ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Mr David Dixon
for
Mr Colin Williams

Middle Heads Farm
Rowley
County Durham

geophysical survey

report 2896
May 2012

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at Middle Heads Farm, Rowley, County Durham. The works comprised the geomagnetic survey of approximately 1.9ha of farmland.

1.2 The works were commissioned by Mr David Dixon on behalf of Mr Colin Williams and conducted by Archaeological Services Durham University.

Results

1.3 Possible soil-filled curvilinear and linear ditches were detected in Areas 1 and 3.

1.4 Concentrations of anomalies probably reflecting mining waste or other ground disturbance were recorded in Areas 1 and 3.

1.5 A possible former track was detected in Area 1.

1.6 Probable land drains were also detected in Area 1.

Recommendations

1.7 The possible soil-filled features might be of local archaeological significance and can be avoided by the proposed development, preserved *in situ* with a 5m buffer zone between them and any groundworks.

1.8 Since the preferred access route is through Area 1, the only likely archaeological impact would be on a possible former track, probable mining waste and land drains; the impact on them would be of no archaeological significance. There is therefore no recommendation for any further archaeological works in relation to this proposed development.

2. Project background

Location (Figure 1)

2.1 The proposed development area was located at Middle Heads Farm, Bowey's Fell, Rowley, County Durham (NGR centre: NZ 0951 4795). Three surveys totalling 1.9ha were conducted in four land parcels. To the north, south and west was open farmland and to the east Knitsley Lane. The Lyardene Sike ran through the site.

Development proposal

2.2 The development proposal is for a single wind turbine and associated access track. Three potential access routes have been proposed, and surveyed where possible.

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.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from the client and in line with national standards and guidelines (below, para. 5.1).

Dates

2.5 Fieldwork was undertaken on the 19th April 2012. This report was prepared for 11th May 2012.

Personnel

2.6 Fieldwork was conducted by Tony Liddell and Natalie Swann (Supervisor). The geophysical data were processed by Natalie Swann. This report was prepared by Natalie Swann with illustrations by Tony Liddell and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **RMH12**, for **R**owley **M**iddle **H**eads Farm 20**12**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-124839**.

3. Historical and archaeological background

3.1 A desk-based assessment has been conducted for the site (Archaeological Services 2011), the results of which are summarised here.

The prehistoric and Roman periods (up to 5th century)

3.2 There is no direct evidence of prehistoric or Roman activity within the proposed development area (PDA). However, there is evidence of activity in the surrounding area suggesting that an as yet unidentified resource relating to this period has the potential to exist.

The medieval and post-medieval periods (5th century to 1899)

3.3 The PDA lies east of the medieval settlement of Rowley. The area covered by the PDA may have been utilised as agricultural land during the medieval and post-medieval periods; evidence relating to this in the form of ridge and furrow cultivation or former field boundaries has the potential to exist. Historic maps show that the PDA was first enclosed in the late 18th century.

3.4 The wider area around the PDA was exploited industrially during these periods. Early coal mines are known within a 5km radius of the site and metalworking was being undertaken 1km to the south at China Hall Farm during the medieval period.

3.5 In the first half of the 19th century the railway network was beginning to move into the region. The Stanhope and Tyne Railway was opened in 1834; it ran from Stanhope through Consett to the Tyne docks at South Shields and passed 300m north-west of the proposed development area.

The modern period (1900 to present)

3.6 By the 1920s the land at Bowey's Fell had been further enclosed and a coal drift mine was in operation at Lyardene, south-west of the PDA. There was no further change within the PDA until the middle of the 20th century when there was further enclosure of Bowey's Fell to produce the current field pattern.

4. Landuse, topography and geology

4.1 At the time of the survey the proposed development area comprised four fields of pasture. It was not possible to collect data in parts of Areas 2 and 3 due to very steep slopes down to Lyardene Sike, man-made ponds and gorse scrub (Figures 5 and 6).

