ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Banks Property

Hurworth-on-Tees
Darlington

geophysical survey phase 2

report 4132
April 2016

Durham University

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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 Hurworth-on-Tees, south of Darlington. The works comprised detailed geomagnetic survey of approximately 5ha of agricultural land.

1.2 The works were commissioned by Banks Property and conducted by Archaeological Services Durham University.

Results

1.3 The surveys have identified a complex system of enclosures in the east of the proposed development area (Area 2). Some of the features identified in the geomagnetic survey correspond to cropmarks, visible on aerial photographs, which extend to the north and north-west of the area. The survey has also detected probable ring-ditches, which might be associated with roundhouses, and possible, but not strong, evidence for stone-founded structures.

1.4 A series of probable former enclosures, perhaps a field system, have been identified in Area 3 and may be associated with the archaeological features detected in Area 2.

1.5 The anomalies detected here are likely to represent a significant late prehistoric or Romano-British settlement given the types of features detected, the proximity of known and supposed Romano-British activity both in the immediate area and along the Tees Valley.

1.6 Probable former ridge and furrow cultivation has been detected in Areas 1 and 2, which appears to cut the earlier enclosure ditches and other features. It is possible that stone drains have been laid in the former furrows.

1.7 A former field boundary, as shown on early Ordnance Survey editions, has been identified in the south of Area 2.

1.8 Modern features, including recent ploughing, a service, telegraph poles, dumped material and rubbish, have also been detected.

2. Project background

Location (Figure 1)

2.1 The proposed development area (PDA) was located north of the village of Hurworth-on-Tees, south of Darlington (NGR centre: NZ 30544 10672). Three surveys totalling approximately 5ha were conducted in three land parcels. To the south was a housing estate, to the east and north open fields and to the west Roundhill Road.

Development proposal

2.2 The proposed development is for residential housing.

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 area, 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.

2.4 The regional research framework (Petts & Gerrard 2006) contains an agenda for archaeological research in the region, which is incorporated into regional planning policy implementation with respect to archaeology. In this instance, the scheme of works was designed to address agenda items Lii: Late Bronze Age and Iron Age settlement; Ri: The Iron Age to Roman Transition; MDii: medieval landscape.

Methods statement

2.5 The surveys have been undertaken in accordance with instructions from the client and national standards and guidance (see para. 5.1 below).

Dates

2.6 Fieldwork was undertaken on 28th January 2016 with reporting originally prepared for February 2016. A second phase of fieldwork was undertaken on 30th March 2016. This report was prepared for April 2016.

Personnel

2.7 Fieldwork was conducted by Tessi Loeffelmann, Patricia Voke and Mark Woolston-Houshold (supervisor). The geophysical data were processed by Mark Woolston-Houshold, Richie Villis and Duncan Hale. This report was prepared by Richie Villis and Patricia Voke with illustrations by Janine Watson and Dr Helen Drinkall, and edited by Peter Carne. The Project Manager was Daniel Still.

Archive/OASIS

2.8 The site code is **DHT16-2**, for **D**arlington **H**urworth-on-Tees **2016** phase **2**. The survey archive will be retained at Archaeological Services Durham University and a copy 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 **Acces**S to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-248301**.

3. Historical and archaeological background

3.1 A detailed archaeological desk-based assessment has been conducted for the proposed development area (Archaeological Services 2016); the results of that assessment are summarised here.

3.2 There are no historic or statutorily protected buildings in the vicinity of the site. The houses south of the site are of 20th-century date. There are no scheduled ancient monuments on or in the near vicinity of the site.

3.3 There is no direct evidence for prehistoric activity in the proposed development area. However, there is evidence that the surrounding area may have been exploited in prehistory; three sets of cropmarks noted from aerial photographs at Round Hill between 360m and 960m north of the PDA and two sets of cropmarks 650m north-east and 900m east of the PDA at Brickyard Farm may be prehistoric in date. The dating is uncertain, the features may relate to later field boundaries and drainage. A resource relating to prehistoric exploitation may therefore survive within the proposed development area.

