

Llandyfaelog Substation Geophysical Survey



On behalf of **National Grid**
nationalgrid

LLANDYFAELOG, CARMARTHENSHIRE: GEOPHYSICAL SURVEY 2024



Photograph 1: Looking across the survey area from Field 38.

Prepared by Dyfed
Archaeological Services
For: Stantec Ltd on behalf of
National Grid Transmission



Heneb



HENEB – DYFED ARCHAEOLOGICAL SERVICES

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**LLANDYFAELOG, CARMARTHENSHIRE:
GEOPHYSICAL SURVEY 2024**

By

Luke Jenkins and Andrew Shobbrook

With contributions from:

**Jessica Domiczew, Tom Jaimeson, Fran Murphy, Ken Murphy,
Phil Poucher, and Shelley Williams**

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Heneb

Ymddiriedolaeth Archaeolegol Cymru
Corner House, 6 Stryd Caerfyrddin, Llandeilo,
Sir Gaerfyrddin SA19 6AE
Ffon: Ymholiadau Cyffredinol 01558 823121
Epost: info@heneb.org.uk
Gwefan: www.heneb.org.uk

Heneb: The Trust for Welsh Archaeology
Corner House, 6 Carmarthen Street, Llandeilo,
Carmarthenshire SA19 6AE
Tel: General Enquiries 01558 823121
Email: info@heneb.org.uk
Website: www.heneb.org.uk

CADEIRYDD CHAIR: DR CAROL BELL, CYFARWYDDWR DIRECTOR: R NICHOLLS

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**LLANDYFAELOG, CARMARTHENSHERE:
GEOPHYSICAL SURVEY 2024**

Client	Stantec Ltd on behalf of National Grid Transmission
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Event Record No 131132

Report No	2024-55
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Report Prepared By	Luke Jenkins
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Fieldwork Directed By Luke Jenkins

Illustrated By	Luke Jenkins
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**LLANDYFAELOG, CARMARTHENSHIRE:
GEOPHYSICAL SURVEY 2024**

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**LAND AT STATION ROAD, LETTERSTON, PEMBROKESHIRE:
GEOPHYSICAL SURVEY 2024**

EXECUTIVE SUMMARY

Heneb – Dyfed Archaeological Services were commissioned to undertake a geophysical survey on land northeast of Llandyfaelog, Carmarthenshire (centred on NGR SN 41921 13396). Geophysical survey was conducted across 37 ha divided into 19 fields.

The purpose of the survey was to provide a better indication of the archaeological potential of the site and if required, enable targeting of any further archaeological mitigation requirements before or during the development.

Possible archaeological remains were identified throughout the survey area. The route of the Via Julia Maritima Roman road was identified.

CRYNODEB GWEITHREDOL

Comisiynwyd Heneb - Gwasanaethau Archeolegol Dyfed i gynnal arolwg geoffisegol ar dir i'r gogledd-ddwyrain o Landyfaelog, Sir Gaerfyrddin (yn ganolog ar NGR SN 41921 13396). Cynhaliwyd arolwg geoffisegol ar draws 37 ha wedi'i rannu'n 19 maes.

Pwrpas yr arolwg oedd rhoi gwell syniad o botensial archeolegol y safle ac os oedd angen, galluogi targedu unrhyw ofynion lliniaru archeolegol pellach cyn neu yn ystod y datblygiad.

Canfuwyd olion archeolegol posibl ledled ardal yr arolwg. Nodwyd llwybr Ffordd Rufeinig Via Julia Maritima.

1. INTRODUCTION

1.1 Project Commission

- 1.1.1 Dyfed Archaeological Services (a contracting arm of Heneb – the Trust for Welsh Archaeology) was commissioned by Stantec Ltd on behalf of National Grid Electricity Transmission to undertake a geophysical survey ahead of a proposed Air Insulated Substation (AIS) development near Llandyfaelog, Carmarthenshire (centred on NGR SN 41921 13396; Figures 1–3).
- 1.1.2 The proposed development area was subject to a Historic Environment Desk-Based Assessment (Robinson-Hooper 2023), which identified limited evidence for prehistoric activity but highlighted the potential for Romano-British remains associated with the Via Julia Maritima Roman road (PRNs 3401, 7459). The Roman road was identified through aerial observations during the 2018 drought (Toby et al. 2020) and is visible on LiDAR running northeast–southwest across the study area.
- 1.1.3 A geophysical survey was recommended to help assess the archaeological potential of the site and inform any necessary mitigation measures prior to development.
- 1.1.4 Previous archaeological investigations within the development area include a desk-based assessment (Crane 2000) and an archaeological watching brief (Crane 2002) associated with the Pontyates to Bancyfelin gas pipeline. The pipeline was constructed in 2002 before the identification of the Roman road, and therefore unfortunately did not undergo archaeological mitigation.
- 1.1.5 The geophysical survey was undertaken using a fluxgate gradiometer, a method designed to detect subtle magnetic variations in the earth. This technique can identify subsurface features such as ditches, pits, or foundations that may not be visible at the surface.
- 1.1.6 The objective of the geophysical survey was to provide further information on the archaeological potential of the site, enabling informed decisions about the need for additional evaluation or mitigation measures before or during construction.
- 1.1.7 A Written Scheme of Investigation (WSI) outlining the methodology for the geophysical survey was prepared and submitted to Heneb, the archaeological advisors to Carmarthenshire County Council, for approval. A copy of the WSI is included in APPENDIX II
- 1.1.8 The results of the geophysical survey will contribute to understanding the archaeological significance of the site and guide further archaeological mitigation in accordance with Planning Policy Wales (2021) and Technical Advice Note 24: The Historic Environment (2017).

