
**LAND AT
CALVERT/GREATMOOR
BUCKINGHAMSHIRE
GEOPHYSICAL SURVEY**

**Work undertaken for
Waste Recycling Group**

October 2011

**Report produced by
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**ARCHAEOLOGICAL
PROJECT
SERVICES**



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1. SUMMARY

Detailed magnetic gradiometer survey was undertaken on behalf of the Waste Recycling Group on c. 12ha of land, a 50% sample of the 24.5ha site of their proposed Energy from Waste (EfW) facility and associated works at Greatmoor, Calvert, Buckinghamshire.

The surveys at Calvert/Greatmoor identified few anomalies of potential significance. One linear feature is recorded in Area 1, but this is very straight and matches well the position of a track on earlier Ordnance Survey mapping. Earlier field divisions known from this mapping in Areas 1 and 2 were not picked up by the survey. However, differences in response in some areas may reflect earlier subdivision, and infill of former ponds shown on this mapping produced strong responses. A positive linear response in the northwest of Area 3 may indicate the line of a ditched feature here. Other indications are weak and discontinuous or isolated, forming no obvious pattern.

2. INTRODUCTION

2.1 Definition of Geophysical Survey

Geophysical survey is a non-intrusive method of archaeological evaluation which 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 SLR Consulting on behalf of Waste Recycling Group to undertake detailed magnetometer survey on some 12ha of land (a 50% sample of the 24.5ha total) at Calvert/Greatmoor, Buckinghamshire. The surveys were carried out between the 2nd August and 2nd September 2011.

2.3 Topography and Geology

Calvert is located in Charndon parish, 10km south of Buckingham and 15km northwest of Aylesbury in the Aylesbury Vale District of Buckinghamshire (Fig. 1). Greatmoor lies southeast of the Calvert waste facility within Grendon Underwood Parish at SP 4704 2223.

The site is situated in a gently rolling landscape with land generally falling from east (78m AOD) to west (74m AOD). Local soils are clayey soils of the Denchworth Association (Hodge *et al.* 1984, 155) developed on mudstones of the Oxford Clay Formation.

Survey was undertaken in three areas, the IBA Processing Plant, the EfW Development area and the Pit 6 Extension Area. For the purposes of this report these areas will hereafter be referred to as Areas 1, 2 and 3 respectively. Areas 1 and 2 lie west and north of Lower Greatmoor Farm; Area 3 lies immediately adjacent to the landfill site and former clay pits (Fig. 2).

2.4 Archaeological Setting

There are no recorded heritage assets within the proposed development areas. Dispersed prehistoric activity has been recorded within the area with Iron Age activity focussed around the A41, 5km to the south, at Newhouse Farm.

The A41 follows the line of Akeman Street, a principal Roman road leading to the town of Alchester, just south of Bicester, some 12km to the west. Contemporary settlement has been identified through archaeological excavation at Grendon Underwood and at Quainton, 2-3km from the site. Surface artefact scatters more widely in the landscape indicate the presence of a population at this time.

Evidence for early medieval activity is very limited locally. By the medieval period a network of roads, manors, moated homesteads, hamlets and villages emerges surrounding Akeman Street. The investigation areas lie at some remove from these medieval foci of settlement.

3. AIMS

The aim of the surveys was to locate any features of possible archaeological significance within designated areas in order to inform management of the archaeological resource at the site.

4. GEOPHYSICAL SURVEY

4.1 Methods

Location and layout of survey areas are shown in Figures 2, 10 and 15. In accordance with the SLR written scheme of investigation (SLR 2011) and APS detailed methodology (APS nd), survey was undertaken of a 50% sample of the investigation areas with the intention of moving to 100% if the initial surveys proved productive. The 50% sample was achieved by laying out transects 30m wide across each area and surveying alternate transects. These transects were laid out perpendicular to the longest straight boundary in each of the three surveyed

areas. The areas were staked out to form a grid with each square measuring 30m by 30m. The individual grid squares were then subdivided into 15 transects measuring 2m in width. Weather and ground conditions during the survey were generally dry. Areas 1 and 2 were under stubble and in good condition for survey. Area 3 had been under grass and had been recently mown, but field boundaries here were very overgrown and much wider than depicted on available mapping.

Survey was undertaken in accordance with English Heritage (2008) and IfA (2010) guidelines and codes of conduct.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, 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.

The mapping of anomalies in a systematic manner allows an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies representing pits and ditches can be seen where they 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). Wall foundations can 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.

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.

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.

Readings are logged consecutively into the data logger which is downloaded daily either into a portable computer whilst on site or directly to the office computer. At the end of each job, data is transferred to the office for processing and presentation.

Processing and presentation of results

Processing is performed using specialist ArchaeoSurveyor 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. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following shows 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): -3 to 3nT.

4.2 Results

The presentation of the data for the site involves a print-out of the raw data as greyscale and trace plots (Figs 3, 4, 6, 7, 11, 12; clipped to +/-100nT for display but otherwise unprocessed), together with greyscale plots of the processed data (Figs 5, 8, 9, 13, 14). Magnetic anomalies have been identified and plotted onto interpretative drawings (Fig. 10, Areas 1 and 2; Fig. 15, Area 3) and are described below.

Linear positive anomalies

Few positive linear anomalies can be seen. At Greatmoor a short length **A** is visible at the southwest corner of Area 1. Although only some 2m in width, this can be seen to match the location of a track shown on earlier Ordnance Survey mapping. In the western corner of Area 3 a rather weak and discontinuous feature **H** is recorded, probably representing a ditch feature. Another possible short length can be seen further east at **I**.

Discrete positive anomalies

A small number of discrete positive

responses (**J**, **K**) within the eastern part of Area 3 may indicate isolated pit features. These show elevated responses but not so strong as the bipolar responses suggestive of relatively recent disturbance.

Linear negative anomalies

Two short parallel negative anomalies are highlighted at **L** in the eastern part of Area 3. These may reflect agricultural features but not enough can be seen to establish a pattern (see below: ridge and furrow tends to give rise to alternating positive and negative responses, but where weak both may not be equally expressed).

Agricultural features

Parallel trends **M** visible in the centre of Area 3 may reflect prior agricultural use of the land (ridge and furrow) but these are very faint and not widespread enough to have great confidence in the apparent pattern.

Modern/magnetic disturbance

Strong bipolar variations are evident at various points within the survey and have a variety of causes. **B** and **C** in Area 2 match the locations of earlier mapped ponds; **D** in Area 1 is more diffuse but does perhaps reflect different land use as this area was once separately enclosed. **E**, **F** and **G** are caused by metal caps of water monitoring dipwells. Further disturbance at the eastern end of Area 2 close to Upper Greatmoor Farm is possibly due to accumulation of material beneath the tree here and to the presence of farm machinery parked at the field entrance. A pipeline **N** crosses the north of Area 3 giving rise to strong responses. A weaker linear response just to the east perhaps also reflects some modern disturbance (drainage perhaps).

Iron spikes (discrete bipolar anomalies)

Iron items within the topsoil give a distinctive localised bipolar (strong

negative and positive) 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 widely scattered across the survey area.

Geological variation

A diffuse area of elevated readings **O** occurs alongside a field drain in the north of Area 3 perhaps indicating some earlier origin such as a natural watercourse.

5. DISCUSSION

Magnetic survey at Calvert/Greatmoor identified few anomalies of potential significance. One linear feature is recorded in Area 1, but this is very straight and matches well the position of a track on earlier Ordnance Survey mapping. Earlier field divisions known from this mapping in Areas 1 and 2 were not picked up by the survey (many that do survive are simply hedged boundaries, so there may be little remnant of those since removed). However, differences in response in some areas may reflect earlier subdivision and infill of former ponds shown on this mapping produced strong responses. A positive linear response in the northwest of Area 3 may indicate the line of a ditched feature here. Other indications are weak and discontinuous or isolated, forming no obvious pattern. Fainter parallel trends in some areas may reflect earlier agricultural use on a different layout but the pattern is not extensive enough for any firm conclusion.

Few features can be confidently ascribed an archaeological origin with the probable ditch at the westernmost end of Area 3 the most likely such.

