Archaeological Services
University of Durham

Land at *Longovicium*, Lanchester, County Durham

geophysical surveys

on behalf of
The Friends of *Longovicium*

heritage lottery fund
LOTTERY FUNDED

Report 2313
November 2009

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% 15 Thirlmere, Birtley, Chester-le-Street, County Durham DH3 2JY

Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted on land to the east, southeast and north of the Roman fort of *Longovicium,* west of the town of Lanchester, County Durham.

1.2 The work was commissioned by The Friends of L*ongovicium* and conducted by The Friends of *Longovicium* and volunteers from the local community under guidance from Archaeological Services. The research was supported by the National Lottery through the Heritage Lottery Fund and by Durham County Council.

Results

1.3 Areas A and B clearly show the continuation of the v*icus* east and southeast of the fort. Area A also clearly shows the Roman road of Dere Street. A complex of probable stone buildings and soil-filled features, such as pits and ditches, flanks both sides of the road.

1.4 To the east of the buildings in Area A there are soil-filled ditches which appear to form enclosures with back-boundaries flanked by a back-street.

1.5 In the eastern part of Area B, and partly in one of the 2008 surveys, there appears to be half of a possible sub-rectangular enclosure, measuring *c*.40m across. This feature seems out-of character with the rest of the settlement, and may not be contemporary. This could possibly represent earlier, or later, activity at the site.

1.6 A number of other linear and discrete possible soil-filled features were detected in the areas north of the fort.

1.7 A ferrous service pipe was detected across Areas C1 and D. The intense dipolar magnetic anomaly resulting from this pipe may have masked archaeological features that survive outside the actual line of the pipe. Similarly, its effect may have masked the line of Dere Street, which is believed to lie along the western edge of Area D.

1.8 One way to overcome this effect would be to conduct an earth electrical resistance survey over the probable line of the Roman road. This technique would detect the line of the pipe but would not produce such a wide masking effect, thus enabling detection of archaeological features, particularly stone or metalled features.

2. Project background

Location (Figures 1 & 2)

2.1 The study area comprised land around the Roman fort of *Longovicium*, southwest of the town of Lanchester in County Durham (Figure 1; NGR fort centre: NZ 15945 46898). The fort and its surroundings are a Scheduled Ancient Monument (SAM No. DU 22).

2.2 Six areas totalling 5.5ha were surveyed: Area A was located to the southeast of the fort; Area B was located east of the fort; Areas C1, C2 and E were located approximately 0.5km north of the fort, bounded to the north by the Alderdene Burn; and Areas D and F were located to the north of Alderdene Burn, south of Margery Flatts farm. The locations of these, and previous geophysical surveys, are shown in Figure 2.

Objective

2.3 The aims of the survey were three-fold: 1. to engage with the local community in researching the heritage of the area; 2. to train The Friends of *Longovicium* and volunteers from the local community in the use of geophysical survey equipment; and 3. to assess the nature and extent of any sub-surface features of potential archaeological significance within the survey area, in particular to determine the extent of the *vicus* to the southeast of the fort and the alignment of Dere Street Roman road to the north of the fort.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from The Friends of *Longovicium* and with national standards and guidelines (see para. 5.1 below).

2.5 Since Areas A and B are within the Scheduled Ancient Monument the surveys there 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 between 26th and 28th October 2009. This report was prepared between 9th and 23rd November 2009.

Personnel

2.7 Fieldwork was conducted by The Friends of *Longovicium* and volunteers from the local community, assisted by Jamie Armstrong, Andy Platell and Natalie Swann (Supervisor) of Archaeological Services Durham University. Data processing was by Natalie Swann. This report was prepared by Natalie Swann and Duncan Hale (the Project Manager), with illustrations by Ed Davies.

Archive/OASIS

2.8 The site code is **LAN09**, for **LAN**chester 20**09**. The survey archive will be supplied on CD to the Bowes Museum and the English Heritage Geophysics Team 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 **archaeol3-67506**.

Acknowledgements

2.9 Archaeological Services and The Friends of *Longovicium* are grateful to Mr John Brown and Mr Nick Greenwell, the landowners, for facilitating this research and to the volunteers from the local community without whose hard work it would have been impossible to achieve so much over the course of three days.

2.10 The research was supported by the National Lottery through the Heritage Lottery Fund (HLF) and by Durham County Council.