4.2 Areas 1/1a sloped gently from approximately 254m OD in the west to 247m OD in the east. Area 2 was predominantly level at 252m OD. The north end of Area 3 lies at approximately 254m OD before dropping sharply down to 240m OD at Lyardene Sike. It then rises up to 252m OD at Knitsley Lane.

4.3 The underlying solid geology of the area comprises Westphalian coal measures overlain by boulder clay and morainic drift.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance,

ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on the desk-based assessment, it was considered possible 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) could 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 related to known, mapped Ordnance Survey points 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 20m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 1,600 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.

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 2-3; the trace plots are provided in Figure 4. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.

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

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities

destagger	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

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided. Two types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

General comments

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Small, discrete dipolar magnetic anomalies have been detected in each survey area. Unless stated otherwise in the discussion below 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.

Areas 1 and 1a

5.13 A weak linear positive magnetic anomaly was detected aligned approximately north-east/south-west in the south-west corner of this area. This could reflect a soil-filled feature such as a ditch. This anomaly extends into Area 3.

5.14 Three linear and curvilinear positive magnetic anomalies were detected in the southern corner of this area. These anomalies could reflect the remains of soil-filled features such as pits and ditches.

5.15 A series of parallel positive magnetic anomalies was detected aligned north-east/south-west. These anomalies are likely to reflect land drains. Further linear positive magnetic anomalies were detected aligned east-west in the eastern end of this area which may also reflect land drains.

5.16 A concentration of intense dipolar magnetic anomalies was detected in the north-eastern part of the turbine area. These anomalies are likely to reflect near-surface ferrous or fired debris and may indicate ground disturbance or waste dumping from nearby mining.

5.17 A second, broad, linear concentration of dipolar magnetic anomalies was recorded close to the field boundary dividing this area. This concentration of anomalies

appears to be aligned approximately north-east/south-west and could possibly reflect a former track. The north side of this feature is aligned with the possible soil-filled ditch or drainage gully to the south-west.

Area 2

5.18 The only anomalies detected in this area were small, discrete dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes, brick fragments and mining waste, and are likely to have little or no archaeological significance.

Area 3

5.19 As mentioned above, a possible former ditch extends from the northern end of this survey area into Area 1.

5.20 Small, irregular magnetic anomalies in the western corner of this survey area could possibly reflect the remains of soil-filled ditches.

5.21 In the southern end of this area an intense concentration of dipolar magnetic anomalies was detected, which may reflect the dumping of mining waste or other ground disturbance.

6. Conclusions and recommendations

6.1 Geomagnetic survey was undertaken at Middle Heads Farm prior to proposed development.

6.2 Possible soil-filled curvilinear and linear ditches were detected in Areas 1 and 3.

6.3 Concentrations of anomalies probably reflecting mining waste or other ground disturbance were recorded in Areas 1 and 3.

6.4 A possible former track was detected in Area 1.

6.5 Probable land drains were also detected in Area 1.

6.6 The possible soil-filled features might be of local archaeological significance and can be avoided by the proposed development, preserved *in situ* with a 5m buffer zone between them and any groundworks.

6.7 Since the preferred access route is through Area 1, the only likely archaeological impact would be on a possible former track, probable mining waste and land drains; the impact on them would be of no archaeological significance. There is therefore no recommendation for any further archaeological works in relation to this proposed development.

7. Sources

Archaeological Services 2011, *Middle Heads Farm, Rowley, County Durham: archaeological desk-based assessment.* Unpublished report **2710**, Archaeological Services Durham University