6. ACKNOWLEDGEMENTS

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7. PERSONNEL

Project coordinator: Steve Malone
 Geophysical Survey: Steve Malone, Jonathon Smith, Bryn Leadbetter.
 Survey processing and reporting: Steve Malone

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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**

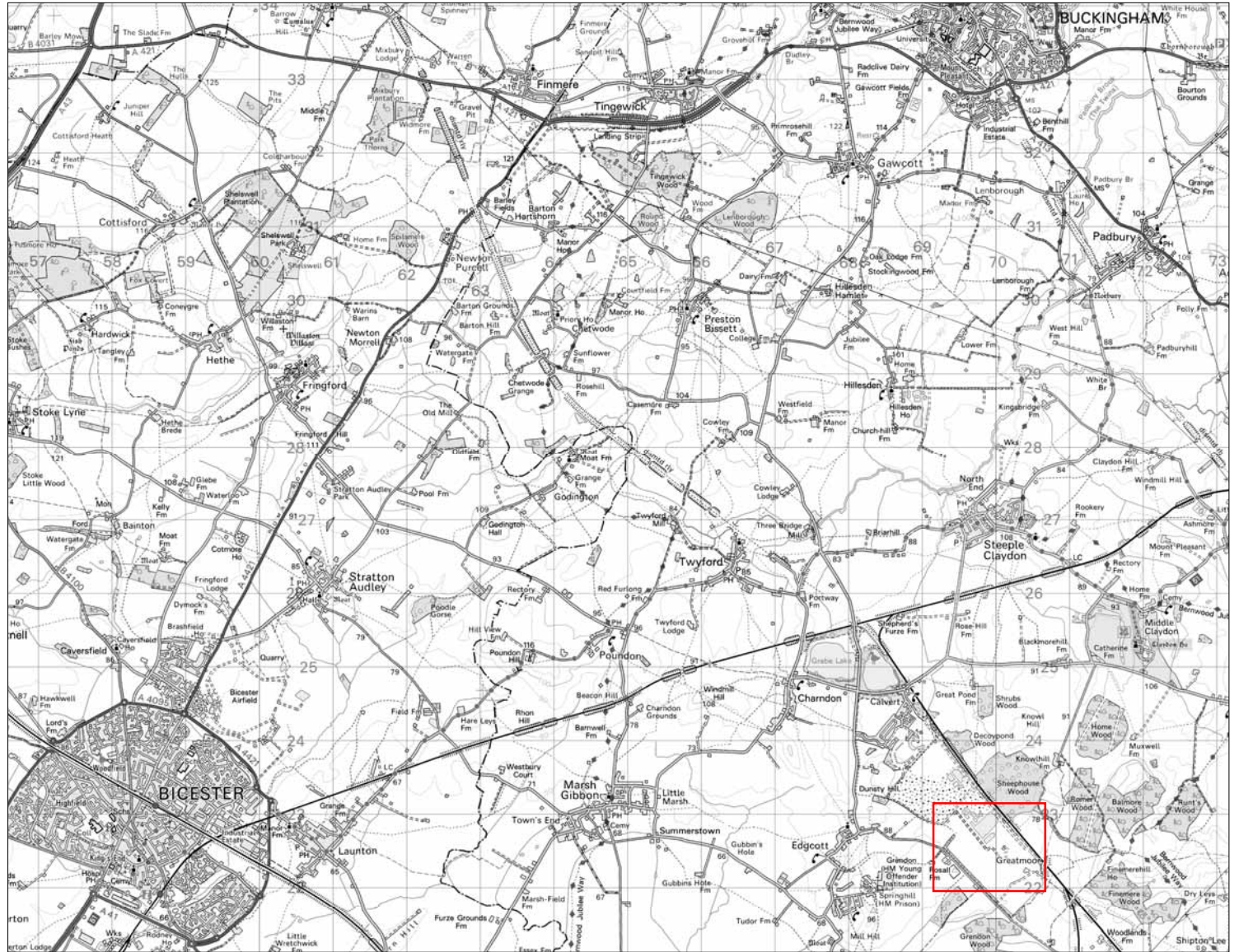
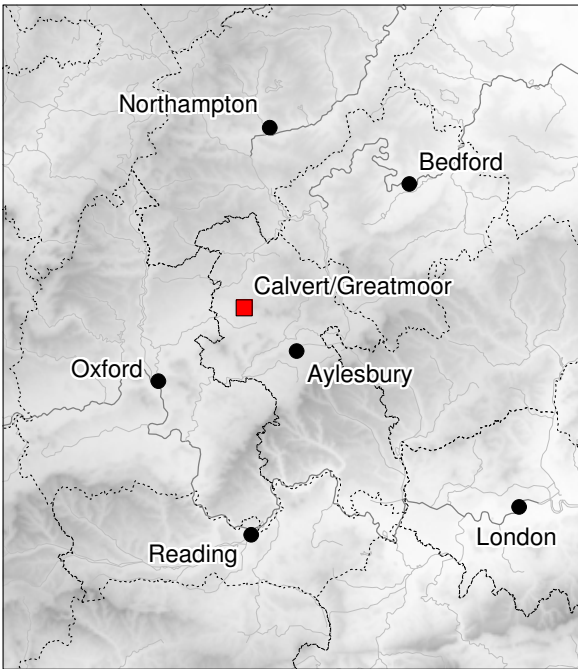
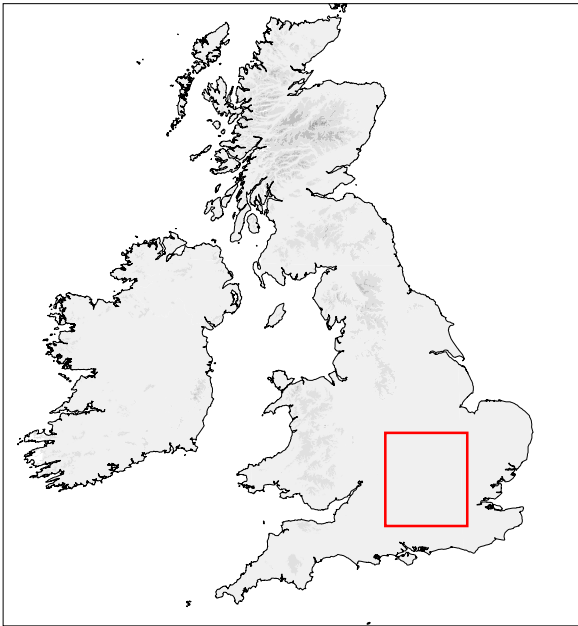
IfA, 2008 *Standard and Guidance for Archaeological Field Evaluation*

IfA, 2010 *Draft Standard and Guidance for Geophysical Survey*

SLR, 2011 *Greatmoor EfW, Calvert, Buckinghamshire Archaeological Written Scheme of Investigation SLR Ref: 411-*

9. ABBREVIATIONS

APS	Archaeological Project Services
BGS	British Geological Survey
EH	English Heritage
IfA	Institute for Archaeologists
HER	Historic Environment Record
SM	Scheduled Monument



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 Archaeological Project Services		
Project: Calvert/Greatmoor Geophysics		
Scale: varies	Drawn by: SJM	Report No: 109/11

