ARCHAEOLOGICAL EVALUATION REPORT:

GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND AT BAGLETTS WIND FARM, ELLERKER, EAST YORKSHIRE

NGR: SE 9042 2861
Planning Reference: 14/03106/STPLFE
AAL Site Code: ELBA 14
OASIS Reference Number: allenarc1-206199

Report prepared for Ecus Limited

By
Allen Archaeology Limited
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Allenarchaeology

Contents

List of Figures

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Cover image: View of site taken from southeast corner of the site looking north-northwest

Executive Summary

- A geophysical survey by magnetometry was undertaken by Allen Archaeology Limited (AAL) for Ecus Limited, prior to the determination of a planning application for the proposed Bagletts Wind Farm, Ellerker, East Riding of Yorkshire.

- Later prehistoric and Roman activity has previously been identified in the vicinity of the site, as well as possible medieval ridge and furrow.

- The survey has identified very little of archaeological interest. There are a large number of positive and negative linear, curvilinear, and amorphous anomalies across the surveyed areas that are likely represent former water courses, as well as waterlogging of the soils, and this indicates some potential for deposits of palaeoenvironmental interest to be encountered.

- There are a number of linear positive anomalies relating to former field boundaries as well as possible field drains.

1.0 Introduction

1.1 A geophysical survey by magnetometry was undertaken by Allen Archaeology Limited for Ecus Limited, prior to the determination of a planning application for construction of the proposed Bagletts Wind Farm, Ellerker, East Riding of Yorkshire.

1.2 The site works and reporting conform to current national guidelines, as set out in '*Geophysical Survey in Archaeological Field Evaluation*' (English Heritage 2008), '*The Use of Geophysical Techniques in Archaeological Evaluations*' (CIfA Paper 6) and the Chartered Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2014).

2.0 Site Location and Description

2.1 The site is located approximately 1.5km west southwest of Ellerker, extending either side of Ings Lane, centred on NGR SE 0942 2861.

2.2 The bedrock geology comprises Penarth Group Mudstone, overlain by a superficial geology of alluvial clay, silt, sand and gravel (http://mapapps.bgs.ac.uk/geologyofbritain /home.html).

3.0 Planning Background

3.1 A planning application has been submitted for '*Erection of 3 no. wind turbines (height to hub 80.0m and 121.0m to tip), 1 no. anemometry mast (80.0m to tip), 1 no. temporary anemometry mast (for a period of six months), erection of substation building, temporary compound area and associated access and infrastructure'* (Reference 14/03106/STPLFE). Prior to the determination of the application, Humber Archaeology Partnership, advising East Yorkshire Council advised for a geophysical survey of the site in order to provide further information concerning the archaeological potential of the proposed development area, to allow the planning authority to make a reasoned decision as to the nature and extent of further archaeological works that may be required in order to mitigate the effects of the proposed development upon the archaeological resource.

3.2 The approach adopted is consistent with the recommendations of the National Planning Policy Framework (NPPF), with the particular chapter of relevance being '*Chapter 12: Conserving and enhancing the historic environment'* (Department for Communities and Local Government 2012).

4.0 Archaeological and Historical Background

4.1 There is some evidence for later prehistoric and Roman activity in the vicinity of the site, with scatters of Roman pottery recorded c.500m northeast of the site (National Monuments Record Reference 63937). Aerial photography has identified a series of rectilinear enclosures suggestive of later prehistoric or Roman field systems in an extensive area to the west and northwest of the site (NMR References 1257913, 1257951).

4.2 In the Domesday Book of 1086, the parish is listed as *Alrecher*, a name deriving from Old Norse elements and meaning 'alder marsh' (http://kepn.nottingham.ac.uk/map/place/Yorkshire%20ER/Ellerker). It was at the time a *berewick*, or outlying estate of a manor at Welton owned by the Bishop of Durham (Williams and Martin 2002). The current site is well beyond the core of the village and ridge and furrow cropmarks indicative of medieval agriculture survive c.1km to the southwest of the site (NMR Reference 1257396).

5.0 Methodology

5.1 The geophysical survey consisted of a detailed gradiometer survey of the full extent of the proposed development area. This comprised the site of the three wind turbines and associated access roads, and all infrastructure. A 1 hectare area was centred on each turbine base and crane hardstanding, with a 20m wide survey corridor along the line of the access roads, which was widened where necessary to encompass turning heads, a substation, and a control building and construction compound, a total area of approximately 5.2ha.

5.2 The fieldwork was carried out by a team of two experienced geophysicists from AAL over a period of three working days, Monday 9th to Wednesday 11th March 2015. The survey area was accurately located using a Leica GS08 Netrover receiving RTK corrections. This accurately 3D plotted the area of investigation and tied it into the National Grid.

5.3 The survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an on-board automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the on-board data logger.

5.4 Data collection was undertaken in a zigzag traverse pattern, using a sample interval of 0.25m and a traverse interval of 1m.

