

ARCHAEOLOGICAL
SERVICES
DURHAM UNIVERSITY

in partnership with
Durham County Council

Sedgefield Community Research Project
East Park
Sedgefield
Co Durham

geophysical surveys 2005-2009

report 2331
March 2010

Contents

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

Figures

Figure 1:	Site location
Figure 2:	Survey areas
Figure 3:	Geophysical survey overview
Figure 4:	Excavation areas
Figure 5:	Geophysical surveys
Figure 6:	Geophysical interpretation
Figure 7:	Archaeological interpretation
Figure 8:	Trace plots of geomagnetic data, Areas 3 & 5
Figure 9:	Trace plot of geomagnetic data, Area 4

1. Summary

The project

- 1.1 This report presents the results of geophysical surveys undertaken at East Park in Sedgefield, County Durham, between 2005 and 2009. The surveys form part of the Sedgefield Community Research Project, a partnership project between Archaeological Services Durham University and Durham County Council.

Results

- 1.2 The 53ha of survey have recorded a substantial complex of ditched enclosures to both sides of Cades Road, with internal features suggesting industrial and domestic functions, rather than simply animal husbandry. Subsequent excavation has indicated a probable public function for one of the enclosures. Taken as a whole, the site is a significant Roman civilian settlement with no evidence for any military presence.
- 1.3 There appear to be features from an earlier phase of settlement beneath the Roman town in Area 3, which may continue into the field to the north.
- 1.4 The surveys have added significantly to existing knowledge, gained from previous aerial photography, survey and evaluation.
- 1.5 Later features at the site include medieval ridge and furrow cultivation remains, post-medieval land boundaries and more recent land drains and services.

2. Project background

Location (Figures 1 & 2)

- 2.1 The study area comprises fields known as East Park, part of the larger Hardwick Park, at Sedgefield in County Durham (NGR centre: NZ 350 289). The area is bounded by the A177 road and Hardwick Park to the west, Station Road and housing to the south, Sedgefield town to the east, and a track and farmland to the north. Eight surveys have been undertaken covering 53ha.

Survey background

- 2.2 These extensive geophysical surveys have been undertaken as part of the Sedgefield Community Research Project, a partnership project led by Archaeological Services Durham University and the Archaeology Section at Durham County Council. The project was set up in 2005 to enable student training and community involvement in archaeological research.
- 2.3 The site was first recognised from the air as cropmarks in the large southern field in the 1990s and the aerial photographs that were taken then, together with the large number of Roman coins found by local detectorists, prompted evaluation of the site as part of a Time Team Channel 4 production in 2002. The evaluation included fieldwalking, metal detecting, geophysical survey of sample areas and trial trenching of selected geophysical anomalies, which confirmed the presence of Roman features and evidence for industrial activities. The results of the evaluation, together with an account of the archaeological and historical background to the site, are presented in the Time Team report (Gallagher 2002).
- 2.4 Between 2005 and 2009 approximately 53 hectares have been surveyed geomagnetically and four open-area excavations have been undertaken with students and members of the local community (Figures 3 & 4). This report presents the results of all the geophysical surveys, and supercedes our Report 1648 (Archaeological Services 2007), which described the 2005-06 surveys. The excavation results have been presented in interim reports and magazine articles (Archaeological Services 2008; 2009).

Objective

- 2.5 The principal aim of the surveys was to determine the extent and nature of sub-surface features of potential archaeological significance. The survey results would inform the location and landscape contexts of other components of the project, including excavation.

Dates

- 2.6 The surveys were undertaken in several phases between May 2005 and October 2009. This report was completed in March 2010.

Personnel

- 2.7 The surveys were conducted by Janice Adams, Jamie Armstrong, Bryan Atkinson, Graeme Attwood, Janet Beveridge, Ed Davies, Lorne Elliott, Duncan Hale, Martin Railton, Sam Roberts, Natalie Swann and Richie Willis. This report was prepared by Duncan Hale (the survey Project Manager) with illustrations by Ed Davies, David Graham and Janine Watson.

Acknowledgements

- 2.8 Archaeological Services is grateful to the landowners (Durham County Council and Sedgefield Cricket Club) and the tenant farmers, particularly Mr Sedgwick, for their co-operation and support.

Archive/OASIS

- 2.9 The survey archive is currently held at Archaeological Services Durham University. It will be deposited with the Bowes Museum with the rest of the project archive upon completion of the project. The survey site codes are, **SEP05, SEP05CC, SEP06, SEP062, SEP08, SEP09A, SEP09B** and **SEP09C**, for Sedgefield East Park year/area. 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 **archaeol3-73337**.

3. Landuse, topography and geology

- 3.1 The survey areas are shown in Figure 2. The landuse at the time of each survey was:

Areas 1 & 2 (May 2009 & May 2006)

Both survey areas were within this large pasture field, with a seasonally waterlogged area in the south which appears to have been largely infilled with rubble and slag, and a broad band of scrub in the north. A number of stands of trees and small planted areas were bounded by fences, preventing survey of those areas.

Area 3 (May 2005)

This comprised a field of pasture. This is believed to have been parkland for the last 200 years and ridge and furrow cultivation earthworks are still visible in parts of the field. There was a tree-lined avenue in the western part of the field; these trees and the other occasional trees across the field were surrounded by either wood or iron fences.

Area 4 (April 2006)

This covered one large field that had been ploughed until 2005; all of the post-medieval field boundaries had been removed here to form one very large field. At the time of survey a grass cover was developing, though the previous plough direction was still evident. There were a number of stands of trees in the field, where survey was either hindered or not possible.

