

**ARCHAEOLOGICAL EVALUATION REPORT:**  
**GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND NORTH OF CROOK LANE, WEST NEWTON B  
WELLSITE, WEST NEWTON, EAST RIDING OF YORKSHIRE**

Planning Reference: 14/04107/STPLF  
NGR: TA 2047 3724  
AAL Site Code: WENB 15  
OASIS Reference Number: allenarc1-210928



Report prepared for Petroleum Safety Services Limited  
on behalf of Rathlin Energy (UK) Limited

By  
Allen Archaeology Limited  
Report Number AAL 2015068

May 2015



Allenarchaeology



## Contents

Executive Summary .....	1
1.0 Introduction.....	2
2.0 Site Location and Description.....	2
3.0 Planning Background.....	2
4.0 Archaeological and Historical Background.....	2
5.0 Methodology .....	3
Summary of Survey Parameters.....	3
Data Collection and Processing .....	3
6.0 Results .....	4
7.0 Discussion and Conclusions.....	6
8.0 Effectiveness of Methodology.....	6
9.0 Acknowledgements .....	6
10.0 References.....	6

### List of Appendices

Appendix 1: Figures .....	8
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### List of Figures

Figure 1: Site location outlined in red .....	8
Figure 2: Greyscale raw data and processed trace plot, northern half.....	9
Figure 3: Greyscale raw data and processed trace plot, southern half.....	10
Figure 4: Processed greyscale plot and interpretation, northern half.....	11
Figure 5: Processed greyscale plot and interpretation, southern half.....	12
Figure 6: Location of processed greyscale plot .....	13
Figure 7: Location of geophysical interpretation .....	14

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*Cover image: View across the proposed wellsite looking west*

## Executive Summary

- A geophysical survey by magnetometry was undertaken by Allen Archaeology Limited for Petroleum Safety Services Limited on behalf of Rathlin Energy (UK) Limited on land north of Crook Lane, West Newton, East Riding of Yorkshire. The survey was undertaken to evaluate by non-intrusive means prior to the determination of a planning application for a proposed temporary wellsite.
- The proposed wellsite lies within the parishes of Burton Constable and Humbleton approximately 13km northeast of the centre of Hull. The site is located 1km southeast of West Newton village core and is centred on NGR TA 2047 3724.
- Across the entire area, orientated east to west, are parallel positive linears that represent modern field drains.
- There are a number of positive linear features that represent former field boundaries that can be identified on former Ordnance Survey maps.
- There are a large number of positive linears that are not aligned on the same orientation as the field drains and most likely represent field boundaries and other anthropogenic features of a much earlier date.
- There appears to be archaeological potential within both the wellsite area and the access trackway and further archaeological investigation may be necessary.

## **1.0 Introduction**

- 1.1 A geophysical survey by magnetometry was undertaken by Allen Archaeology Limited for Petroleum Safety Services Limited on behalf of Rathlin Energy (UK) Limited to help inform the determination of a planning application for a proposed temporary wellsite.
- 1.2 The site works and reporting conformed 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*' (Gaffney *et al.* 2002) and the Chartered Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2014).

## **2.0 Site Location and Description**

- 2.1 West Newton village is situated within the administrative district of Holderness. The proposed wellsite (hereafter referred to as 'the site') lies within the parishes of Burton Constable and Humbleton approximately 13km northeast of the centre of Hull. The site is located 1km southeast of the village core and is centred on NGR TA 2047 3724.
- 2.2 The bedrock geology comprises Flamborough Chalk Formation, with a superficial geology of Devensian till (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>).

## **3.0 Planning Background**

- 3.1 A planning application has been submitted for the '*Construction of a temporary wellsite, erection of a drilling rig to a maximum of 50m with associated plant, equipment and access track followed by wellsite restoration*' (Reference 14/04107/STPLF). Prior to determination of the application, Humber Archaeology Partnership, advising East Yorkshire Council, had recommended the undertaking a geophysical survey by magnetometry, in order to provide further information concerning the nature and extent of the archaeological resource in the proposed development area.
- 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 A preceding desk-based assessment detailed the archaeological and historical background for the site (AAL 2014), and a summary of this information is presented here.
- 4.2 Only a single artefact predating the medieval period was recorded in a 1km radius study area; a prehistoric flint flake found during fieldwalking to the north of the site.
- 4.3 West Newton is recorded as a settlement in the Domesday Survey of 1086, under the control of the Archbishop of York. Earthworks which are evidence of the shrunken medieval village survive around the modern village, to the north of the site.
- 4.4 Later activity was represented in the study area by a number of post-medieval farmsteads, and associated features such as sheep washes and sluices, as well as gravel, sand and clay quarries.

- 4.5 A number of undated cropmarks were recorded in the study area, comprising enclosures, driveways and curvilinear features close to the proposed access road.