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

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

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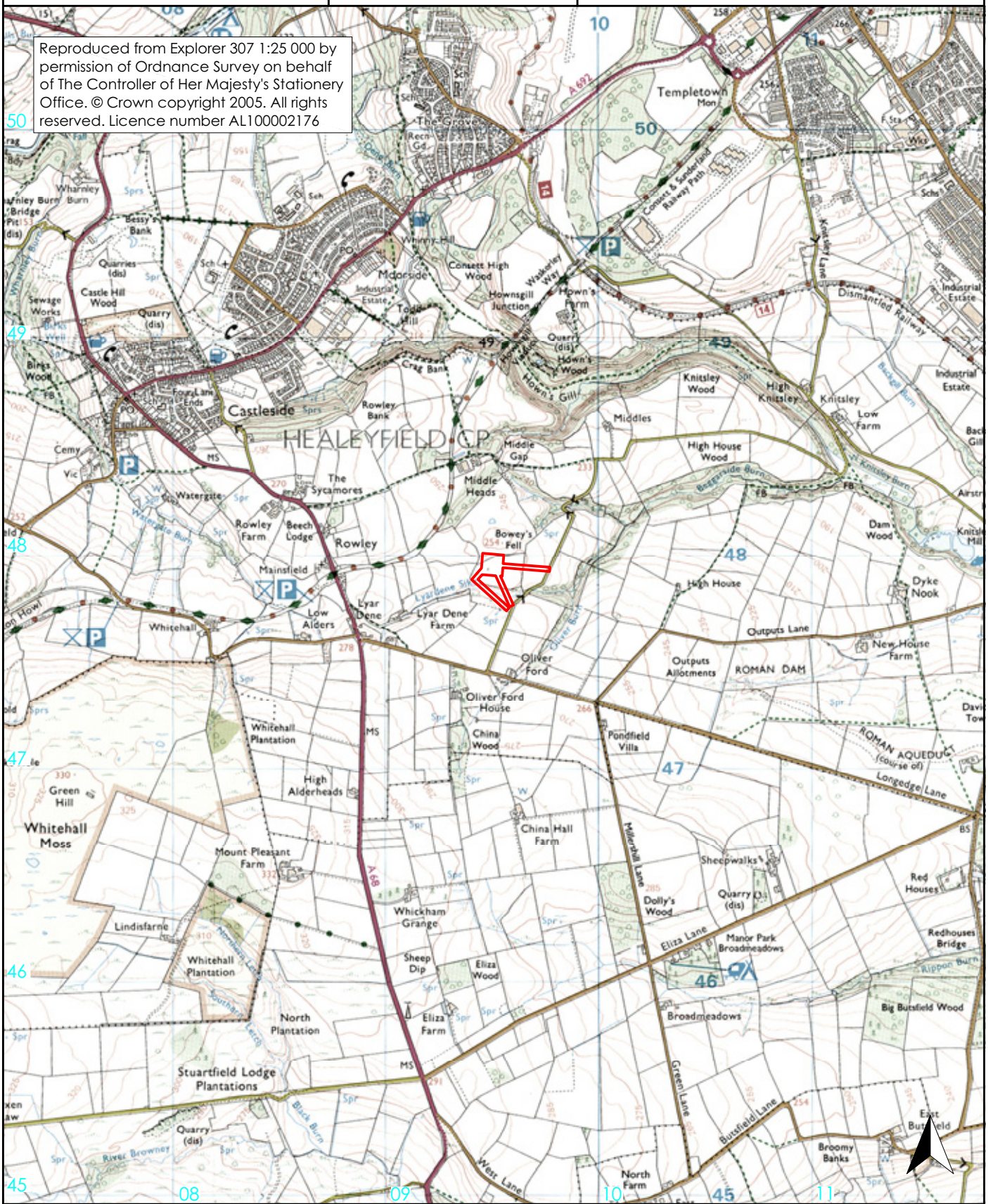
Figure 1: Site location



survey location

0 1km
scale 1:25 000 for A4 plot

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magnetic survey

no survey possible

-5 nT 5

0 75m
scale 1:1500 for A3 plot

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Figure 2: Geophysical survey overview

