysical evidence it is not clear whether this ditch is associated with the road or enclosures.
- 5.15 Some of the stronger anomalies in the north of the area almost certainly reflect further ditches. Some of these appear to reflect the remains of enclosures, which contain discrete, strong anomalies, probably pits and possibly hearths or ovens.
- 5.16 Narrow linear positive and negative anomalies near field edges are almost certainly due to recent ploughing. Pairs of parallel negative magnetic anomalies reflect existing 'tram-lines'.

Area 2

- 5.17 This area contained the Roman reservoir as shown on early Ordnance Survey (OS) maps. This has been detected in the north of the area as a sub-rectangular anomaly and a concentration of particularly strong anomalies. The stronger anomalies probably reflect building rubble and other materials used to infill the hollow associated with the former reservoir. A weak and diffuse positive anomaly heads south from the south-west corner of the reservoir. This could possibly be the remains of a drain associated with the reservoir.
- 5.18 Another cluster of strong magnetic anomalies has been detected just west of the above reservoir. These anomalies could reflect materials used to infill the remains of a second reservoir; a slight depression is also evident on the ground here.
- 5.19 Several further anomalies of probable archaeological origin have also been detected south of the reservoirs. These take the form of linear and rectilinear anomalies which could reflect ditches and gullies, perhaps defining enclosures and drains, and possibly foundation trenches. A possible enclosure measuring approximately 40m by 15m extends south-east from the principal reservoir. The remains of possible roads or tracks appear to lie adjacent to the enclosure on its south and east sides, aligned north-east/south-west and north-west/south-east respectively. The remains of further features and possible structures have been detected to the east of this enclosure, though these are not so well defined. Small areas of particularly intense anomalies could reflect burnt or fired materials. As in Area 1, discrete positive anomalies probably reflect soil-filled pits.

- 5.20 Another probable ditched enclosure lies to the south of the above enclosure, and a probable ditch extends south from here into the next field, Area 3.
- 5.21 Dipolar anomalies detected in the south-east corner of the field correspond to the former location of a spring, as shown on early OS editions.
- 5.22 A linear negative magnetic anomaly detected around the northern and eastern sides of this field corresponds to the edge of the ploughed area.

Area 3

- 5.23 Relatively few anomalies were detected in this area, however, several linear positive magnetic anomalies could reflect soil-filled features such as ditches and gullies. One of these appears to be a continuation of ditch from Area 2 to the north.
- 5.24 A few small rectilinear anomalies in the north of this area could possibly be associated with former structures.

Area 4

- 5.25 The most prominent anomaly in this area is a strong linear anomaly aligned north-west/south-east. This appears to be a continuation of a feature detected in an earlier survey of the field to the immediate north. This feature is almost certainly associated with a road heading south-east from the *porta principalis dextra*, on the south side of the fort, towards Dere Street.
- 5.26 Other linear anomalies here probably reflect parts of ditched enclosures or possibly house-plot boundaries, as well as pits and possible ovens.

6. Conclusions

- 6.1 3.5ha of geomagnetic survey was undertaken to the west and south of *Longovicium* Roman fort near Lanchester in County Durham.
- 6.2 Two substantial ditches were detected along the western side of the fort (Area 1). A causewayed entrance is apparent in the outer ditch, together with the possible remains of a roadside ditch heading west. Among several other ditches in the north of Area 1 are the probable remains of at least one enclosure. Discrete anomalies could reflect former pits and possibly hearths or ovens.
- 6.3 The extent of the former reservoir in Area 2 has been clearly defined by the survey. The reservoir may have been at least partly filled with building rubble. The remains of a probable second reservoir have also been detected just to the west.
- 6.4 Many anomalies to the south of the reservoirs appear to reflect ditched enclosures or plots to both sides of former roads. Some anomalies are better defined than others, but there are possibly some structural remains present here also.
- 6.5 Occasional further ditches, pits and possible small structural remains have been detected in Areas 3 and 4. The most prominent anomaly here is almost certainly associated with a road heading south-east from the fort to join Dere Street.