## 5.0 Methodology

- 5.1 The geophysical survey consisted of a detailed gradiometer survey of the proposed development area. This comprised the proposed wellsite and its associated access road. A 30m wide survey corridor was surveyed along the line of the access road, giving a total area of approximately 6ha.
- 5.2 The fieldwork was carried out by a team of two experienced geophysicists from AAL over a period of three working days. The survey areas was accurately located using a Leica GS08 RTK NetRover GPS. 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 zig-zag traverse pattern, using a sample interval of 0.25m and a traverse interval of 1m.

### **Summary of Survey Parameters**

#### 5.5 Fluxgate Magnetometer

Instrument:	Bartington Grad601-2 Dual Fluxgate Gradiometer
Sample interval:	0.25m
Traverse interval:	1.00m
Traverse separation:	1.00m
Resolution:	0.01 nT
Processing software:	Terrasurveyor 3.0.25
Surface conditions:	Short grass crop and ploughed/harrowed areas
Area surveyed:	6.13 ha
Date surveyed:	Monday 13 <sup>th</sup> to Wednesday 15 <sup>th</sup> April 2015
Surveyor:	Robert Evershed
Survey assistant:	Jesse Johnson
Data interpretation:	Robert Evershed

### **Data Collection and Processing**

- 5.6 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 *et al.* 2008). On this occasion,

magnetic data was collected close to a north-south alignment due to the orientation of the pre-programmed survey grids and the fields.

- 5.7 The data collected from the survey has been analysed using the current version of Terrasurveyor (version 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-stripping
- Clipping
- De-staggering

- 5.8 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.

- 5.9 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.

- 5.10 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.

- 5.11 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 and 5). 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 one or two digit numbers in square brackets.

- 6.2 Immediately noticeable is the curvilinear dipolar feature [1] running parallel with the road next to the field. This produced magnetic readings of -100 to 100 nT/m, with some spikes as high as -3000 to 3000 nT/m. This feature relates to a modern cast iron water pipe.

- 6.3 The magnetic noise along the southern edge of the wellsite [2], -10 to 25 nT/m, relates to the road running adjacent to the site.

- 6.4 The area of magnetic noise [3] at the southwest corner of the wellsite, -20 to 30 nT/m, with occasional much higher spikes, likely corresponds to a build of waste/detritus associated with the field boundary and the road. There were also visible items of modern debris in the topsoil, so the readings may indicate a spread of material within the plough zone.

- 6.5 Slightly further to the north there is another area of magnetic noise [4], -5 to 5 nT/m, which could also relate to a spread of waste/detritus.
- 6.6 Running across the well site and across the access track, orientated east to west, are a number of positive linear features [5]. These have produced magnetic readings of 1 to 2 nT/m and relate to modern field drains.
- 6.7 There are a number of positive linear features [6], 2 to 3 nT/m, on a differing alignment to that of the field drains. These are aligned broadly northeast to southwest and northwest to southeast and may reflect former ditches relating to field systems or enclosures.
- 6.8 There is an area of magnetic noise [7] running north to south, -3 to 4 nT/m, that likely relates to a former field boundary shown on former Ordnance Survey maps.
- 6.9 There are a number of positive amorphous anomalies [8], 4 to 6 nT/m, that likely represent pits, former ponds or soil-filled hollows. They may relate to positive linear anomalies [6].
- 6.10 The negative linear feature [9], -2 to -1 nT/m, running roughly north to south, could represent a ditch, track, path or former channel.
- 6.11 The large dipolar area [10], -3000 to 3000 nT/m, corresponds to metal gates.
- 6.12 The area of magnetic noise [11], with readings as high as -3000 to 3000 nT/m, relates to a trackway running north to south next to a field boundary.
- 6.13 There is a potential positive curvilinear feature [12], 0.5 to 1 nT/m, which may represent a ditch, track or path and likely relates to the positive features running across the wellsite.
- 6.14 The positive amorphous anomalies [13], 2 to 4 nT/m, are possible pits, former ponds or soil-filled hollows, or possibly material relating to the adjacent field boundary.
- 6.15 The linear positive features [14], 1 to 2 nT/m, running east to west may relate to ditches or paths, but most likely represent modern field drains.
- 6.16 The linear positive features [15], 1 nT/m, likely represent ditches, paths or tracks.
- 6.17 The positive linear features [16], 1 nT/m, likely represent modern field drains.
- 6.18 The parallel positive linear features [17], 1 to 2 nT/m, likely represent modern field drains.
- 6.19 The linear area of magnetic noise [18] running roughly north to south, producing readings on average of -5 to 5 nT/m but with occasional larger spikes, represents a former field boundary.
- 6.20 The positive linear feature [19], 1 nT/m, represents a former field boundary identified on former Ordnance Survey mapping.
- 6.21 The positive linear/curvilinear feature [20], 3 to 4 nT/m, likely relates to a former palaeochannel.
- 6.22 The positive linear feature [21], 1 to 2 nT/m, represents a former field boundary seen on former Ordnance Survey maps.

