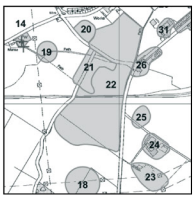
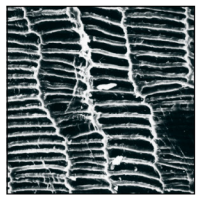
BTHW/01










HOPE VALLEY CAPACITY SCHEME
HATHERSAGE, DERBYSHIRE

GEOPHYSICAL SURVEY

commissioned by Network Rail
on behalf of Mott MacDonald

September 2015

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

HOPE VALLEY CAPACITY SCHEME
HATHERSAGE, DERBYSHIRE

GEOPHYSICAL SURVEY

commissioned by Network Railon behalf of Mott MacDonald

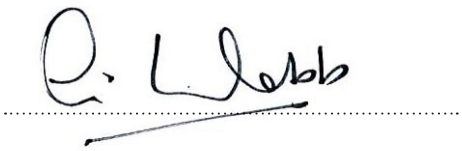
September 2015

project info

HA JOB NO.	BTHW/01
NGR	Area 1: SK 21524 82031
	Area 2: SK 21699 81945
	Area 3: SK 21752 81994
	Area 4: SK 21699 81945
	Area 5: SK 22347 81631
PARISH	Hathersage
LOCAL AUTHORITY	Derbyshire
OASIS REF.	Headland5-225508

project team

PROJECT MANAGER	Sam Harrison
AUTHOR	David Harrison
FIELDWORK	David Harrison
GRAPHICS	Caroline Norrman, Mano Kapazoglou
APPROVED BY	Alistair Webb



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PROJECT SUMMARY

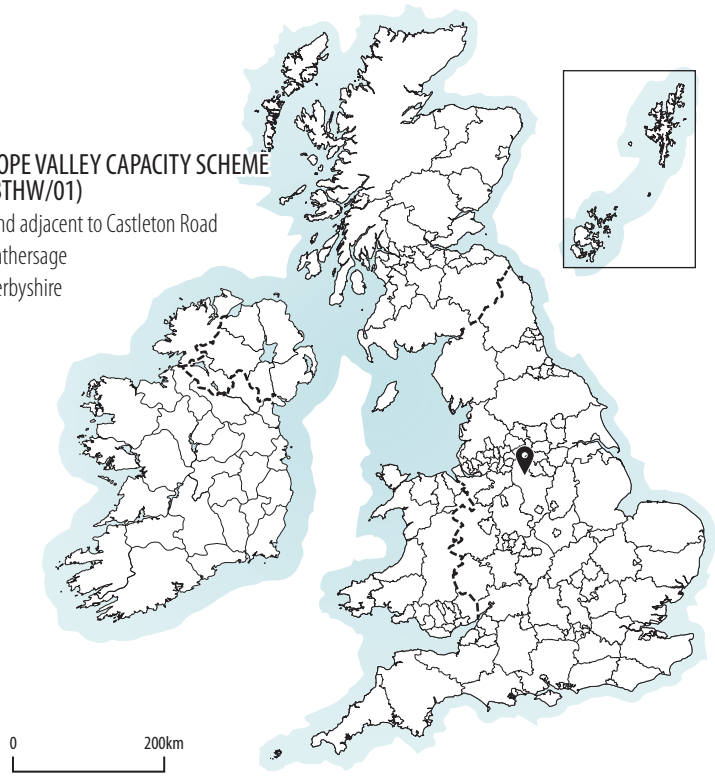
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of five areas covering 1.7 hectares on agricultural land to the west of Hathersage, Derbyshire, to inform an application for a Transport for Works Act Order for the proposed development of a footbridge over the Hope Valley Railway, as part of the construction of a loop line parallel to the existing railway alignment. The survey has not identified any anomalies of obvious archaeological potential although three discontinuous curvilinear anomalies may be of archaeological interest. Evidence for the historical agricultural landscape has been detected in the form of a former farm track and a former field boundary which are depicted on 19th century Ordnance Survey maps. There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the survey boundaries. Therefore, based solely on the results and interpretation of the data, the archaeological potential of the five survey areas is assessed as low.