3. Archaeological and historical 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.

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 was and an aqueduct and a cemetery to the southwest 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, south and east, along the line of Dere Street (Archaeological Services 2008a, 2008b; Cousins 1990; Noel 1991; Payne 1991). The locations of previous geophysical surveys are shown in Figure 2.

4. Landuse, topography and geology

4.1 The survey areas comprised six fields of pasture near the Roman fort, which sits on a spur of land between the River Browney to the south and Alderdene Burn to the north.

4.2 Area A sloped from approximately 170m OD in the north to 155m OD in the south. Area B was predominantly level with a height of approximately 170m OD. To the north of the fort the ground sloped from 160m OD at the south end of Areas C1 and C2 down to 135m OD at the Alderdene Burn, before rising up to 140m OD at the north end of areas D and F, towards Margery Flatts farm.

4.3 The underlying solid geology of the area comprises Pennine Lower Coal Measures, which are overlain by boulder clay.

5. Geophysical survey

Standards

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

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 20m 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 Geoscan FM256 (Area B) and Bartington Grad601-2 (Areas A, C-F) fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m 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.

Geomagnetic survey in progress

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 (unfiltered) data. The greyscale images and interpretations for the most recent surveys are presented in Figures 3-8; overviews of all the survey results from 2008-09 are presented in Figures 9-10; trace plots of the most recent data are provided in Figure 11. 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, or limits 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 anomalies caused by alternate zig-zag traverses.
despike	locates and suppresses iron spikes in gradiometer data.
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 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.10 Many more anomalies are present in the data for Area A than it is practical to include on the interpretation plot; simplified colour-coded interpretation plans are therefore 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

5.11 Colour-coded archaeological interpretation plans are 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 plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

Area A

5.13 Aligned approximately northwest-southeast across the survey area is a broad band of relatively smooth data. This corresponds to the Roman road known as

Dere Street, as shown on earlier geophysical surveys around the fort (Figures 9 & 10), to the east of its location shown on the Ordnance Survey.

5.14 East and west of the road distinct linear and rectilinear negative magnetic anomalies have been detected. Most of these anomalies are aligned at right angles to or parallel with the road, and form rectangular enclosures. These negative magnetic anomalies are likely to reflect features such as wall-footings or other stone structures and almost certainly represent a series of buildings along Dere Street.

5.15 Several other negative magnetic anomalies are aligned at a different angle to the road. These may also reflect wall-footings or other stone structures distinct from the main roadside buildings.

5.16 Within and surrounding the structures there are some concentrations of positive magnetic anomalies. It is possible that the large areas of positive magnetic anomalies could reflect concentrations of collapsed material such as tile or brick, or earthen floors within the structures. Smaller, isolated anomalies within the structures could reflect features with thermoremanent magnetism such as hearths and ovens, or soil-filled features such as postholes and pits.

5.17 There are also a number of linear and rectilinear positive magnetic anomalies aligned at right angles to, or parallel with, the road. These anomalies are likely to reflect soil-filled features such as ditches and may represent ditched-enclosures or boundary ditches.

5.18 To the east of the road-side structures a number of linear positive magnetic anomalies are likely to reflect soil-filled ditches which form a series of enclosures. The eastern edge of these enclosures is marked by two weak, parallel positive magnetic anomalies; these may reflect soil-filled ditches and could represent boundary ditches or road-side ditches. It appears that on this east side of Dere Street in particular the buildings sit in enclosures with ditched back-boundaries flanked by a back-street.

5.19 A number of discrete positive magnetic anomalies detected across the survey area may reflect soil-filled features such as pits.

Area B

5.20 A number of linear and curvilinear positive magnetic anomalies have been detected in this area. These are likely to reflect soil-filled ditches, as detected in adjacent surveys. One enclosure ditch here was also detected to the immediate north in one of the 2008 surveys, and it appears that three sides of a possible sub-rectangular enclosure have now been detected, measuring *c*.40m across. This feature seems slightly incongruous with the rest of the settlement, and may not be contemporary. This could possibly represent earlier, or later, activity at the site.

5.21 The linear negative magnetic anomalies detected in this area may again reflect stone structures such as wall-footings.

5.22 On the eastern side of the survey area a number of parallel positive magnetic anomalies have been detected, which correspond to former ridge and furrow cultivation of this area, visible as upstanding earthworks in the field.

