LAND AT
LOUTH ROAD
HORNCASTLE
LINCOLNSHIRE

GEOPHYSICAL SURVEY

Work undertaken for
Larkfleet Homes

Report produced by
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October 2013

National Grid Reference: TF 2630 7047
OASIS Reference No.: archaeol1-162707

APS Report No: 129/13

ARCHAEOLOGICAL
PROJECT
SERVICES

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1. SUMMARY

Detailed magnetic gradiometer survey was undertaken in connection with proposed development on land at Louth Road, Horncastle, Lincolnshire. The survey area totalled some 2.8ha.

Features of potential archaeological origin were sparse within the survey. Of the three linear features recorded all are on very regular straight alignments with a somewhat intermittent and/or bipolar response. The strongest might perhaps represent a former field division, but on the whole these all seem most likely to represent the routes of pipes/services of no great antiquity.

Modern disturbance, possibly due to the dumping/burial of material within the field, is quite widespread, especially in the southwest corner, but the good expression of the traces of medieval ridge and furrow suggests that archaeological features would show within the survey if more widely present.

2. INTRODUCTION

2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive method of archaeological evaluation. Evaluation is defined as *'a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site. If such archaeological remains are present Field Evaluation defines their character and extent, quality and preservation, and it enables an assessment of their worth in a local, regional, national or international context as appropriate'* (IFA 2008).

2.2 Background

Archaeological Project Services was commissioned by Larkfleet Homes to undertake detailed magnetometer survey totalling some 2.8ha on land at Louth Road, Horncastle, Lincolnshire in connection with proposed development of the area. The survey was carried out between the 4th and 7th October 2013.

2.3 Topography and Geology

Horncastle is located 27km east of Lincoln and 29km west of Skegness in the administrative district of East Lindsey, Lincolnshire (Fig. 1).

The site lies on the northern fringe of the town, 1km northeast of the church of Saint Mary, on the west side of Louth Road, at National Grid Reference TF 2630 7047 (Fig. 2).

The survey area lies at c. 35m AOD on ground sloping westward into the valley of the River Bain. Local soils are fine loamy calcareous soils of the Swaffham Prior Association developed on chalky drift above a solid geology of Kimmeridge Clay (Hodge *et al*. 1984, 351; BGS 50000 scale digital geology).

3. GEOPHYSICAL SURVEY

3.1 Methods

Location and layout of the survey area is shown in Figure 2. The field was under stubble and in good condition for survey.

Survey was undertaken in accordance with English Heritage (2008) and IfA (2011) guidelines and codes of conduct.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. This records subtle changes in the magnetic field resulting from differing features in the soil. Changes as small as 0.2 nanoTesla (nT) in an overall field strength of c. 49,000nT can be accurately detected using this instrumentation, although in practice instrument interference and soil noise can limit sensitivity.

Magnetometers measure changes in the Earth's magnetic field. With two sensors configured as a gradiometer the recorded values indicate the difference between two magnetic measurements separated by a fixed distance. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame with a 1m separation between the sensing elements giving a strong response to deep anomalies.

The mapping of anomalies in a systematic manner allows interpretation of the type of material present beneath the surface. Strong magnetic anomalies are generated by buried iron-based objects or by kilns or hearths, usually resulting in a bipolar (positive/negative) response. More subtle positive anomalies representing pits and ditches can be seen where these contain more topsoil which is normally richer in magnetic iron oxides and provides a contrast with the natural subsoil (but this can vary depending on the nature of the underlying deposits). A negative anomaly may result from upcast bank material. Wall foundations can also show as negative anomalies where the stone is less magnetic than the surrounding soil, or as stronger positive and negative anomalies if of brick, but are not always responsive to the technique.

It should be noted that not all features will be responsive and absence of anomalies does not necessarily indicate absence of archaeological features.

Sampling interval and data capture
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid. The Grad 601 has a typical depth of penetration of 0.5m to 1.0m although a greater range is possible where strongly magnetic objects have been buried in the site.

Processing and presentation of results
Processing is performed using specialist ArcheoSurveyor software. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves flattening the background levels with respect to adjacent traverses and adjacent grids (Destripe or zero mean traverse). Despiking is also performed to reduce the effect of the anomalies resulting from small iron objects often found on agricultural land. Further processing can then be carried out which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following are the processing techniques carried out on the processed gradiometer data used in this report:

1. DeStripe (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

2. Despike (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)
Parameters: X radius = 1; Y radius = 1; Threshold = 3SD; Spike replacement = mean

3. Clip (excludes extreme values allowing better representation of detail in the mid range): -15 to 15nT and -10nT to 10nT.