Figure 1 Site location map

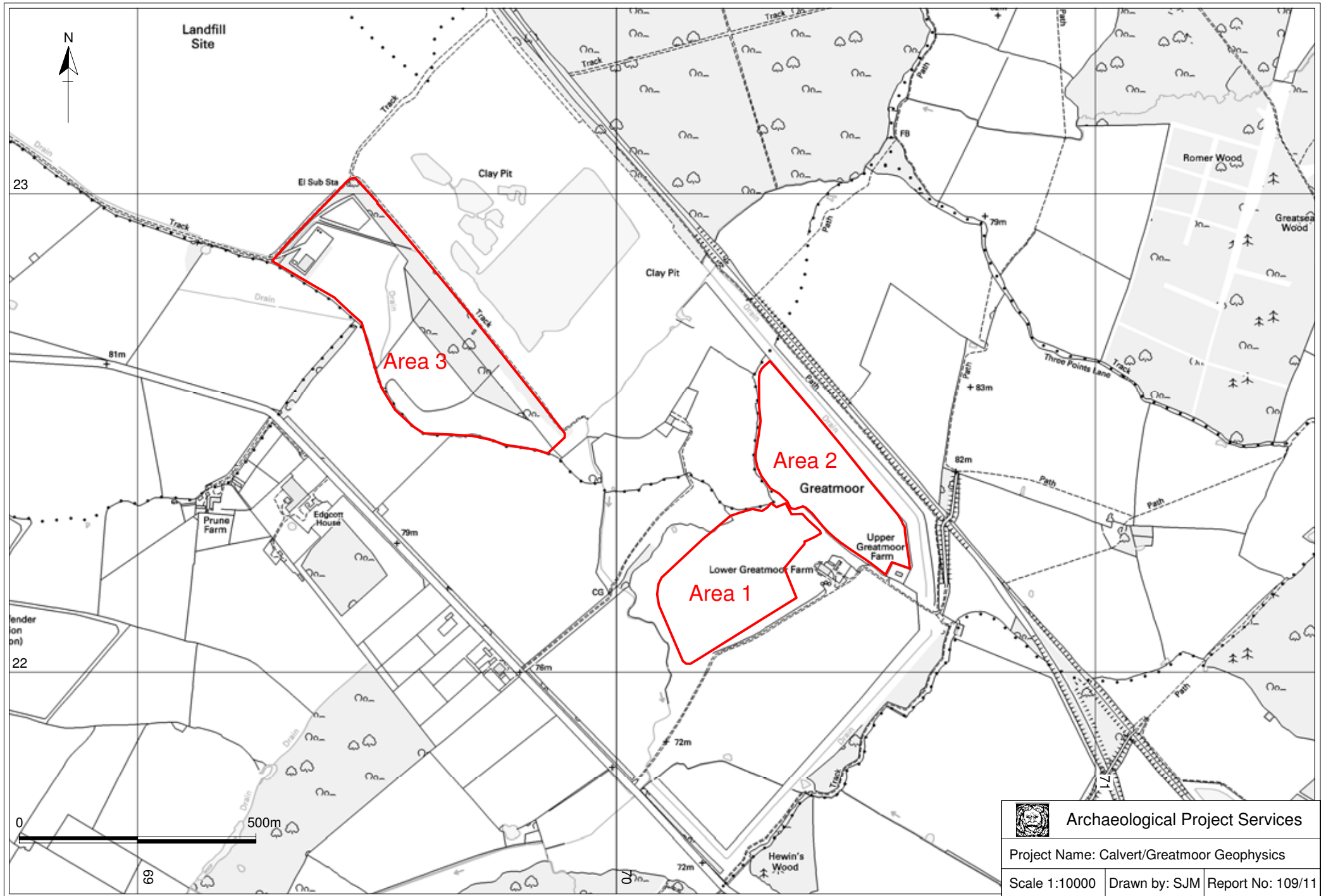
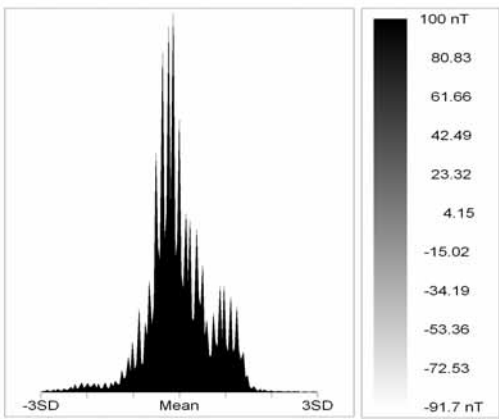
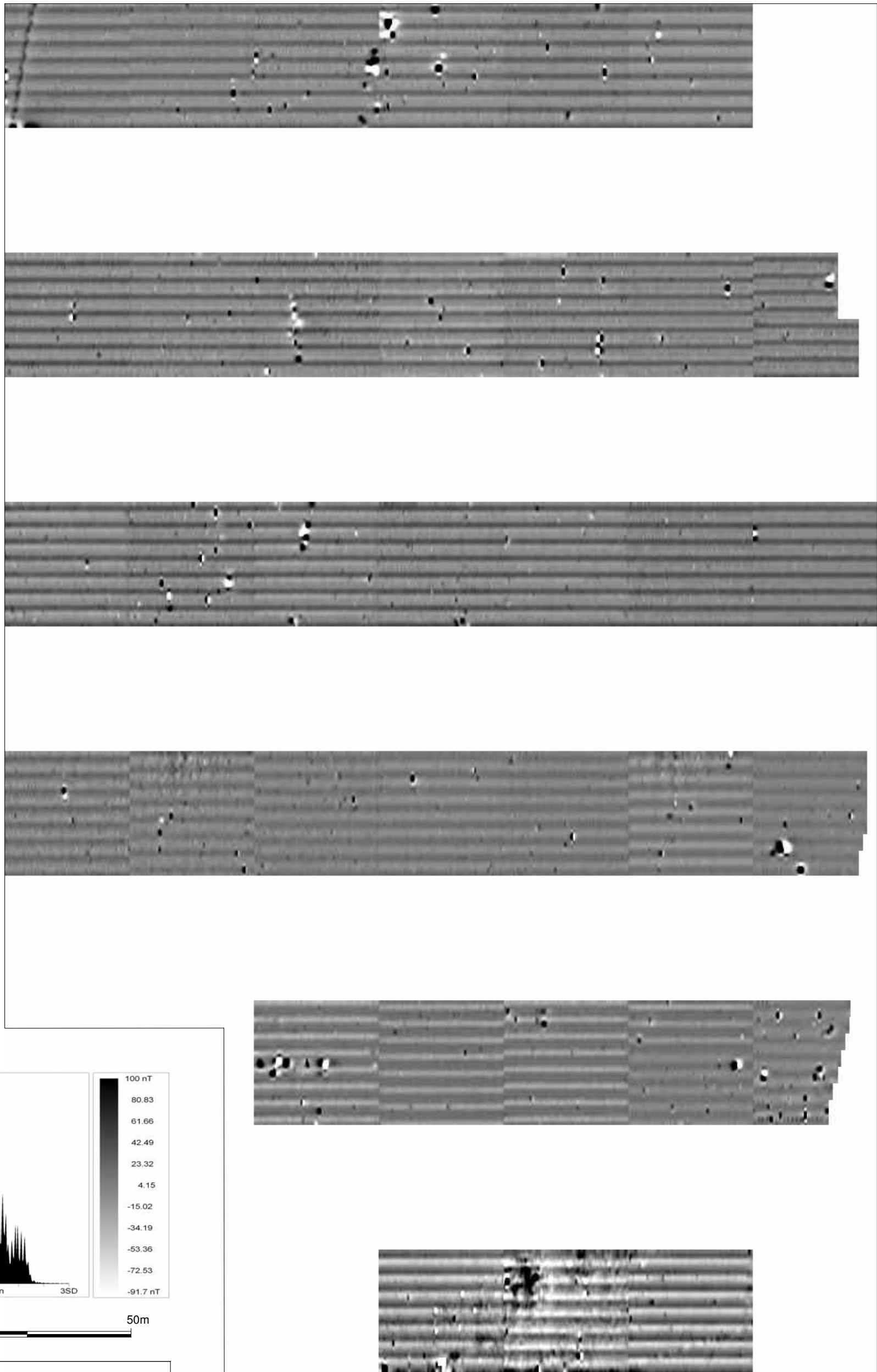
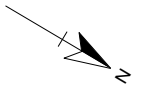