Area C1

5.23 The strong dipolar magnetic anomaly aligned northwest-southeast across the survey area almost certainly reflects a ferrous service pipe.

5.24 The positive magnetic anomaly detected in the northeast corner of the survey area could possibly reflect a soil-filled feature such as a pit, or possibly natural geomorphological variation such as a soil-filled hollow in the slope.

5.25 The dipolar magnetic anomalies along the west and north edges of the survey reflect the adjacent wire fence field boundaries.

Area C2

5.26 A number of generally weak, linear positive magnetic anomalies have been detected across this survey area. These anomalies may reflect soil-filled features such as ditches.

5.27 A number of small, discrete positive magnetic anomalies have also been detected which may reflect soil-filled pits.

5.28 The dipolar magnetic anomalies along the east and south edges of the survey area reflect wire fences along those field boundaries. The dipolar magnetic anomaly in the northeast corner of the survey area reflects an adjacent gate.

5.29 The small, discrete dipolar anomalies on the north edge of the survey area represent modern debris on the surface such as tyres and bricks; they could also reflect some sub-surface debris.

Area D

5.30 The strong dipolar magnetic anomaly aligned northwest-southeast across the survey area almost certainly reflects a continuation of the ferrous pipe detected in Area C1 to the south. A second dipolar magnetic anomaly aligned roughly north-south on the eastern edge of the survey area may also reflect a ferrous service pipe.

Area E

5.31 Due to the small size of this area individual features are difficult to discern. However, there does appear to be a linear dipolar magnetic anomaly aligned approximately northeast-southwest in the centre of the area which is likely to reflect a ferrous service pipe.

Area F

5.32 A series of parallel, alternate positive and negative magnetic anomalies aligned approximately north-south have been detected across the survey area. These almost certainly reflect former ridge and furrow cultivation of the area, which can be seen as upstanding earthworks in the field.

5.33 The linear dipolar magnetic anomaly aligned approximately northeast-southwest in the northeast corner of the survey area is likely to reflect a service pipe.

6. Conclusions

6.1 5.5ha of geomagnetic survey was undertaken near *Longovicium* Roman fort, southwest of Lanchester, by the Friends of *Longovicium* and volunteers from the local community.

6.2 Areas A and B clearly show the continuation of the v*icus* east and southeast of the fort. Area A also clearly shows the Roman road of Dere Street. A complex of probable stone buildings and soil-filled features, such as pits and ditches, lines both sides of the road.

6.3 To the east of the buildings in Area A there are soil-filled ditches which appear to form enclosures with back-boundaries flanked by a back-street.

6.4 In the eastern part of Area B, and partly in one of the 2008 surveys, there appears to be half of a possible sub-rectangular enclosure, measuring *c*.40m across. This feature seems out-of character with the rest of the settlement, and may not be contemporary. This could possibly represent earlier, or later, activity at the site.

6.5 A number of other linear and discrete possible soil-filled features were detected in the areas north of the fort.

6.6 A ferrous service pipe was detected across Areas C1 and D. The intense dipolar magnetic anomaly resulting from this pipe may have masked archaeological features that survive outside the actual line of the pipe. Similarly, its effect may have masked the line of Dere Street, which is believed to lie along the western edge of Area D. One way to overcome this effect would be to conduct an earth electrical resistance survey over the probable line of the Roman road. This technique would detect the line of the pipe but would not produce such a wide masking effect, thus enabling detection of archaeological features, particularly stone or metalled features.

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

Casey, PJ, Noel, M, & Wright, J, 1992 The Roman Fort at Lanchester, Co. Durham: a Geophysical Survey and Discussion of Garrisons. *Archaeol J*, **149** (1992), 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, 2nd edition*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, 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, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

Turner, RC, 1990 A Romano-British cemetery at Lanchester. *Archaeologia Aeliana*, 5th series, **18**, 63-77