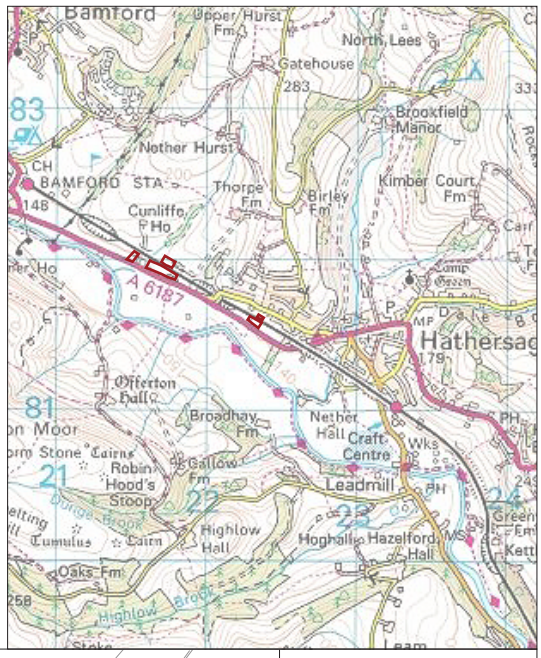
CONTENTS

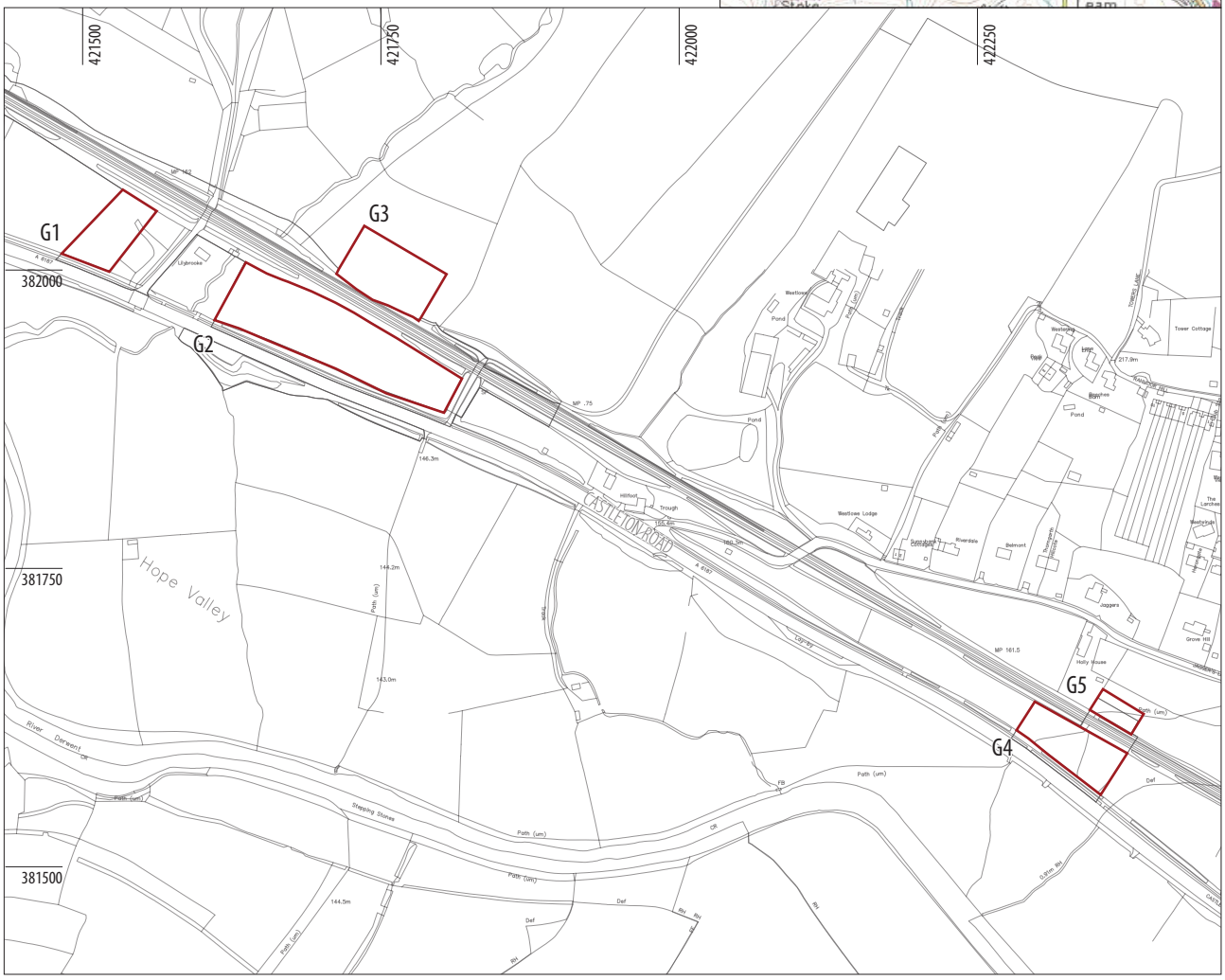
LIST OF ILLUSTRATIONS

HOPE VALLEY CAPACITY SCHEME (BTHW/01)