Figure 2 Location of survey areas



0 50m


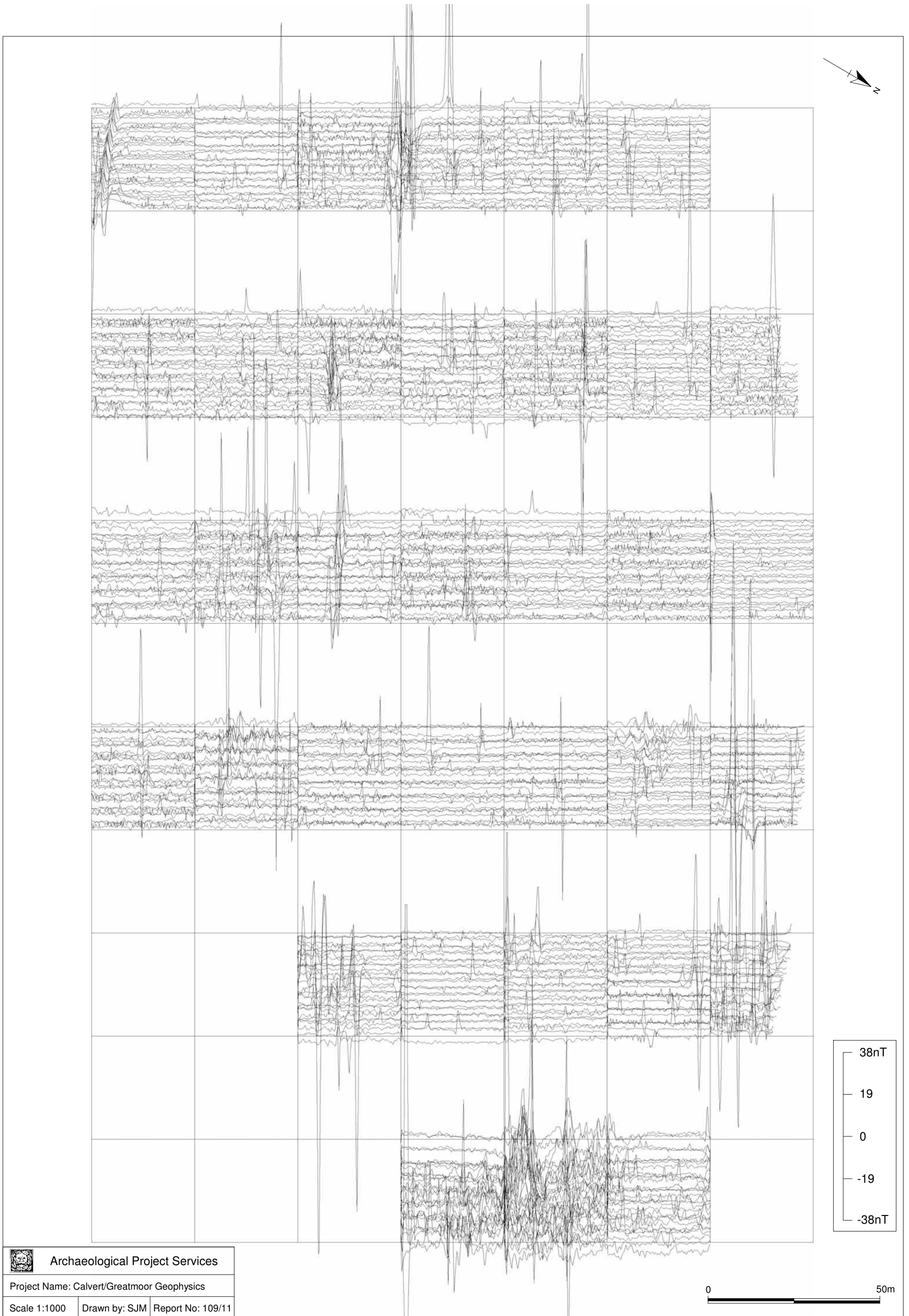
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Figure 3 Area 1 unprocessed greyscale plot - clip +/-100nT

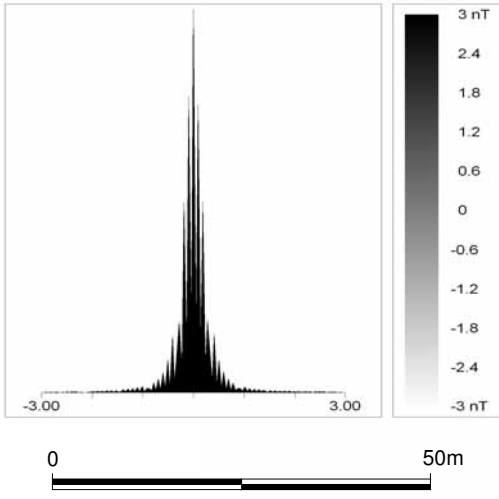
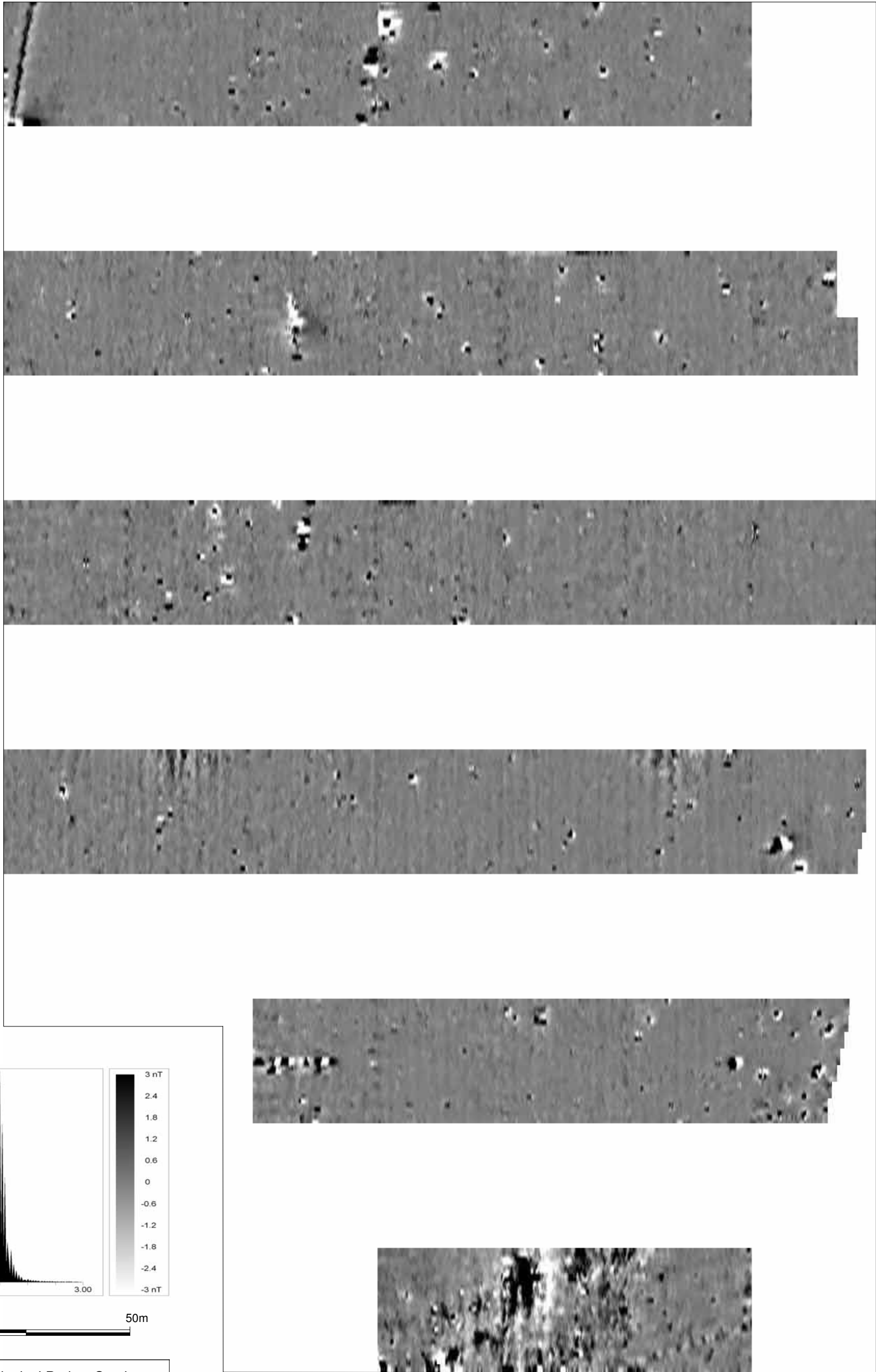
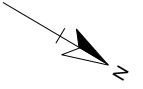


Archaeological Project Services

Project Name: Calvert/Greatmoor Geophysics

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Figure 4 Area 1 unprocessed data trace plot