1.2. Scope of the Project

- 1.2.1 The aim of the project was:
 - To identify the presence/absence of any potential archaeological deposits through an initial gradiometer survey.
 - To establish the character and extent of any potential archaeological remains within the site area that could be affected by the proposed works.
 - To prepare a report and archive on the results of the geophysical survey.

1.3 Report Outline

1.3.1 This report provides a summary and discussion of the geophysical survey and its results and puts those results within their regional and national context.

1.4 Abbreviations

1.4.1 Sites recorded on the regional Historic Environment Record (HER) are identified by their Primary Record Number (PRN) and located by their National Grid Reference (NGR). Altitude is expressed to Ordnance Datum (OD). References to cartographic and documentary evidence and published sources will be given in brackets throughout the text, with full details listed in the sources section at the rear of the report.

1.5 Illustrations

1.5.1 Printed map extracts are not necessarily produced to their original scale.

1.6 Timeline

1.6.1 The following timeline (Table 1) is used within this report to give date ranges for the various archaeological periods that may be mentioned within the text.

Table 1: Archaeological and Historical Timeline for Wales.

Period	Approximate date	
Palaeolithic –	c.450,000 – 10,000 BC	Prehistoric
Mesolithic –	c. 10,000 – 4400 BC	
Neolithic –	c.4400 – 2300 BC	
Bronze Age –	c.2300 – 700 BC	
Iron Age –	c.700 BC – AD 43	
Roman (Romano-British) Period –	AD 43 – c. AD 410	Historic
Post-Roman / Early Medieval Period –	c. AD 410 – AD 1086	
Medieval Period –	1086 – 1536	
Post-Medieval Period ¹ –	1536 – 1750	
Industrial Period –	1750 – 1899	
Modern –	20 th century onwards	

¹ The post-medieval and industrial periods are combined as the post-medieval period on the Regional Historic Environment Record as held by Heneb.