land adjacent to Castleton Road
Hathersage
Derbyshire







KEY

geophysical survey areas

N

0 250m

scale 1:6,000 @ A4

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ILLUS 1

Site location

HOPE VALLEY CAPACITY SCHEME HATHERSAGE, DERBYSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Network Rail to undertake a geophysical (magnetometer) survey on five parcels of land located either side of the Hope Valley Railway between Bamford and Hathersage Station. The work was undertaken in accordance with a Specification for Geophysical Survey (Mott MacDonald 2015), with guidance within the National Planning Policy Framework (DCLG 2012) and in line with current best practice (David et al. 2008). The survey was carried out on August 14th and September 18th 2015 in order to provide additional information on the archaeological potential of the survey areas.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises five parcels of land (G1 to G5 inclusive) to the immediate west of the village of Hathersage, Derbyshire (see **ILLUS 1**). The five areas are located on both sides of the Hope Valley Railway and are under permanent pasture (see **ILLUS 2** – **ILLUS 6**).

- Geophysical Area 1 (G1) is bounded by the Hope Valley Railway to the north and Castleton Road to the south (centred at NGR SK 21524 82031).
- Geophysical Area 2 (G2) is bounded by the Hope Valley Railway to the north and Castleton Road to the south (centred at NGR SK 21699 81945).
- Geophysical Area 3 (G3) is bounded by the Hope Valley Railway to the south and is unbound to the north (centred at NGR SK 21752 81994).
- Geophysical Area 4 (G4) is bounded by the Hope Valley Railway to the north and Castleton Road to the south (centred at NGR SK 21699 81945).
- Geophysical Area 5 (G5) is bounded by Holly House to the north and the Hope Valley Railway to the south (centred at SK 22347 81631).

The survey areas are located on the floor of the Hope Valley with the survey areas being on a gradient of between 170m above Ordnance Datum (aOD) in the north of G5 and 150m aOD in the south of G1.

1.2 GEOLOGY AND SOILS

The underlying bedrock comprises of Mam Tor Beds (siltstone and sandstone). No superficial deposits are recorded within the PDA although undifferentiated River Terrace Deposits (sand and gravel) are recorded a short distance to the south (British Geological Survey 2015). The soils are classified in the Soilscape 17 association, characterised as slowly permeable, seasonally wet loams and clays with impeded drainage (Landis 2015).

2 ARCHAEOLOGICAL BACKGROUND

A Specification for Geophysical Survey (Mott MacDonald 2015) surmised that there is a moderate potential to encounter archaeological remains, most likely of medieval or post medieval origin, and associated with the use of the land parcels for agricultural purposes.

3 AIMS, METHODOLOGY AND PRESENTATION

The aim of the geophysical survey is to determine the presence or absence of archaeological remains, and characterise (the nature, complexity and extent) any deposits which are discovered. The results of the evaluation will determine the need, or otherwise, for any further archaeological investigation at the five sites.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. Features such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the Earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney and Gater, 2003). Further information

ILLUS 2

General view of Area G1, looking S

ILLUS 3

General view of Area G2, looking SE

ILLUS 4

General view of Area G3, looking NW

on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

Bartington Grad601 magnetic gradiometers were used during the survey, taking readings at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m grids, so that 3,600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data.

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble GeoXR model).

3.2 REPORTING

A general site location plan is shown in **ILLUS 1** at a scale of 1:6,000. **ILLUS 2** to **ILLUS 6** inclusive are photographs depicting ground conditions at the time of the survey. **ILLUS 7** and **ILLUS 8** are large scale (1:3,000) survey location plans displaying the processed greyscale magnetometer data and overall interpretation plans of the data respectively. Detailed data plots ('raw' and processed) and interpretative illustrations are presented at a scale of 1:1,000 in **ILLUS 9** to **ILLUS 14** inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 4.

The survey methodology, report and any recommendations comply with the Risk Assessment Method Statement (Headland Archaeology (UK) Ltd 2015) presented to and approved by the client, with guidelines outlined by English Heritage (David et al. 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations reproduced from

ILLUS 5
General view of Area G4, looking SE

ILLUS 6
General view of Area G5, looking W

Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Two diverse magnetic backgrounds have been recorded by the geophysical survey. The background data within Area G1, Area G4 and Area G5 shows minimal background variation, resulting in a uniform greyscale tone to the data. Conversely, the magnetic background within Area G2 and Area G3 is much more variable, resulting in a 'speckled' appearance throughout. The reason for this difference is thought to be likely to be caused by differing former land use, and is discussed further below. Numerous anomalies have been identified by the survey within this varied background. The anomalies are discussed below and cross-referenced to specific examples depicted on the interpretative figures, where appropriate.

4.1 FERROUS/MODERN ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on most sites, often being present as a consequence of manuring or tipping/infilling.