The minimally processed greyscale plots are clipped for display, but otherwise unprocessed. Trace plots are destriped before clipping as the effects of heading errors can produce noticeable offsets in this method of display.

3.2 Results

The presentation of the data for the site involves a print-out of the raw or minimally processed data as greyscale and trace plots (Figs 3, 4), together with greyscale plots of the processed data (Figs 5). Magnetic anomalies have been identified and plotted onto an interpretative drawing (Fig. 6) and are described below.

Linear anomalies
Positive linear anomaly **A**, runs slightly west of north from the southern edge of the field and possibly represents a former ditched boundary, although it appears to fall in with a rather more disturbed and modern-looking linear anomaly **B** close to the centre of the field. **B** shows a somewhat intermittent bipolar response more typical of modern pipes/services, running south-north initially, before turning slightly eastwards in the centre of the field where it meets a further linear anomaly **C**. This shows a somewhat weaker response but runs on a very straight alignment W-E through the centre of the field. A number of strong bipolar anomalies also lie on this line suggesting that it also may result from the presence of a relatively modern pipe or service.

Agricultural response
A pattern of weak, parallel, slightly curving linear response running NE-SW from the Louth road is indicative of the former presence of ridge and furrow cultivation across this area.

Magnetic disturbance
Strong bipolar response is apparent covering a large area in the southwest corner of the field and in more localised areas in the centre and west of the field. Such response can derive from metallic or highly fired material either buried or incorporated into the ploughsoil. Strong individual response (e.g. at **D**, **E**) is more indicative of larger discrete buried items.

Iron spikes (discrete bipolar anomalies)
Iron items within the topsoil give a distinctive localised bipolar (strong positive with associated strong negative) response. Such items usually derive from relatively recent management or agricultural use of the land – broken or discarded pieces of agricultural machinery or other modern debris. These are fairly sparsely scattered across this area.

4. DISCUSSION

Detailed magnetic gradiometer survey was undertaken in advance of proposed development at the site. Features of potential archaeological origin are sparse. Of the three linear features recorded all are on very regular straight alignments with a somewhat intermittent and/or bipolar response. The strongest, **A**, might perhaps represent a former field division, but on the whole these seem most likely to represent the routes of pipes/services of no great antiquity.

Modern disturbance, possibly due to the dumping/burial of material within the field, is quite widespread, especially in the southwest corner, but the good expression of the traces of medieval ridge and furrow suggests that archaeological features would show within the survey if present more widely.

5. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge Dan Endersby of Larkfleet Homes who commissioned the project and arranged access. The work was coordinated by Gary Taylor. The report was edited by Gary Taylor and Tom Lane.

6. PERSONNEL

Project coordinator: Gary Taylor
Geophysical Survey: Neil Jefferson, Jonathon Smith
Survey processing and reporting: Steve Malone

7. BIBLIOGRAPHY

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

Hodge, CAH., Burton, RGO., Corbett, WM., Evans, R., and Seale, RS, 1984 *Soils and their use in Eastern England*, Soil Survey of England and Wales 13

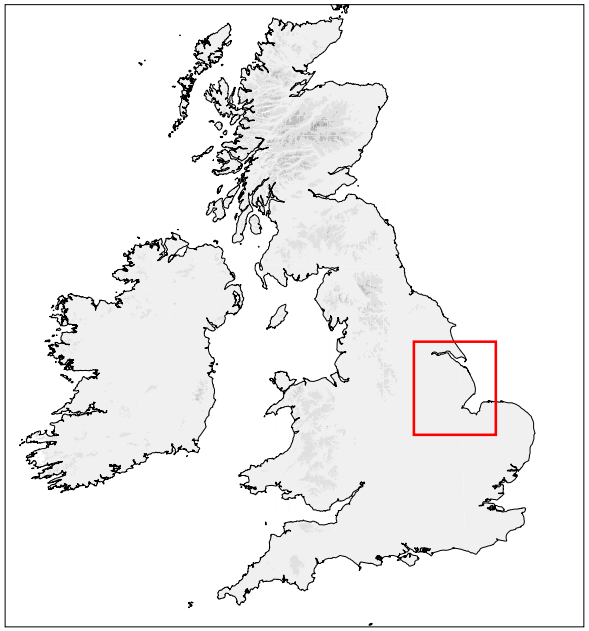
IfA, 2008 *Standard and Guidance for Field Evaluation.*