Area 5 (July 2008)

This pasture field is also known as the 'Show Field'. Two parallel earthen banks and very slight ridge and furrow remains were evident on the ground, aligned east-west.

Area 6 (October 2009)

This comprised a small pasture field.

Area 7 (July 2005)

This small area was used for cutting hay. The survey was undertaken prior to the extension of the cricket ground into this area.

Area 8 (October 2009)

This survey covered the cricket ground, which by now also included some land previously surveyed as part of Area 7.

- 3.2 The landscape at East Park is gently undulating with a mean elevation of 105m OD. A shallow linear depression in the central part of the site, between gentle east- and

west-facing slopes rising to 110m OD, broadly corresponds to the course of the Roman 'Cades Road'. This road is believed to start at Brough-on-Humber and head north via York and Chester-le-Street to Newcastle upon Tyne.

- 3.3 The local geology comprises Late Permian limestones of the Raisby and Ford Formations, which are overlain by Devonian glaciofluvial deposits of sand and gravel with beds of good quality clay.

4. Geophysical survey Standards

- 4.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David 1995; 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

- 4.2 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.
- 4.3 In this instance, it was known that cut features such as ditches and pits would be present in the study area, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.
- 4.4 Given the 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

- 4.5 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 or a total station survey instrument.
- 4.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers, with the exceptions of Areas 2 and 7 where Geoscan FM256 fluxgate gradiometers were used. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument

sensitivity was typically 0.03nT; the sample interval was 0.25m and the traverse interval 1.0m, thus providing 3,600 sample measurements per 30m grid unit.

- 4.7 Data were downloaded on site into laptop computers for initial processing and storage and subsequently transferred to desktop computers for processing, interpretation and archiving.

Data processing

- 4.8 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. An overview of all the geomagnetic results is provided in Figure 3; larger greyscale images and interpretations are presented in Figures 5-7; selected areas are shown as trace plots in Figures 8-9. 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.

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

<i>clip</i>	clips, or limits 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>destagger</i>	corrects for displacement of anomalies caused by alternate zig-zag traverses.
<i>despike</i>	locates and suppresses iron spikes in gradiometer data.
<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, except Area 4, which could only be interpolated to 0.5m x 0.25m intervals due to its size.

Interpretation: anomaly types

- 4.10 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 features such as pits, ditches and furrows.
<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

- 4.11 A colour-coded archaeological interpretation plan is provided. 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.
- 4.12 Small, discrete dipolar magnetic anomalies have been detected across the study area. These anomalies typically reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and often have little or no archaeological significance. A representative sample of these anomalies is presented in the geophysical interpretation drawing, though for clarity they have not been included in the archaeological interpretation. Some of the larger dipolar magnetic anomalies could reflect fired structures such as hearths, ovens and kilns.
- 4.13 The surveys have recorded an extensive complex of linear, rectilinear and sub-circular magnetic anomalies, covering much of the study area. The majority of the anomalies reflect soil-filled ditches, which here define several roads and dozens of enclosures, while others reflect large soil-filled pits and ovens/kilns. A more irregular complex of slightly weaker anomalies in Area 3 appears to underlie the more regular system of enclosures and roads, which is evident over a much larger area. No roads or tracks have been identified in the earlier phase of settlement, which seems to have been in place prior to the construction of Cades Road, and is likely to be pre-Roman.
- 4.14 The principal axis of the small Roman town is aligned roughly north-south along Cades Road. The majority of the settlement is located on the east side of this road, although a continuous row of enclosures does flank the western side of the road for over 800m, throughout the surveyed area. Indeed, the ditched enclosures on both sides of the road appear to continue beyond both the north-western and southern limits of the study area.
- 4.15 The enclosures typically measure 40-50m square, though both larger and smaller ones are also present. Many of the enclosures have large sub-circular positive magnetic anomalies associated with them, almost certainly pits, often at or near their corners. Up to 30 of these features have been detected by the surveys. Excavation of one such anomaly in 2005 confirmed that it was a large pit, measuring several metres across and at least 3m deep. These pits may originally have been excavated to provide sand or gravel, or, where it occurs, clay, possibly for a local pottery industry. Subsequent use of the pits may have been for water storage for the small-scale industries in this part of the town, as evidenced by metal-working slag and several clay and stone ovens recorded in another part of the 2005 excavation. One geophysical anomaly investigated by Time Team in Area 3 was proven to be a pottery kiln, believed to have been built with clay from a local source, and probably used in the late second or early third century AD (Gallagher 2002).
- 4.16 The pits could also have served as watering holes for stock, however, as above, many of the enclosures appear to have internal features indicative of domestic or industrial activities rather than simply livestock management. The internal anomalies almost certainly reflect a variety of features, including postholes, beamslots, gullies, pits, ovens, hearths and kilns.