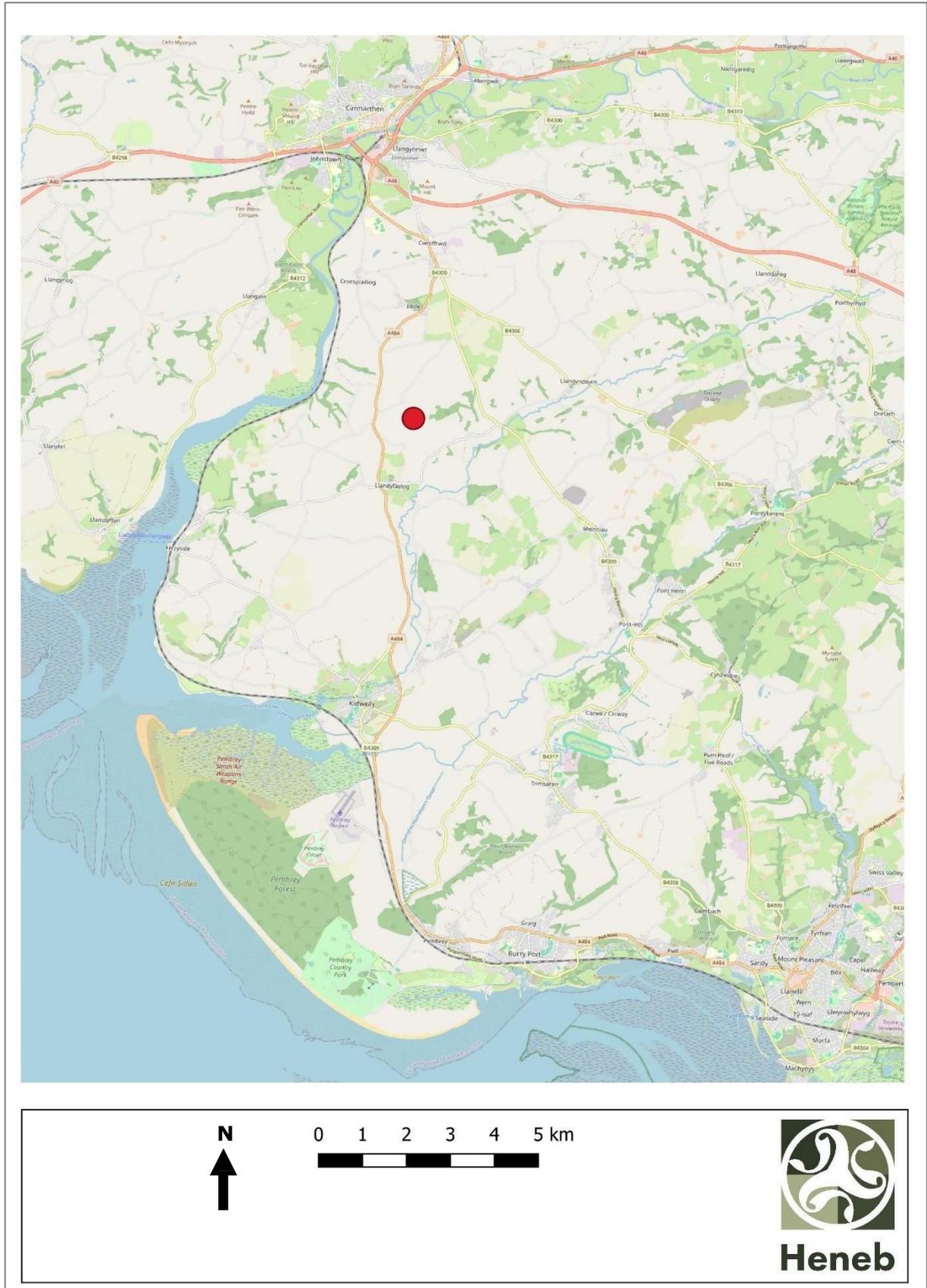


Figure 1: Location map. Survey area shown in red (Background mapping ©OSM 2024).