Elsewhere, magnetic disturbance at the perimeters of the survey areas is caused by ferrous material within, or close to, the adjacent field boundaries.

4.2 AGRICULTURAL ANOMALIES

Analysis of historical OS mapping indicates that the division and layout of land within the proposed development areas has remained largely unchanged since the publication of the first edition Ordnance Survey map in 1854, although the surrounding landscape was altered considerably by the construction of the adjacent Hope Valley Railway (completed in 1894). A north-east/south-west aligned farm track is shown on OS mapping in the east of Area G2 running towards a building which is depicted immediately east of Area G3. The farm track is no longer recorded by the time of the 1898 OS map. The track manifests in the data as high magnitude parallel linear anomalies, A and B (see **ILLUS 9**, **ILLUS 10** and **ILLUS 11**). Within Area G3 an east-west aligned linear anomaly, C, corresponds to a former field boundary which is shown on the 1899 edition OS map. These anomalies may be of local historical interest but are unlikely to be of any archaeological significance. A lower magnitude linear anomaly, D, is identified within the west of Area G2, on a north-east/south-west orientation and parallel with the existing pattern

of land division. The anomaly corresponds closely to the projected extension of a field boundary shown on current mapping (see **ILLUS 7** and **ILLUS 8**) to the immediate north of the Hope Valley Railway and it is likely, therefore, that it is also due to an unmapped post-medieval boundary ditch.

Evidence of former agriculture is identified within the west of Area G2 in the form of faint parallel linear trends aligned north-west/ south-east. The close distance between the trend anomalies is indicative of post-medieval or modern ploughing.

4.3 GEOLOGICAL ANOMALIES

As mentioned above the variable magnetic background within Area G2 and Area G3 contrasts markedly with that recorded in Area G1, Area G4 and Area G5. It is possible that this variable background is due to the presence of unrecorded superficial deposits – river terrace deposits are recorded to the south of Castleton Road. However, the variable background appears to be bound to the east by the former trackway, A/B, and for this reason it is thought more likely that it is caused by the fracturing and redistribution of the substrata by deep former cultivation.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

No anomalies of obvious archaeological potential have been identified by the geophysical survey. However, two discontinuous curvilinear anomalies, E and F, aligned north-east/south-west within Area G2 and Area G3 respectively, may be due to soil-filled ditches, and have therefore been ascribed a possible archaeological interpretation. A third curvilinear anomaly, G, is identified in the west of Area G5 (see **ILLUS 12**, **ILLUS 13** and **ILLUS 14**) and is also interpreted as possibly of archaeological origin in the absence of any other obvious cause. It is possible that any of these curving anomalies could be due to geological features such as soil-filled fissures, but an archaeological origin cannot be dismissed.

5 CONCLUSION

No anomalies of obvious archaeological potential have been identified by the geophysical survey. Three discontinuous curvilinear anomalies have been ascribed some archaeological potential in the absence of any obvious modern or agricultural origin, but a geological interpretation is viable. Elsewhere, anomalies have been identified which pertain to the 19th century agricultural landscape as depicted on early Ordnance Survey mapping. There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the proposed road corridor. Therefore, based solely on the results and interpretation of the data, the archaeological potential of the site is considered to be low.