7. Sources

- Archaeological Services 2008a *North vicus at Longovicium, Lanchester, County Durham: geophysical survey*. Unpublished report **1908**, Archaeological Services Durham University
- Archaeological Services 2008b *East vicus at Longovicium, Lanchester, County Durham: geophysical surveys*. Unpublished report **2102**, Archaeological Services Durham University
- Archaeological Services 2009 *Land at Longovicium, Lanchester, County Durham: geophysical surveys*. Unpublished report **2313**, Archaeological Services Durham University
- Archaeological Services 2013 *Cadger Bank, Lanchester, County Durham: geophysical survey*. Unpublished report **3141**, Archaeological Services Durham University
- Casey, PJ, Noel, M, & Wright, J, 1992 The Roman Fort at Lanchester, Co. Durham: a Geophysical Survey and Discussion of Garrisons. *Archaeol J*, **149**, 69-81
- Cousins, SM, 1990 *A resistivity survey within the Roman vicus at Lanchester, County Durham*. Unpublished dissertation, 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
- Noel, MJ, 1991 *Geophysical and Topographic Surveys of Lanchester Roman Fort*. Unpublished report, GeoQuest Associates
- Payne, AW, 1991 *Report on geophysical survey at Lanchester, County Durham*. Ancient Monuments Laboratory Report **51/91**, English Heritage
- Schmidt, A, 2013 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service & Digital Antiquity, Oxbow
- The Friends of Longovicium 2007 *Longovicium: Lanchester's Roman Fort*. Lanchester Partnership
- The Friends of Longovicium 2011 *Longovicium: A Roman town at Lanchester*. Lanchester Partnership
- Turner, R, 1990 A Romano-British Cemetery at Lanchester, Durham. *Arch. Aeliana* 5th Series, **18**, 63-77

Appendix: Geophysical Survey Database Questionnaire



ENGLISH HERITAGE

English Heritage Geophysical Survey Database Questionnaire

Survey Details

Name of Site: LONGOVICIUM ROMAN FORT AND VICUS

County: DURHAM

NGR Grid Reference: fort centre NZ 15945 46898

Start Date: 18 MARCH 2014

End Date: 18 MARCH 2014

Geology at site (Drift and Solid):

Westphalian mudstone, siltstone and sandstone with coal seams of the Pennine Lower Coal Measures Formation. In Areas 2-4 these strata were overlain by Devensian till.

Known archaeological Sites/Monuments covered by the survey

(Scheduled Monument No. or National Archaeological Record No. if known)
LANCHESTER ROMAN FORT (LONGOVICIUM), LANCHESTER, CO DURHAM
Scheduled Ancient Monument, Asset UID 100236

Archaeological Sites/Monument types detected by survey

(Type and Period if known. "?" where any doubt).

Roman fort ditches, roadside ditches, enclosure ditches, infilled reservoirs, possible structural remains, pits, probable ovens/hearthths

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Duncan Hale, ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

Name of Client, if any:

LANCHESTER PARTNERSHIP (THE FRIENDS OF LONGOVICIUM)

Purpose of Survey: RESEARCH

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

b) Full Report:

LANCHESTER PARTNERSHIP (THE FRIENDS OF LONGOVICIUM)
DURHAM COUNTY COUNCIL ARCHAEOLOGY SECTION/SMR
ENGLISH HERITAGE (NORTH EAST OFFICE, NEWCASTLE)
ENGLISH HERITAGE (GEOPHYSICS SECTION, PORTSMOUTH)
OASIS ref 184530
ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

Technical Details

(Please fill out a separate sheet for each survey technique used)

Type of Survey (Use term from attached list or specify other):

MAGNETOMETRY

Area Surveyed, if applicable (In hectares to one decimal place): 3.5HA

Traverse Separation, if regular: 1m **Reading/Sample Interval:** 0.25m

Type, Make and model of Instrumentation:

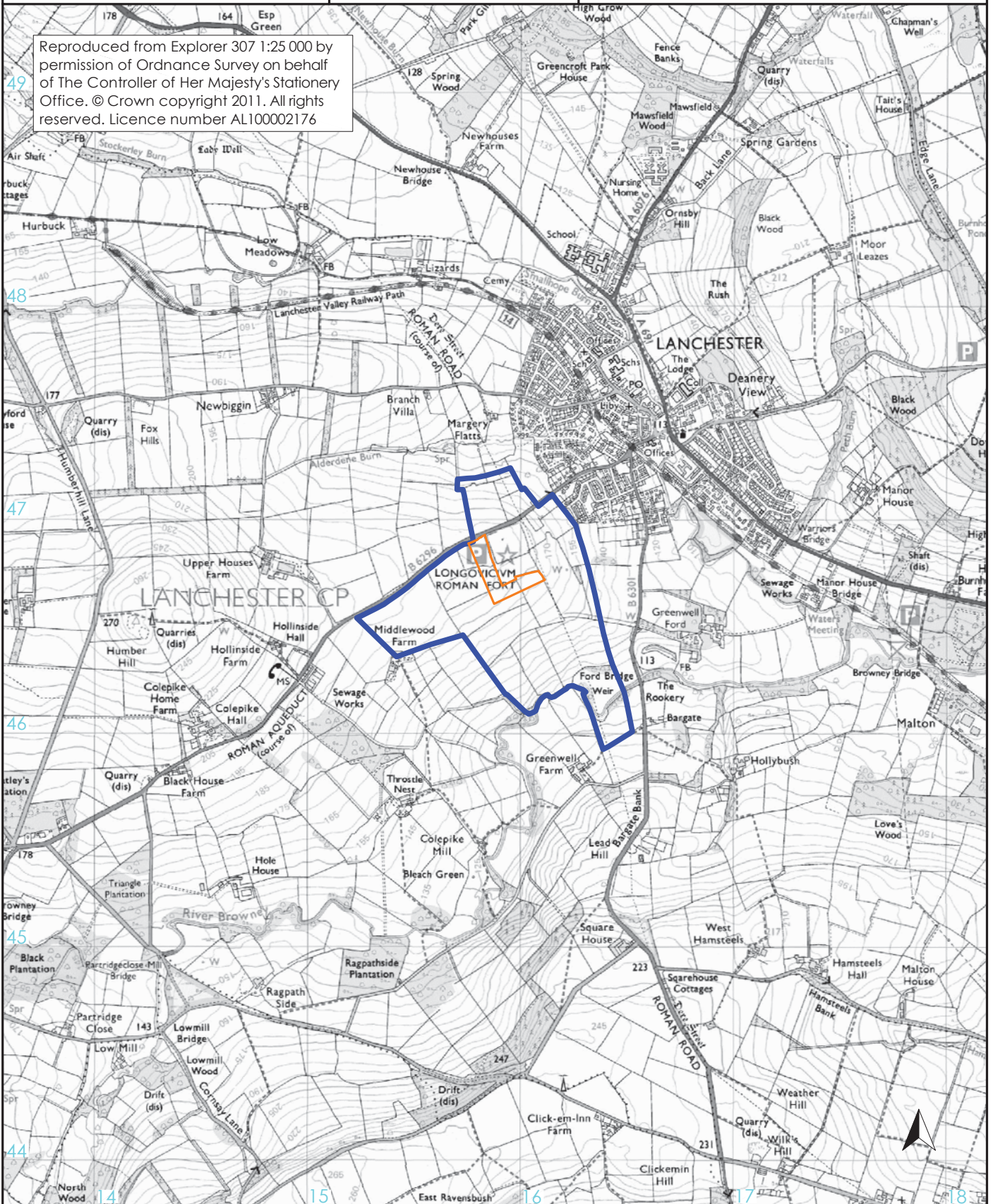
BARTINGTON GRAD601-2 FLUXGATE GRADIOMETERS


Land use at the time of the survey (Use term/terms from the attached list or specify other):

ARABLE, YOUNG CEREAL


Additional Remarks (Please mention any other technical aspects of the survey that have not been covered by the above questions such as sampling strategy, non standard technique, problems with equipment etc.):