- 6.23 There are a number of positive linear features [22], 4 to 6 nT/m, that potentially relate to ditches or paths/tracks. These linears may represent enclosure ditches or boundary ditches forming a rectilinear feature.
- 6.24 The linear positive feature [23], 4 nT/m, represents a former field boundary identified on former Ordnance Survey maps.
- 6.25 The linear positive feature [24], 3 nT/m, represents a former field boundary former Ordnance Survey maps.
- 6.26 Scattered randomly throughout the site are a number of other strong and weak dipolar responses [25], examples of which are highlighted as yellow circles. The characteristic dipolar response of pairs of positive and negative 'spikes' suggest near surface ferrous metal or other highly fired material in the topsoil.

## **7.0 Discussion and Conclusions**

- 7.1 The geophysical survey has revealed a number of potential archaeological features across both the wellsite and access track. Across the entire area, orientated east-west, are parallel positive linears that represent modern field drains. There are a number of positive linear anomalies that do not follow the alignment of the field drains and most likely represent field boundaries and other anthropogenic features of an unknown date. To the north of the site are earthworks that belong to the medieval village of West Newton, and it is possible that the linear features identified by the survey relate to this, although it is equally plausible that they are of earlier date.
- 7.2 There are a number of positive linear features that represent former field boundaries that have been noted on former Ordnance Survey maps.
- 7.3 The well site survey area appears to contain deposits of archaeological interest within its boundaries, and these may need to be examined through a programme of evaluation trenching. The access road will require a narrow linear area to be stripped of ploughsoil, so it is proposed that this is monitored as part of a watching brief.

## **8.0 Effectiveness of Methodology**

- 8.1 The non-intrusive evaluation methodology employed was appropriate to the scale and nature of the site to be surveyed.

## **9.0 Acknowledgements**

- 9.1 Allen Archaeology Limited would like to thank Petroleum Safety Services Limited on behalf of Rathlin Energy (UK) Limited for this commission.

## **10.0 References**

- AAL, 2014, *Archaeological Desk-Based Assessment: Land north of Crook Lane, West Newton B Wellsite, West Newton, East Riding of Yorkshire*. Allen Archaeology Limited report number 2014140
- Aspinall, A, Gaffney, C, and Schmidt, A, 2008, *Magnetometry for Archaeologists*, Plymouth: Altamira Press



CIfA, 2014, *Standard and guidance for archaeological geophysical survey*, Institute for Archaeologists, Reading

Department for Communities and Local Government, 2012, *National Planning Policy Framework*. London, Department for Communities and Local Government