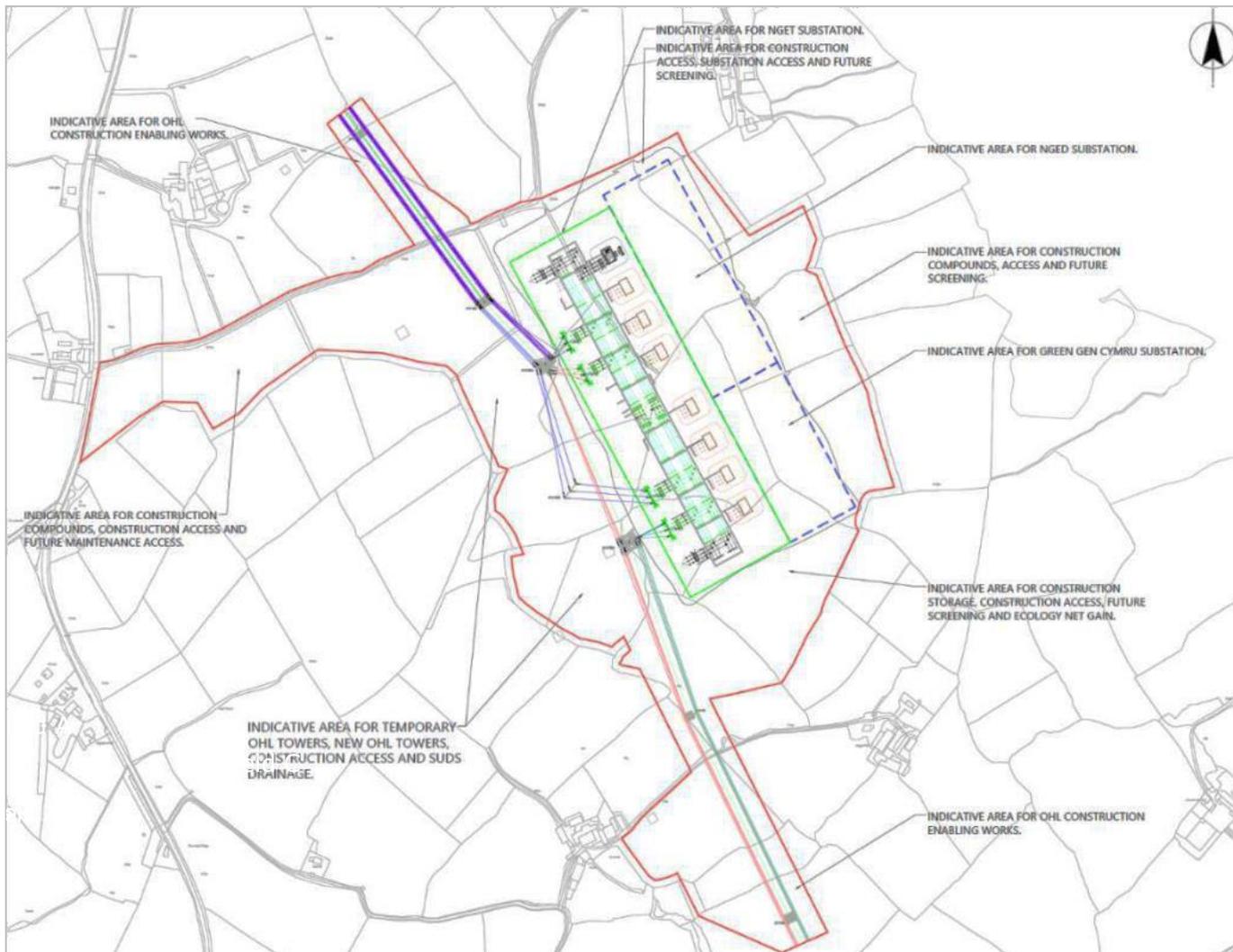


Figure 2: Proposed development. Plan supplied by client, not necessarily reproduced to scale.



Figure 3: Overview of geophysical survey overlain on satellite mapping (©Bing).

2. THE SITE

- 2.1. The proposed development area is located 1.5 km north-northeast of the small village of Llandyfaelog and 7 km south-southwest of the county town of Carmarthen in southwest Wales.
- 2.2. The survey area, which includes the proposed Air Insulated Substation (AIS) as well as some of the proposed landscaping and infrastructure, covers an area of 37 ha. This land is currently agricultural, sub-divided into 19 fields, mostly laid to pasture and surrounded by established hedgerows.
- 2.3. When considered as a whole, the survey area forms a broad, gradually sloping valley running roughly east west through the centre of the survey area, with ridges of high ground running along the northern and southern extents.
- 2.4. The proposed development area has been subject to a Historic Environment Desk-Based Assessment (Robinson-Hooper 2023). The assessment found limited evidence for prehistoric remains within the development area. The site occupies an elevated position near a water source, a location preferable for prehistoric activity. Therefore, although the potential for prehistoric remains is low, it cannot be ruled out.
- 2.5. The study also highlighted the potential for Romano-British remains, mainly associated with the Via Julia Maritima Roman road (PRNs 3401, 7459). The road was identified during aerial observations conducted in the drought of 2018 (Toby et al. 2020) and is visible on LiDAR, running northeast-southwest across the study area (Figure 4).
- 2.6. Only two archaeological events are recorded within the study area: a desk-based assessment (Crane 2000) and an archaeological watching brief (Crane 2002), both associated with the Pontyates to Bancyfelin Gas pipeline. The gas pipeline is identifiable on LiDAR (Figure 4), showing that it crosses the proposed development area along the line of the Via Julia Maritima Roman road. The gas pipeline was constructed in 2002, before the Roman road had been identified, and unfortunately, no archaeological mitigation was carried out.
- 2.7. The British Geological Survey records the bedrock beneath the northern part survey area as being a part of the Milford Haven Group - interbedded argillaceous rocks, sandstone and conglomerate. A sedimentary bedrock formed between 427.4 and 407.6 million years ago during the Silurian and Devonian periods. Towards the south of the proposed development area the bedrock is record as being sandstone, part of the Senni Formation. A sedimentary bedrock formed between 410.8 and 393.3 million years ago during the Devonian period. A superficial geology is also recorded in the southern part of the survey area consisting of diamicton from Devensian Till. A sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.



Photograph 2: Looking northwest across proposed development area from Field 38.



Photograph 3: Looking northeast across the proposed development area from Field 42.

3. METHODOLOGY

Data Collection

- 3.1 The geophysical survey was conducted utilising a fluxgate gradiometer equipped with two sensors at a 1m spacing, accompanied by a DL601 data logger. The gradiometer's sensitivity was configured to identify magnetic variations with a precision of 0.1 nanoTesla. The data was collected within a regulated grid, demarcated to a precision of 0.1 meters. With the aid of a Trimble R8's integrated GNSS system and a TSC5 controller, the grid was aligned with the local Ordnance Survey (OS) grid.

Ground Coverage

- 3.2 Geophysical techniques rely on discerning disparities in physical properties between the buried archaeological remains and the surrounding soil. To effectively characterise these features, it is necessary to conduct a comprehensive survey that not only captures all possible targets but also includes a sizeable portion of natural background response. Typically, the size of the survey area is constrained by external factors that could potentially undermine the survey data, such as chain-linked fences, telegraph poles and modern field boundaries, as these features affect the magnetic readings collected by the gradiometer. To mitigate the impact of these factors, a minimum distance of up to 5m from field boundaries is maintained. For larger modern ferrous objects such as pylons, a greater distance may be required.

Resolution

- 3.3 Data was collected using the zigzag traverse method in 30m x 30m grids, with a sample interval of 0.25m (four readings per meter) along the x-axis and a line separation of 1m along the y-axis.