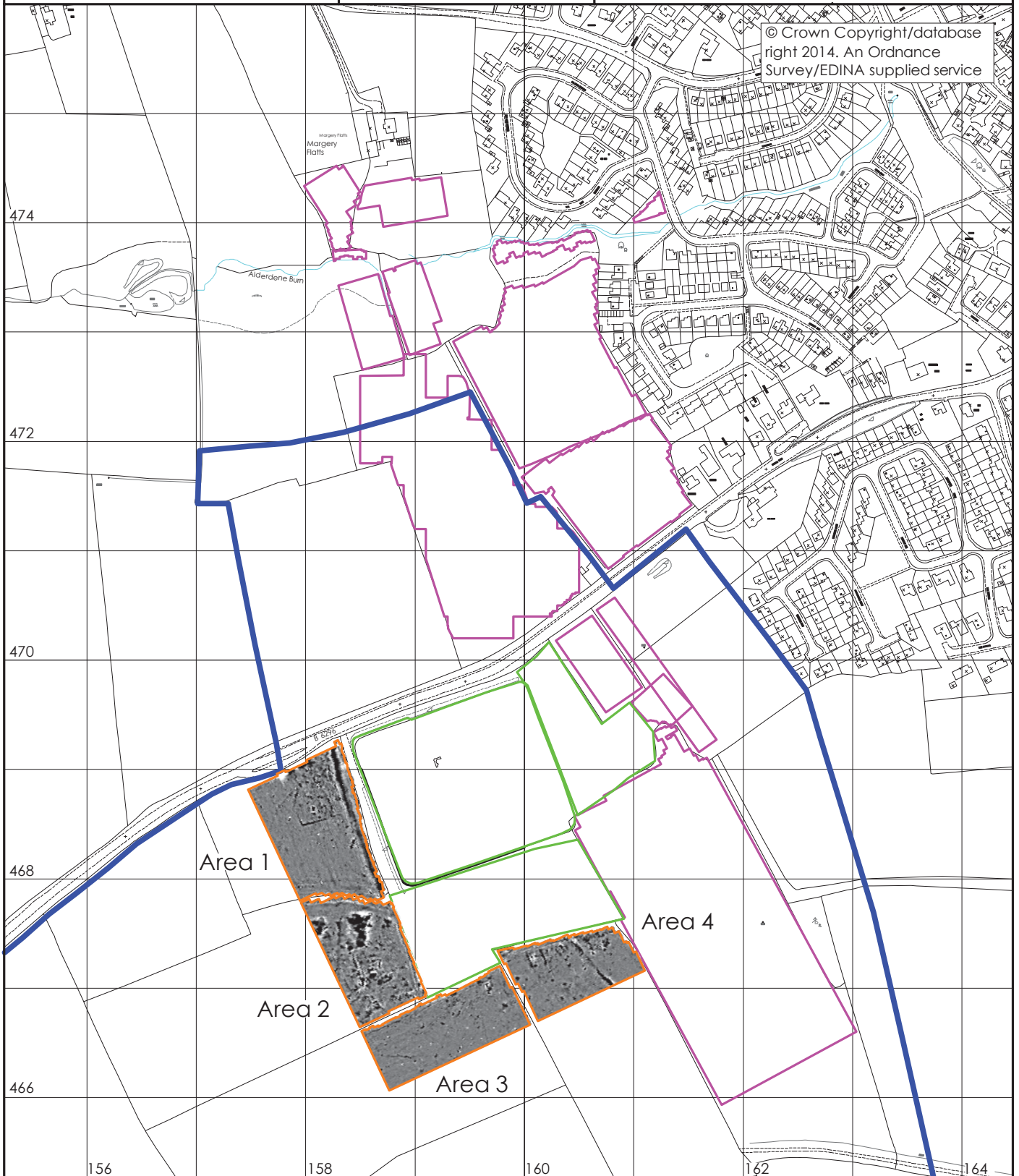
Reproduced from Explorer 307 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright 2011. All rights reserved. Licence number AL100002176