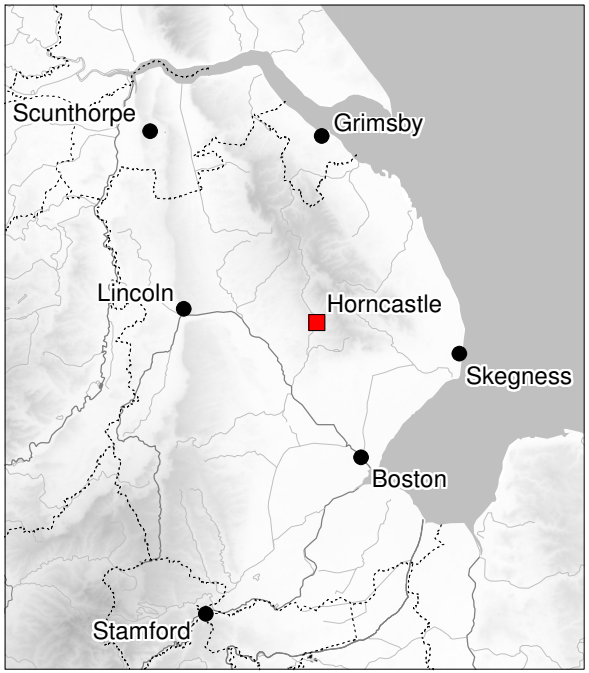
IfA, 2011 *Standard and Guidance for Geophysical Survey.*