Data Processing

- 3.4 The collected data underwent processing utilising *Terrasurveyor 3.0.36.1* and is presented with minimal processing. Typically, the data is subjected to "de-stripping" to eliminate any striping effect produced by imbalances between the two sensors. It is then "clipped" to eliminate high values attributed to ferrous objects, which tend to obscure archaeological features and finer details. Additional processing functions may include "de-staggering" the data to correct line displacement errors caused by variations in traversal rate. The gradiometer readings were collected every 0.25m along the transect (x-axis) and 1.0m (or 0.25m in the higher resolution surveys) along the y-axis, resulting in an imbalanced grid. Therefore, by interpolating the data and adjusting the x and y-axes by an increased factor, the grid is better balanced. Finally, the "low pass filter" can be used to smooth the data without removing any archaeology.

Data Presentation and Interpretation

- 3.5 The data is presented in the form of a grey-scale plot, overlaid on satellite mapping, with minimal processing. The main magnetic anomalies were identified through a combination of the grey-scale plots at different processing stages, and XY traces enabled interpretation by visualising the magnitude and form of a geophysical anomaly. The results were compared with available sources such as satellite imagery, aerial photographs, LiDAR data and historic maps; an increased confidence in the interpretation of geophysical anomalies is gained when their character or form is well-documented, their existence was previously known, or corroborative evidence is available. Examining the results, including the surrounding

environment, often provides greater context and aids in the interpretation of individual features.

Quality of Results

- 3.6 It is important to note that survey results and interpretation diagrams should not be considered as a conclusive representation of archaeological remains. Not all buried features will produce a detectable magnetic response that can be identified by the gradiometer. In assessing these recorded features, the shape serves as the primary diagnostic tool, alongside comparison with known features from other surveys. The magnitude of the magnetic response can also yield supplementary insights; for instance, a strongly recorded response may indicate burning, high ferric content, or geological thermoremanent magnetisation. While the context may provide additional indications, the interpretation of numerous features is still largely subjective.
- 3.7 All measurements provided are approximations, as determining precise measurements from fluxgate gradiometer surveys is challenging. The breadth and length of identified features may be influenced by their depth and magnetic strength.

4. RESULTS

4.1 General

- 4.1.1 The geophysical survey was conducted between the 4th and 13th of November 2024. The survey was undertaken using two Bartington 601 fluxgate magnetometers.
- 4.1.2 The total survey area measured approximately 37 hectares. This area was subdivided into 19 fields, which were predominantly classified as either unimproved or improved pasture. These fields are identified on Figure 3.
- 4.1.3 The numbering system used to describe each field within the survey area was provided by the client. The description of the results does not follow this numerical system but instead describes the fields in logical blocks, working roughly from the northwestern corner of the survey area and finishing in the northeast.
- 4.1.4 All survey results were "clipped" to +/- 20 nT and are presented as greyscale plots overlaid on satellite mapping. Where required, these results have also been de-spiked.
- 4.1.5 An additional figure showing an interpretative overlay is included for each field. Here, each anomaly discussed in the text is assigned a unique identifier, prefixed with the field number (e.g., Field 1, response 3 is represented as 1 (3)).
- 4.1.6 During the results and discussion historic mapping and LiDAR coverage is frequent referenced. The consulted sources and their respective shortenings in text are listed below:
- The Llandyfaelog tithe map of 1841 (tithe mapping).
 - 1st Edition Ordnance Survey 1887 - 1:2500 mapping (1st Edition OS mapping).
 - 2nd Edition Ordnance Survey 1910 - 1:2500 mapping (2nd Edition OS mapping).
 - Natural Resources Wales 2024 1m LiDAR Survey of Wales (LiDAR coverage).
- 4.1.5 A trace plot and a gridded greyscale plot of all fields is included in APPENDIX 1.
- 4.1.6 As with all geophysical surveys, the possibility of undiscovered archaeological remains cannot be dismissed. Significant archaeological features may survive but fail to produce a magnetic response, particularly in areas of magnetic disturbance, such as the northwestern part of the survey area.



Figure 4: Greyscale plot of geophysical survey in Fields 31 and 32 overlain on satellite mapping(©Bing).



Figure 5: Greyscale plot of geophysical survey in Fields 31 and 32 with interpretive overlay (Background mapping ©Bing).

4.2 Field 31 (Figures 4 and 5)

4.2.1 Field 31 was located in the northwestern part of the survey area, situated near the top of a ridge overlooking a small valley. This ridge extended east-west through Fields 31, 32, and 14 before turning north. The field consisted of a small parcel of rough pasture, bounded by established hedge banks with barbed and rabbit wire. To the south and east, the terrain became wetter, with the ground gradually sloping downward to the south.

4.2.2 The following responses were identified in Field 31:

- **Response 31 (1):**
A modern made-up trackway running along the northern edge of the field, producing a significant dipolar response.
- **Response 31 (2):**
A discrete dipolar response, most likely caused by a ferrous object within the plough soil.
- **Response 31 (3):**
A geotechnical test pit that included a metal gate, creating a significant response.