5.5 The fieldwork and reporting was carried out in accordance with the procedures in 'Geophysical Survey in Archaeological Field Evaluation' (English Heritage 2008) and 'The Use of Geophysical Techniques in Archaeological Evaluations: IfA Paper 6' (Gaffney et. al. 2002).

Summary of Survey Parameters

5.6 Fluxgate Magnetometer

Instrument:	Bartington Grad601-2 Dual Fluxgate Gradiometer
Sample Interval:	0.25m
Traverse Interval:	1.00m
Traverse Separation:	1.00m
Traverse Method:	Zigzag
Resolution:	0.01 nT
Processing Software:	Terrasurveyor 3.0.25
Surface Conditions:	Very short grass crop
Area Surveyed:	5.2 hectares
Date Surveyed:	Monday 9th to Wednesday 11th March 2015
Surveyor:	Robert Evershed
Survey Assistants:	Alice Beasley
Data Interpretation:	Robert Evershed

Data Collection and Processing

5.7 The grids were marked out using pre-programmed coordinates on the Leica GS08 Netrover. The collection of magnetic data using a north – south traverse pattern is preferable as the fluxgate

gradiometer is set up and balanced with respect to the cardinal points. Since the data is plotted as north – south traverses there is considerable merit sampling the north – south response of a magnetic anomaly with as many data points as is possible, this is accomplished as the density collected along the traverse line is greater than that between traverses (Aspinall 2008). On this occasion magnetic data was collected on various alignments due to the orientation of the access roads and turbine areas and of the pre-programmed survey grids.

5.8 The data collected from the survey has been analysed using the current version of Terrasurveyor 3.0.25. The resulting data set plots are presented with positive nT/m values and high resistance as black and negative nT/m values and low resistance as white.

The data sets have been subjected to processing using the following filters:

- De-striping
- Clipping
- De-staggering

5.9 The de-stripe process is used to equalise underlying differences between grids or traverses. Differences are most often caused by directional effects inherent to magnetic surveying instruments, instrument drift, instrument orientation (for example off-axis surveying or heading errors) and delays between surveying adjacent grids. The de-stripe process is used with care however as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.

5.10 The clipping process is used to remove extreme data point values which can mask fine detail in the data set. Excluding these values allows the details to show through.

5.11 The de-staggering process compensates for data correction errors caused by the operator commencing the recording of each traverse too soon or too late. It shifts each traverse forward or backwards by a specified number of intervals.

5.12 Plots of the data are presented in processed linear greyscale (smoothed) with any corrections to the measured values or filtering processes noted, and as separate simplified graphical interpretations of the main anomalies detected.

6.0 Results

6.1 For the purposes of interpreting the anomalies, the survey data has been processed to the values of -3 to 3 nT/m (Figure 4). This enhances faint anomalies that may otherwise not be noted in the data. The survey results revealed a number of anomalies across the data set, and these are discussed in turn and noted as single or double digit numbers in square brackets.

6.2 The area of magnetic noise immediately north of Ings Lane [1], producing readings of -100 to 100 nT/m, represents modern waste/detritus dumped in this area along with disturbance associated with nearby telegraph poles carrying overhead cables.

6.3 The long linear dipolar feature [2], running northwest to southeast through the northern part of the site, producing readings of -100 to 100 nT/m, most probably represents a modern service running along the field boundary. Another linear dipolar feature [3] running parallel to [2], producing readings of -3 to 1 nT/m likely represents a modern field drain. The linear dipolar

features [4], -4 to 12 nT/m, running perpendicular to [2] at the northern end of the site are also likely to represent modern field drains.

6.4 The two faint linear anomalies [5] and [6], which run northeast to southwest across the area of Turbine 3, 1 to 2 nT/m, relate to former field boundaries identified on historic Ordnance Survey maps. The westernmost boundary had disappeared by the time of the 1909 map, the eastern boundary was removed prior to the publication of the 1969 map.

6.5 Also running northeast to southwest within the area for Turbine 3 is a positive linear anomaly [7], 8 to 15 nT/m. This may represent a former field boundary, ditch, trackway or path, or possibly a modern service, although the short length of the feature exposed in the survey area makes interpretation difficult.

6.6 Across the majority of the site there are numerous amorphous and curvilinear positive and negative anomalies. Within the area for Turbine 3 a group of anomalies [8] produced readings of approximately 15 to -10 nT/m. The anomalies are very likely to represent a series of dendritic river channels and creeks.

6.7 To the southeast of [8] are further amorphous positive anomalies [9], 4 to 8 nT/m, which are likely to represent waterlogging or geological changes within the soil but may relate to former river/stream channels.

6.8 To the south of Ings Lane, the area of magnetic noise [10], -10 to 10 nT/m, represents modern waste/detritus accumulating at the field margins and along the road edge.

6.9 The dipolar linear [11], -5 to 8 nT/m, running north-northwest to south-southeast likely represents a modern field drain.