- 4.17 Although evidence for timber buildings was recorded inside both the enclosures excavated in 2005 and 2006, neither appears to represent purely domestic occupation: the one to the west of Cades Road was associated with a number of small clay ovens while that to the east of Cades Road was sited in an otherwise open space near the centre of the known settlement and may have had a public function. Further post-holes identified in the eastern part of the 2007 excavation may have been associated with one or more timber buildings there. Whilst some structures in the surveyed areas may have been occupied, it seems that any higher status houses may have been on the higher ground to the east, beneath the present town. The geophysical survey of the Show Field (Area 5) did not detect evidence for stone-founded buildings, but the regular pattern of enclosures does continue eastwards across this area, to both north and south of another road, and beneath the modern town. The internal divisions and other features within some of these eastern enclosures are particularly clear. At the western end of this main east-west road, the road opens out onto the large central space around the unusual small enclosure mentioned above.
- 4.18 Two very straight and prominent linear anomalies aligned roughly east-west across this area are not contemporary with the Roman settlement but are almost certainly post-medieval and are still evident on the ground.
- 4.19 A series of parallel, alternate, positive and negative magnetic lineations has been detected aligned broadly east-west across most of the study area. A similar series of anomalies aligned broadly north-south was also detected in part of Area 1. The anomalies are generally weak, relative to the settlement features, slightly curving and regularly spaced at c.6m intervals. They almost certainly reflect the remains of ridge and furrow cultivation, a common practice during the medieval and post-medieval periods, and overly the majority of the other features recorded across the site.
- 4.20 A strong linear positive magnetic anomaly, with subsidiary anomalies to the north and south, has been detected traversing Area 4 on a north-west/south-east alignment. These anomalies represent soil-filled features, almost certainly post-medieval ditched land boundaries, as they appear to cut both the Roman site and the medieval ridge and furrow, though they do not correspond to the more recently removed field boundaries in this area, a number of which have also been detected geomagnetically.
- 4.21 A network of weak negative magnetic anomalies in the western part of Area 3 almost certainly reflects land drains. Land drains were also detected in the waterlogged southern part of Area 1 and in Area 2.
- 4.22 A prominent chain of intense dipolar magnetic anomalies in Areas 2 and 3 reflects the presence of a ferrous service pipe. A similar chain of intense anomalies in Area 6 also reflects a ferrous pipe, this one associated with the former water tower in the north-west corner of the field, whose concrete and steel foundation was detected as a ring of intense dipolar magnetic anomalies.