4.2.3 No archaeologically significant anomalies can be seen in this field.

4.3 Field 32 (Figures 4 and 5)

4.3.1 Field 32 was a large, approximately rectangular field oriented roughly east west. It was located in the northwestern part of the survey area, to the east of Field 31 and west of Field 14. Similar to Field 31, it was situated at the top of a small ridge running across the northern part of the survey area, with the ground gradually sloping downward towards a small valley to the south. The field is currently used as fine improved pasture and is bounded by established hedgerows with barbed wire on all sides.

4.3.2 The following responses were identified in Field 32:

- **Response 32 (1):**
A weakly magnetic linear response, likely representing a ditch possibly forming a roughly square enclosure measuring 36m north-east/south-west by 31m north-west/south-east.

At the centre of the possible enclosure is a discrete, weakly magnetically enhanced feature, most likely a pit. The responses from which this possible enclosure is formed are quite diffuse, making this interpretation tentative. If correct it is most likely that it is medieval or post-medieval, appearing to be part of a wider system of boundaries described below ((32 (2-9))).
- **Responses 32 (2-9):**
Surrounding the square enclosure 32 (1), and in some instances appearing to emanate from it, are several linear anomalies with both positive and negative magnetic readings. These features are typical of former field boundaries.
- **Responses 32 (10-11):**
Two curvilinear anomalies within Field 32, both consisting of faint positive magnetic readings that form arcs of incomplete circles. While these features could result from fluctuations in the background geology, they may also represent much-denuded ring ditches, likely of prehistoric origin.

4.3.3 None of the features described above appear on historic maps or in the LiDAR coverage of the area.



Figure 6: Greyscale plot of geophysical survey in Field 14 overlain on satellite mapping(©Bing).



Figure 7: Greyscale plot of geophysical survey in Field 14 with interpretive overlay (Background mapping ©Bing).

4.4 Field 14 (Figures 6 and 7)

4.4.1 Field 14 was located in the north-western part of the survey area, to the east of Field 32, to the west of Field 1, and to the north of Field 12. Like Fields 31 and 32, it is situated on high ground, on a ridge running east-west across the survey area, gently sloping towards the south.

4.4.2 Field 14 is one of the largest surveyed and is currently laid to enhanced pasture, bounded by established hedgerows and barbed wire fences. Along the southern and western boundaries, the ground was very boggy, likely caused by sheltering cattle. In the centre and eastern part of the field were two pylons, which significantly affected the results in this area.

4.4.3 The following responses were identified in Field 14:

- **Responses 14 (1-5):**

These consisted of high dipolar responses caused by the pylons (14 (1-3)) and the overhead wires (14 (2-4)). These responses are not archaeologically significant but may obscure archaeological remains within the immediate area. Response 14 (5) is another similarly magnetic response, most likely associated with the construction of the pylons.

- **Response 14 (6):**

A faint positive linear anomaly running northeast-southwest across Field 14. This response is most likely a field boundary, roughly adjoining a field boundary to the south of Field 14.

- **Responses 14 (7 and 8):**

Response 14 (7) consists of two strong curvilinear positive anomalies in the north-western part of the survey area. These two responses run approximately east-west, appearing to break and curve into an entrance at their midpoint. Within this possible entrance is an area of enhanced magnetic activity, 14 (8). Response 14 (7) is clearly anthropogenic, and it is unfortunate that its eastern extent is obscured by the overhead lines (14 (2)).

The form of this short section of ditch is compelling as the entrance of a small prehistoric enclosure with its western extent obscured by alluvial deposits (14 (14)) or otherwise truncated and its eastern extent hidden by the adjacent pylons (14 (1-2)). If so, the area of magnetic enhancement (14 (8)) could be the result of occupation. However, this interpretation should be considered speculative, with further mitigation required to confirm this.

- **Responses 14 (9-13):**

Responses 14 (9-13) all consist of faint, mostly positive, curvilinear responses that form arcs, appearing to form incomplete circles with a diameter of less than 20 m.

Similar to responses 32 (10-11) in Field 32, one possible interpretation is that these are the much-denuded remains of ring ditches of prehistoric origin. However, this interpretation should be approached with caution, as fluctuations in the background geology are also a possibility.

- **Response 14 (14)**

Possible alluvial extent in lower part of this field. It is possible that this may be obscuring archaeological features.