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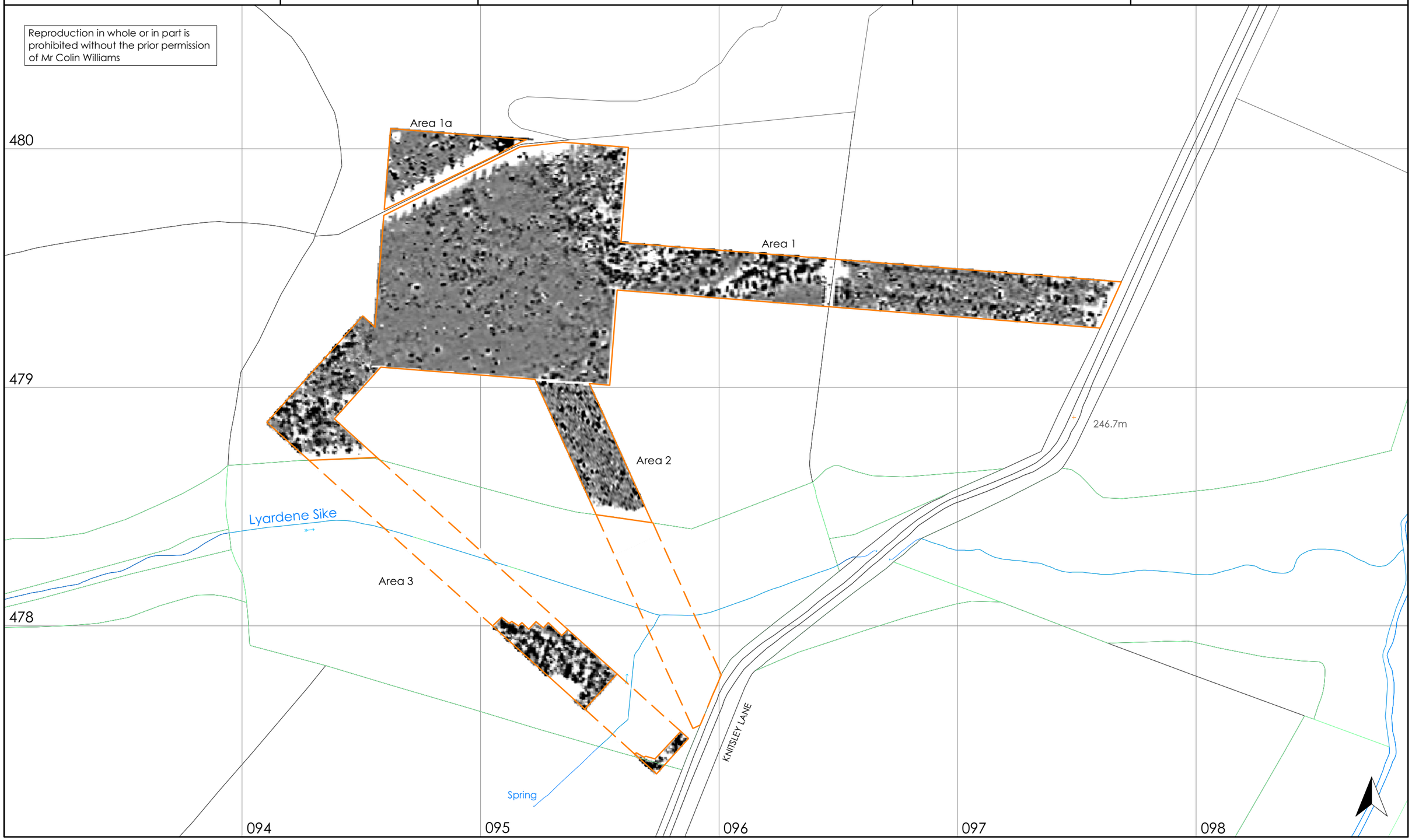