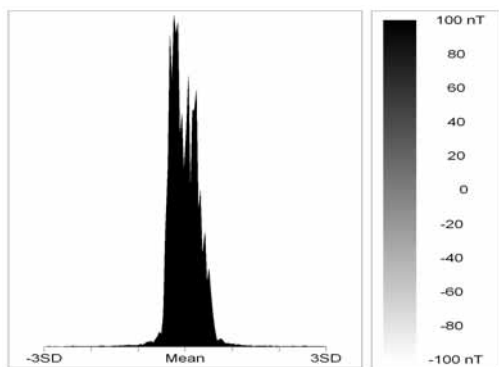
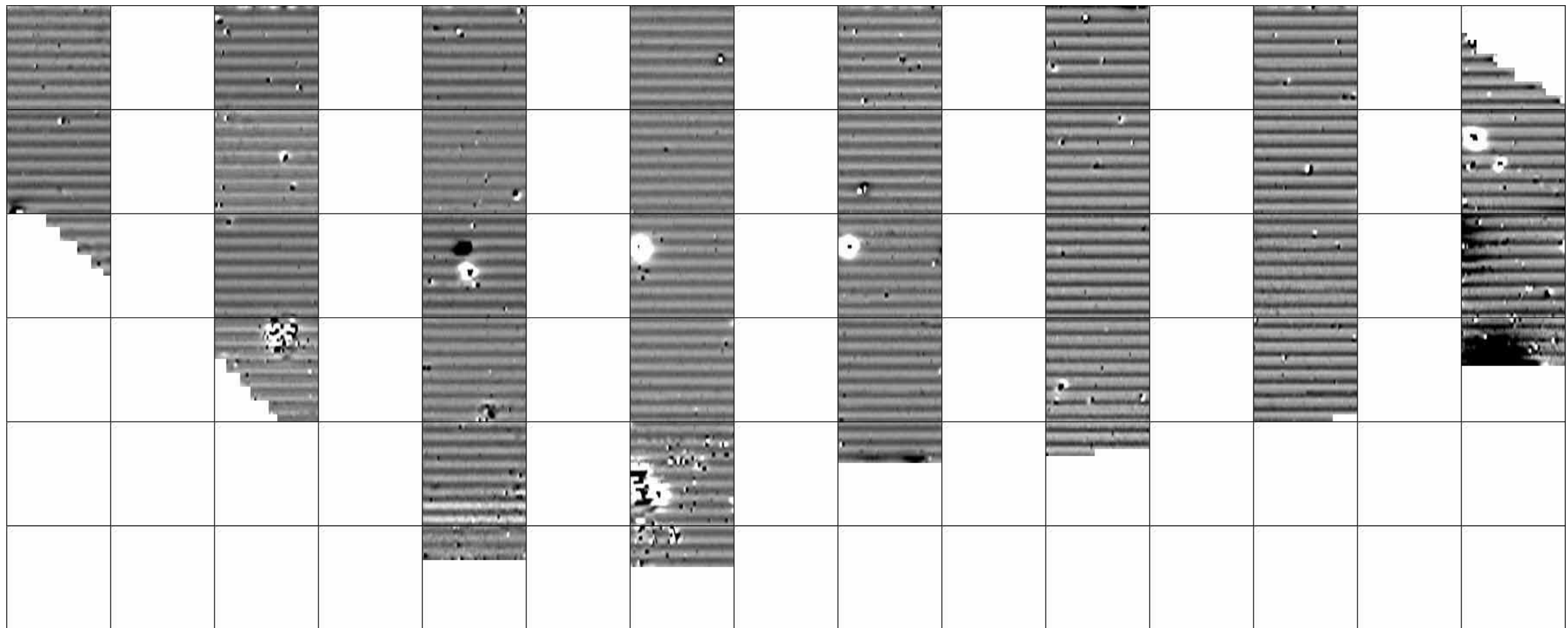
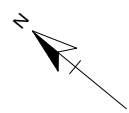
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Figure 5 Area 1 processed greyscale plot - clip +/-5nT




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Figure 6 Area 2 unprocessed data greyscale plot

