RESEARCH REPORT SERIES no. 58-2013

LAKES AND DALES NAIS, HOWERIGG SETTLEMENT, BARBON, CUMBRIA
REPORT ON GEOPHYSICAL SURVEY, AUGUST 2013

Neil Linford, Paul Linford and Andrew Payne

REMOTE SENSING

ENGLISH HERITAGE

This report has been prepared for use on the internet and the images within it have been down-sampled to optimise downloading and printing speeds.

Please note that as a result of this down-sampling the images are not of the highest quality and some of the fine detail may be lost. Any person wishing to obtain a high resolution copy of this report should refer to the ordering information on the following page.

Research Report Series 58-2013

LAKES AND DALES NAIS, HOWERIGG SETTLEMENT, BARBON, CUMBRIA

REPORT ON GEOPHYSICAL SURVEY, AUGUST 2013

Neil Linford, Paul Linford and Andrew Payne

NGR: SD 625 819

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)

The Research Report Series incorporates reports by the expert teams within the Investigation & Analysis Division of the Heritage Protection Department of English Heritage, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

Many of the Research Reports are of an interim nature and serve to make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers must consult the author before citing these reports in any publication. Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of English Heritage.

Requests for further hard copies, after the initial print run, can be made by emailing:
Res.reports@english-heritage.org.uk
or by writing to:

English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD
Please note that a charge will be made to cover printing and postage.

SUMMARY

Caesium magnetometer survey was conducted over a designated earthwork enclosure at Howerigg, near Barbon, Cumbria as part of the National Archaeological Identification Surveys: Upland Pilot (RASMIS 6304). The aim of the geophysical survey was to enhance the previous aerial photographic and earthwork evidence both over the designated site and its wider environs, including the presumed course of a Roman road indicated as running through the enclosure by the Ordnance Survey mapping. A vehicle-towed, caesium magnetometer array was used to cover an area of 4ha over the enclosure and adjacent fields to the south. The survey improved the definition of the northern perimeter ditch of the enclosure, where it was indistinct in the aerial survey and earthwork evidence, and provided additional indications of internal occupation activity including a potential fired structure, such as a hearth or furnace. A tentative linear anomaly, possibly associated with the line of the Roman road, correlates with the lidar data and would suggest an alignment that skirts the settlement to the west.

CONTRIBUTORS

The field work was conducted by Neil Linford, Paul Linford and Andy Payne from the English Heritage, Remote Sensing, Geophysics Team.

ACKNOWLEDGEMENTS

We are most grateful to the landowner at Howerigg Farm, Mr Hodgson, for allowing us access to the site despite reservations about the softness of the ground following a period of heavy rainfall in the 24 hours prior to the fieldwork.

ARCHIVE LOCATION

Fort Cumberland.

DATE OF FIELDWORK AND REPORT

The fieldwork was conducted on 6th August 2013. The report was completed on 28th March 2014. The cover shows the northern side of the enclosure with adjacent traces of ridge and furrow cultivation marks visible in the foreground.

CONTACT DETAILS

Andy Payne, Geophysics Team, English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth, PO4 9LD.; tel. 02392 856750; email andy.payne@english-heritage.org.uk

CONTENTS

INTRODUCTION

A caesium magnetometer survey was conducted over the earthwork remains of an enclosed settlement at Howerigg near Barbon, Cumbria (NGR SD 625819, Heritage List for England 1007218, NHRE Monument HOB UID 44105, Figure 1) during the Upland pilot of the National Archaeological Identification Survey (NAIS) programme (NAIS Upland, Lakes and Dales; NHPP Project Number 3A4.312, RaSMIS 6304). The NAIS Upland pilot project covers the Arnside & Silverdale AONB together with parts of the proposed extensions to the Yorkshire Dales and Lake District National Parks, and aims to improve both the understanding of known sites and also include areas where the current archaeological record is sparse (Oakey 2013). The results of the project will directly feed into the management of these protected landscapes.