6.10 The broad linear trend of linear/amorphous positive and negative anomalies [12], within the area for Turbine 2, 4 and -4 nT/m respectively, are likely to again represent former watercourses.

6.11 The series of parallel linear dipolar features [13], within the area for Turbine 2, -2 to 4 nT/m, running north-northwest to south-southeast probably represent modern field drains.

6.12 The positive linear feature [14], 1 to 2 nT/m, running east-northeast to west-southwest across the area of Turbine 2 corresponds to a former field boundary present on the 1855 Ordnance Survey map, which had been removed prior to 1890. Likewise the positive linear feature [15], 1 nT/m, running east - west across the southern part of the survey area appears on the 1855 map and has been removed between 1958 and 1969.

6.13 Running across the area for Turbine 1 roughly west-northwest to east-southeast is a broad positive linear feature with parallel linear negative features either side, [16]. The positive linear produced readings of approximately 1 to 2 nT/m, whilst the negative features produced readings of approximately -2 nT/m. The positive linear may represent a former river channel, with the negative linears representing flanking banks and possibly suggesting a man-made channel. To the northeast are a number of linear and curvilinear positive anomalies, 1 nT/m, that likely represent geological variation.

6.14 The large dipolar spike [17], -100 to 100 nT/m, relates to the metal cables securing a meteorological data gathering mast.

6.15 Scattered randomly throughout the site are a number of strong and weak dipolar responses, examples of which are highlighted as [18]. The characteristic dipolar response of pairs of positive

and negative 'spikes' suggest near surface ferrous metal or other highly fired material in the ploughsoil.

7.0 Discussion and Conclusions

7.1 The survey has identified no features of specific archaeological interest on the site. There are a large number of positive and negative linear, curvilinear, and amorphous anomalies across the surveyed areas that are likely to represent waterlogging of the underlying soils, as well as former river channels and creeks however, and this does indicate that there may be some palaeoenvironmental potential associated with these features and deposits.

7.2 There are a small number of linear positive anomalies running across the site that can be related to former field boundaries as seen on historic OS maps of the 19th and 20th centuries. There are also a number of linear dipolar features that either represent field drains or modern services.

8.0 Effectiveness of Methodology

8.1 The non-intrusive evaluation methodology employed was particularly appropriate to the scale and nature of the site to be surveyed. Magnetometry was the prospection technique best suited to the identification of archaeological remains on the site. Other techniques would have required further justification and may have proved too time consuming or cost-prohibitive.

9.0 Acknowledgements

9.1 Allen Archaeology Limited would like to thank Ecus Limited for this commission.

10.0 References

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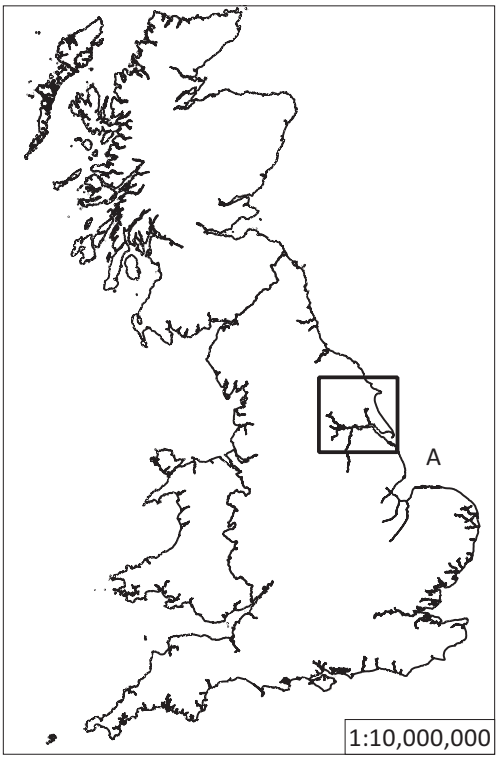
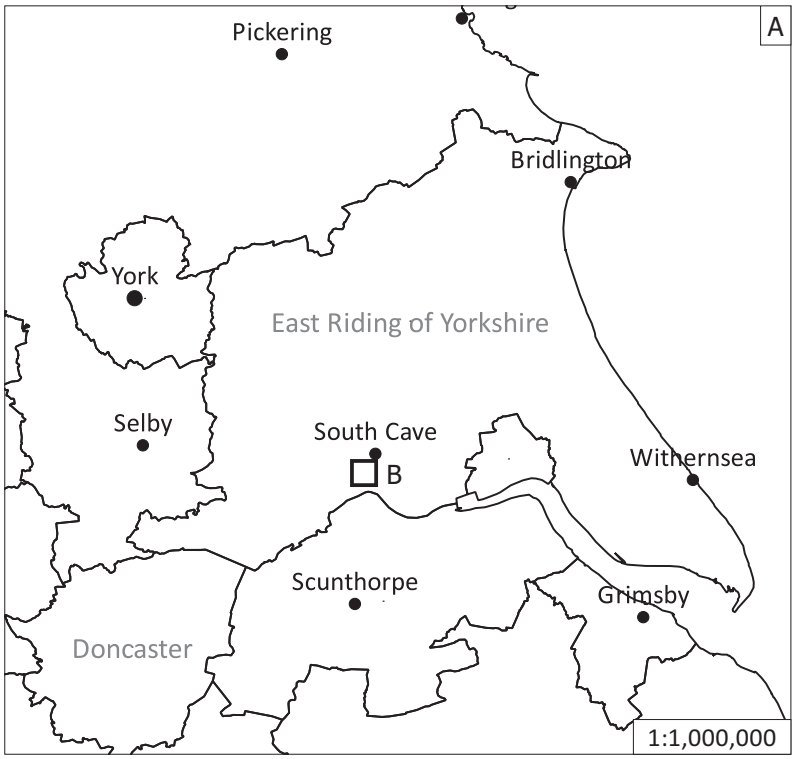
Gaffney C., Gater J., and Ovenden S., 2002, *The Use of Geophysical Techniques in Archaeological Evaluations. IFA Paper No. 6.* The Institute for Archaeologists