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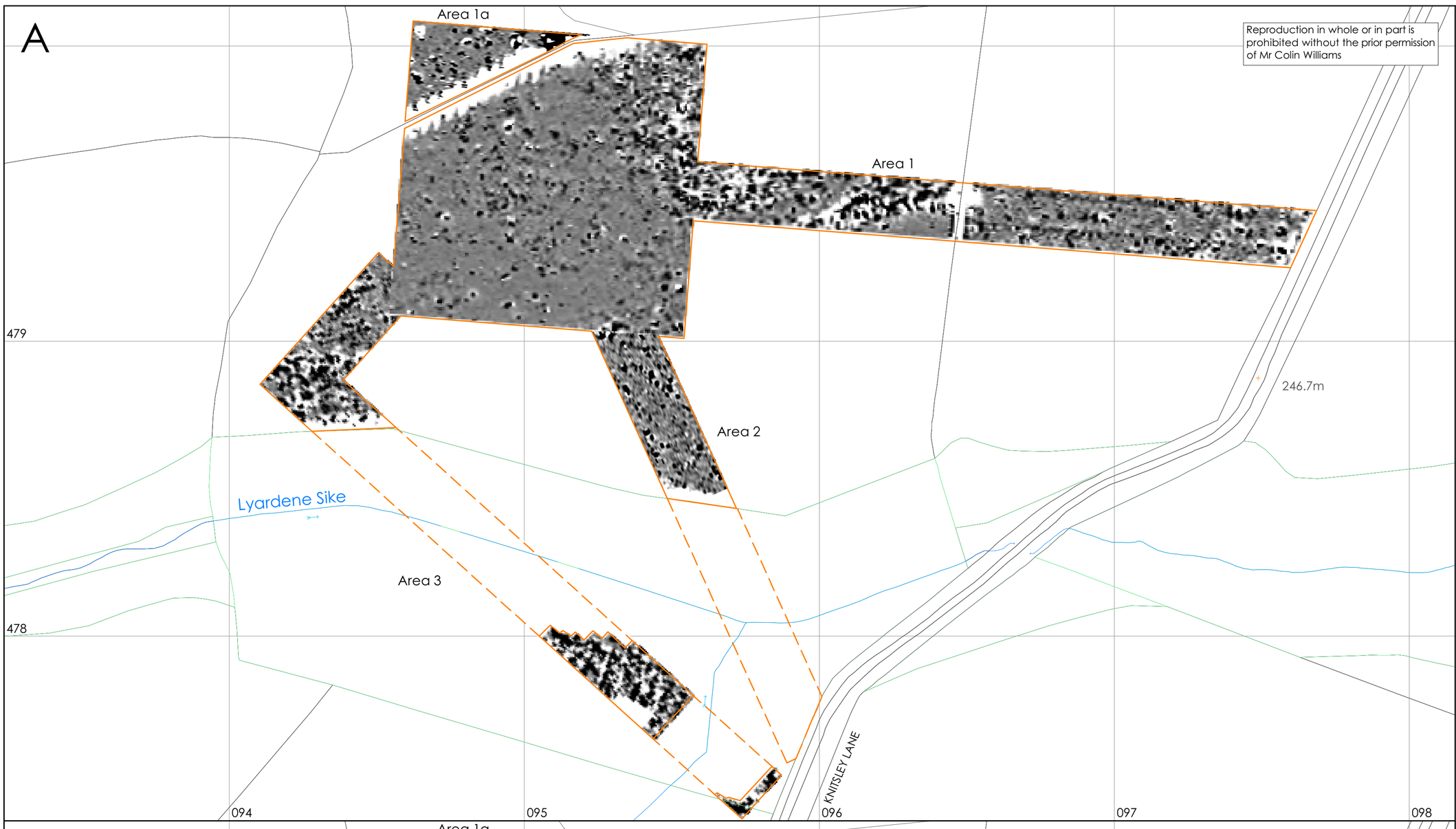
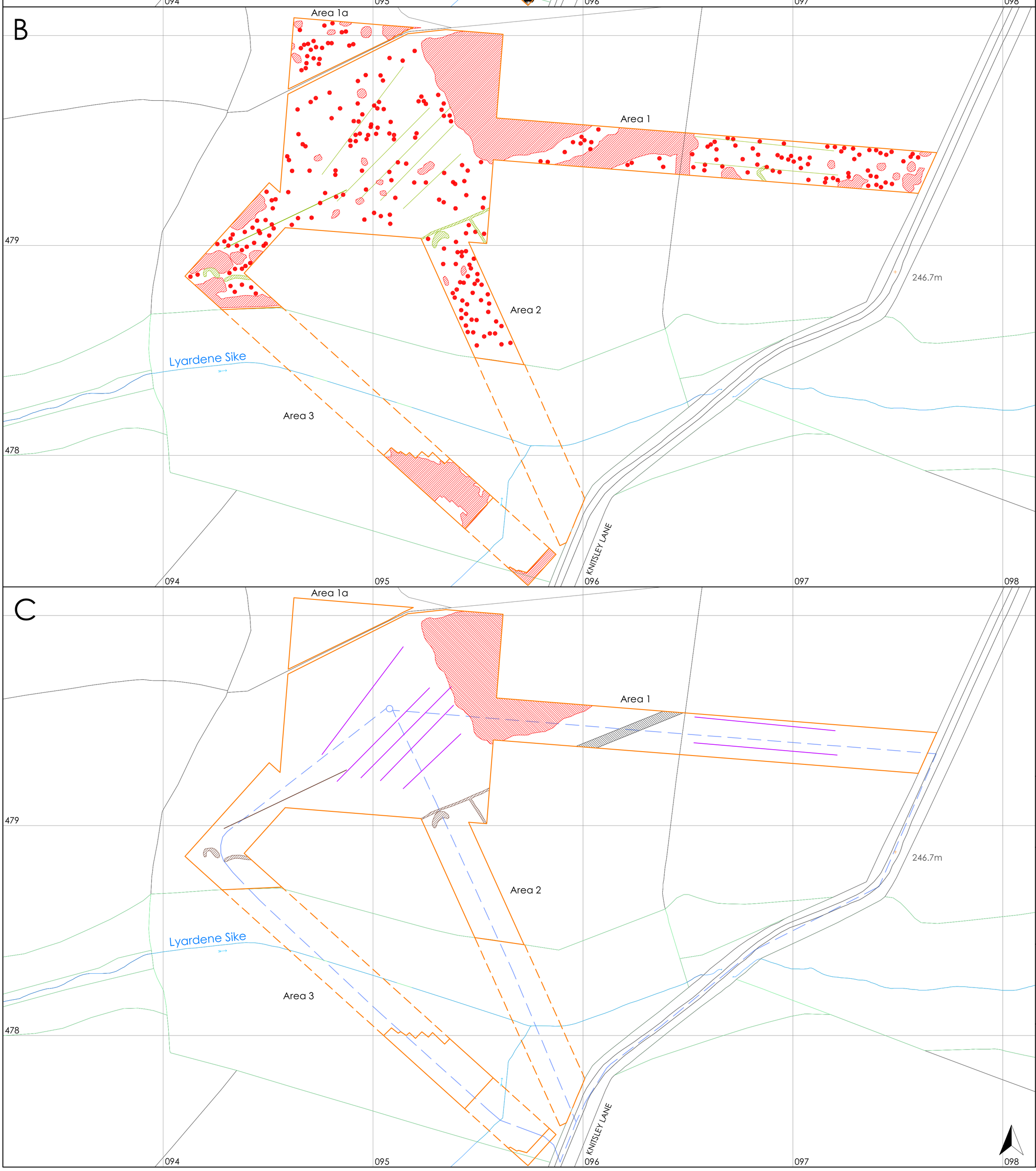
A