6 REFERENCES

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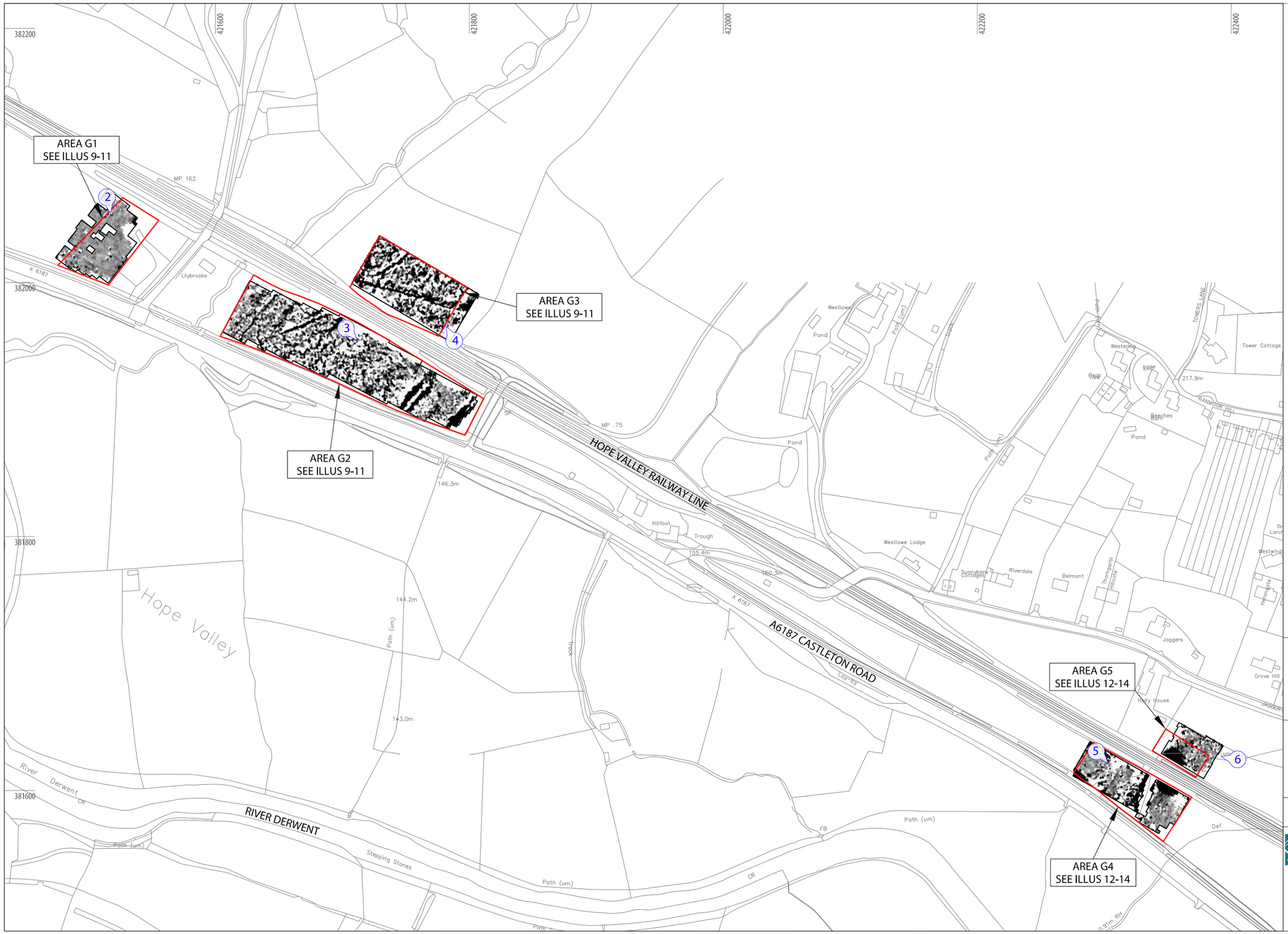

PROJECT Hope Valley Capacity Scheme
Hathersage
Derbyshire
(BTHW/01)

CLIENT Mott MacDonald for National Rail

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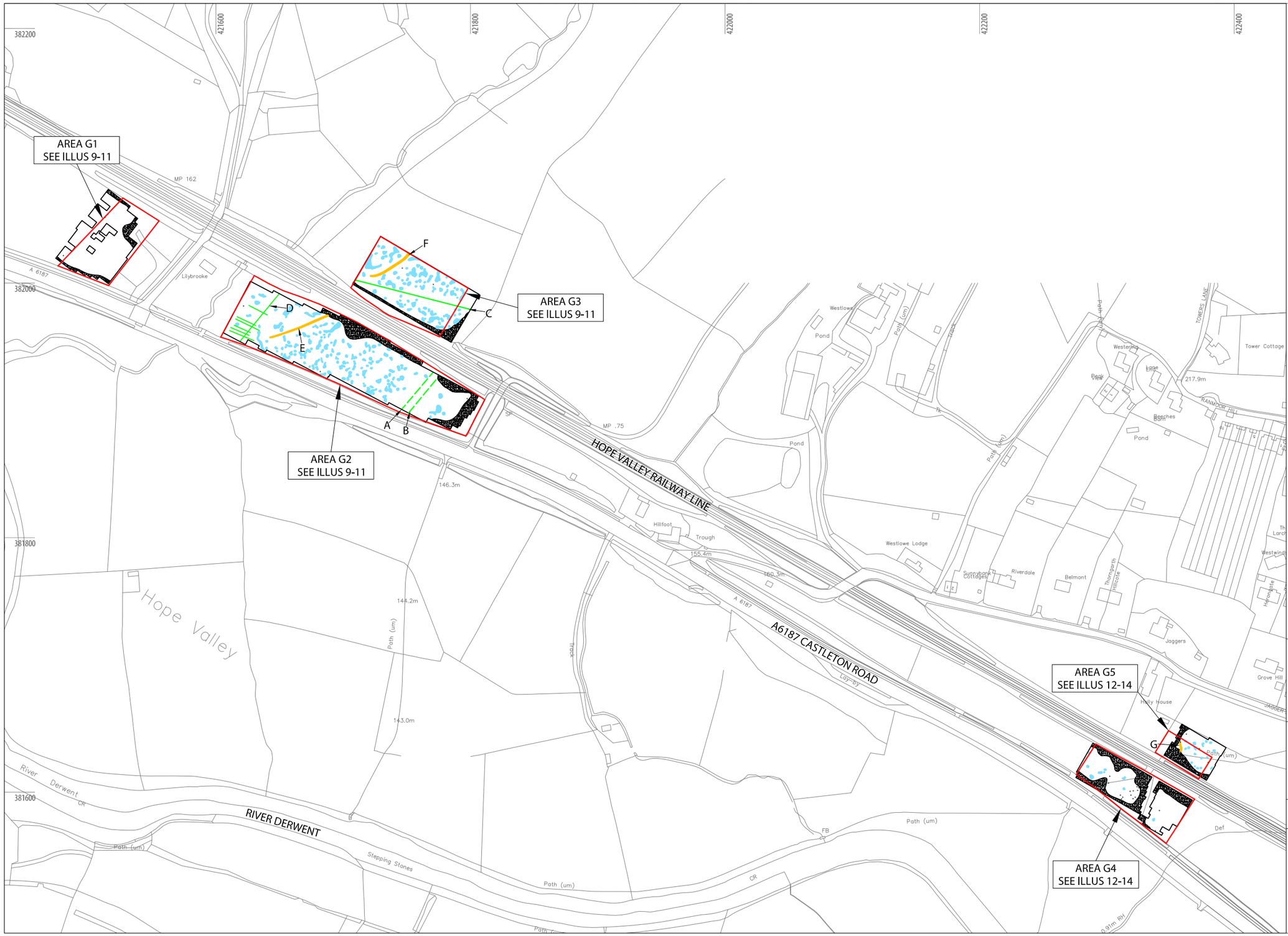
ILLUS 7