Williams A. & Martin G. H., 2002, *Domesday Book: A complete translation,* Alecto Historical Editions, London





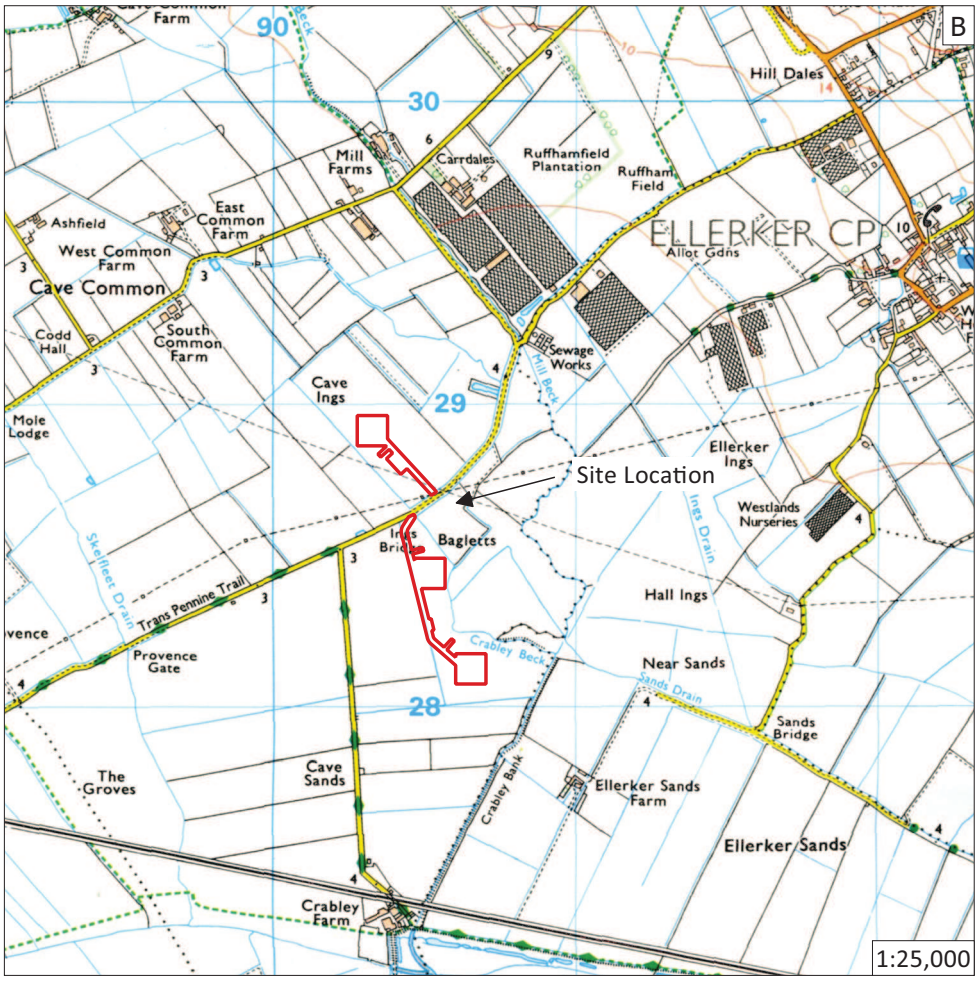


Figure 1: Site location outlined in red

Site Code	ELBA 14
Scale	1:25,000 @ A4
Drawn by	R Evershed
Date	12/03/15