 scheduled ancient monument

 geophysical survey

0  1km
scale 1:25 000 for A4 plot



scheduled monument



previous Archaeological Services
geophysical survey



Geoquest geophysical survey



2014 geophysical survey

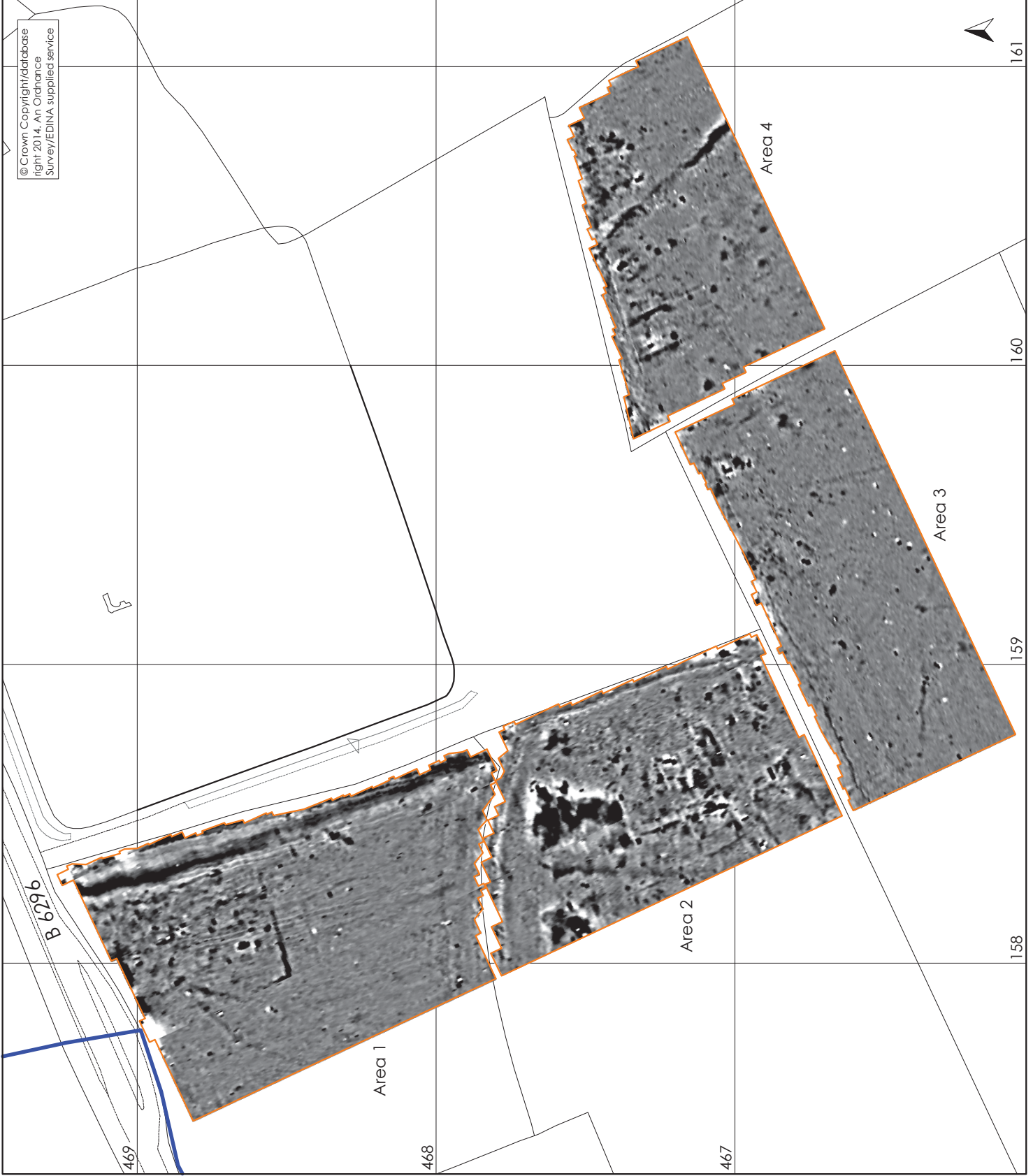


0 250m
scale 1:5000 for A4 plot

on behalf of
The Lanchester Partnership
(Friends of Longovicium)

Land west and south of Longovicium
Lanchester
County Durham
geophysical survey
report 3472

Figure 3: Geophysical survey



on behalf of
The Lanchester Partnership
(Friends of Longovicium)

Land west and south of Longovicium
Lanchester
County Durham
geophysical survey
report 3472

Figure 4: Geophysical interpretation



on behalf of
The Lanchester Partnership
(Friends of Longovicium)

Land west and south of Longovicium
Lanchester
County Durham
geophysical survey
report 3472

Figure 5: Archaeological interpretation

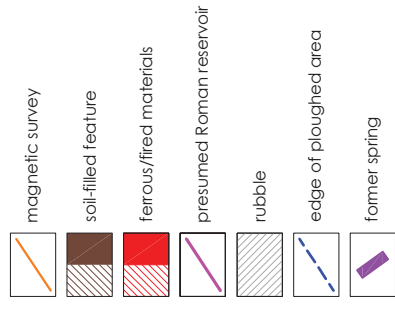




Figure 6: Trace plots of geomagnetic data