Survey location showing processed greyscale magnetometer data



Geophysical Survey Area

TYPE OF ANOMALY	INTERPRETATION
Dipolar Isolated	Ferrous Material
Magnetic Disturbance	Ferrous Material
Linear Trend	Agricultural
Linear	Former field boundary
Linear	Former trackway
Magnetic Enhancement	Geology
Magnetic Enhancement	Archaeology?

N

0 100m

scale 1:3,000 @ A3

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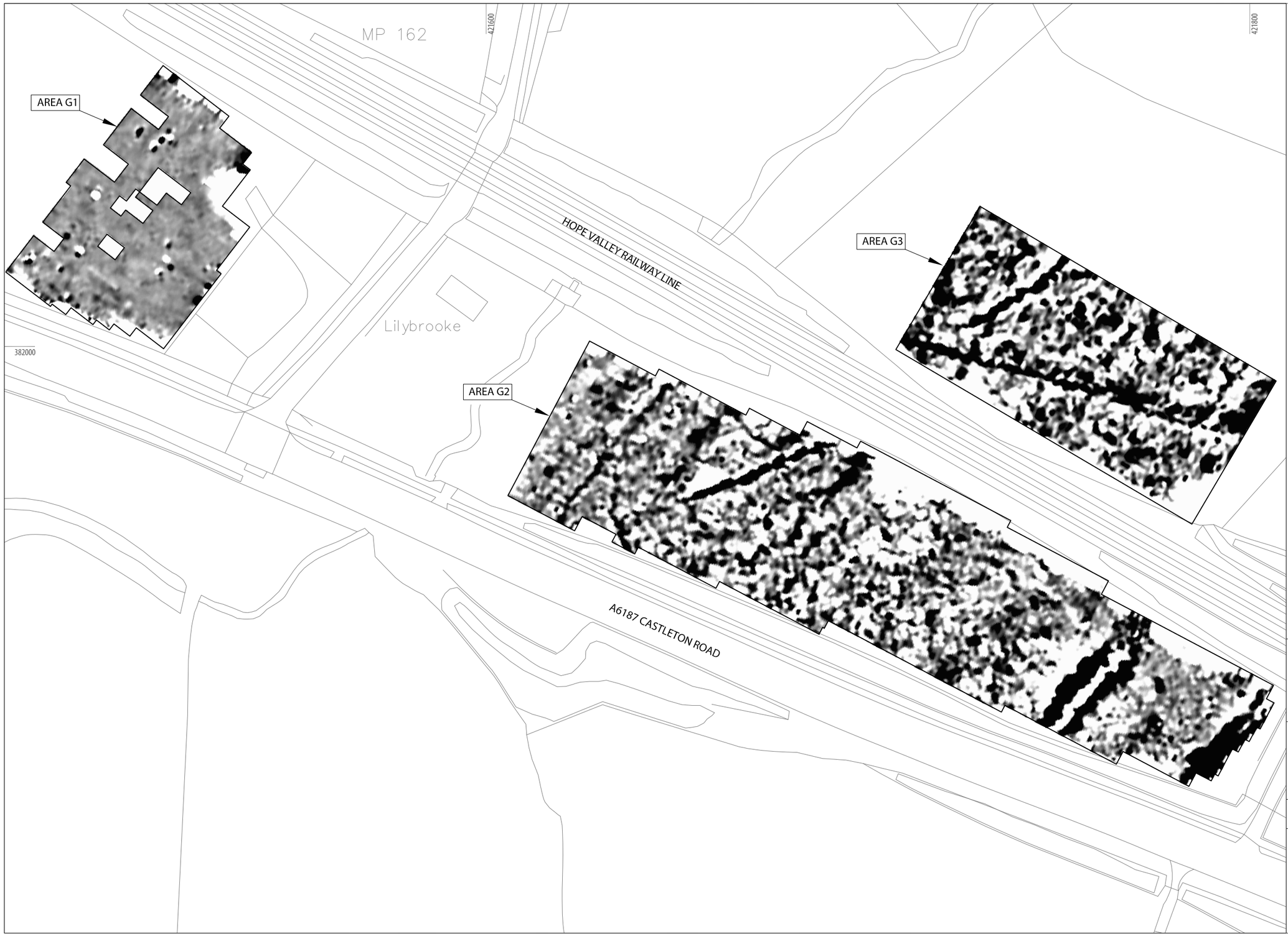
ILLUS 8