Geophysical survey was included in the project to complement the initial aerial investigation on selected sites in the Lune Valley, where ground-based methods could potentially enhance the assessment of the archaeological evidence to support improved protection (Linford *et al.* 2013a; 2013b; Linford *et al.* 2013c). Howerigg was chosen as one of a number of designated but hitherto poorly characterised enclosed sites surviving as earthworks in the project area (cf Borwens, Gawklands, Kitridding Hill among others) and has been suggested as a probable early medieval settlement (Lowndes 1963) based on its location over the projected course of Roman road 7c. However, morphologically a broader date range from pre-Roman to early post-Roman could also be considered and would be compatible with quern stone fragment finds possibly found on the site in 1911 (NHRE HOB UID 44121). In addition, lidar data indicates a possible course of the Roman road to the west of the settlement (UIDs 966101 and 1574944, Figure 6), revealed as a section of slight raised linear bank, perhaps an "agger", and it was hoped that the geophysical survey might clarify the relationship between the enclosure and the putative course of the road.

The site occupies the edge of a steep north facing scarp situated on Carboniferous and Devonian Sedbergh Conglomerate Formation solid geology overlain by deep well drained coarse loamy and sandy soils of the 541r Wick 1association (Soil Survey of England and Wales 1983; British Geological Survey (NERC) 2013). No superficial geology is mapped in the area, but the soil mapping indicates soils developed over glacio-fluvial or river terrace drift. The site lies within an area of pasture fields and weather conditions during the fieldwork were warm, dry and sunny preceded by a period of prolonged and heavy rain that resulted in surface water pooling in places.

Figure 1 The Howerigg settlement photographed from the air with shadows cast to the north in low sunlight to give emphasis to the earthworks (28365/004 11-DEC-2012 © English Heritage).

METHOD

Magnetic Survey

The magnetometer data was collected along the instrument swaths shown on Figure 2 using an array of six high sensitivity Geometrics G862 caesium vapour magnetometer sensors mounted on a non-magnetic sledge. This sledge was towed behind a low impact, all-terrain vehicle (ATV) which also provided the power supply and housed the data logging electronics. Five of the sensors were mounted in a linear array transverse to the direction of travel 0.5m apart and, vertically, ~0.2m above the ground surface. The sixth was fixed 1.0m directly above the central magnetometer in the array to act as a gradient sensor. The sensors were set to sample at a rate of 16 Hz based on the typical average travel speed of the ATV (3.2m/s) giving a sampling density of ~0.2m by 0.5m along successive swaths. Each swath was separated from the last by approximately 2.5m, navigation and positional control being achieved using a Trimble 4700 series Global Positioning System (GPS) receiver mounted on the sensor platform 1.75m in front of the central sensor. Sensor output and survey location was monitored during acquisition to ensure data quality and minimise the risk of gaps in the coverage due to the use of a grid-less system.

After data collection the corresponding readings from the gradient sensor were subtracted from the measurements made by the other five magnetometers to remove any transient magnetic field effects caused by the towing ATV. The median value of each instrument traverse was then adjusted to zero by subtracting a running median value calculated over a 60m 1D window. This operation corrects for slight biases added to the measurements owing to the diurnal variation of the Earth's magnetic field and any slight directional sensitivity of the sensors. A linear greyscale image of the combined magnetic data is shown superimposed over the base Ordnance Survey (OS) mapping on Figure 3 and minimally processed versions of the range truncated data ($\pm$75 nT/m) are presented as a traceplot and a linear greyscale image in Figure 4.

RESULTS

Magnetic survey

A graphical summary of the significant magnetic anomalies, [**m1-19**], discussed in the following text, superimposed on the base OS map data, is provided in Figure 5.