B



C

A - geophysical survey

magnetic survey

-5 nT 5

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

C - archaeological interpretation

soil-filled feature

disturbed area

possible former track

land drain

proposed development

0 50m

scale 1:1000 for A1 plot

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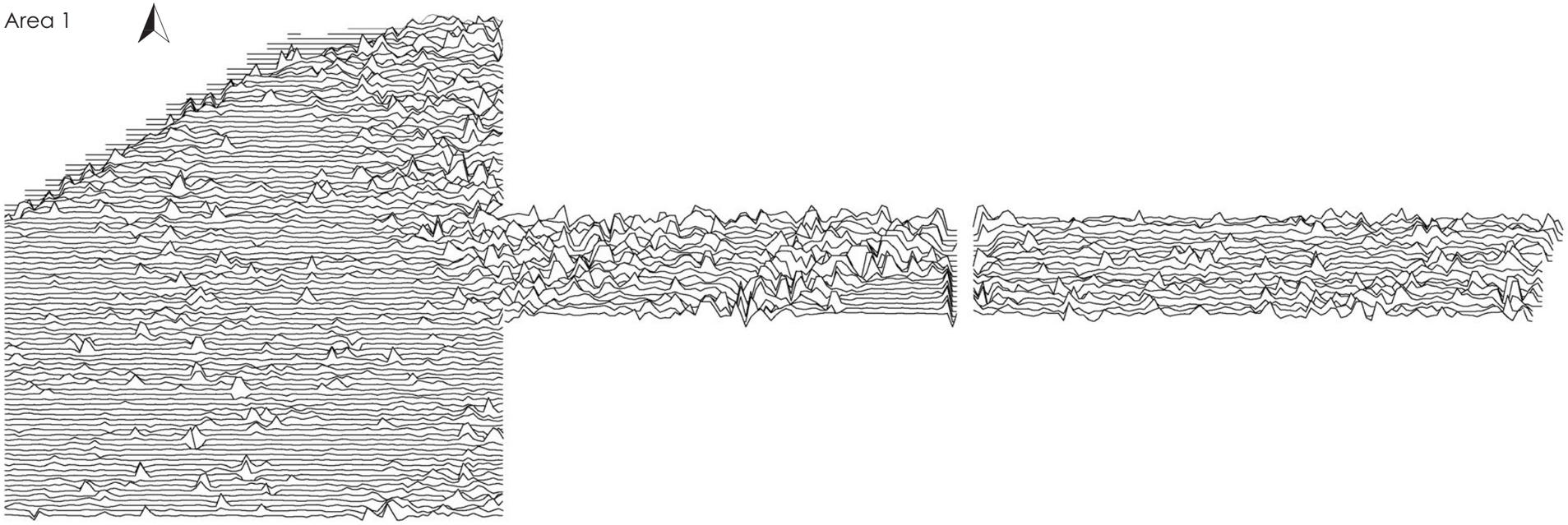
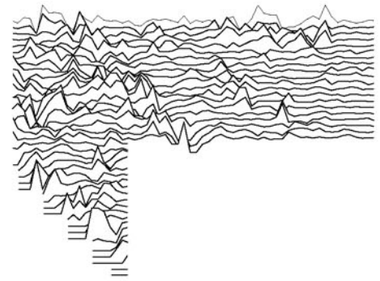
Figure 3: Geophysical survey and interpretation

Area 1

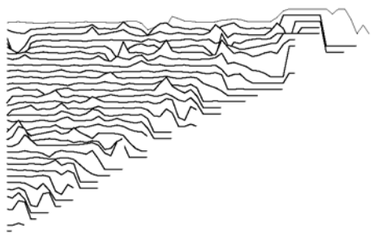


Area 3



Area 2

Area 1a



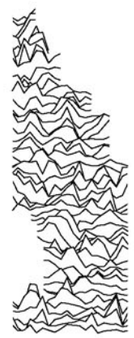


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Figure 4: Trace plots of geomagnetic data

0 50m
scale 1:1000

40.00nT

Figure 5: Man-made ponds along the Lyardene Sike

Figure 6: View along the south part of Area 3 showing steep banks and gorse