Overall interpretation magnetometer data



nT
-1.0
2.0

N

0
25m

scale 1:1,000 @ A3

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ILLUS 9

Processed greyscale magnetometer data; Area G1, Area G2 and Area G3

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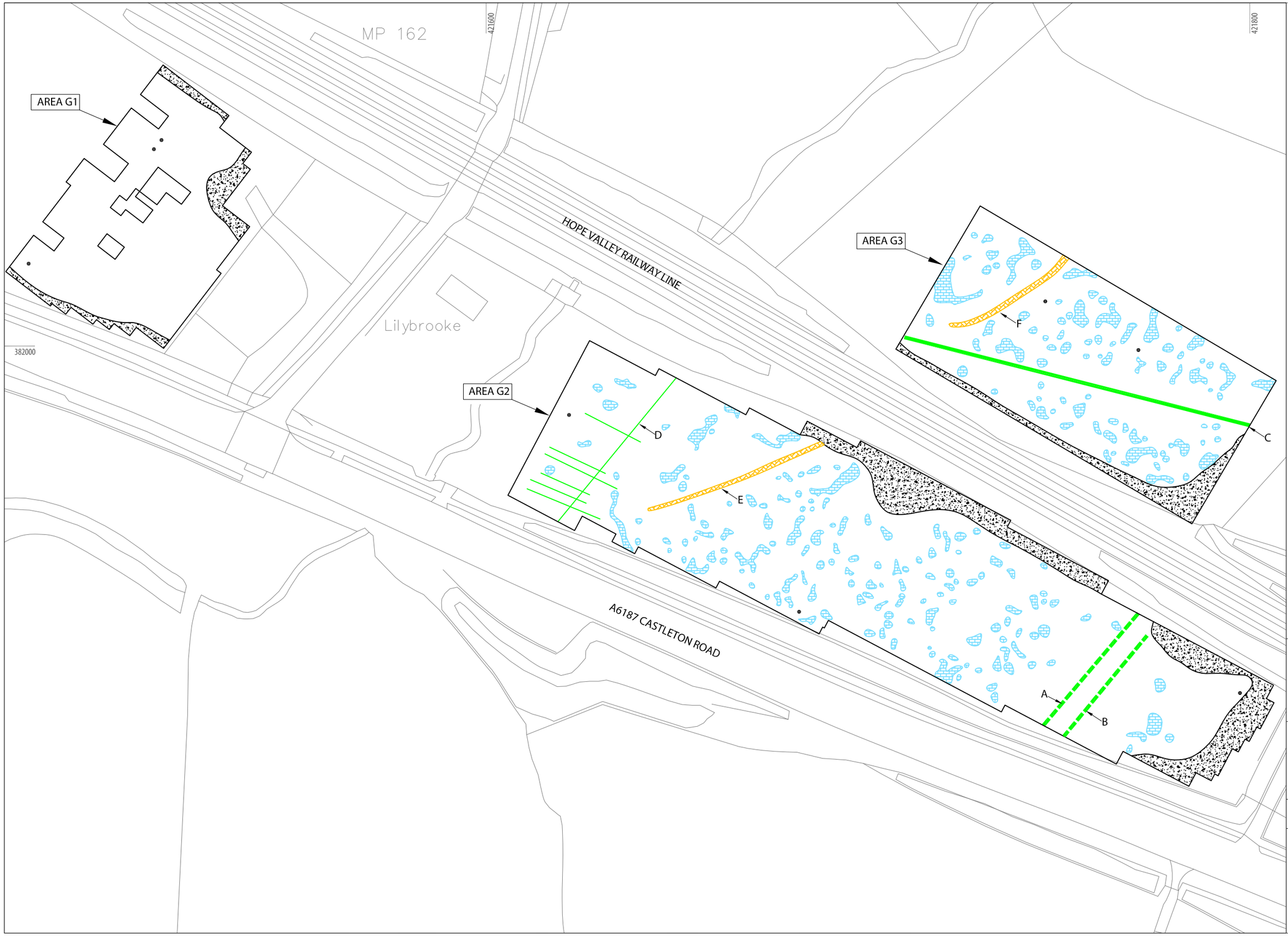
ILLUS 10