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Figure 1
Site location

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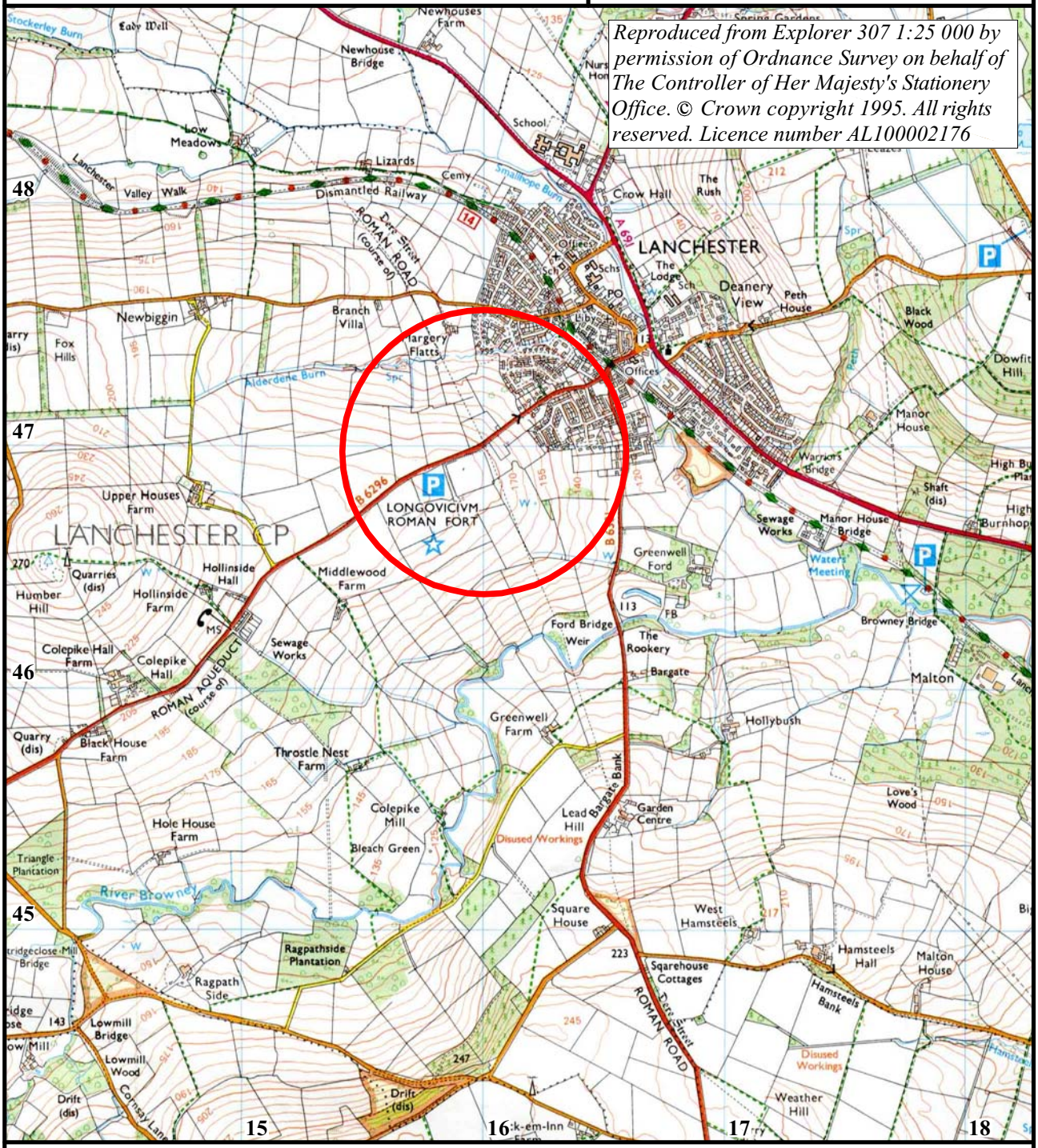