8. ABBREVIATIONS

BGS British Geological Survey

IfA Institute for Archaeologists





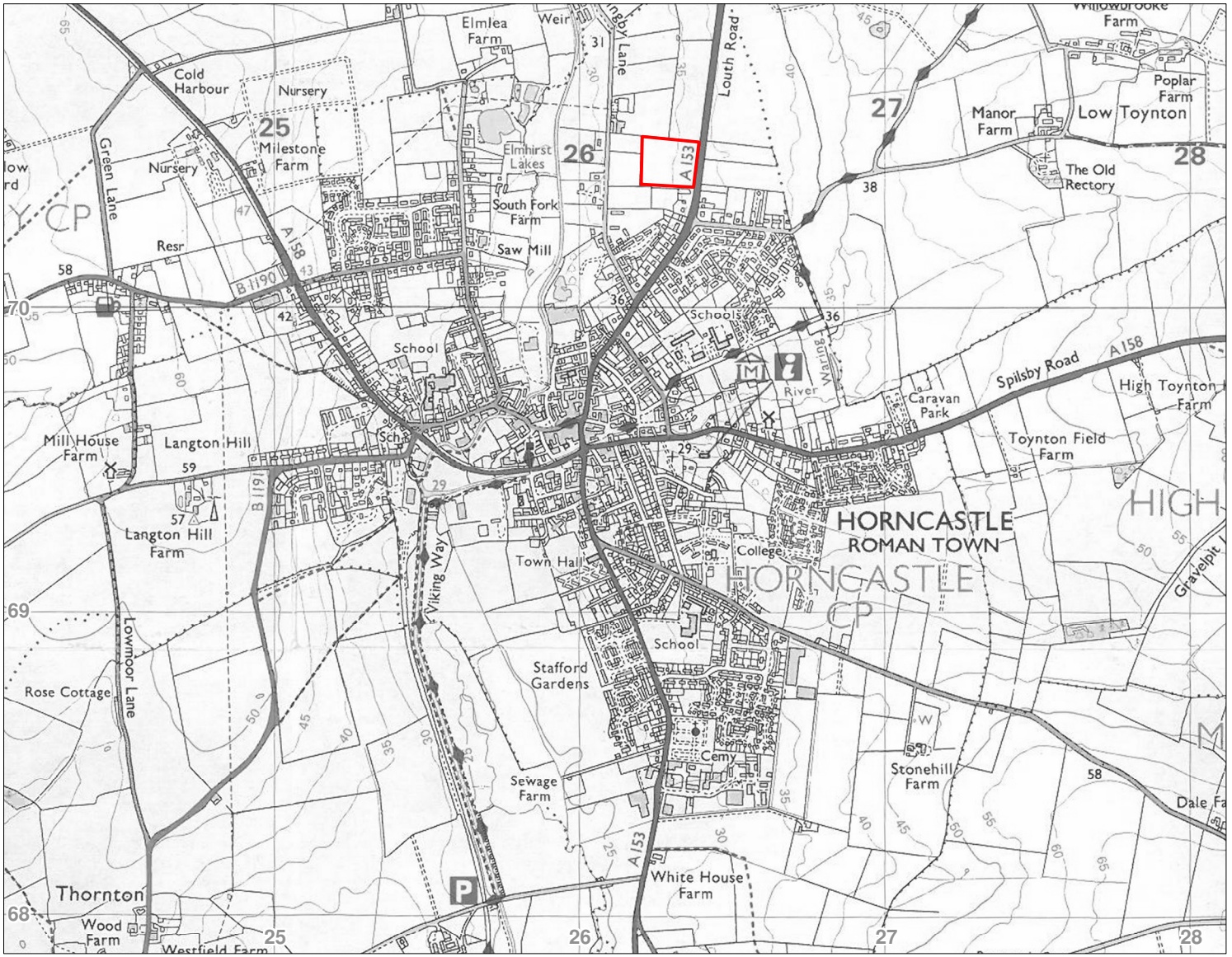