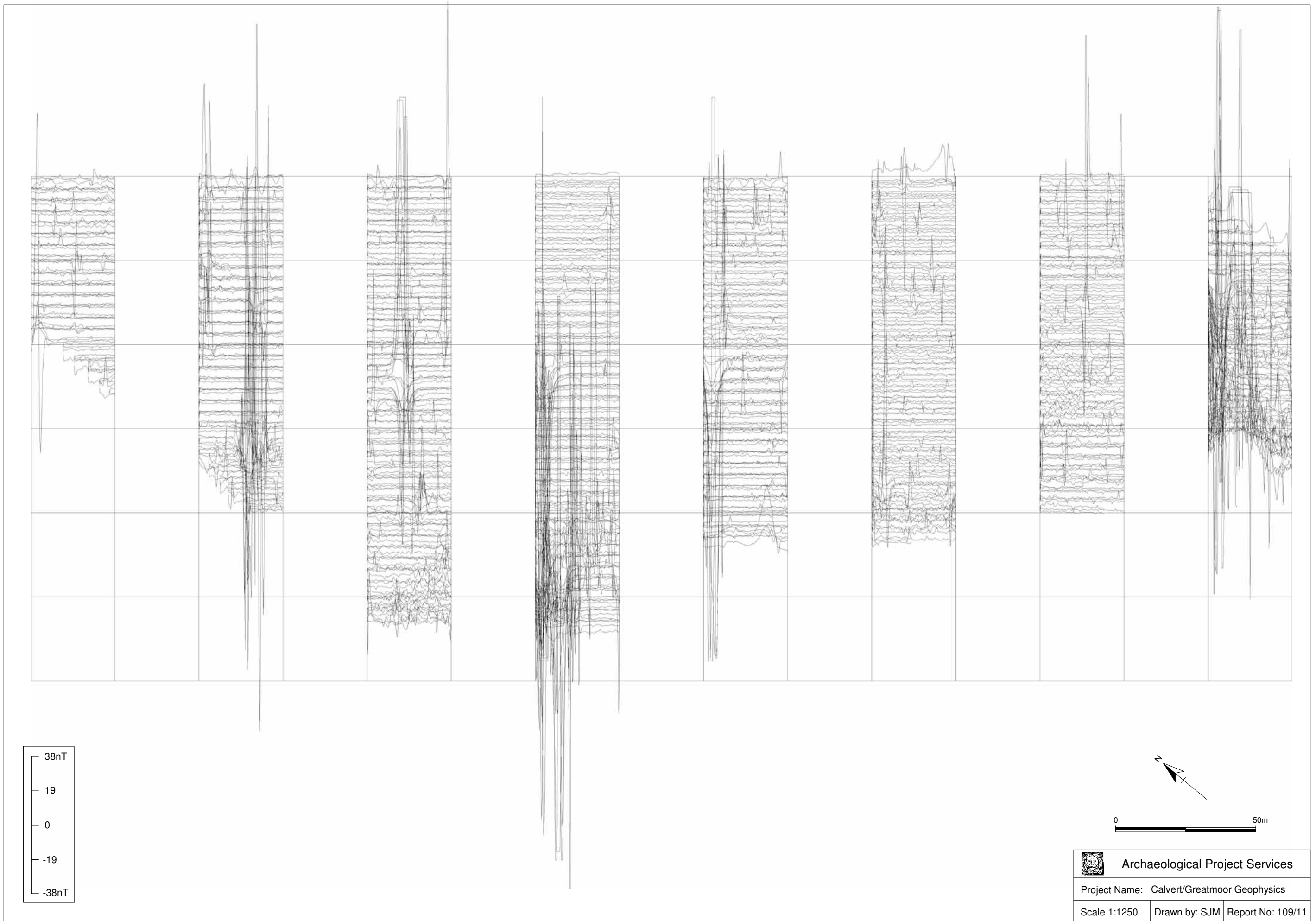


Figure 7 Area 2 unprocessed data trace plot

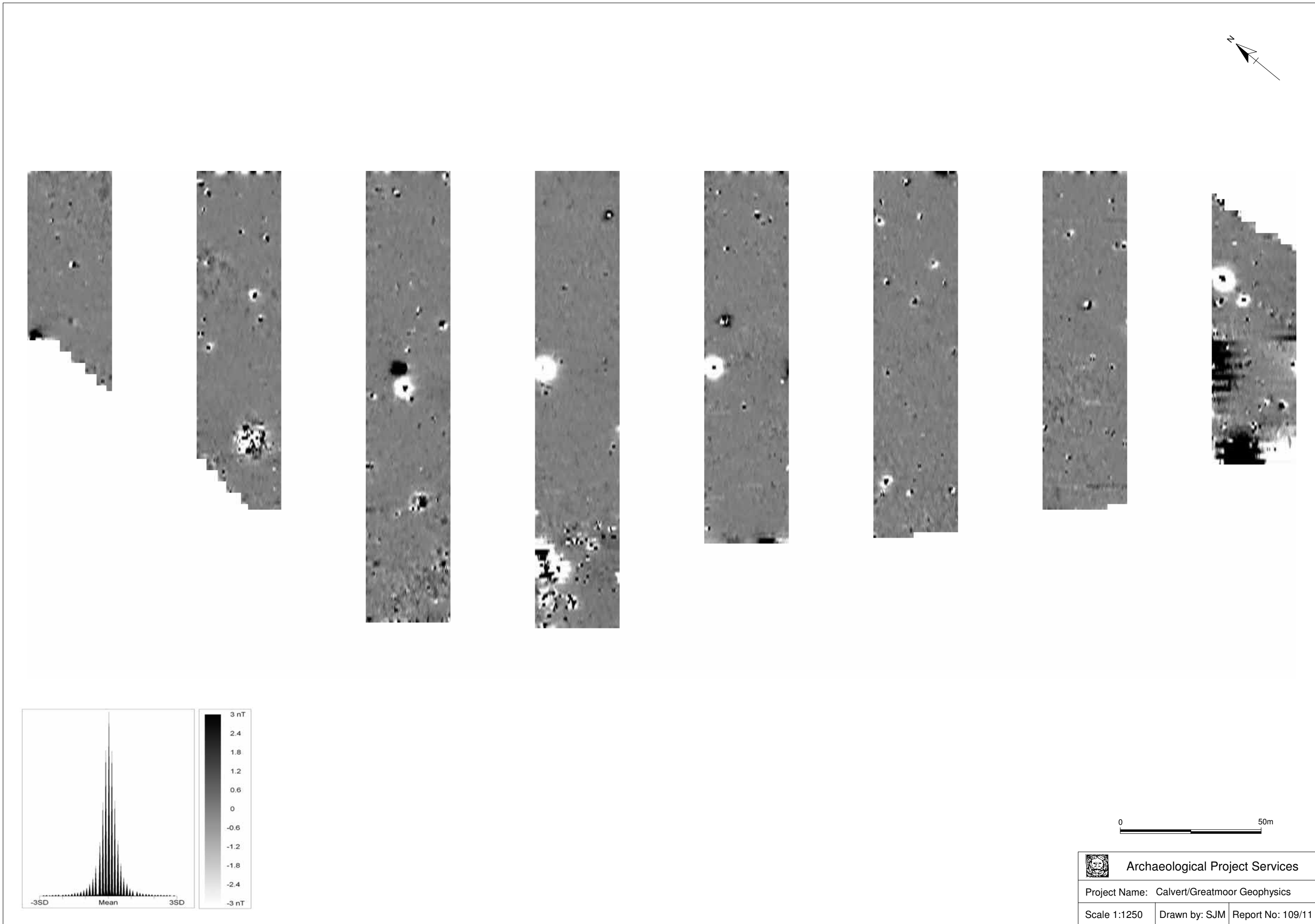


Figure 8 Area 2 processed data greyscale - clip +/-3nT

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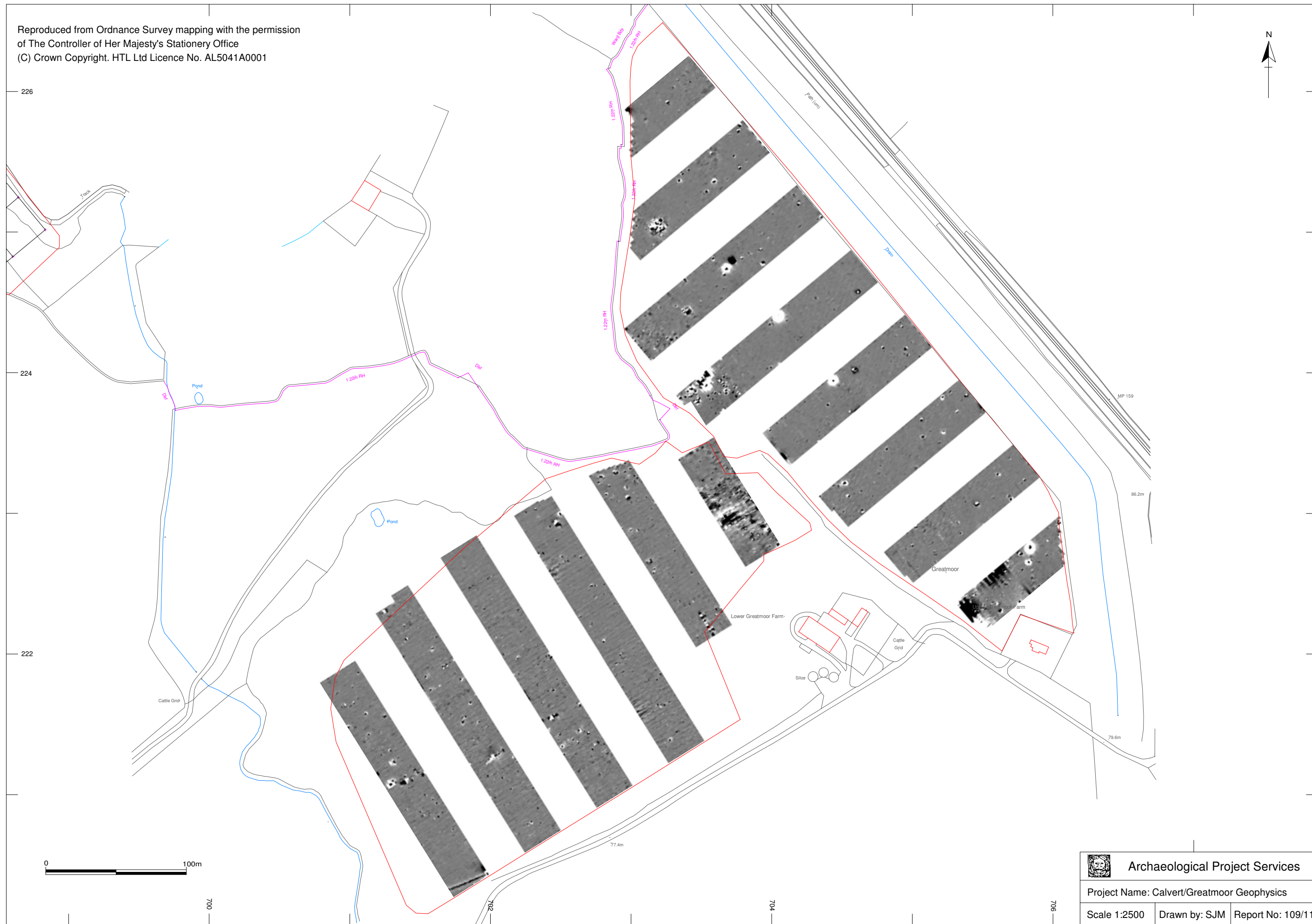