study area

0 1km

scale 1:25 000 - for A4 plot

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Figure 2
Survey locations

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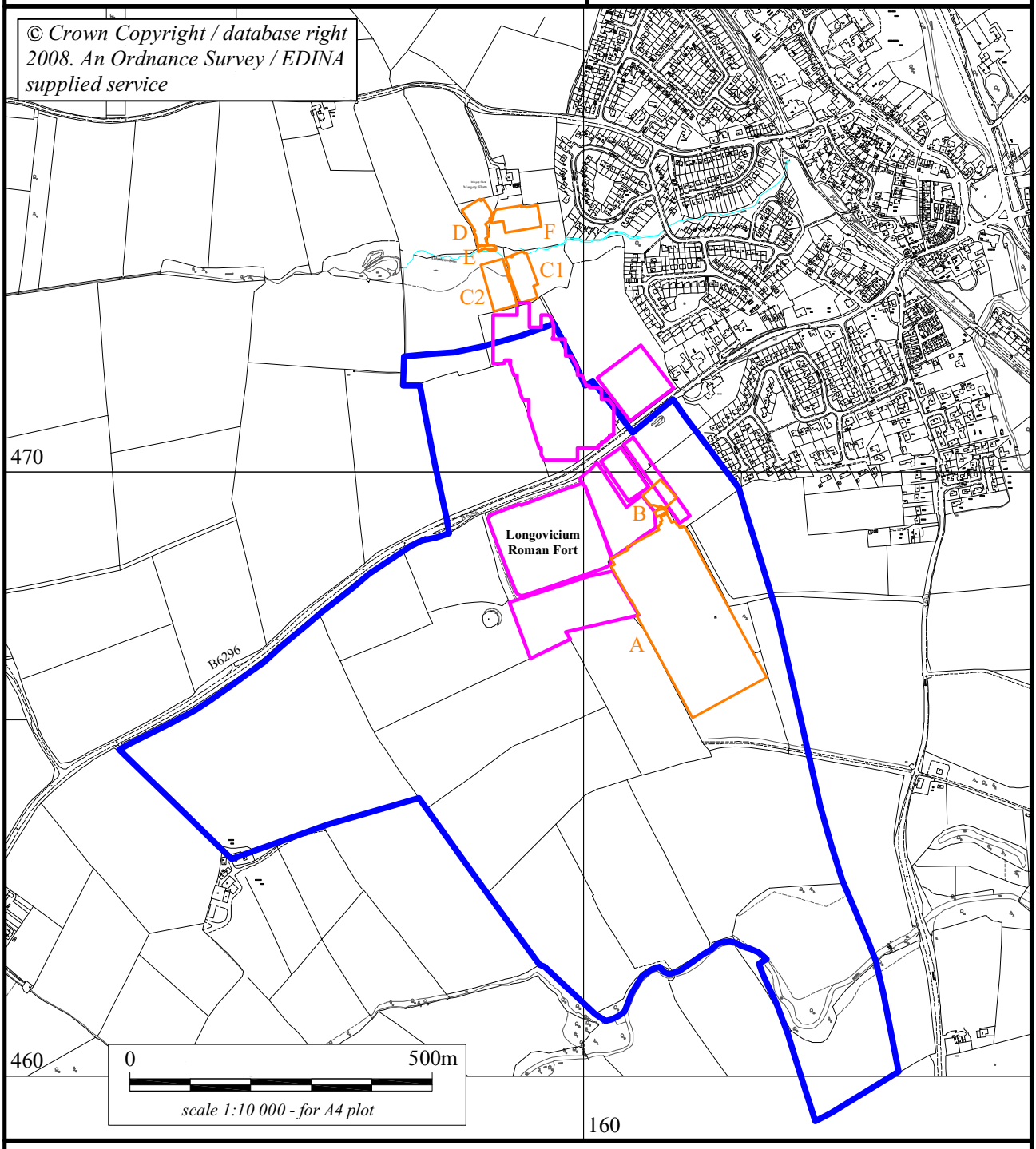