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Figure 1 Site location map

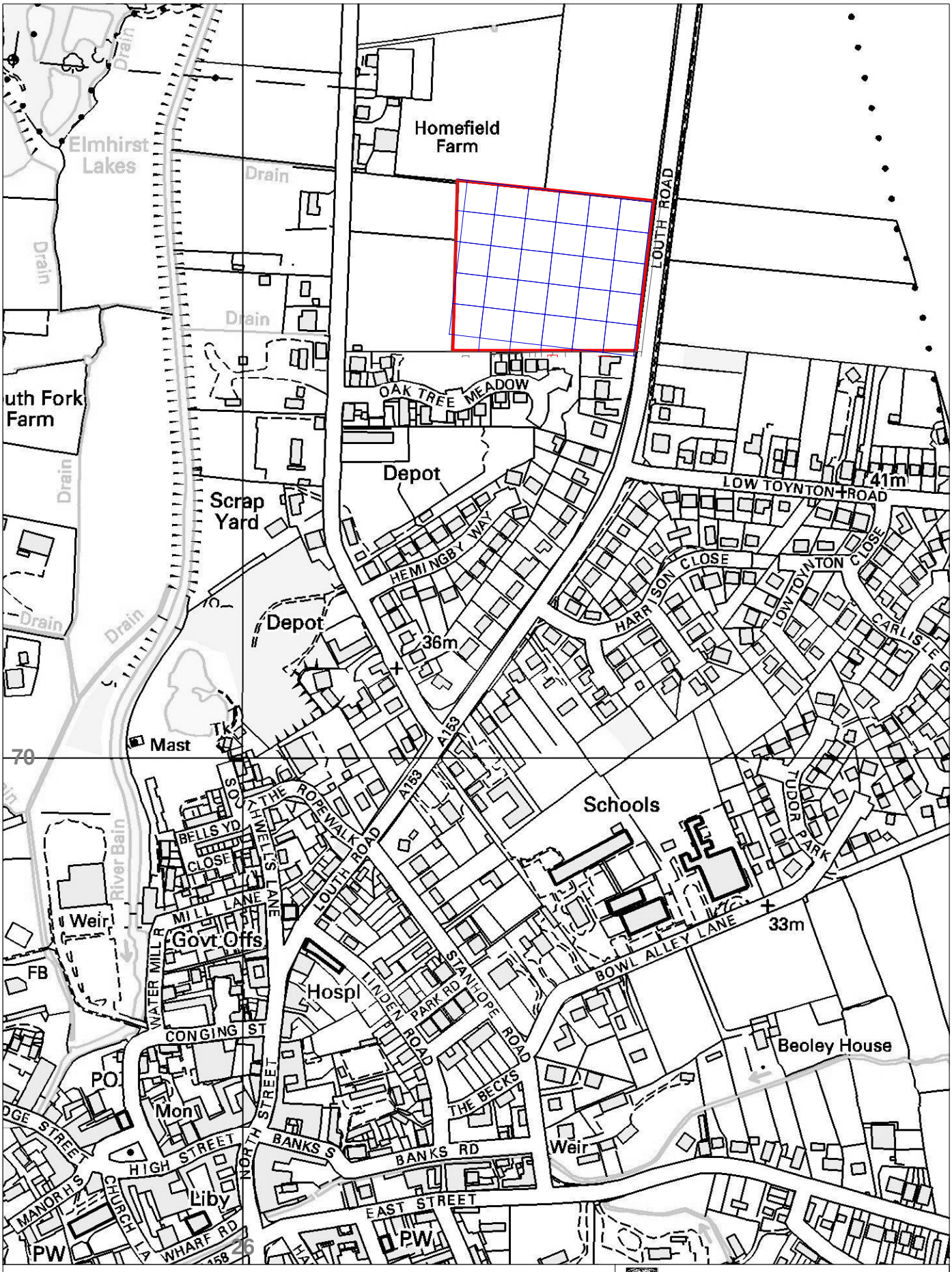