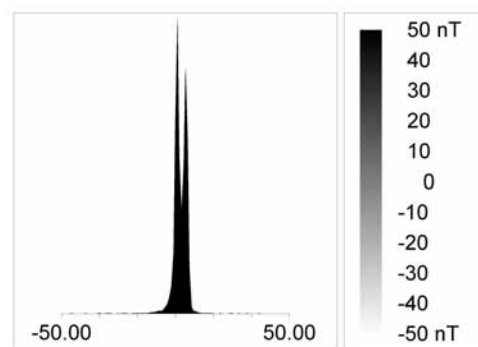
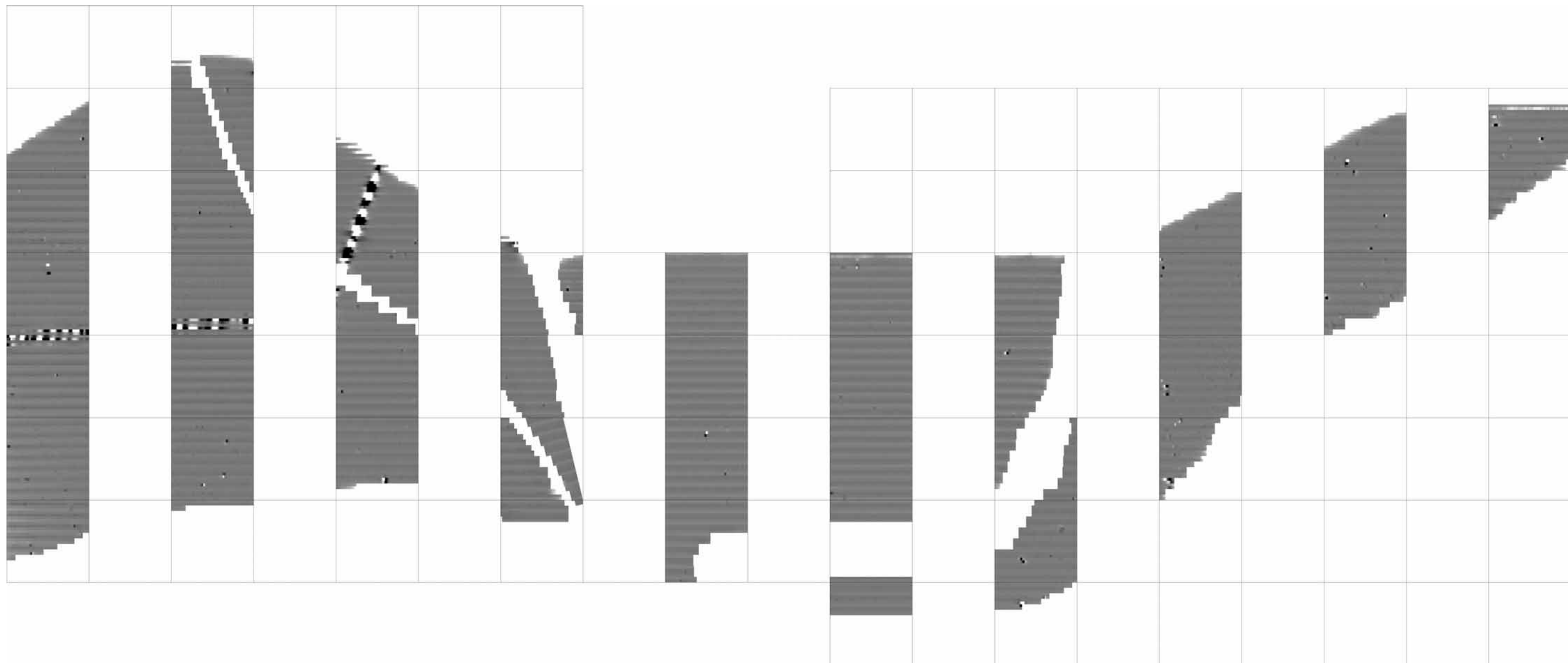
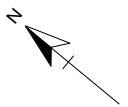
Figure 9 Areas 1 and 2 processed data greyscale

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ferrous response •
positive linear anomaly —
magnetic disturbance



Figure 10 Areas 1 and 2 interpretative plot




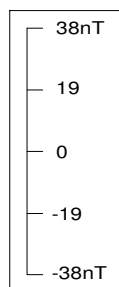
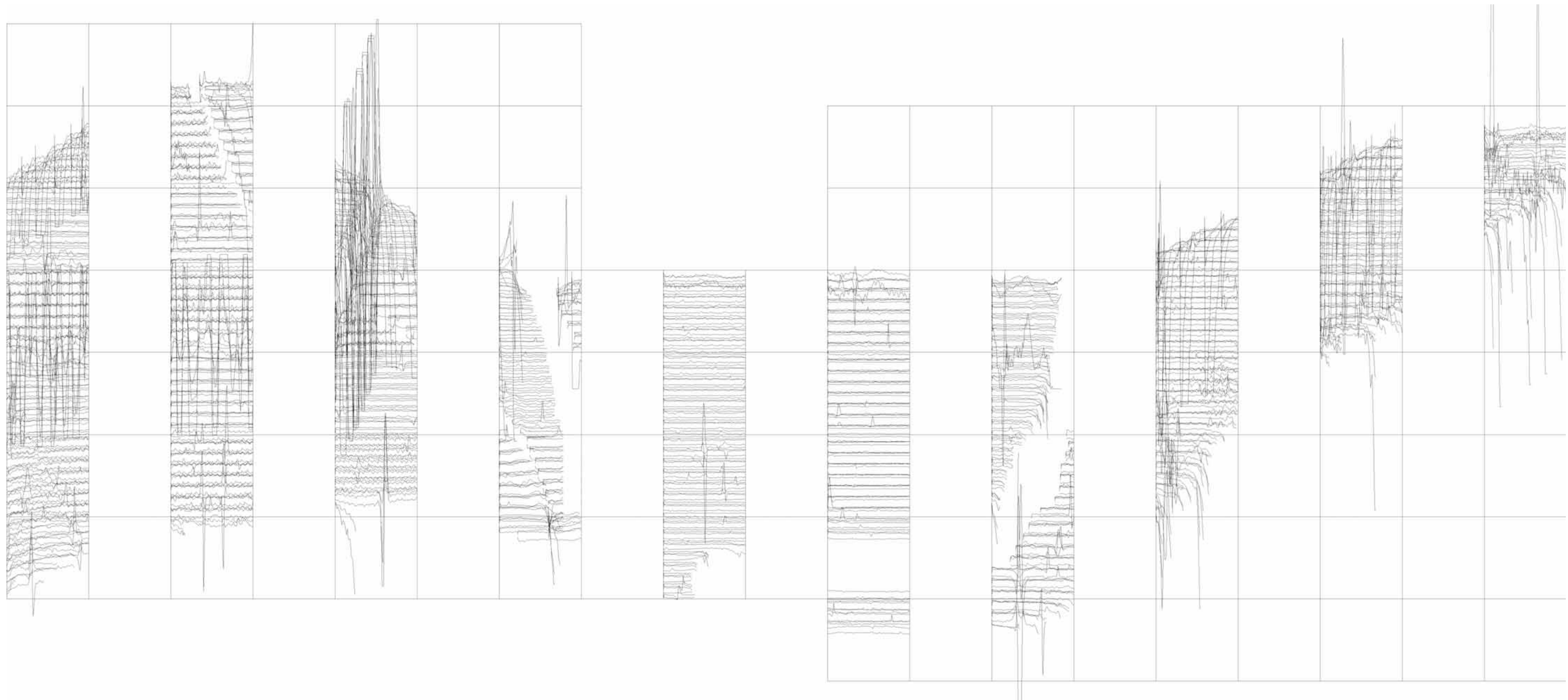
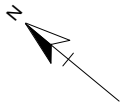
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Figure 11 Area 3 unprocessed data greyscale plot




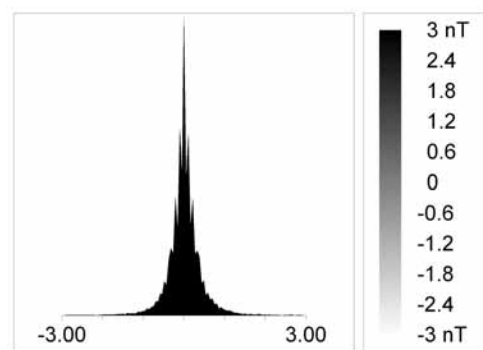
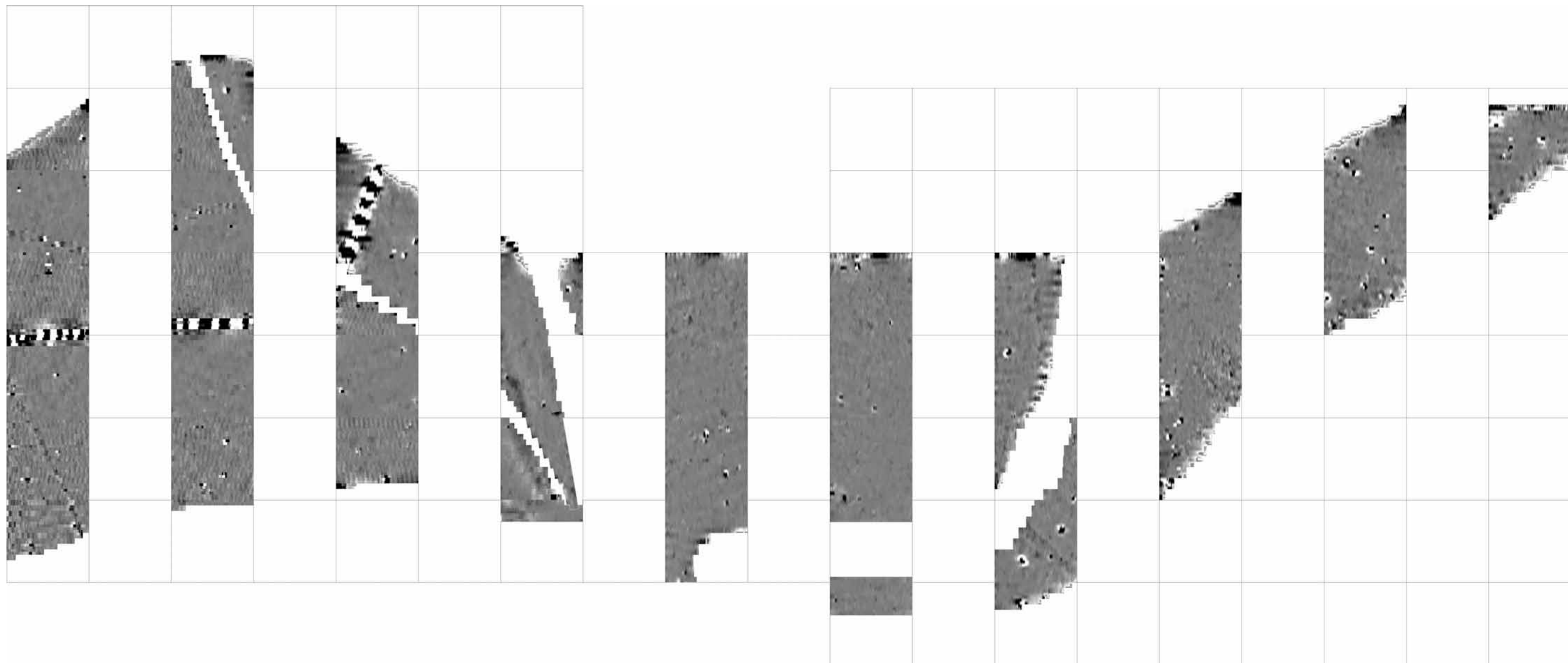
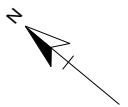
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Figure 12 Area 3 unprocessed data trace plot