4.4.4 None of the features described above appear on historic maps or in the LiDAR coverage of the area

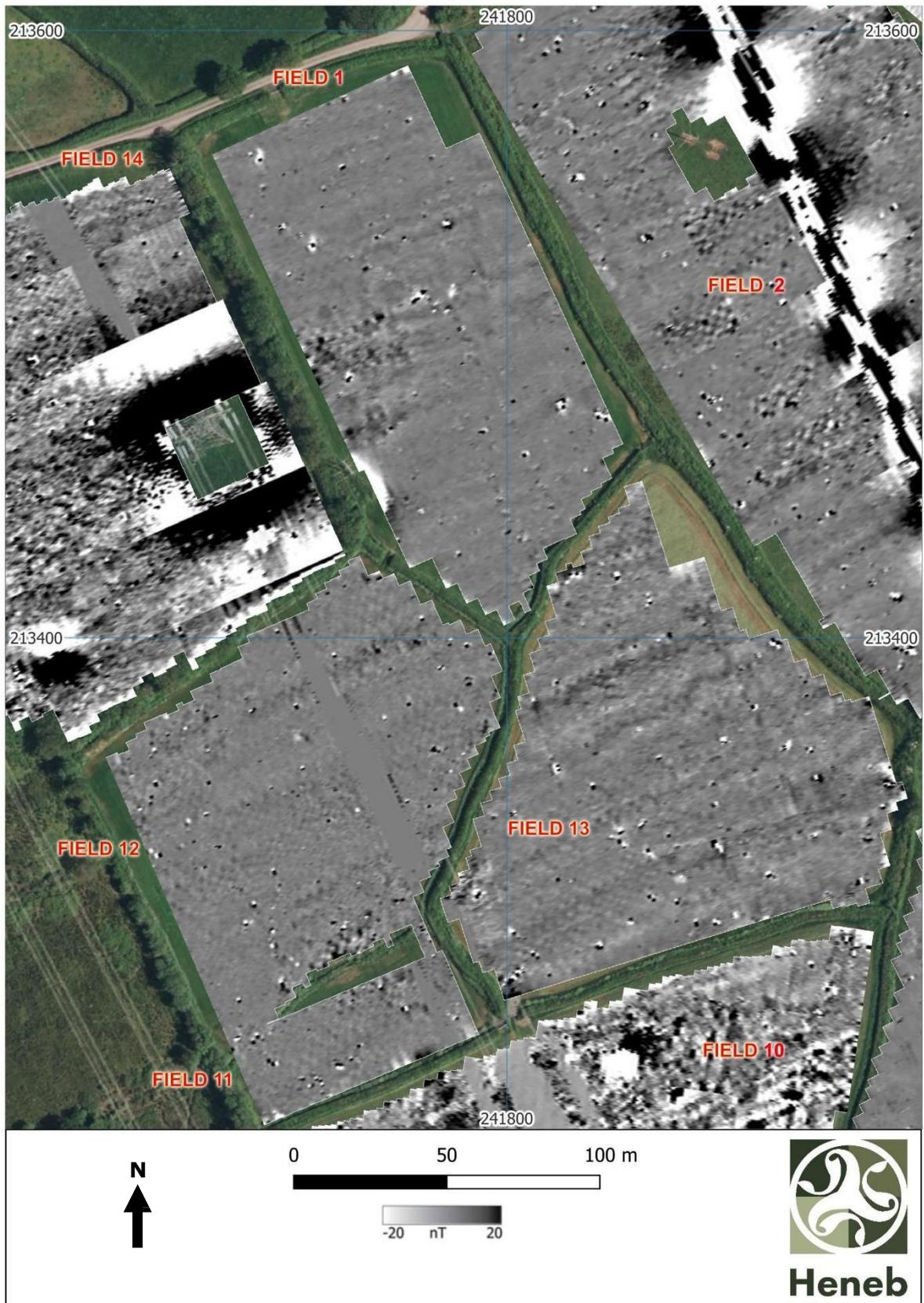


Figure 8: Greyscale plot of geophysical survey in Fields 1, 11, 12 and 13 overlain on satellite mapping(©Bing).