Figure 2 Location and layout of survey area

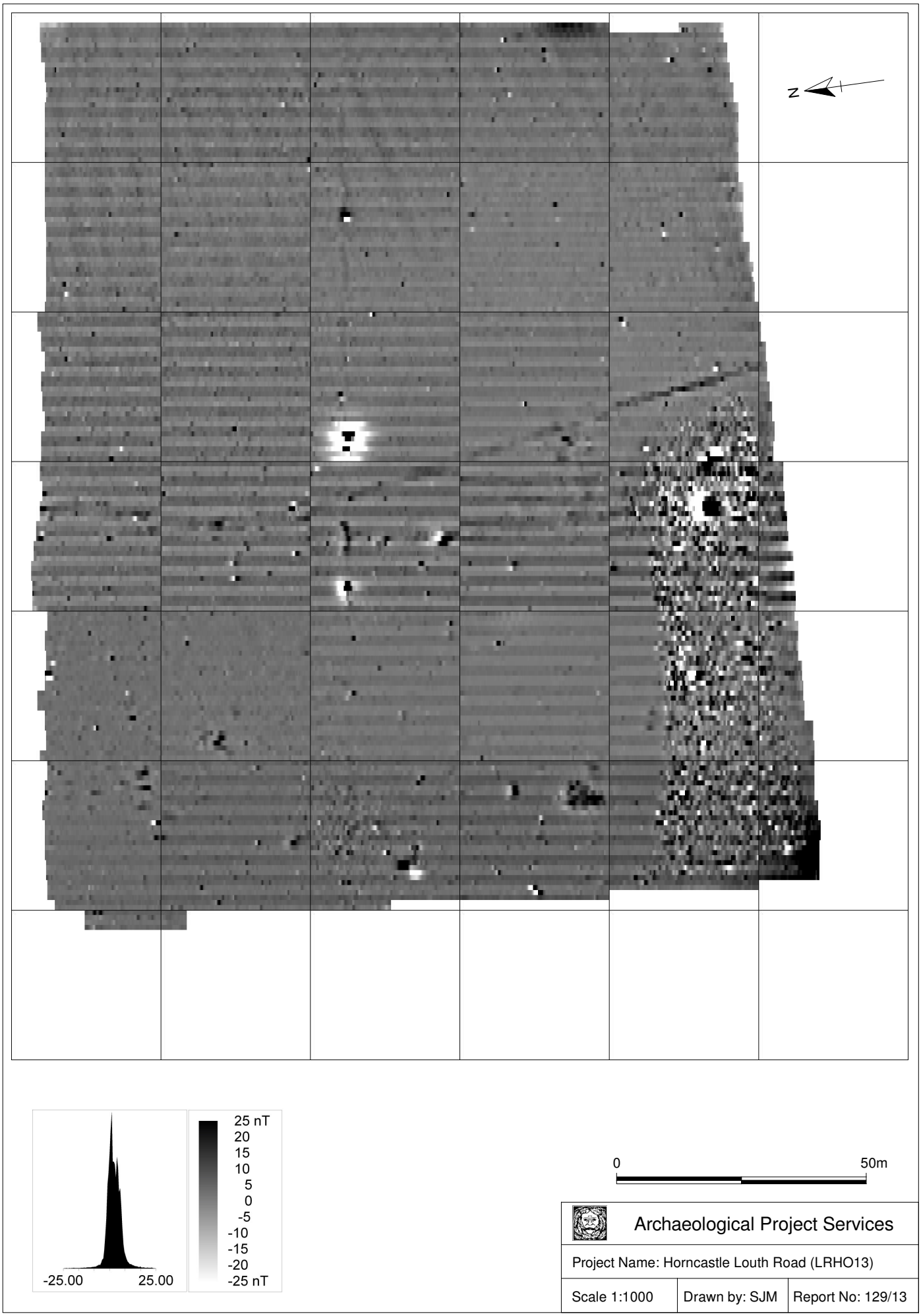


Figure 3 Minimally processed data greyscale plot