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Figure 13 Area 3 processed data greyscale plot

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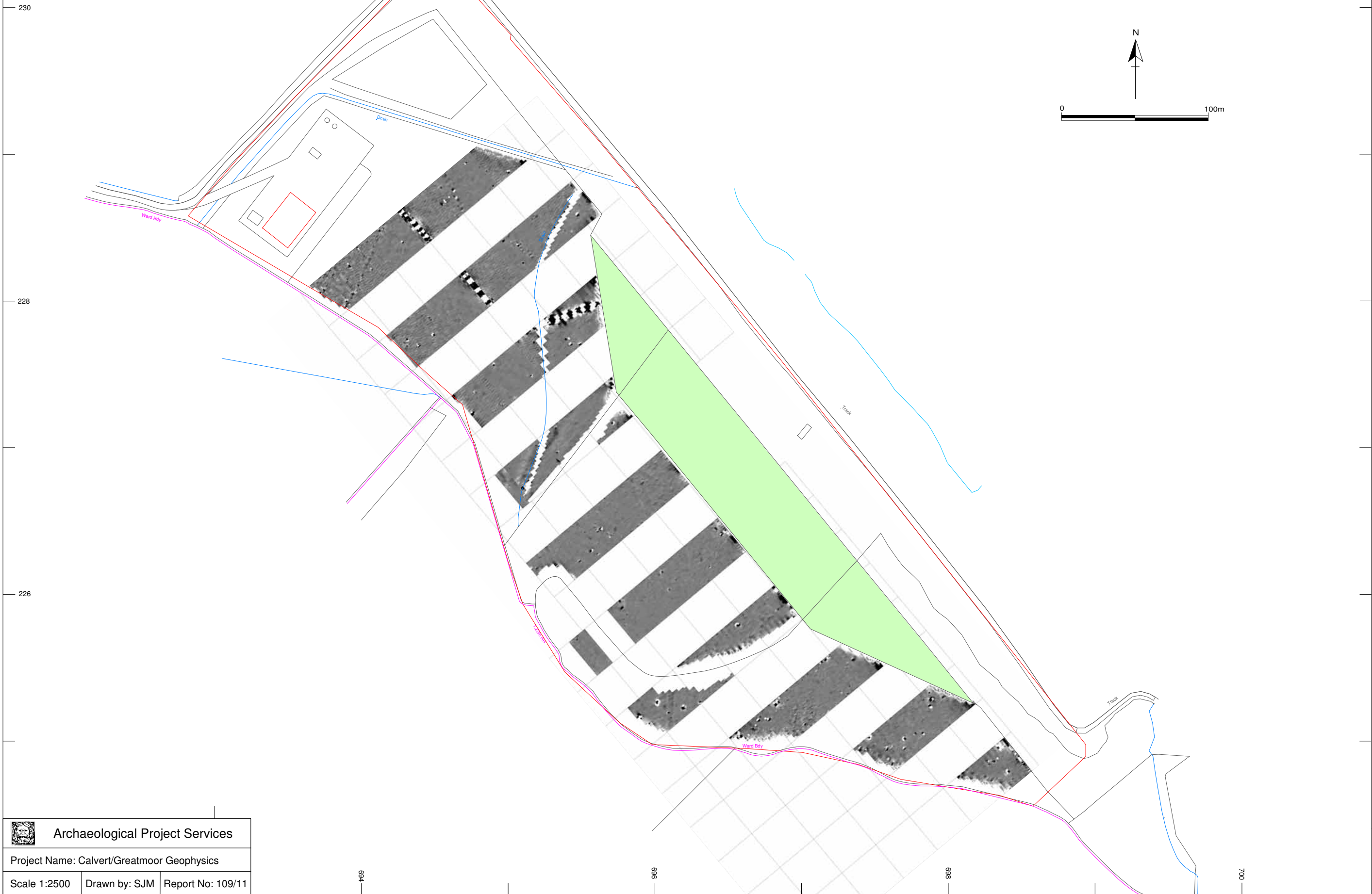










Figure 14 Area 3 processed data greyscale on basemap


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positive linear anomaly	
positive area anomaly	
negative linear anomaly	
agricultural feature	
geological variation	
ferrous response	
magnetic disturbance	

N



0 100m





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Figure 15 Area 3 interpretative plot

Appendix 1 THE ARCHIVE

The archive consists of:

- 8 Daily record sheets
- 1 Report text and illustrations
- Digital data

File names	clgm11-01.xgd clgm11-02.xgd clgm11-03.xgd clgm11-04.xgd clgm11-05.xgd clgm11-06.xgd clgm11-07.xgd clgm11-08.xgd clgm11-09.xgd clgm11-10.xgd clgm11-11.xgd clgm11-12.xgd clgm11-13.xgd clgm11-14.xgd clgm11-15.xgd clgm11-16.xgd clgm11-17.xgd clgm11-18.xgd clgm11-19.xgd clgm11-20.xgd clgm11-21.xgd clgm11-22.xgd clgm11-23.xgd clgm11-24.xgd clgm11-25.xgd	clgm11-26.xgd clgm11-27.xgd clgm11-28.xgd clgm11-29.xgd clgm11-30.xgd clgm11-31.xgd clgm11-32.xgd clgm11-33.xgd clgm11-34.xgd clgm11-35.xgd clgm11-36.xgd clgm11-37.xgd clgm11-38.xgd clgm11-39.xgd clgm11-40.xgd clgm11-41.xgd clgm11-42.xgd clgm11-43.xgd clgm11-44.xgd clgm11-45.xgd clgm11-46.xgd clgm11-47.xgd clgm11-48.xgd clgm11-49.xgd clgm11-50.xgd	clgm11-51.xgd clgm11-52.xgd clgm11-53.xgd clgm11-54.xgd clgm11-55.xgd clgm11-56.xgd clgm11-57.xgd clgm11-58.xgd clgm11-59.xgd clgm11-60.xgd clgm11-61.xgd clgm11-62.xgd clgm11-63.xgd clgm11-64.xgd clgm11-65.xgd clgm11-66.xgd clgm11-67.xgd clgm11-68.xgd clgm11-69.xgd clgm11-70.xgd clgm11-71.xgd clgm11-c1.xcp clgm11-c2.xcp
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Explanation of codes used in file names	xgd files are magnetometer grids, named with site code and number in the order surveyed. Clgm11 relates to Areas 1 and 2 at Greatmoor. Clgmp6 relates to the Pit 6 extension Area 3. 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	ArchaeSurveyor 2.54 running under Windows XP Service Pack 3		

Date of last modification	02/09/11
Indications of known areas of weakness in data	None

All primary records are currently kept at:

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

Archaeological Project Services Site Code:

CLGM11

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