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

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

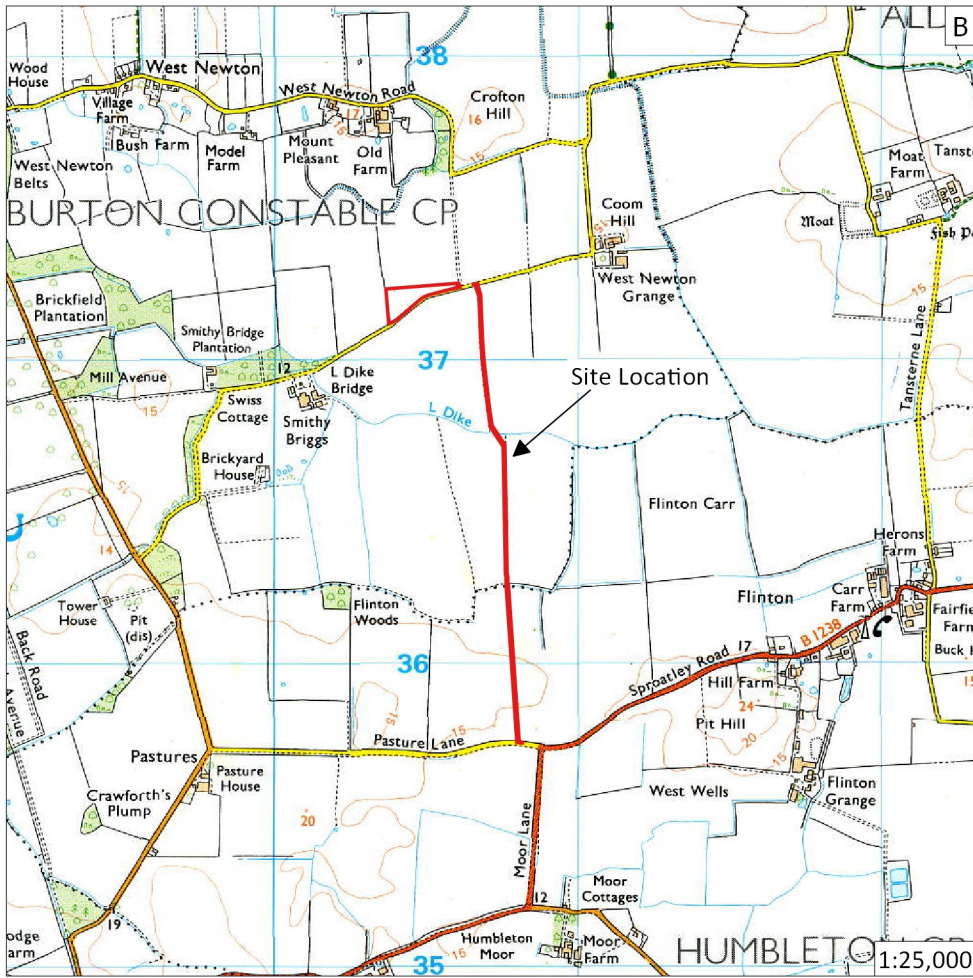
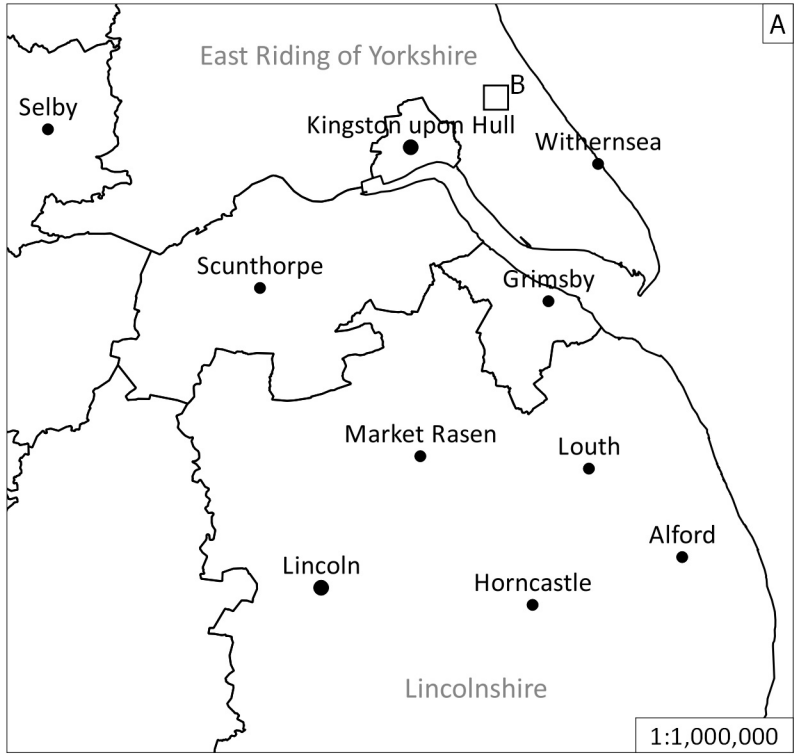
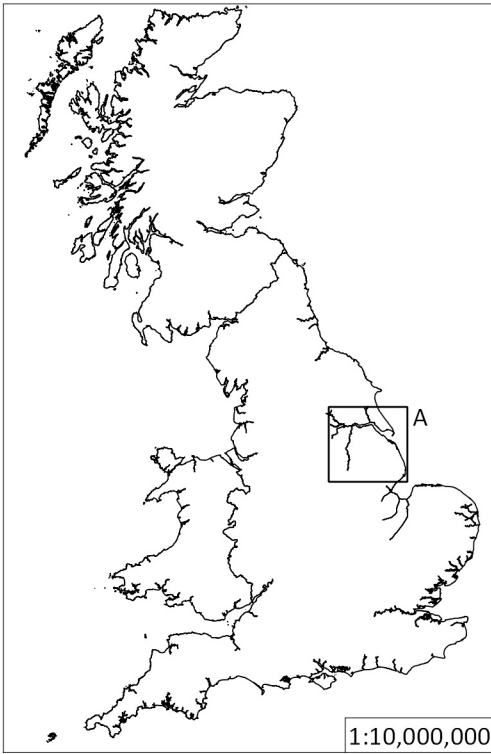