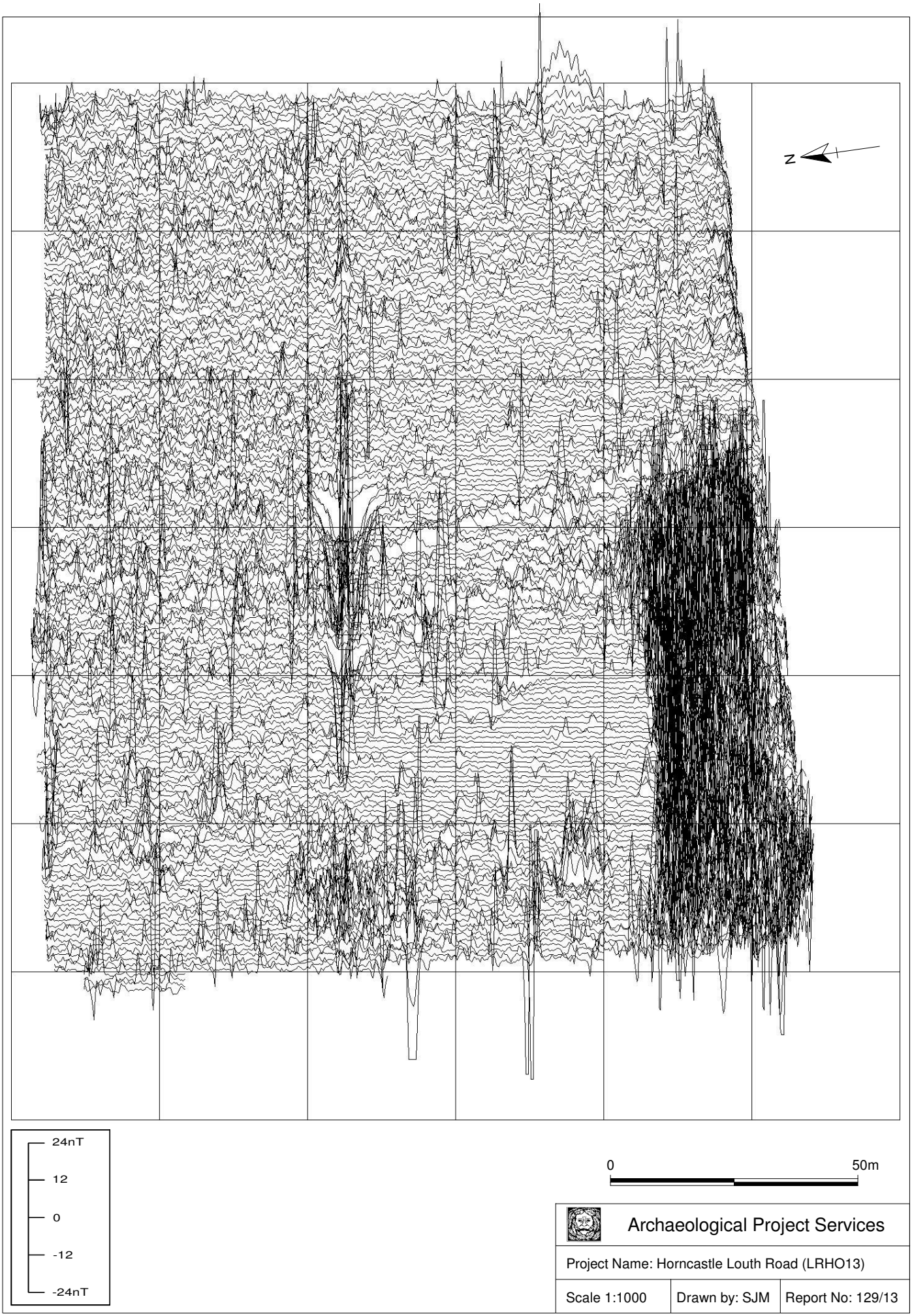
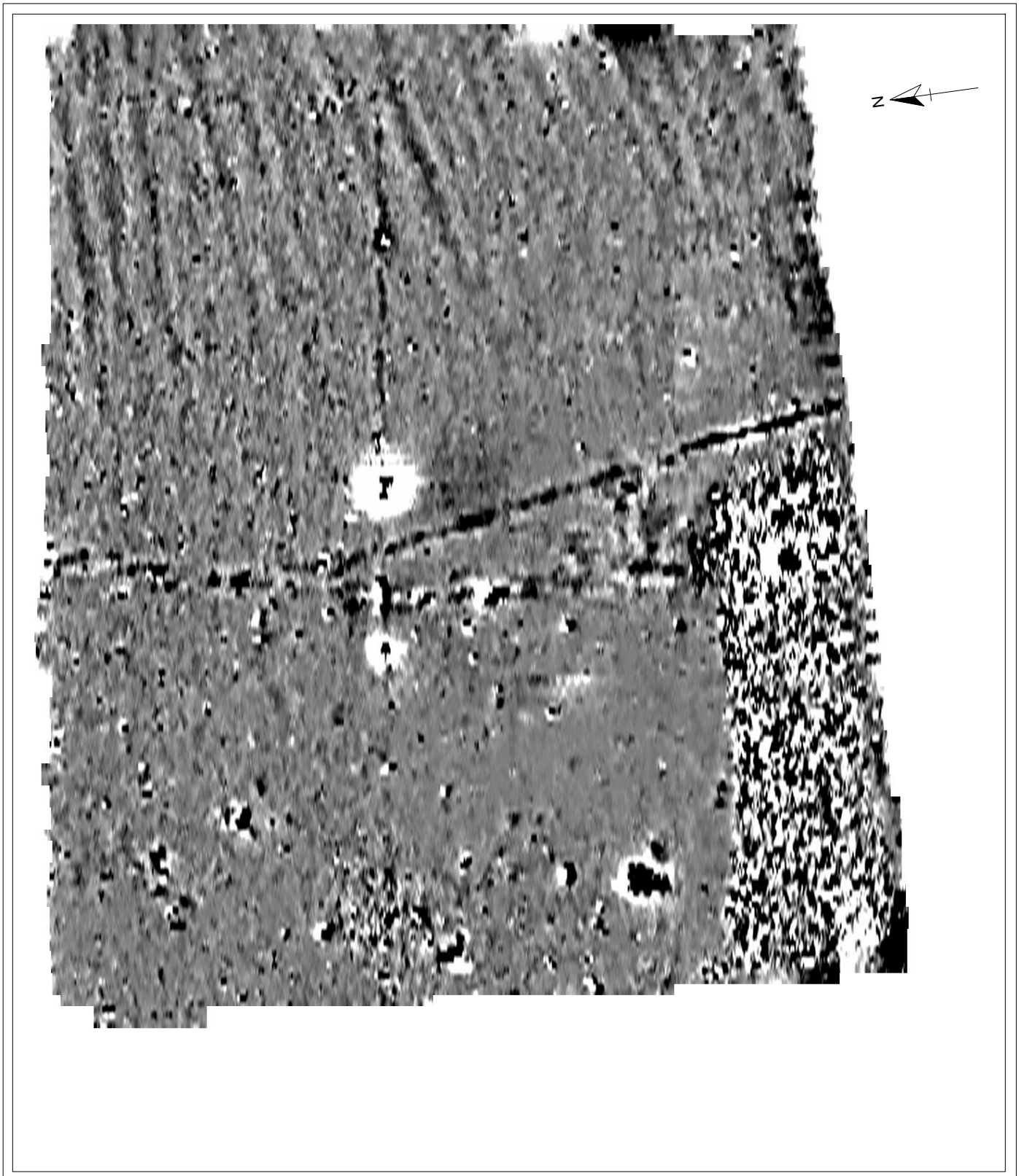
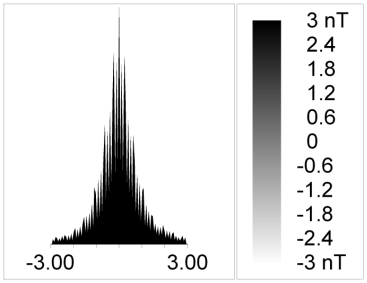