3.4 Cropmarks are visible in the north part of the eastern field, Area 2, in a Google Earth image dated 2006. Two straight linear features, 13-14m apart and aligned north-south, can be seen (Figure 2). The eastern feature is about 105m long and appears to continue into the field to the north. At its south end, the western line appears to turn to the south-east. Parts of three sides of an enclosure are also evident in the north-east quarter of the field; this measures approximately 46m east-west and 14m north-south. The same image shows more cropmarks in the field to the north of Area 3. These are irregular in character and may be natural features, possibly of periglacial origin.

3.5 Hurworth lies between the two major north-south Roman Roads of Dere Street and Cades Road, which cross the River Tees at Piercebridge (10km west) and Middleton St George (4km east), respectively. A cropmark west of Hurworth, approximately 800m west of the PDA, has been identified as the possible remains of a Roman fort. Three Roman coins were recovered from within the village and the remains of a Romano-British settlement were excavated at Rockcliffe Farm, 1.5km south-west of the PDA. Further evidence exists at Chapel House Farm, Dalton-on-Tees, 2.5km south-west, the site of an Iron Age settlement and two Roman winged corridor villas.

3.6 Though there is no evidence for Roman activity within the PDA, evidence from the wider area suggests that a resource dating to this period has the potential to be present within the PDA. Elements of the later prehistoric settlement pattern are likely to have continued in use into the Roman period, and the cropmarks within the site (above, 3.4) have the potential to date to the Roman period.

3.7 The area lies beyond the edge of the medieval village of Hurworth-on-Tees and it is probable that the area was utilised in the medieval and post-medieval periods as agricultural land. Evidence relating to this, in the form of ridge and furrow cultivation and field boundaries, may survive.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised three roughly rectangular fields, one overgrown pasture (Area 1) and two under arable cultivation (Areas 2 and 3). Two muck heaps and a pile of dumped fertilizer were noted in Area 1, with garden waste and other rubbish along a wooden fence to the housing to the south of both Areas 1 and 2. Open drains divided Areas 1 and 3 and bounded Area 2 to the north. A post and wire fence to the playing field bounded Area 2 to the east, with a pavilion and a metal shipping container against this in the next field. Telegraph poles were noted in the east of Areas 2 and 3.

4.2 The PDA was predominantly level with a mean elevation of approximately 35m OD. The Cree Beck flows south in the north-east corner of the site and there was a slight slope down to the beck.

4.3 The underlying solid geology of the area comprises Permian and Triassic strata of the Sherwood Sandstone Group, which are overlain by river terrace deposits of sand and gravel.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2014); the CIfA 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 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 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. Plots of filtered data are also provided. The greyscale images and interpretations are presented in Figures 3-6; the trace plots are provided in Figure 7. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar in Figure 3 relates the greyscale intensities to anomaly values in nanoTesla. The palette bar with the filtered images (Figure 4) relates the greyscale intensities to standard deviations.

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
de-spike	locates and suppresses iron spikes in gradiometer data
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

5.10 The following filter has been applied to the geomagnetic data (Figure 4):

low pass filter	(applied with Gaussian weighting) to remove high frequency, small-scale spatial detail, such as some near-surface ferrous debris; for enhancing larger weak features

Interpretation: anomaly types

5.11 A colour-coded geophysical interpretation plan is 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

General comments

5.12 A colour-coded archaeological interpretation plan is provided.

5.13 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.

5.14 Series of parallel, weak, positive and negative magnetic anomalies, which almost certainly reflect former ridge and furrow cultivation, have been detected across Areas 1 and 2.

5.15 Series of closely spaced positive and negative magnetic striations have been detected in Areas 1 and 3, which almost certainly reflect recent plough textures.

5.16 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 plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

Area 1

5.17 The former ridge and furrow cultivation is aligned east-west across this area.

5.18 Concentrations of dipolar magnetic anomalies have been detected in this area. These almost certainly reflect areas of dumped material. The concentration detected in the south-east corner is likely to reflect rubble laid in and around the gateway between the fields.