XY trace plot of minimally processed magnetometer data; Area G1, Area G2 and Area G3



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ILLUS 11

Interpretation of magnetometer data; Area G1, Area G2 and Area G3

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ILLUS 12

Processed greyscale magnetometer data; Area G4 and Area G5

25.0nT/cm

N

0 25m

scale 1:1,000 @ A3

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ILLUS 13

XY trace plot of minimally processed magnetometer data; Area G4 and Area G5

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(BTHW/01)

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ILLUS 14

Interpretation of magnetometer data; Area G4 and Area G5

7 APPENDICES

APPENDIX 1 MAGNETIC SUSCEPTIBILITY AND SOIL MAGNETISM

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble GeoXR model). The accuracy of this equipment is better than 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology (UK) Ltd cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises:-

- an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-225508

PROJECT DETAILS	
Project name	**HOPE VALLEY CAPACITY SCHEME**
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of five areas covering 1.7 hectares on agricultural land to the west of Hathersage, Derbyshire, to inform an application for a Transport for Works Act Order for the proposed development of a footbridge over the Hope Valley Railway. The survey has not identified any anomalies of obvious archaeological potential although three discontinuous curvilinear anomalies may be of archaeological interest. Evidence for the historical agricultural landscape has been detected in the form of a former farm track and a former field boundary which are depicted on 19th century Ordnance Survey maps. There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the survey boundaries. Therefore, based solely on the results and interpretation of the data, the archaeological potential of the five survey areas is assessed as low.
Project dates	Start: 14-08-2015 End: 18-09-2015
Previous/future work	Not known / Not known
Any associated project reference codes	BTHW - Sitecode
Any associated project reference codes	01 - Contracting Unit No
Type of project	Field evaluation
Site status	National Park
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & Techniques	Geophysical Survey
Development type	New Path network
Prompt	Environmental (unspecified schedule)
Position in the planning process	Not known / Not recorded
Solid geology (other)	Mam Tor Beds
Drift geology (other)	N/A
Techniques	Magnetometry

PROJECT LOCATION	
Country	England
Site location	DERBYSHIRE DERBYSHIRE DALES HATHERSAGE Hope Valley Capacity Scheme
Study area	2.3 Hectares
Site coordinates	SK 21524 82031 53.334480195174 -1.676739461574 53 20 04 N 001 40 36 W Polygon
	SK 21699 81945 53.333699943417 -1.674117144017 53 20 01 N 001 40 26 W Polygon
	SK 21752 81994 53.334138255652 -1.673317820805 53 20 02 N 001 40 23 W Polygon
	SK 21699 81945 53.333699943417 -1.674117144017 53 20 01 N 001 40 26 W Polygon
	SK 22347 81631 53.330850246237 -1.664407598024 53 19 51 N 001 39 51 W Polygon

PROJECT CREATORS	
Name of organisation	Headland Archaeology
Project brief originator	Mott MacDonald
Project design originator	Headland Archaeology (UK) Ltd
Project director/manager	Harrison, S
Project supervisor	Harrison, D
Type of sponsoring/funding body	Network Rail

PROJECT ARCHIVES	
Physical Archive exists	No
Digital Archive recipient	In house
Digital Contents	other
Digital Media available	Geophysics
Paper Archive exists	No

PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Hope Valley Capacity Scheme
Author(s)/Editor(s)	Harrison, D.
Other bibliographic details	BTHW/01
Date	2015
Issuer or publisher	Headland Archaeology (UK) Ltd
Place of issue or publication	Edinburgh
Description	A4 bound report

ENTERED BY	Sam Harrison (sam.harrison@headlandarchaeology.com)
ENTERED ON	5 October 2015

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