Figure 4 Minimally processed data trace plot





0 50m

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Figure 5 Processed data greyscale plot

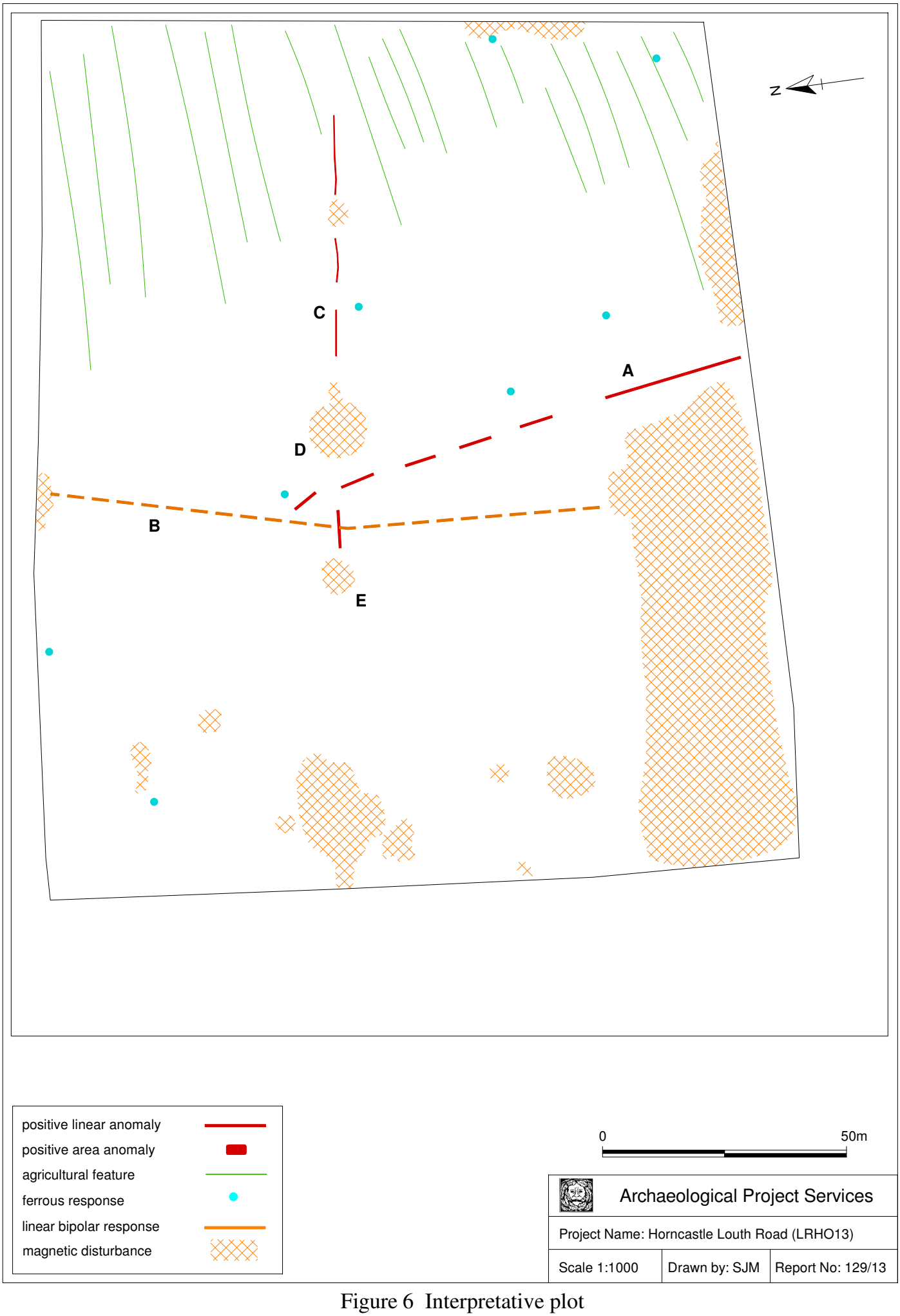

Figure 6 Interpretative plot

Appendix 1
THE ARCHIVE

The archive consists of:

2 Daily record sheets
1 Report text and illustrations
Digital data

File names	Grid files sequentially numbered: HOLR13-1.xgd to HOLR13-36.xgd		Composite files HOLR13-c1.xcp
Explanation of codes used in file names	xgd files are magnetometer grids, named with site code and number in the order surveyed. xcp files are composites containing record of all the data and processes used to produce the end product		
Description of file formats	All files are in plain text xml format with header data defining survey and processing parameters		
List of codes used in files	D indicates a "dummy" value within the composite data		
Hardware, software and operating systems	ArcheoSurveyor 2.5.19 running under Windows 7		
Date of last modification	25/10/13		
Indications of known areas of weakness in data			

All primary records are currently kept at:

Archaeological Project Services, The Old School, Cameron Street, Heckington, Sleaford, Lincolnshire NG34 9RW

The ultimate destination of the project archive is:

The Collection
Art and Archaeology in Lincolnshire
Danes Terrace
Lincoln
LN2 1LP

Archaeological Project Services Site Code: HOLR13

Museum Accession No: LCNCC:2013.172