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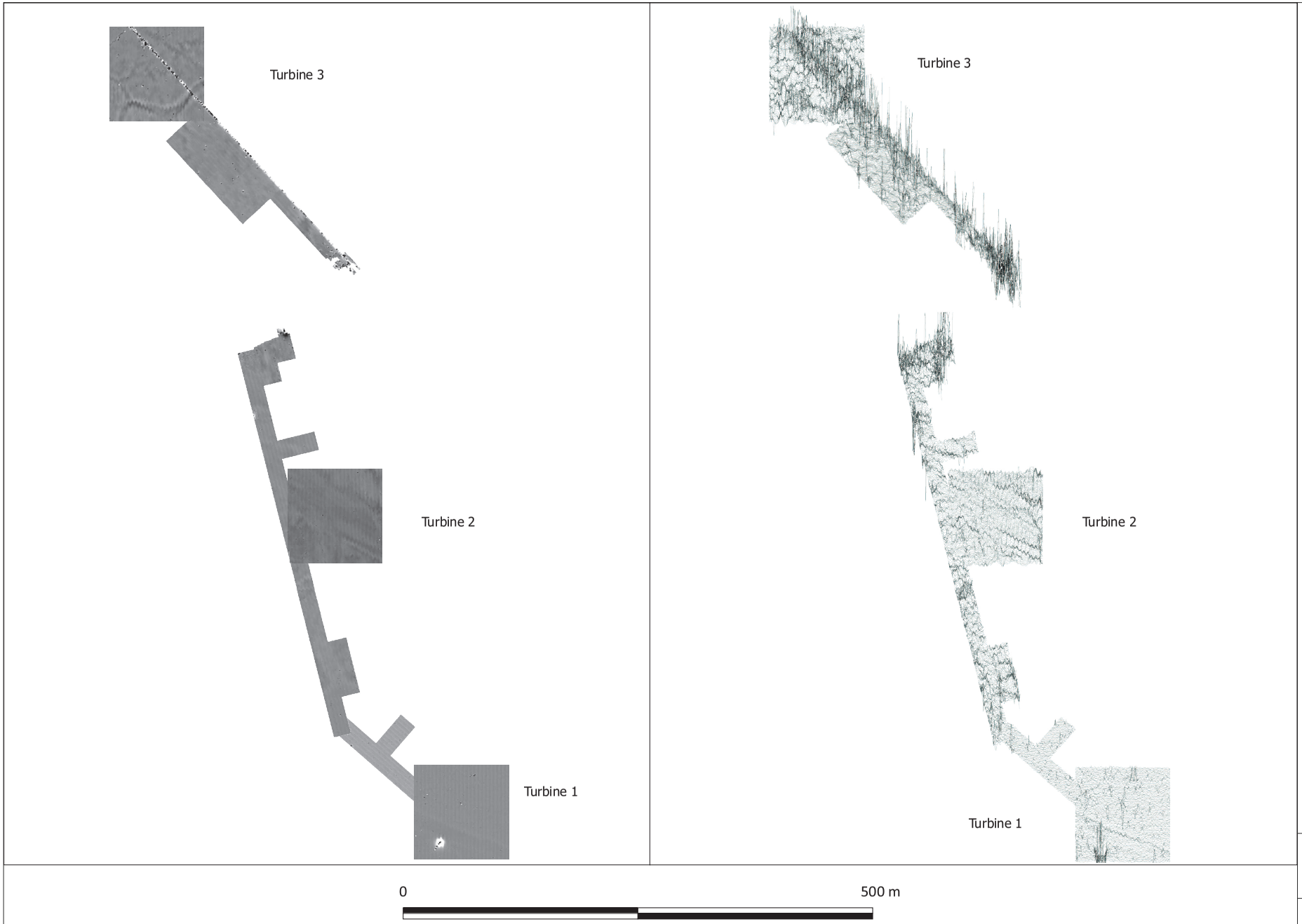

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Code	1:4,000 @A3
Scale	Robert Evershed
Drawn	13/03/15

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Figure 2: Greyscale raw data and processed trace plot