General response

The magnitude of response at the site is relatively weak, although anomalies have been recorded due to topographic variation over the site including the extant ridge and furrow identified by the aerial survey at [**m1**] and [**m2**], and the dry valley at [**m3**] that also coincides with a former field boundary depicted on the historical mapping (OS Historic County Mapping Series: Cumbria, Epoch 1, 1859). A broad negative linear anomaly [**m4**] coincides with a sharp scarp (Figure 6) crossing the north of the enclosure and may represent an unrecorded former field boundary. Finally, a service pipe or field drain is found at [**m5**] together with a number of other areas of strong magnetic disturbance related to ferrous material associated with modern field boundary walls.

The earthwork enclosure

The oval boundary ditch of the enclosure is defined by a series of positive magnetic anomalies [**m6-9**] partially interrupted by surface obstacles and modern ferrous interference. A break in the ditch at [**m10**] coincides with an extant E-W ditch indicated by [**a1**] on the aerial interpretation (Figure 6) running down the slope, although due to the magnetic disturbance here it is not possible to determine whether this represents an entrance to the enclosure or a later drain or erosion feature. The combined survey evidence provides a more complete description of the enclosure, particularly to the north where the magnetic response [**m6**] to the ditch circuit is clear even where the corresponding earthworks are partially obscured by the natural topography and remnant ridge and furrow [**m1**].

Areas of noisier response [m11] mainly concentrated in the south of the enclosure (but with one more strongly defined curvilinear anomaly [m12] to the north) may be associated with occupation activity, for example magnetic stone rubble or burnt material. These only partially correspond with the recorded earthwork banks and platforms (Figure 6) but the stronger area of noisier response at [m12] appears to correspond more closely with the aerial photography and the OS mapping of the earthworks. An intense magnetic anomaly [m13] may represent a thermoremanent causative feature such as a furnace, oven or kiln, although the magnitude of the response (270nT/m) and traceplot representation suggest that a more recent ferrous origin cannot be completely discounted (Figure 4(A)).

The wider environs of the enclosure

The fields to the south of the enclosure are generally magnetically quieter, although a response to the ridge and furrow [m2] replicates the evidence from aerial photography (Figures 1 and 6). An interrupted alignment of linear ditch-type anomalies [m14] coincides with the eastern edge of the scarp identified in the lidar data (Figure 6) and are possibly associated with weaker, parallel responses [m15] to the west. Further to the south, a closely clustered group of 3 quite pronounced (7nT/m peak magnitude) discrete anomalies [m16] are more suggestive of pits or quarrying activity, perhaps containing burnt material. A further localised group of weaker pit-type anomalies occur at [m17].

Whilst anomalies [m14-17] follow a similar orientation to the ridge and furrow, [m14 and 15] correlate with a section of slight raised linear bank or "agger" revealed by the lidar data (LIDAR SD6281 DSM 12-20-MAY-2009, Figure 6), suggested as a possible route of the Roman road (NHRE HOB UID 44105, authority 5), where the historic cultivation pattern is less pronounced. However, [m14 and 15] are not sufficiently well defined, nor continuous enough through the survey area to offer a more expansive interpretation here.

A series of narrow and weakly defined negative linear anomalies forming an "L" shaped arrangement in the southern part of the survey area [m18] with an extension to the north [m19] may relate to cultivation, trackway erosion or drainage features all of which are likely to be of relatively modern origin.

CONCLUSION

The magnetic survey has successfully enhanced both the aerial photographic and earthwork evidence, providing improved definition of the enclosure ditch to the north and areas of noisier response suggestive of internal occupation activity. These areas of noise, in part, correlate with extant rectilinear divisions in the southern half of the enclosure, but it is difficult to discern a more precise interpretation from the geophysical data, although either more magnetic stone rubble or waste from a high-temperature process are possible. The magnetic data also corroborates the slight linear earthwork

revealed by lidar to the west of the enclosure, but can not substantiate this as the course of the Roman road or suggest any definitive continuation of the anomaly within the survey area, perhaps due to erosion through ploughing. Further geophysical survey, for example using earth resistance in the immediate vicinity of the enclosure might help resolve this, as would investigation both approximately 1km south of Howerigg where the course of the Roman road seems better defined, and to the north as it approaches the assumed river crossing at Hodge Bridge. However, there is also no magnetic anomaly associated with the course of the Roman road passing through the enclosure following the orientation suggested by the OS mapping.