5.19 Small unsurveyed areas in this field correspond to muck heaps, a pile of fertilizer and a tree. A strong dipolar magnetic anomaly detected in the north-west corner of the area corresponds to a metal gate lying on the ground; a pile of rubbish was noted

next to this. Dipolar magnetic anomalies along the south edge of the area correspond to waste material along the garden fences.

Area 2

5.20 Parallel positive and negative magnetic anomalies almost certainly reflecting former ridge and furrow cultivation have been detected aligned broadly north-south across this area. This has been removed from the greyscale images in Figure 4 by means of a filter.

5.21 An extensive complex of linear and rectilinear positive magnetic anomalies has been detected in this area. The majority of these anomalies almost certainly reflect soil-filled ditches, which in this instance define a system of enclosures. The largest of these enclosures typically measure between 30m-50m square, although much smaller, around 10m, 'cells' have also been detected, particularly towards the centre and south-east of the complex. These enclosure ditches appear to continue beyond the survey extents to the north and the east of the PDA.

5.22 Occasional double-ditched edges have been detected, especially at the west of the main enclosure complex. These may reflect different phases and re-cutting of the enclosure ditches.

5.23 Two of the north-south and one of the east-west aligned ditches correspond to the cropmarks identified in this area from Google Earth aerial photographs. Further cropmarks have been identified in the field to the north, and almost certainly represent a continuation of the enclosure complex.

5.24 Several rectilinear negative magnetic anomalies have been detected in the central and south-eastern parts of the area. In some instances, these types of anomalies can reflect sedimentary stone, and occasionally stone-founded structures. In this case, it is possible that some of these anomalies might represent the remains of Roman villa buildings; villas previously identified in the Tees Valley include Dalton on Tees, to the south, and Ingleby Barwick, to the east. However, in this survey, the north-south aligned anomalies coincide with the ridge and furrow features, and could reflect stone drains laid in the former furrows; the east-west aligned negative magnetic anomalies are typically located immediately north of strong positive magnetic anomalies and may be shadow effects rather than features in their own right. Although the enclosure complex here is similar to that associated with the villa at Ingleby Barwick, the evidence for stone-founded buildings here is perhaps more apparent than real.

5.25 Some of the smaller linear positive magnetic anomalies could nevertheless reflect trenches associated with robbed-out walls, as opposed to ditches.

5.26 Curvilinear positive magnetic anomalies have been detected in the west of the area. These probably reflect the remains of ring-ditches, perhaps associated with round-houses.

5.27 A chain of weak dipolar magnetic anomalies has been detected in the centre of the enclosure complex. Typically this type of anomaly reflects brick lined culverts or drains, although in this instance there is a possibility that it reflects a feature such as an infilled ditch with a high concentration of fired ceramic waste, such as clay tiles

used for roofing or hypocausts. This feature does however cut one square ditched enclosure in the central-eastern part of the complex, indicating a later phase of activity. Similarly, the north-south aligned former ridge and furrow cultivation, a typical medieval and post-medieval agricultural practice, appears to cut the ditched features discussed above. This would indicate that the enclosure complex pre-dates the ridge and furrow.

5.28 Given the presence of the enclosure complex and possible roundhouses, it is possible that some of the discrete dipolar magnetic anomalies, and occasional dipolar magnetic anomalies associated with presumed ditches, reflect burnt materials. Some of these could represent the remains of ovens or hearths.

5.29 There are broad parallels between the enclosure complex detected here and those associated with the Romano-British villas at Quarry Farm, Ingleby Barwick on the River Tees (Archaeological Services 2008), and near Leeming Bar, North Yorkshire (Archaeological Services 2009; 2013). Similar complex Romano-British enclosure systems have also been identified at East Park, Sedgefield (Archaeological Services 2010).