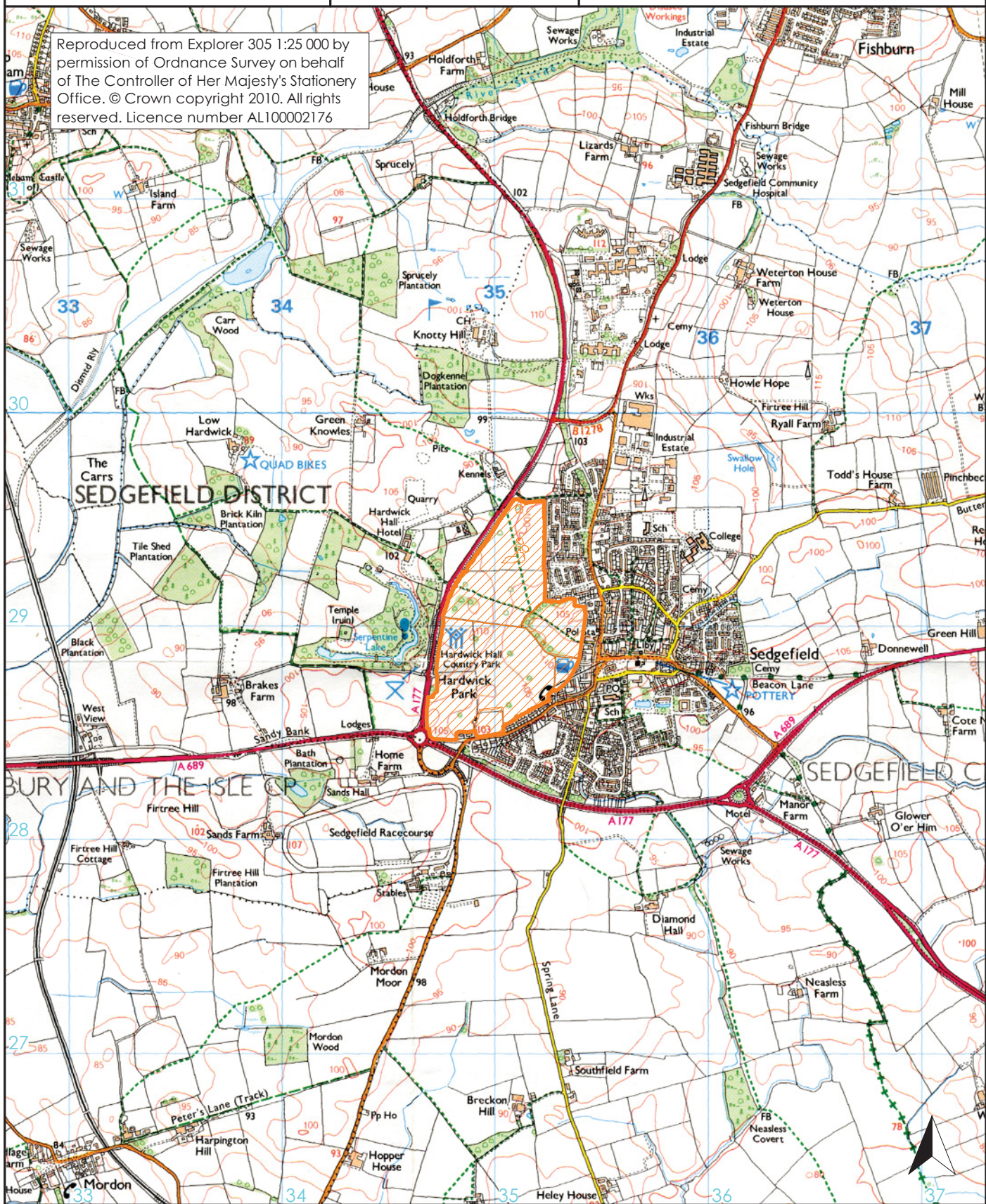
5. Conclusions

- 5.1 Geomagnetic survey at East Park, Sedgfield, has revealed the plan of an extensive, significant Roman civilian settlement, together with elements of a possible earlier settlement. The settlement flanks both sides of the north-south Cades Road and extends eastwards, towards the modern town.
- 5.2 The regular nature of the enclosures, the roads and the central open area all indicate that this was a planned settlement rather than one that developed in an *ad hoc* fashion.
- 5.3 Subsequent excavation at the site has confirmed the nature of different parts of the settlement and found evidence for timber buildings, metal-working, pottery manufacture and, significantly for this region, no evidence for a Roman military presence. Higher status occupation may have occupied the higher ground to the east, beneath the modern town.
- 5.4 Detailed analysis of the excavations will make a significant contribution to our understanding of the Roman occupation of north-east England.

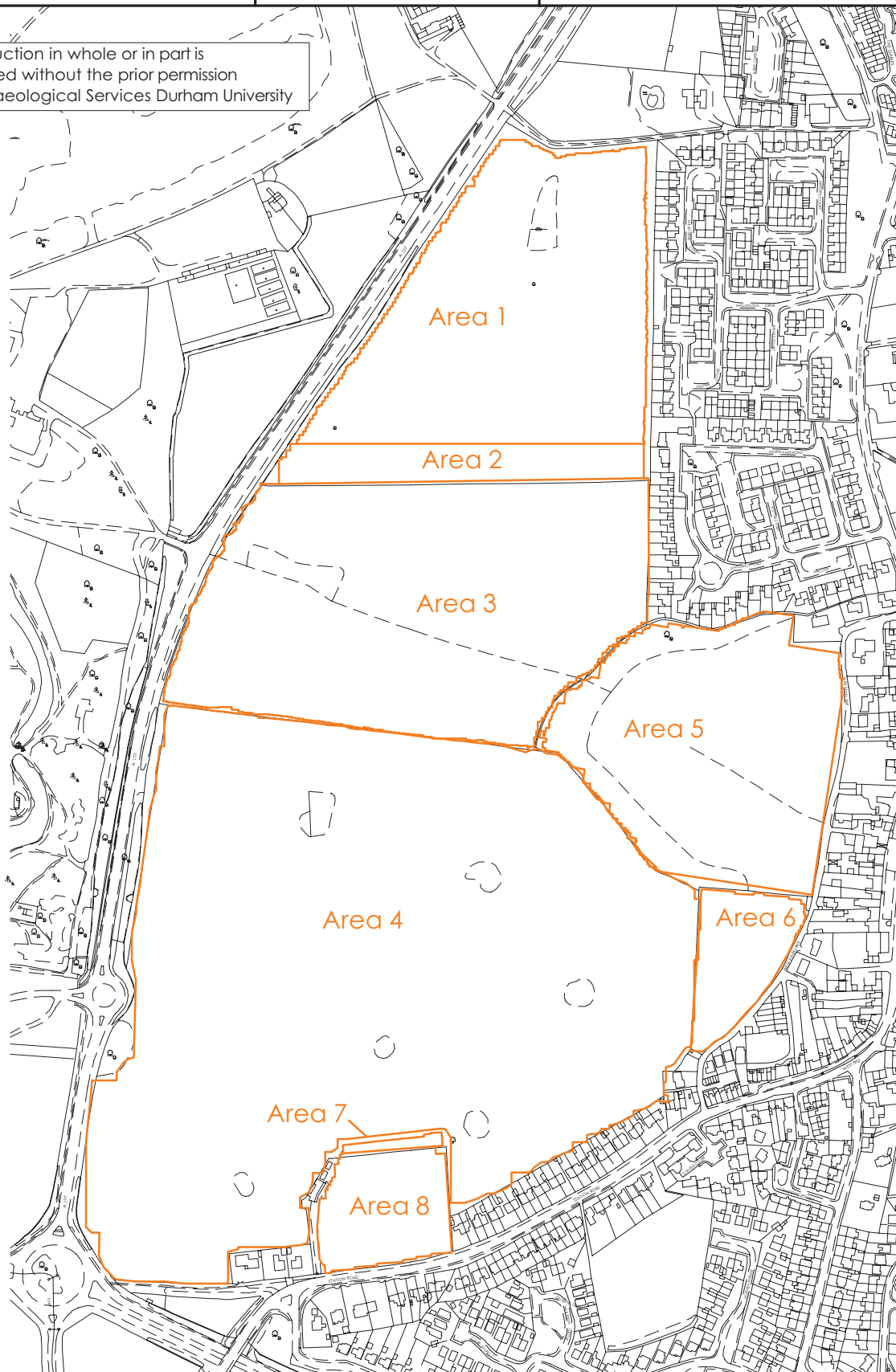
6. Sources

- Archaeological Services 2007 *Sedgfield Community Research Project, East Park, Sedgfield, Co Durham: geophysical surveys 2005-2006*. Unpublished report **1648**, Archaeological Services Durham University
- Archaeological Services 2008 Excavations at East Park, Sedgfield, 2007. *Archaeology County Durham*, Issue **3**
- Archaeological Services 2009 Excavations at East Park, Sedgfield, 2008. *Archaeology County Durham*, Issue **4**
- David, A, 1995 *Geophysical survey in archaeological field evaluation*, Research and Professional Services Guideline **1**, English Heritage
- 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 of Field Archaeologists
- Gallagher, B, 2002 *Sedgfield County Durham: An archaeological evaluation by Time Team 8-10 April 2002*. Unpublished report by Time Team, London
- Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