LIST OF ENCLOSED FIGURES

REFERENCES

British Geological Survey (NERC) (2013). OpenGeoscience, Geology of Britain, map viewer. Geological Survey of England and Wales 1892 One Inch Geology Map Series - Sheet 49 Kirkby Lonsdale. [web page]; http://www.bgs.ac.uk/data/mapViewers/home.html. [Accessed 22/11/2013].

Linford, N, Linford, P and Payne, A 2013a Lakes and Dales NAIS, Millbeck Farm, Middleton, Cumbria. Report on Geophysical Survey, July 2013. *Research Reports Series*, **55/2013**. English Heritage.

Linford, N, Linford, P and Payne, A 2013b Lakes and Dales NAIS, Gowrey Farm, High Casterton, Cumbria. Report on Geophysical Survey, August 2013. *Research Reports Series*, **57/2013**. English Heritage.

Linford, N, Linford, P, Payne, A and Hardwick, I 2013c Lakes and Dales NAIS, Kitridding Hill, Lupton, Cumbria. Report on Geophysical Survey, July 2013. *Research Reports Series*, **56/2013**. English Heritage.

Lowndes, R A C 1963 ''Celtic' fields, farmsteads and burial mounds in the Lune Valley'. *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, **63**, 81-83.

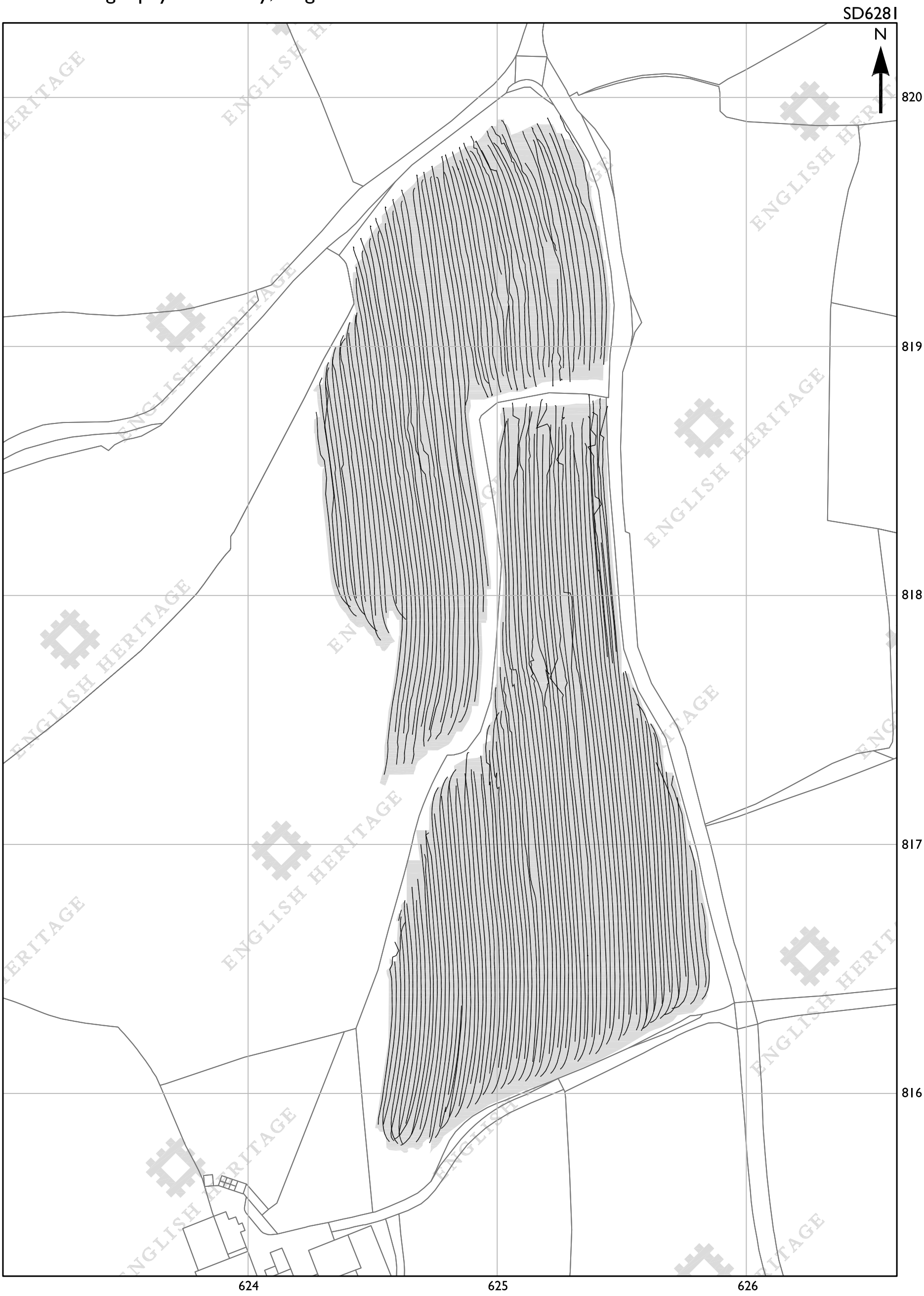
Oakey, M 2013 *National Archaeological Identification Survey: Upland Pilot, NHPP Project Number 3A4.312, Project Design Main Stage*. English Heritage, Heritage Protection & Planning Group, Heritage Protection Department. Unpublished project design.