Figure 1: Site location outlined in red

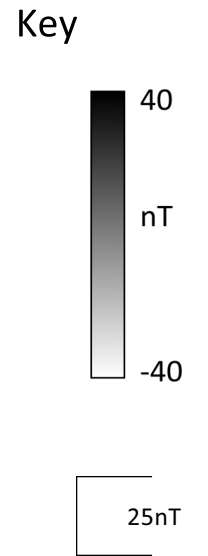
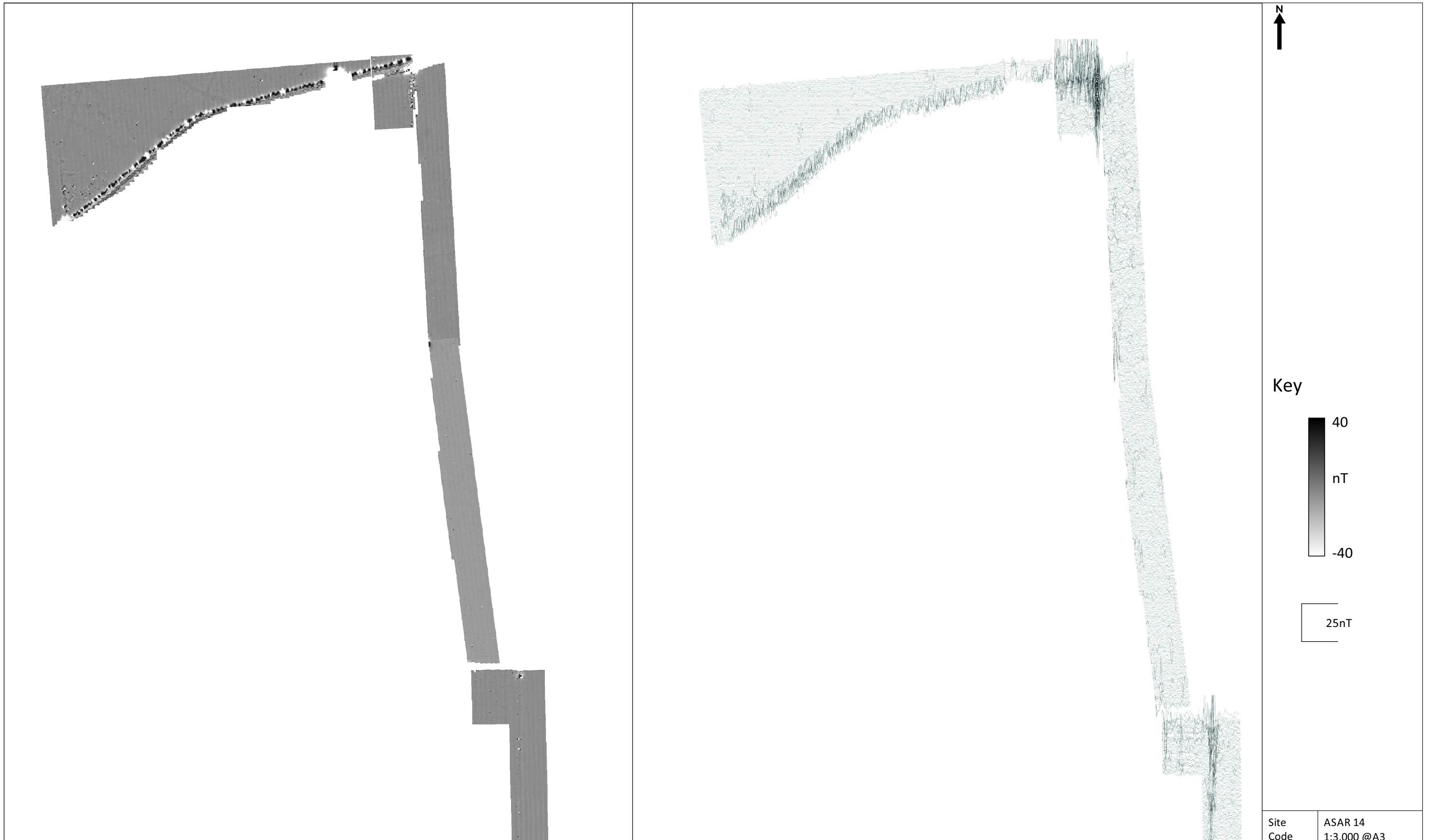
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Site Code	WENB 14
Scale	1:10,000,000 1:1,000,000 1:25,000 @ A4
Drawn by	RE
Date	11/05/15