5.30 A broadly east-west aligned weak positive magnetic anomaly has been detected in the south of the area. This corresponds to a former field boundary as shown on historic OS editions. A building is also shown at the east end of this, just on or beyond the survey extent.

5.31 A chain of very strong dipolar magnetic anomalies has been detected along the east edge of the area. This reflects a service. Two collapsed inspection chamber accesses were noted on the ground along the line of this. A discrete dipolar magnetic anomaly in the north of the area corresponds to a telegraph pole. The very strong dipolar magnetic anomaly detected in the centre of the east edge of the area reflects the nearby pavilion and metal shipping container in the field to the east.

Area 3

5.32 A series of rectilinear positive magnetic anomalies has been detected in the north of this area. Given the presence of the enclosure complex and possible roundhouses detected in Area 2, to the east, it is probable that these anomalies reflect associated enclosures, such as a field system. Current and former ploughing may have truncated further features of archaeological interest in this area.

5.33 Broadly north-east/south-west aligned positive and negative magnetic striations have been detected in the centre of this area. These are likely to reflect a former ploughing regime.

5.34 A discrete, large and strong, dipolar magnetic anomaly has been detected in the east of this area, which corresponds to a telegraph pole.

6. Conclusions

6.1 Approximately 5ha of detailed geomagnetic survey was undertaken at Hurworth-on-Tees, south of Darlington, prior to proposed residential development.

6.2 The surveys have identified a complex system of enclosures in the east of the proposed development area (Area 2). Some of the features identified in the geomagnetic survey correspond to cropmarks, visible on aerial photographs, which extend to the north and north-west of the area. The survey has also detected probable ring-ditches, which might be associated with roundhouses, and possible, but not strong, evidence for stone-founded structures.

6.3 A series of probable former enclosures, perhaps a field system, have been identified in Area 3 and may be associated with the archaeological features detected in Area 2.

6.4 The anomalies detected here are likely to represent a significant late prehistoric or Romano-British settlement given the types of features detected, the proximity of known and supposed Romano-British activity both in the immediate area and along the Tees Valley, and the probable extension of features to the north, north-west and east of the PDA.

6.5 Probable former ridge and furrow cultivation has been detected in Areas 1 and 2, which appears to cut the earlier enclosure ditches and other features. It is possible that stone drains have been laid in the former furrows.

6.6 A former field boundary, as shown on early OS editions, has been identified in the south of Area 2.

6.7 Modern features, including recent ploughing, a service, telegraph poles, dumped material and rubbish, have also been detected.

7. Sources

Archaeological Services 2008 *A Romano-British villa and settlement at Ingleby Barwick, Stockton-on-Tees: archaeological excavation*. Unpublished report **1709**, Archaeological Services Durham University