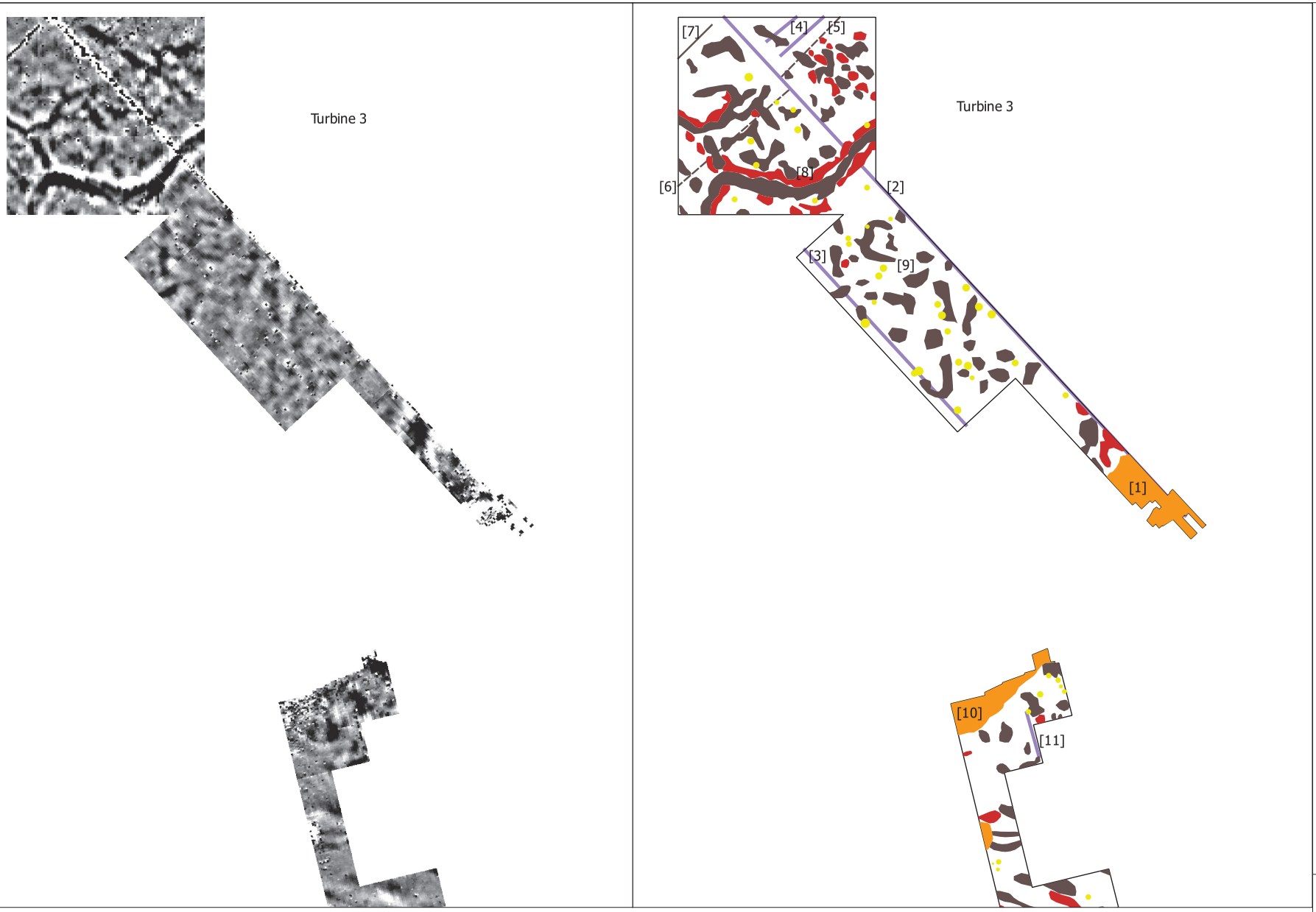

Figure 3: Processed greyscale plot and interpretation of northern area

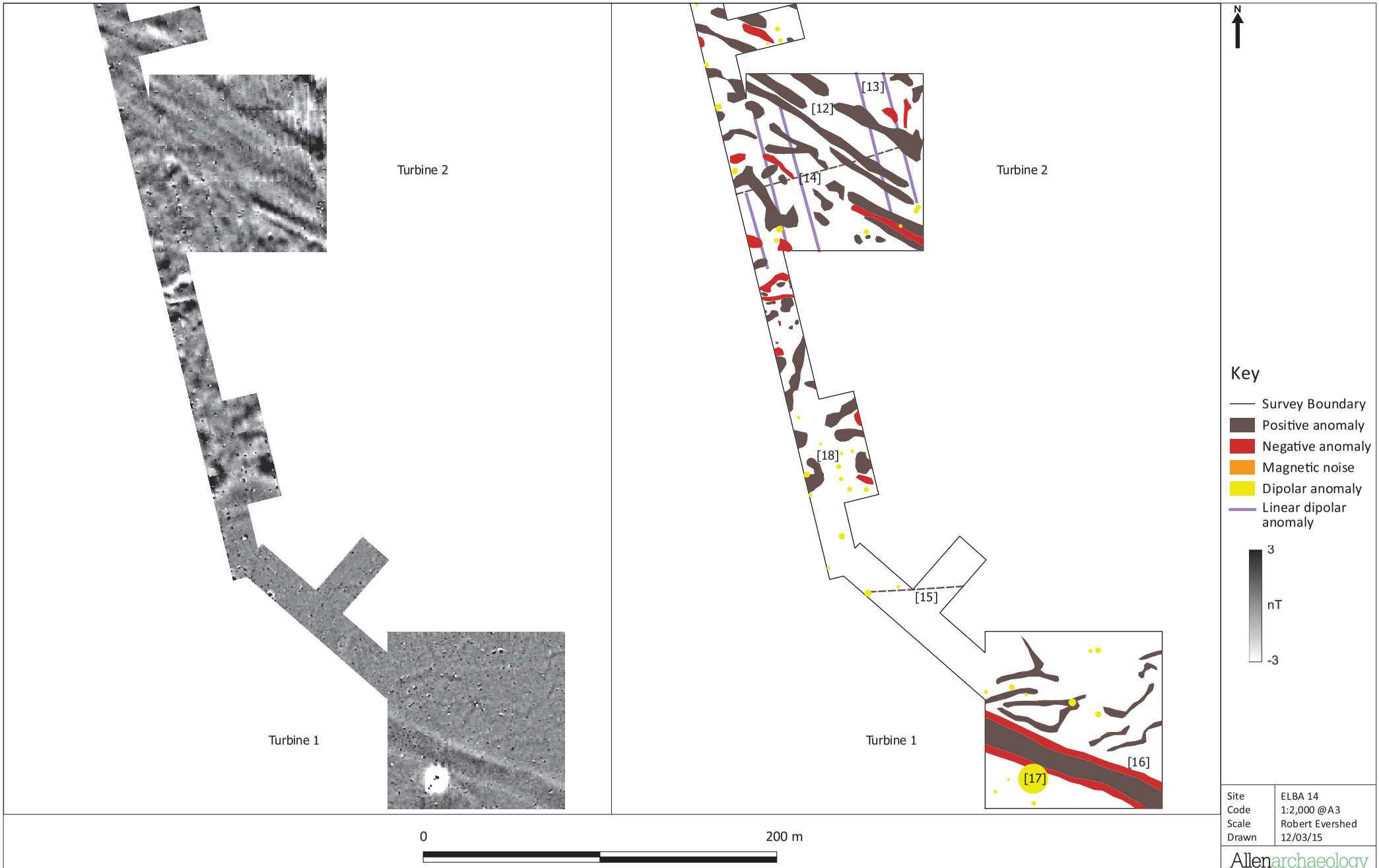

Figure 4: Processed greyscale plot and