Reproduced from Explorer 305 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright 2010. All rights reserved. Licence number AL100002176



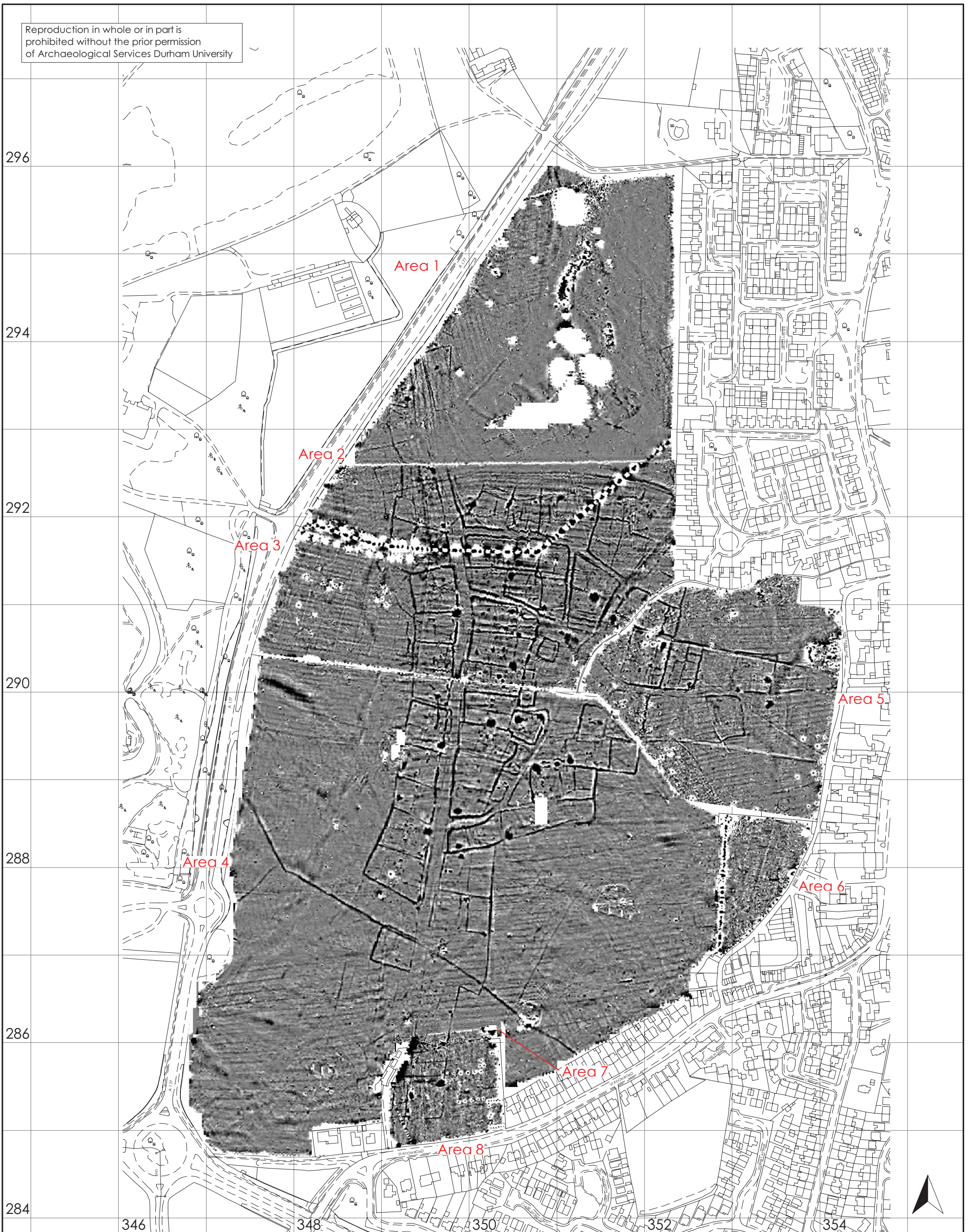
Reproduction in whole or in part is prohibited without the prior permission of Archaeological Services Durham University



 survey areas

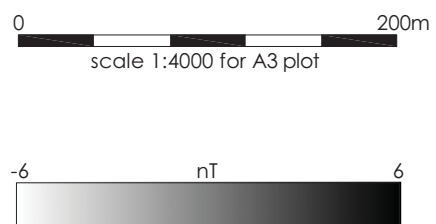
0  250m
scale 1:5000 for A4 plot

Reproduction in whole or in part is prohibited without the prior permission of Archaeological Services Durham University



ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

in partnership with
Durham County Council

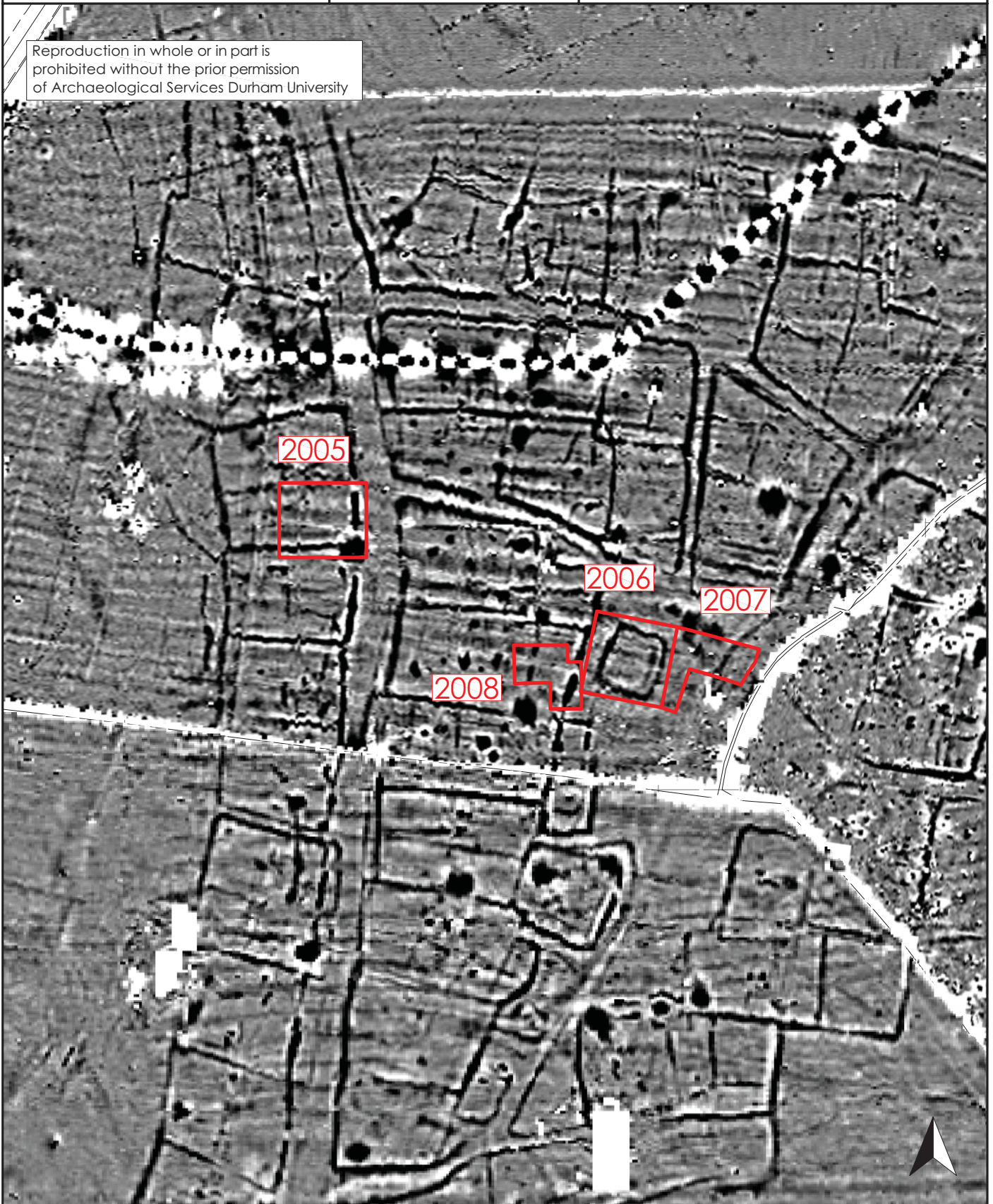


Sedgefield Community Research Project,
East Park, Sedgefield, County Durham

geophysical surveys 2005-2009
report 2331

Figure 3: Geophysical survey overview

Reproduction in whole or in part is prohibited without the prior permission of Archaeological Services Durham University