2009 surveys

previous surveys

Scheduled Ancient Monument

COLEPIKE ROAD

MIDDLEWOOD ROAD

470

469

468

467

466

161

162

163

A

B

2009 surveys

6.00
5.17
4.33
3.50
2.67
1.83
1.00
0.17
-0.67
-1.50
-2.33
-3.17
-4.00 nT

0 50m

scale 1:1000 - for A2 plot

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Figure 3

Areas A and B geophysical surveys

MIDDLEWOOD ROAD

COLEPIKE ROAD

Well

Well

A

B

470

469

468

467

466

161

162

163

2009 surveys

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

0 50m

scale 1:1000 - for A2 plot

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Figure 4

Areas A and B geophysical interpretations

COLPHEE ROAD

MIDDLEWOOD ROAD

Well

Well

A

B

2009 surveys

soil-filled/earthen features

orientation of ridge and furrow

stone/rubble

road surface

0 50m

scale 1:1000 - for A2 plot

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Figure 5

Areas A and B archaeological interpretations

475

Margery Flatts

FOX HILLS CRESCENT

D

F

474

E

Alderdene Burn

C1

C2

473

158

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Figure 6

Areas C to F geophysical surveys

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0 50m

scale 1:1000 - for A3 plot

2009 surveys

5.00
4.17
3.33
2.50
1.67
0.83
0.00
-0.83
-1.67
-2.50
-3.33
-4.17
-5.00 nT

475

Margery Flatts

FOX HILLS CRESCENT

D

F

474

Alderdene Burn

E

C1

473

C2

158

159

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Figure 7

Areas C to F geophysical interpretations

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0 50m

scale 1:1000 - for A3 plot

2009 surveys

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

475

Margery Flatts

FOX HILLS CRESCENT

D

F

474

E

Alderdene Burn

C1

473

C2

158

159

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Figure 8

Areas C to F archaeological interpretations

on behalf of
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0 50m

scale 1:1000 - for A3 plot

2009 surveys

soil-filled features

service pipes

orientation of ridge and furrow

Margery Flatts

Alderdene Burn

B 6296

A

B

C1

C2

D

E

F

2009 surveys

previous surveys

Scheduled Ancient Monument

0 100m

scale 1:2000 - for A2 plot

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Figure 9

Survey overview 2008-2009

476
475
474
473
472
471
470
469
468
467
466
158
159
160
161
162
163

Margery Flatts

D
F
E
C1
C2
A
B

Alderdene Burn

B 6296

2009 surveys

previous surveys

Scheduled Ancient Monument

soil-filled/earthen features

service pipes

orientation of ridge and furrow

stone/rubble

road surface

0 100m

scale 1:2000 - for A2 plot

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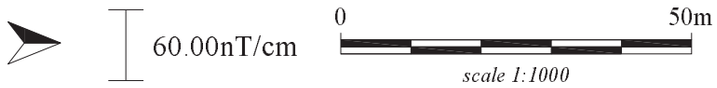
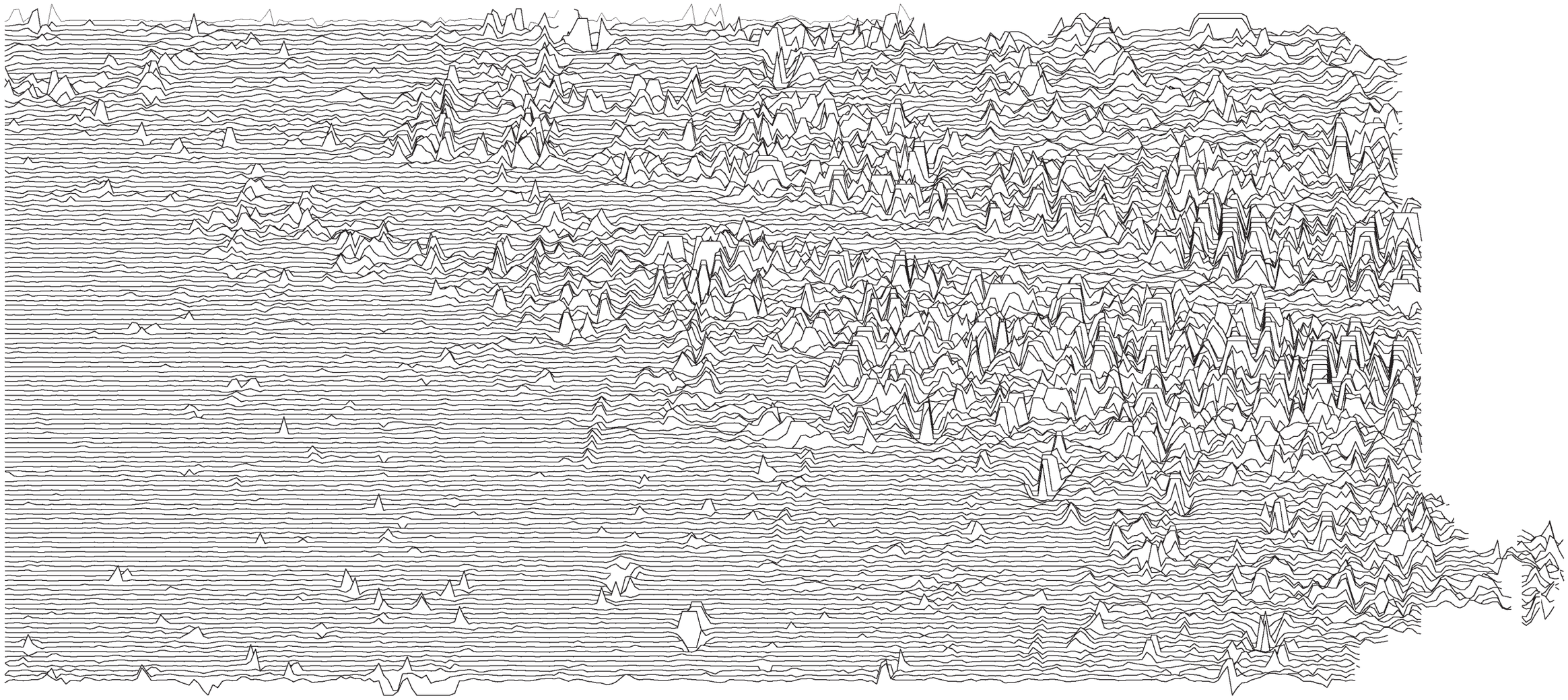
Figure 10