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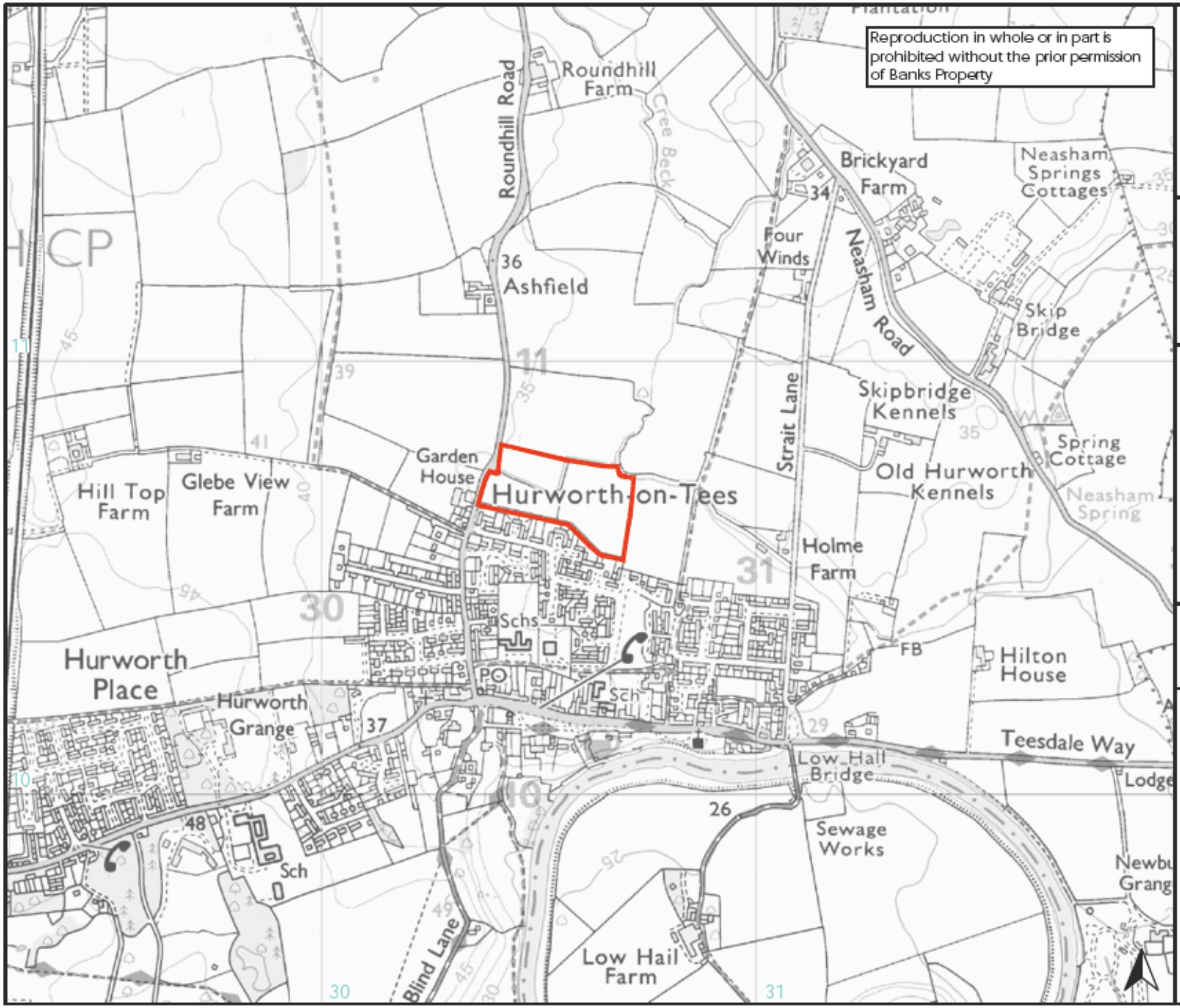