 excavated areas

0  100m
scale 1:2000 for A4 plot



0 10 20 m

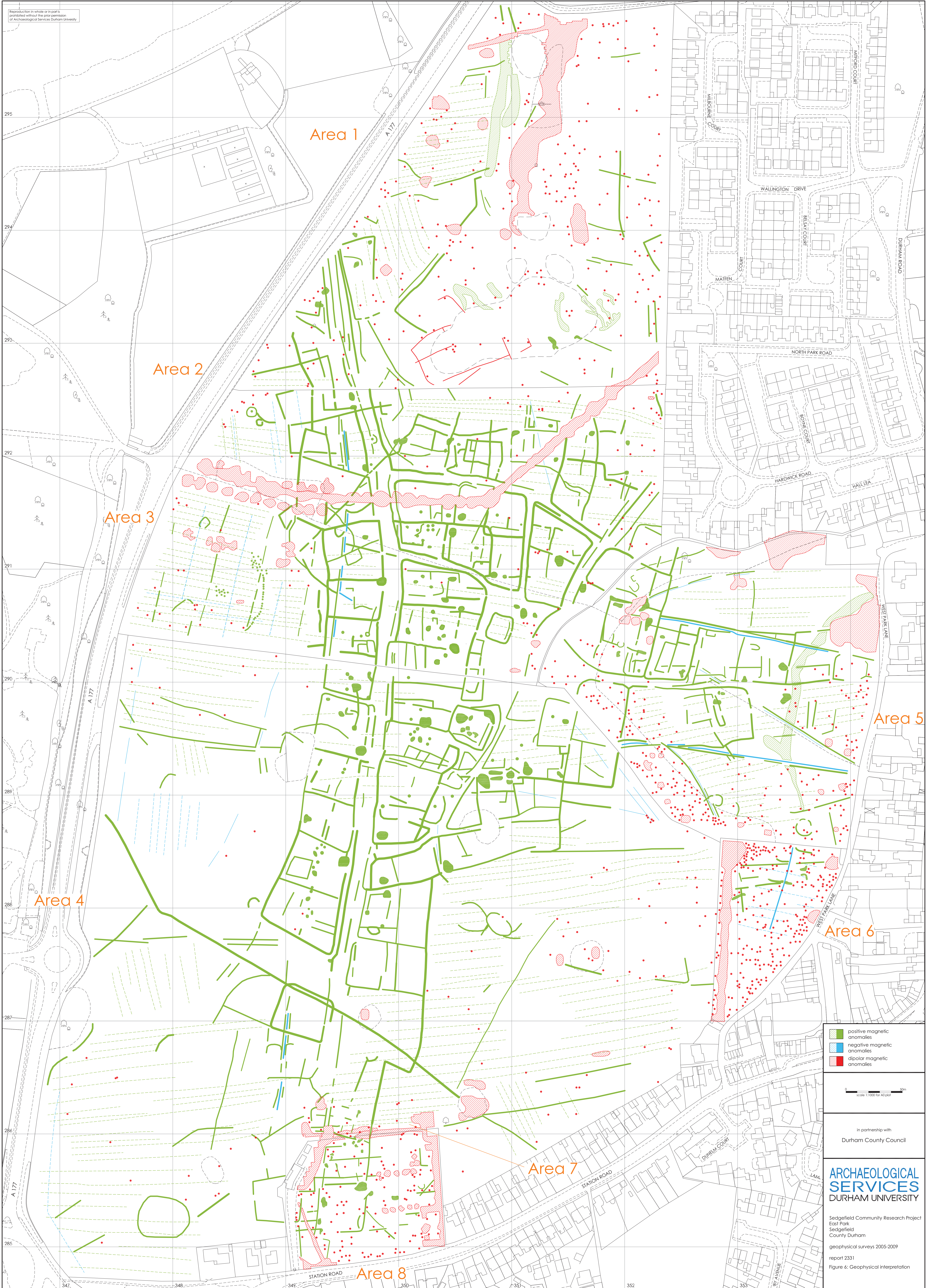
0 10 20 m
Scale 1:1000 for A0 plot

In partnership with
Durham County Council

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

Sedgefield Community Research Project
East Park
Sedgfield
County Durham

geophysical surveys 2005-2009
report 2331
Figure 5: Geophysical surveys



positive magnetic anomalies
negative magnetic anomalies
dipolar magnetic anomalies

Scale 1:1000 for A0 paper

In partnership with
Durham County Council

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

Sedgfield Community Research Project
East Park
Sedgfield
County Durham

geophysical surveys 2005-2009
report 2331
Figure 6: Geophysical interpretation



soil-filled features
service pipes
orientation of ridge and furrow
former field boundary

0 9m
scale 1:1000 for A0 paper

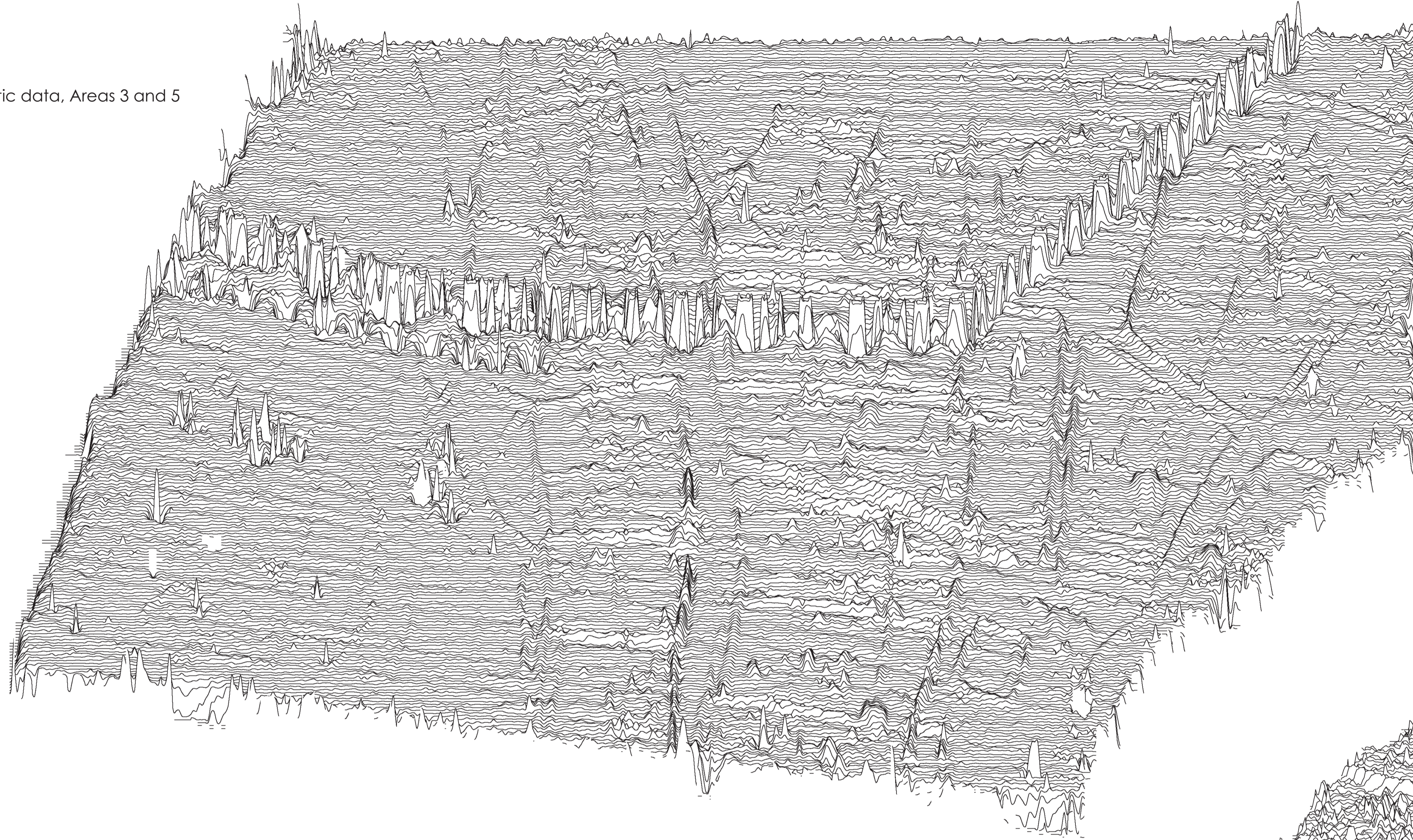
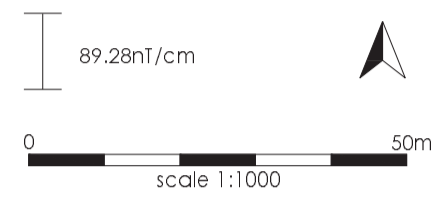
In partnership with
Durham County Council