Soil Survey of England and Wales 1983 Soils of England and Wales: Sheet 1 - Northern England, 1:250,000 soil map. Lawes Agricultural Trust, Harpenden.

Figure 2

LAKES AND DALES NAIS, HOWERIGG ENCLOSURE, BARBON, CUMBRIA

Location of geophysical survey, August 2013



0 90m

1:1500

magnetometer survey swaths

Geophysics Team 2013

ENGLISH HERITAGE

Figure 3

LAKES AND DALES NAIS, HOWERIGG ENCLOSURE, BARBON, CUMBRIA

Location of geophysical survey, August 2013

0 90m

1:1500

A - B course of Roman road 7c derived from OS mapping

Geophysics Team 2013

ENGLISH HERITAGE

Figure 4

LAKES AND DALES NAIS, HOWERIGG SETTLEMENT, BARBON, CUMBRIA
Caesium magnetometer survey, August 2013

(A) Traceplot of minimally processed caesium data

(B) Linear greyscale image of minimally processed caesium data

0 90m

1:1250

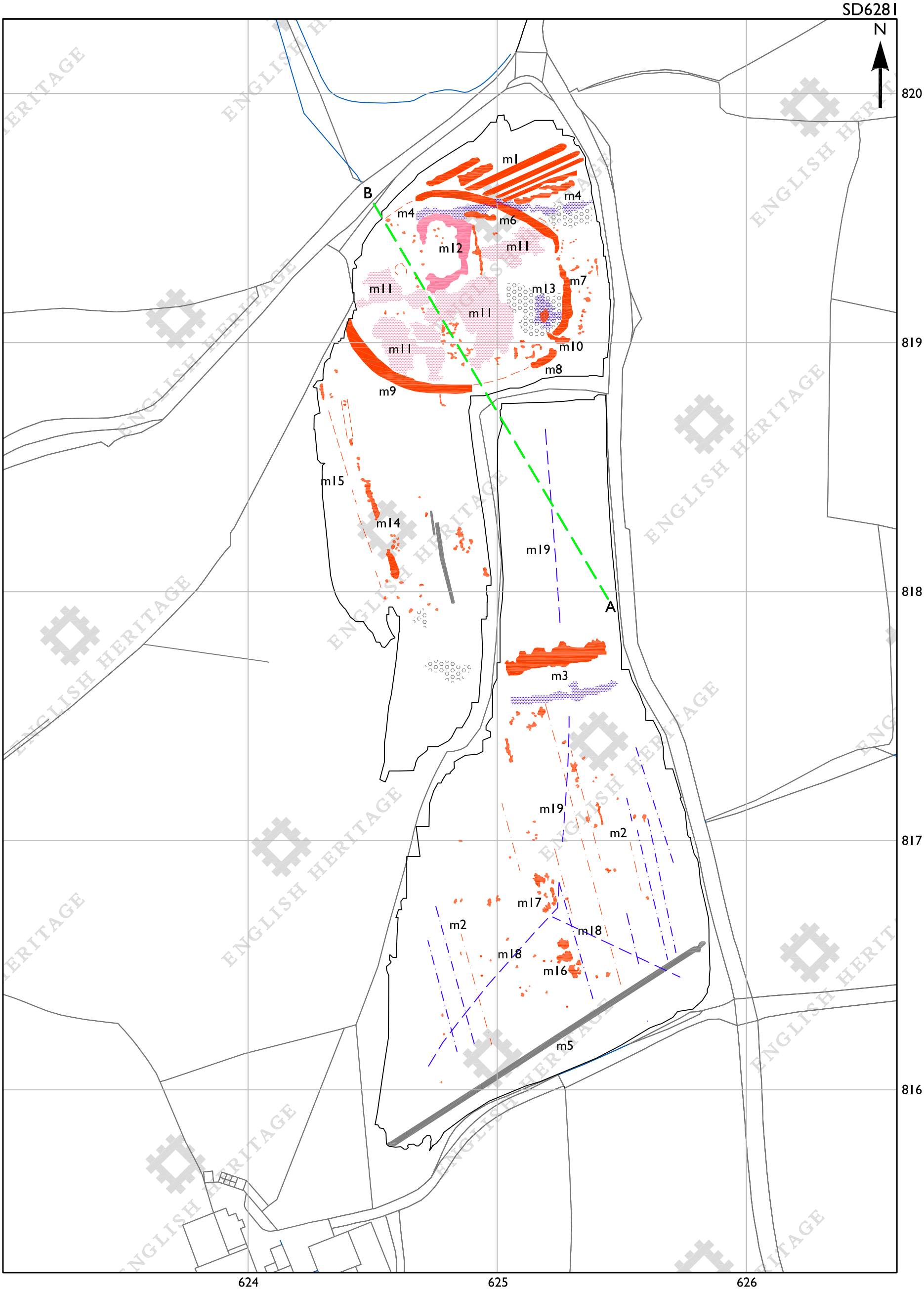
Geophysics Team 2013

ENGLISH HERITAGE

Figure 5

LAKES AND DALES NAIS, HOWERIGG ENCLOSURE, BARBON, CUMBRIA

Graphical summary of significant magnetic anomalies, August 2013



A - B course of Roman road derived from OS mapping

positive magnetic

negative magnetic

raised magnetic

ferrous / agricultural noise

0 90m

1:1500