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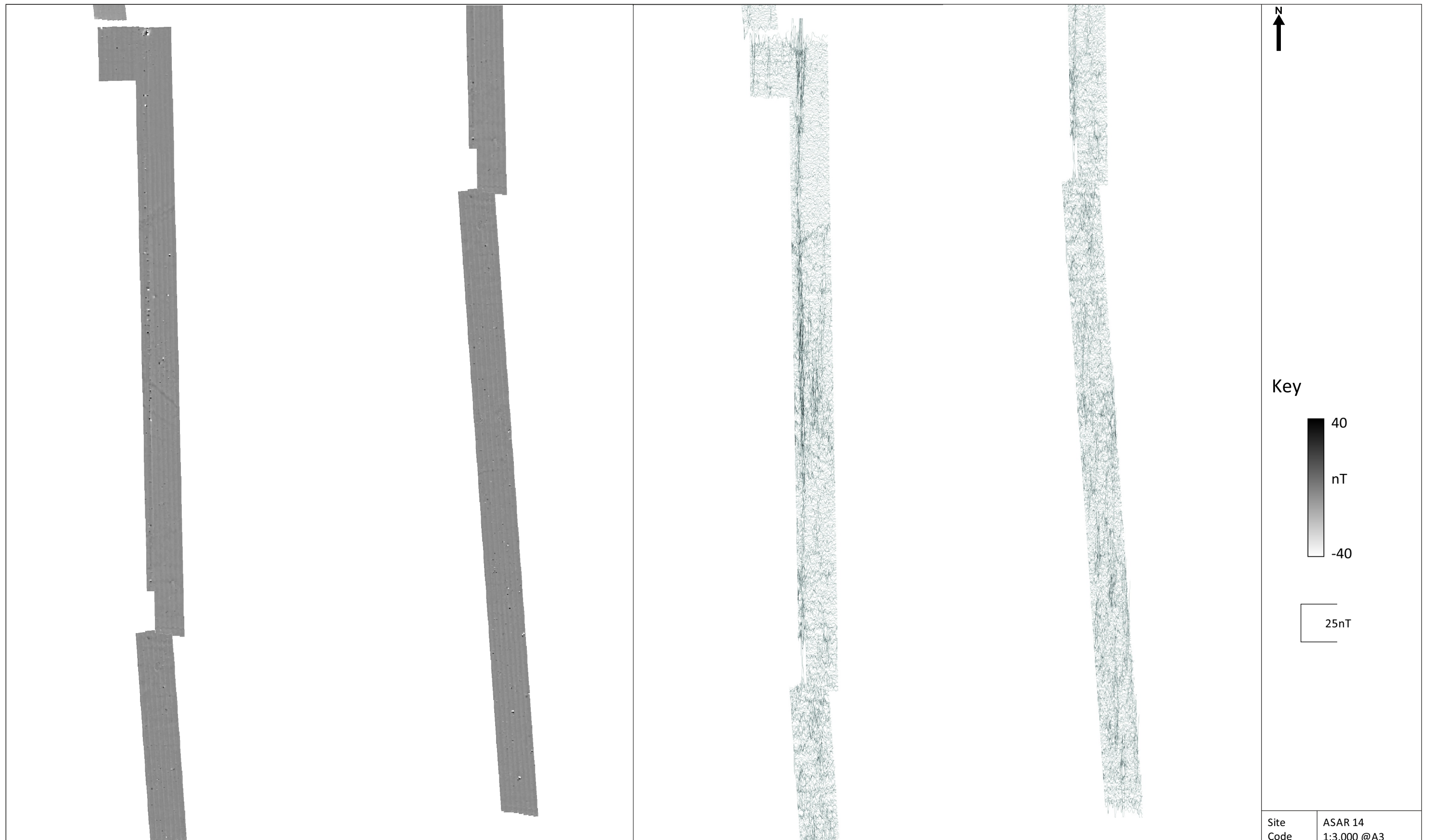


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Scale	Robert Evershed
Drawn	11/05/15

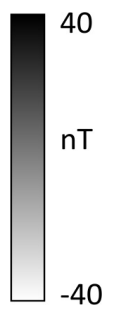
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**Figure 2:** Greyscale raw data and processed trace plot, northern half



Key



25nT



Site	ASAR 14
Code	1:3,000 @A3
Scale	Robert Evershed
Drawn	11/05/15

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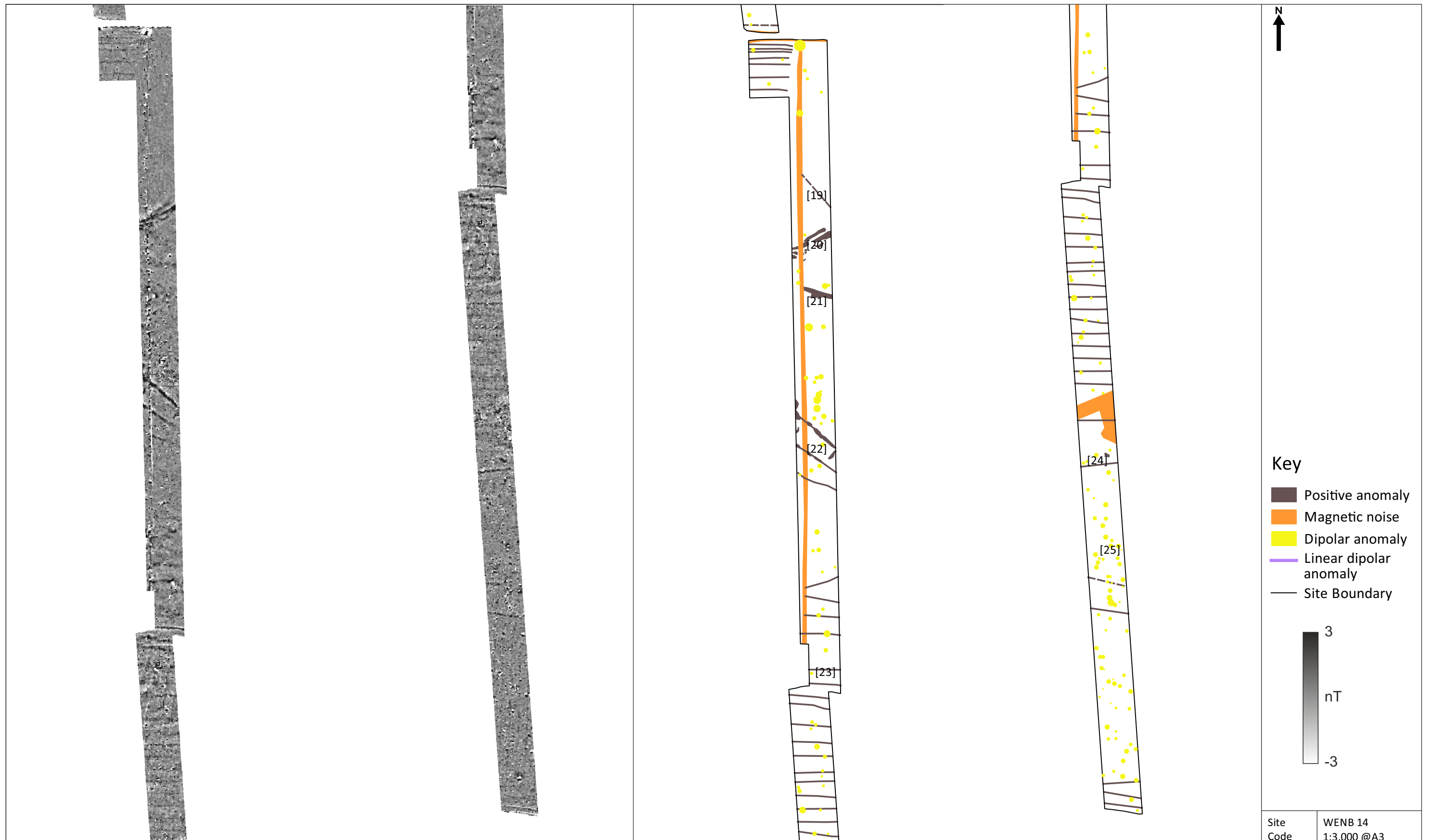
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Figure 3: Greyscale raw data and processed trace plot, southern half