interpretation of southern area

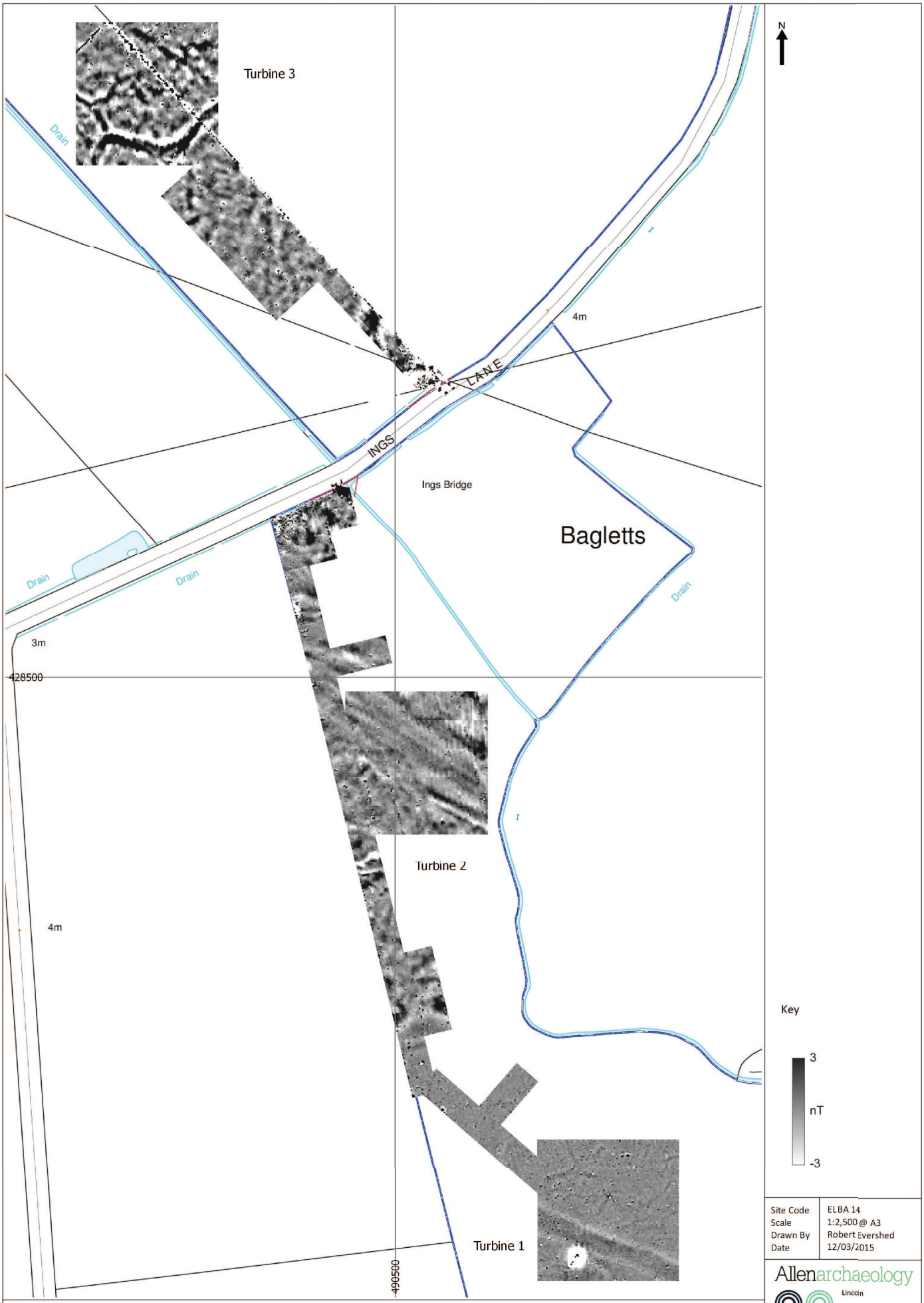

Figure 5: Location of processed greyscale

Site Code	ELBA 14
Scale	1:2,500 @ A3
Drawn By	Robert Evershed
Date	12/03/2015