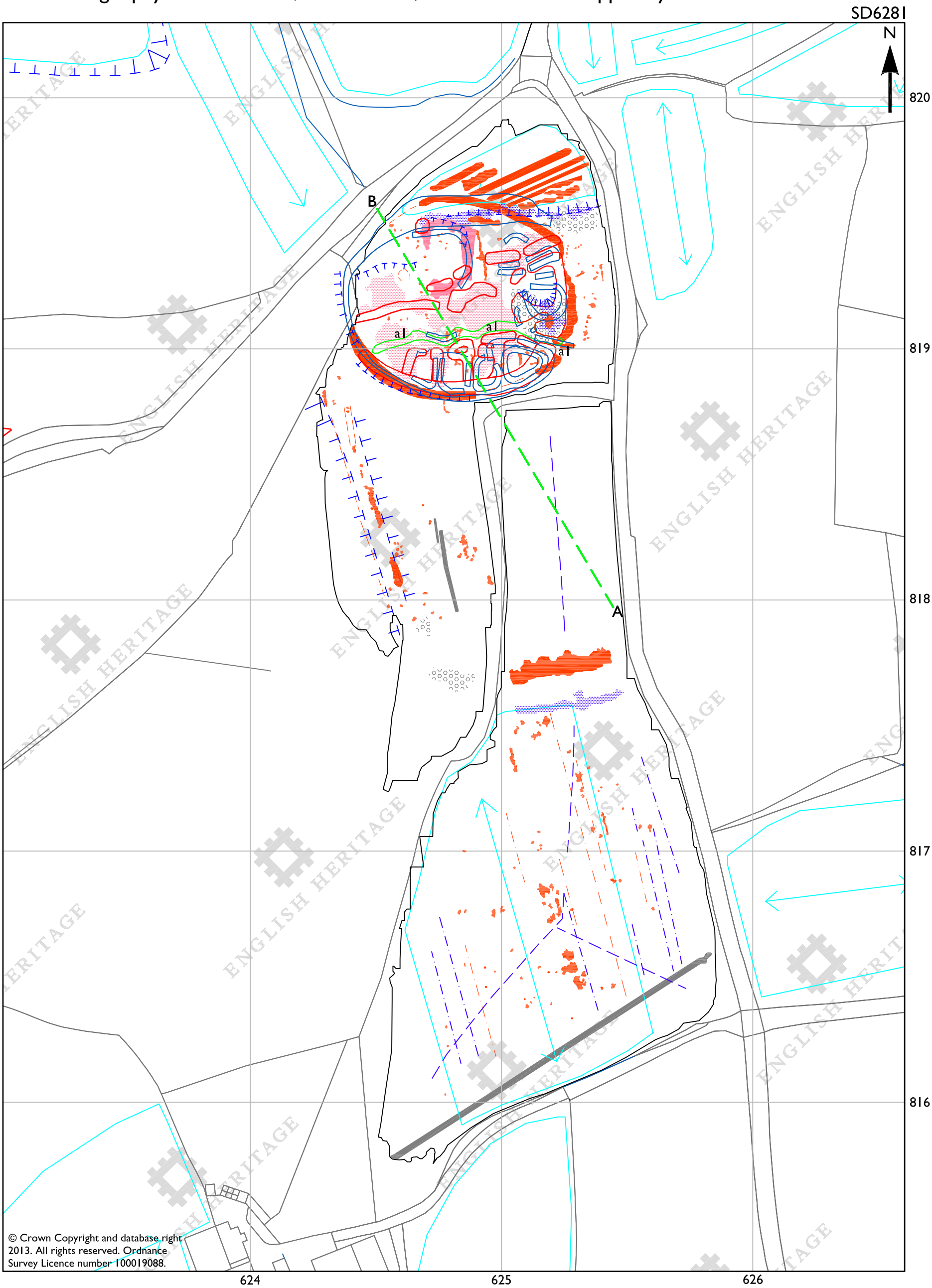
Geophysics Team 2013

ENGLISH HERITAGE

Figure 6

LAKES AND DALES NAIS, HOWERIGG ENCLOSURE, BARBON, CUMBRIA

Combined geophysical anomalies, AP evidence, and earthworks mapped by OS



A - B line of Roman road derived from OS mapping

positive magnetic

negative magnetic

magnetic disturbance

ferrous / agricultural noise

rig and furrow alignment

bank

scarp

ditch

OS earthwork features

0 90m

1:1500

Geophysics Team 2013

ENGLISH HERITAGE

ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

ENGLISH HERITAGE

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)