**Figure 4:** Processed greyscale plot and interpretation, northern half



**Key**

- Positive anomaly
- Magnetic noise
- Dipolar anomaly
- Linear dipolar anomaly
- Site Boundary

3  
nT  
-3

Site Code	WENB 14
Scale	1:3,000 @A3
Drawn	Robert Evershed 11/05/15

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**Figure 5:** Processed greyscale plot and interpretation, southern half

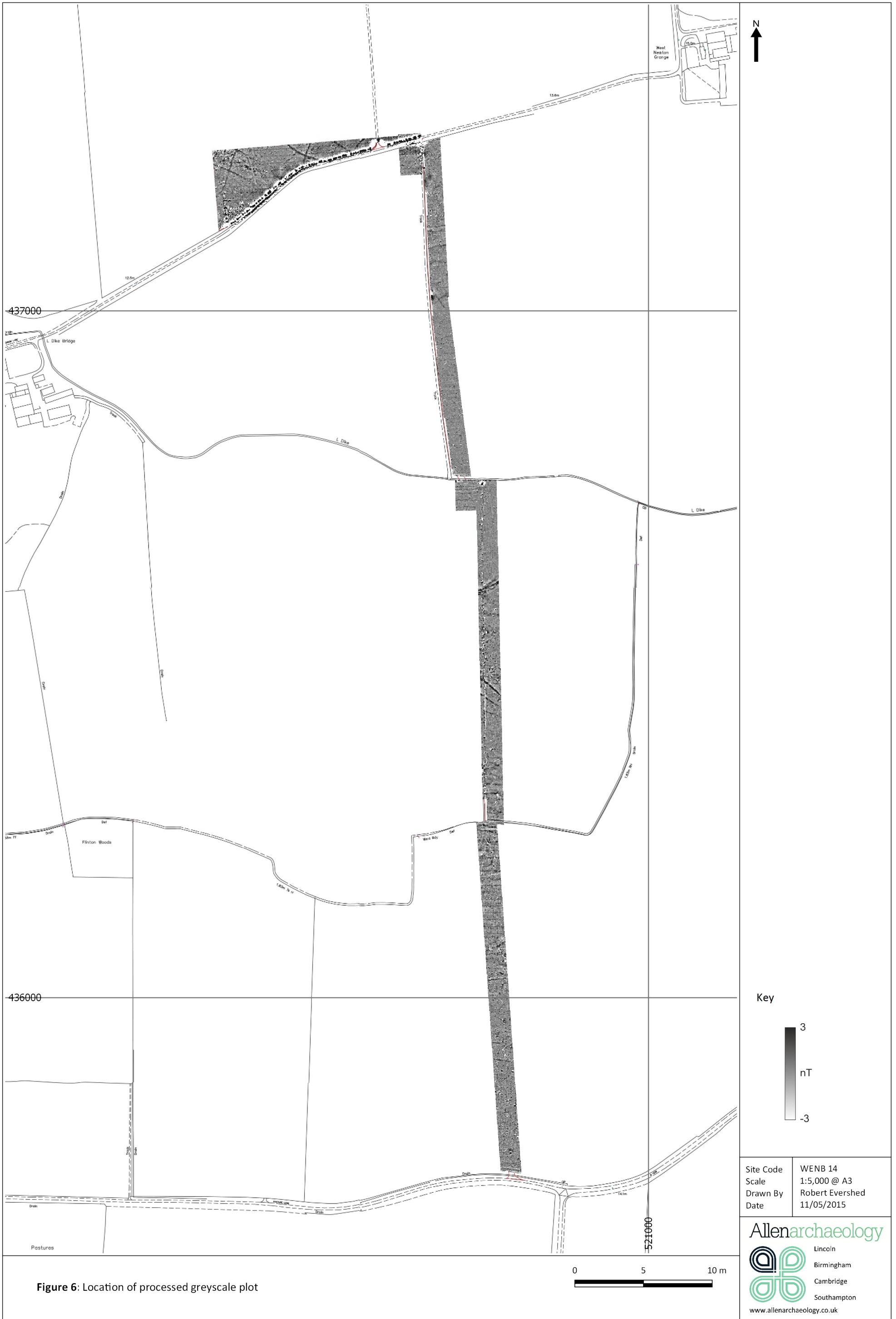