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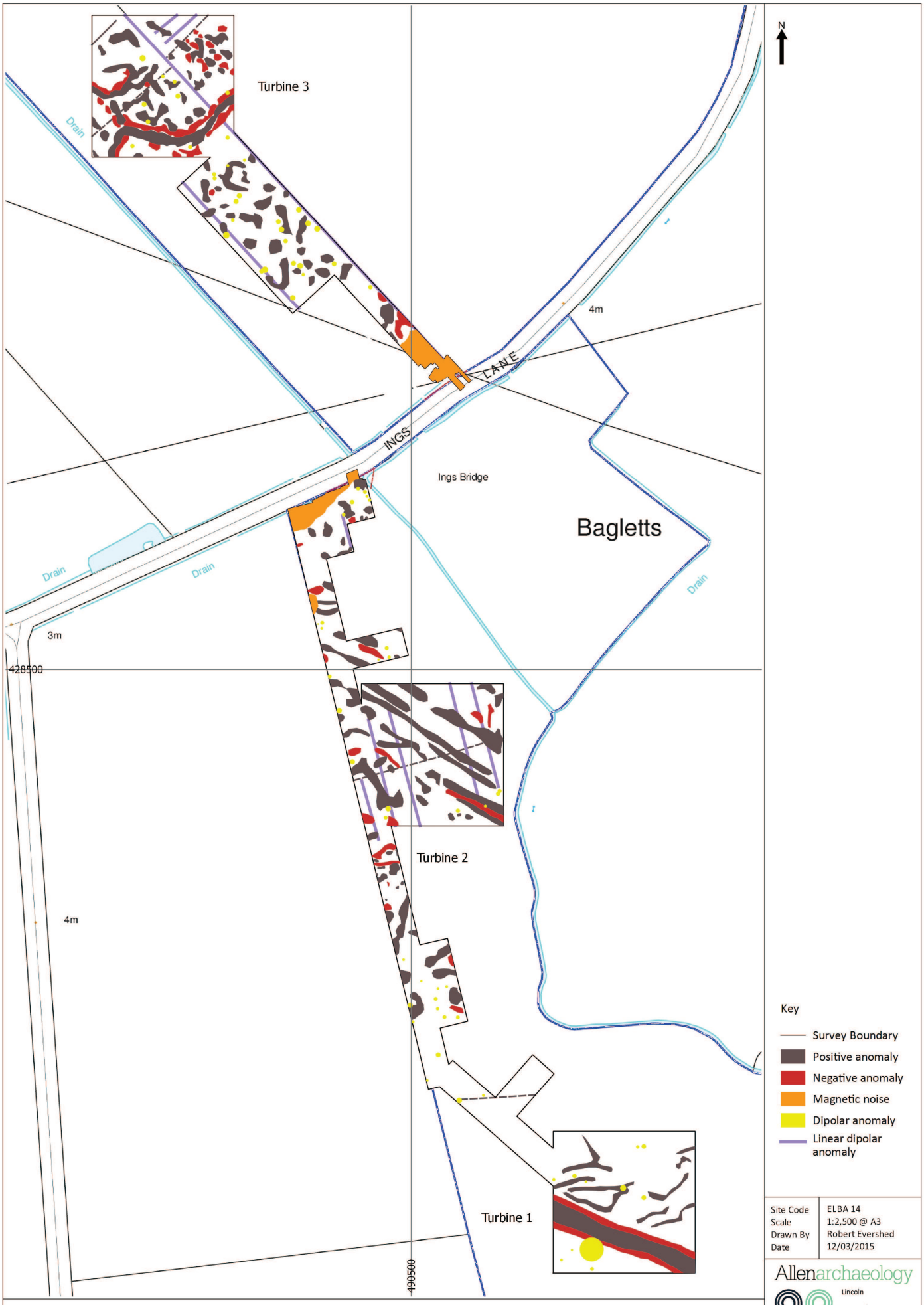

Figure 6: Location of geophysical interpretation

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