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

Sedgefield Community Research Project
East Park,
Sedgfield,
County Durham
geophysical surveys 2005-2009
report 2331
Figure 7: Archaeological interpretation

Figure 8: Trace plots of geomagnetic data, Areas 3 and 5

Area 3



Area 5

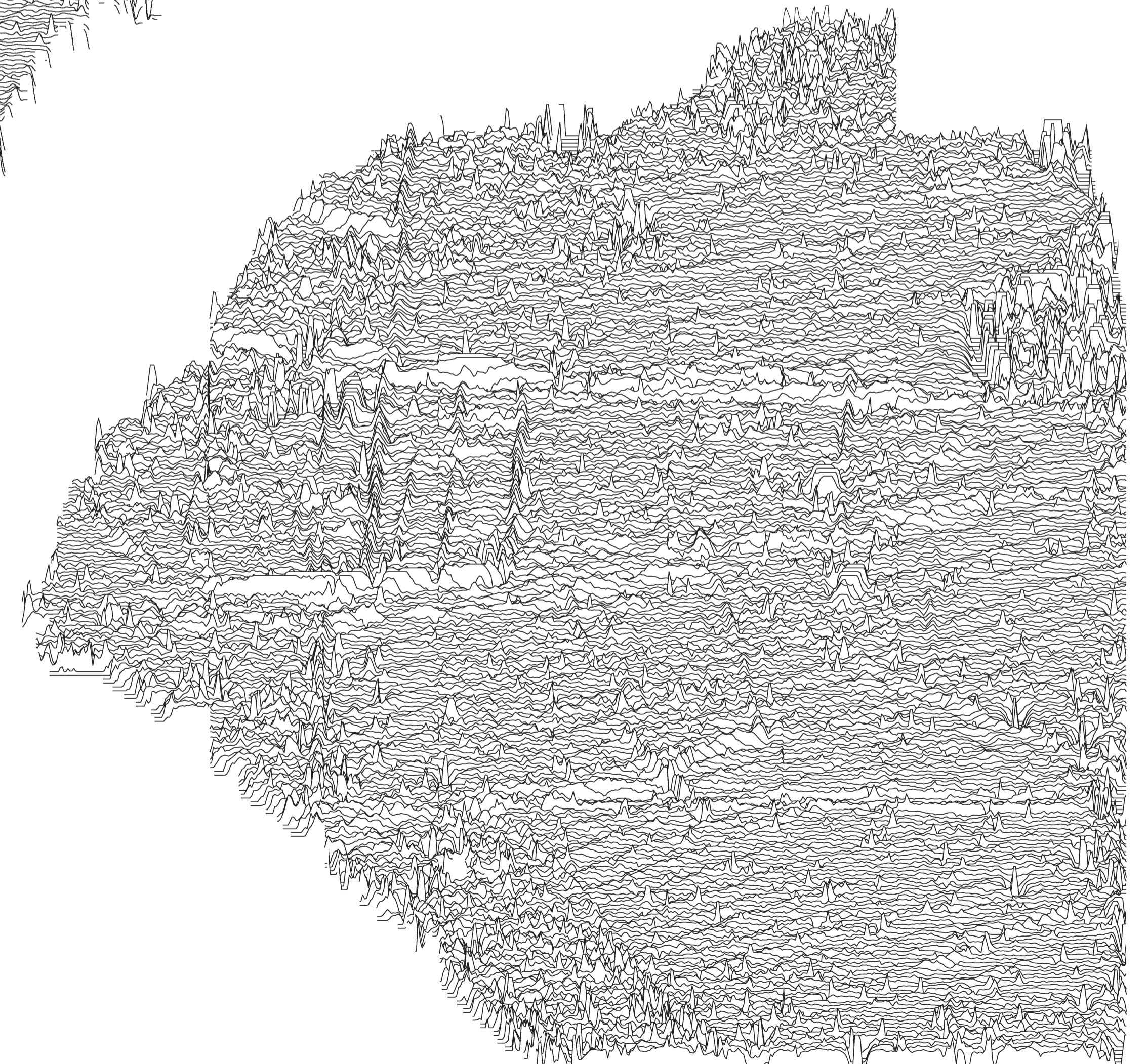
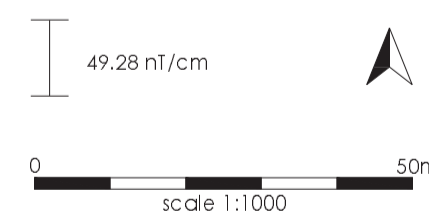


Figure 9: Trace plot of geomagnetic data, Area 4