Survey interpretation 2008-2009

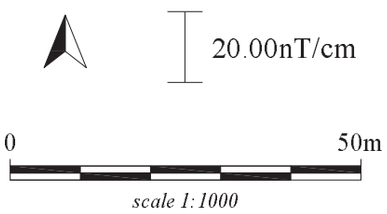
Figure 11: Trace plots of geomagnetic data

Area A

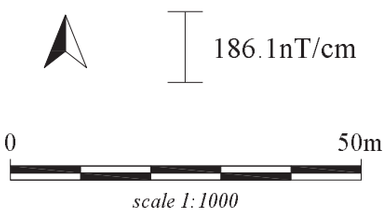


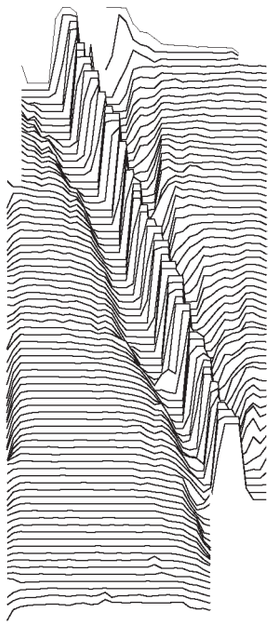


Area B

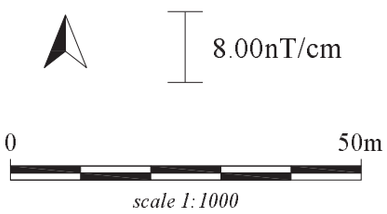


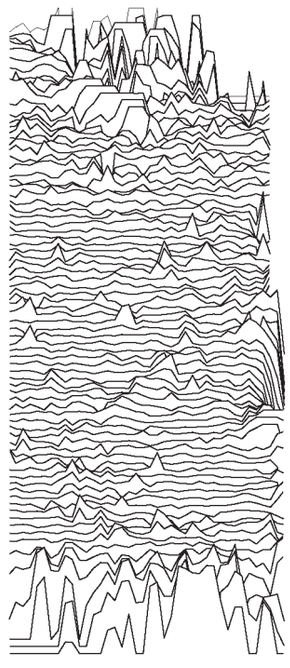
Area C1



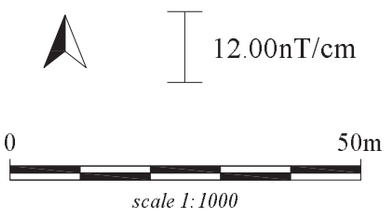


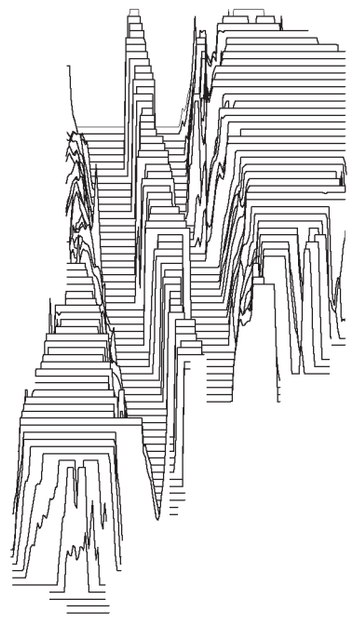
Area C2





Area D





Area E