Figure 6: Location of processed greyscale plot

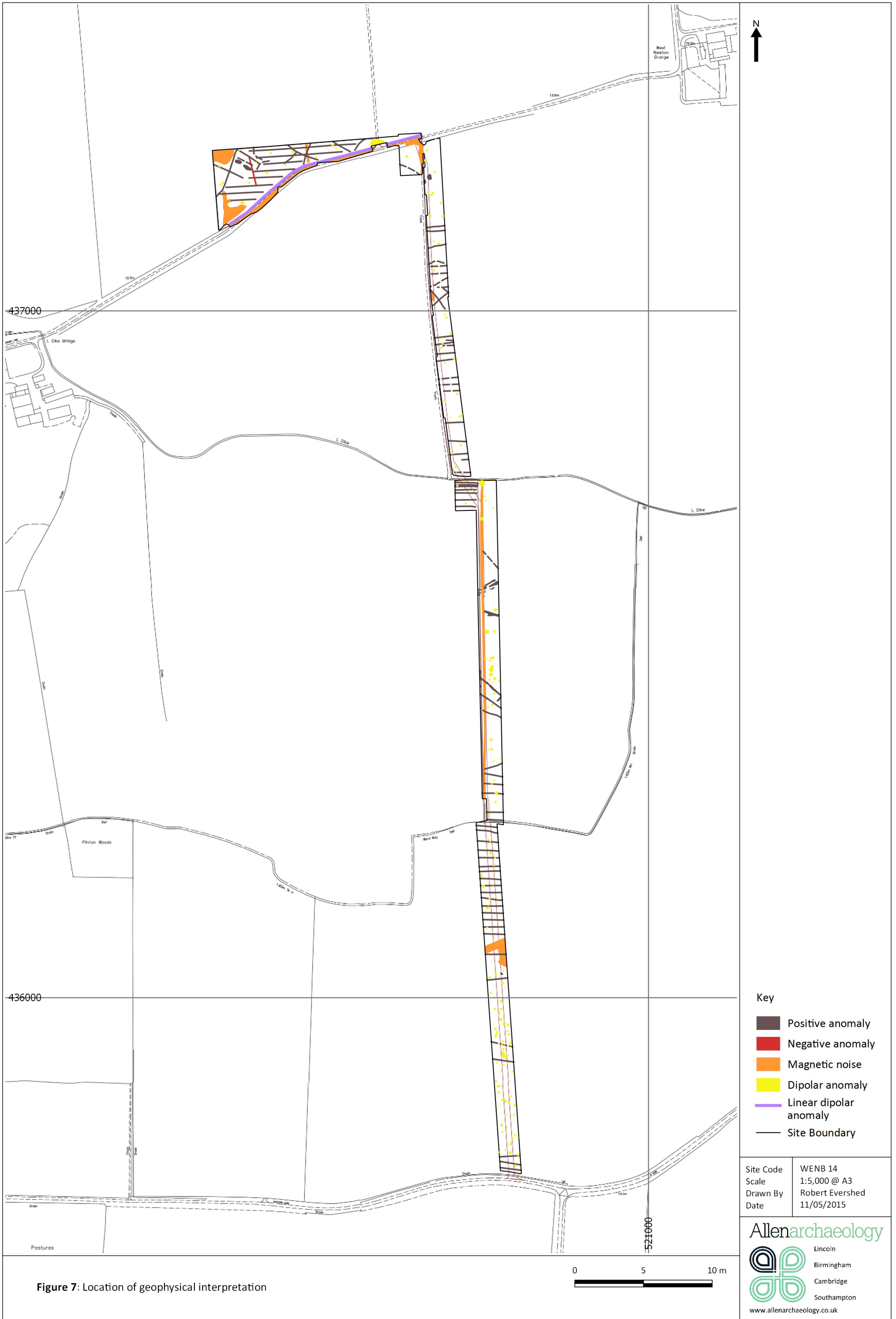


Figure 7: Location of geophysical interpretation

- Key
- Positive anomaly
  - Negative anomaly
  - Magnetic noise
  - Dipolar anomaly
  - Linear dipolar anomaly
  - Site Boundary

Site Code	WENB 14
Scale	1:5,000 @ A3
Drawn By	Robert Evershed
Date	11/05/2015

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