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Figure 1: Site location

0 500m
scale 1:12 500 for A3 plot

proposed development area

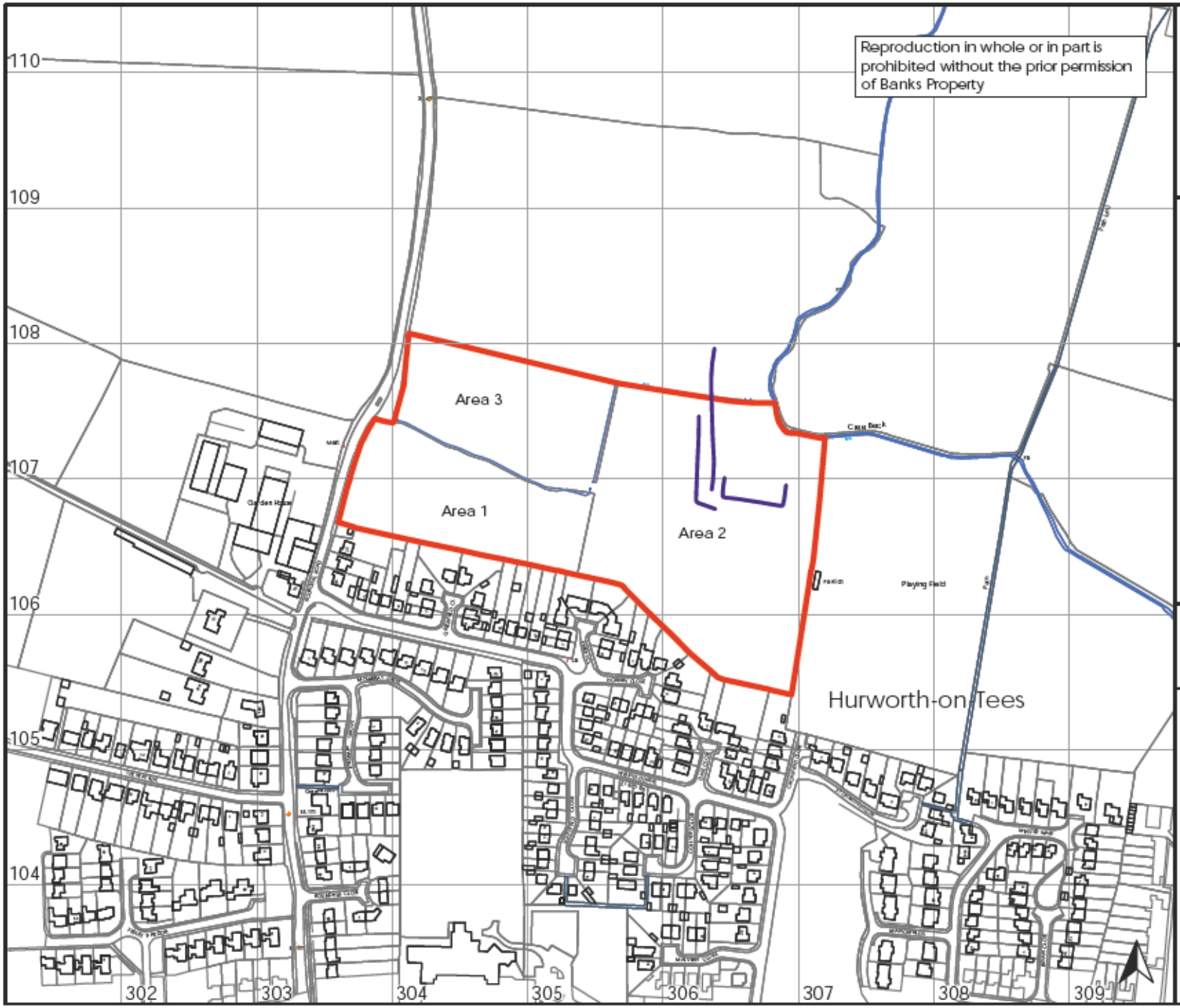

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Figure 2: Survey area showing cropmarks

0 200m
scale 1:4000 for A4 plot

proposed development area

cropmark

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proposed development area

magnetic survey

-4 nT 6

0 50m
scale 1:1250 for A3 plot

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Figure 3: Geophysical survey

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proposed development area

magnetic survey

-2 SD 2

0 50m
scale 1:1250 for A3 plot

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Figure 4: Geophysical survey (filtered)

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0 50m
scale 1:1250 for A3 plot

proposed development area
magnetic survey

dipolar magnetic anomaly
positive magnetic anomaly
negative magnetic anomaly

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Figure 5: Geophysical interpretation

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0 50m
scale 1:1250 for A3 plot

- proposed development area
- magnetic survey
- soil-filled feature
- dumped material
- possible stone wall footings
- muck heaps
- former field boundary
- service
- ridge and furrow
- former ploughing
- telegraph pole
- inspection cover

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Figure 6: Archaeological interpretation

Area 3
Area 2
Area 1
Cree Beck
fertilizer
ROUNDHILL ROAD
GREENFIELD CL
EMERY CL
HORNBY CLOSE
MOWBRAY DRIVE
LB
108
107
106
304
305
306
307

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0 50m
scale 1:1250 for A3 plot

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Figure 7: Trace plots of geomagnetic data