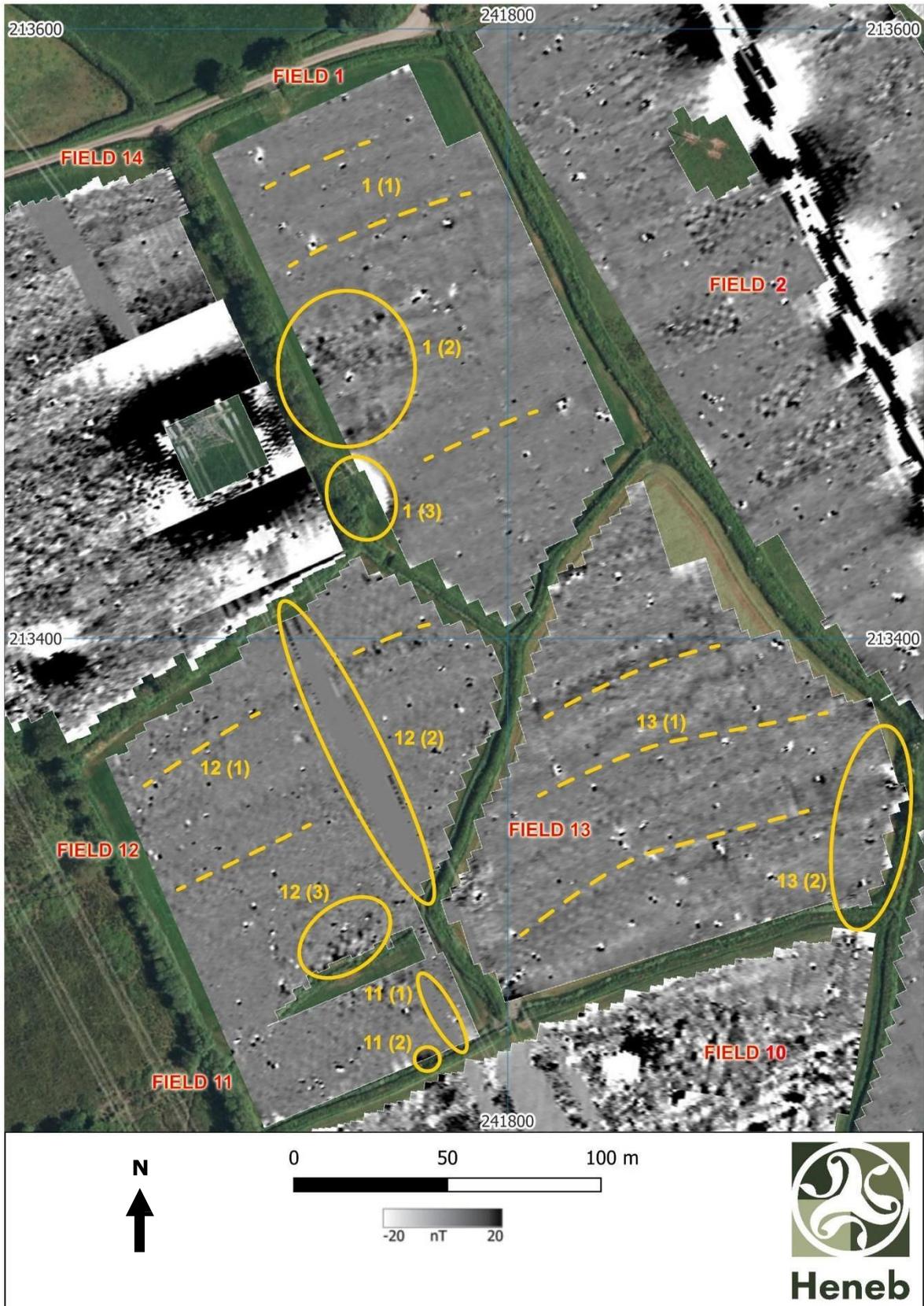


Figure 9: Greyscale plot of geophysical survey in Fields 1, 11, 12 and 13 with interpretive overlay (Background mapping ©Bing).

4.5 Field 1 (Figures 8 and 9)

4.5.1 Field 1 is a roughly rectangular field located in the north-central part of the survey area, with Field 14 to the west and Field 2 to the east. It lies somewhat downslope from Field 14, gently sloping towards the south. Field 1 is laid to rough pasture and was extremely wet at the time of the survey. It is bounded by established hedgerows on all sides.

4.5.2 The following responses were identified in Field 1:

- **Response 1 (1):**
Faint geological banding running northeast-southwest, a feature observed in many of the fields surveyed.
- **Response 1 (2):**
An area of slight magnetic disturbance located in a slightly mounded area of the field. This response is not thought to be anthropogenic.
- **Response 1 (3):**
A pylon with an attached transformer located in the western part of the field.

4.5.3 No archaeologically significant responses were identified in this field.

4.6 Fields 11 and 12 (Figures 8 and 9)

4.6.1 Fields 11 and 12 were located along the western edge of the main survey area, to the south of Field 14 and to the west of Field 13. In reality, the two fields were a single unit, separated only by a large drainage ditch that was unnavigable. These fields are therefore described together.

4.6.2 The field was laid to improved pasture, bounded by established hedgerows and barbed wire fences. It sloped significantly towards the south off the ridge seen in Field 14, with Field 11, beyond the drainage ditch, marking the beginning of the valley bottom and the alluvial plain.

4.6.3 The following responses were identified:

- **Response 11 (1-2):**
Responses caused by overhead lines from pylons.
- **Response 12 (1):**
Faint geological banding running northeast-southwest, a feature observed in many of the fields surveyed.
- **Response 12 (2):**
A response caused by overhead lines from pylons.
- **Response 12 (3):**
An area of disturbance likely caused by boggy ground adjacent to the drainage ditch.

4.6.4 No archaeologically significant responses were identified in these fields.

4.7 Field 13 (Figures 8 and 9)

4.7.1 Field 13 is a roughly triangular field located to the east of Fields 11 and 12 and to the west of Field 2. The field lies on flat ground at the base of the valley, forming part of the alluvial plain. It is laid to rough pasture and is bounded on all sides by established hedgerows and stock proof fencing.

4.7.2 The following responses were identified:

- **Response 13 (1):**

Faint geological banding running northeast-southwest, a feature observed in many of the fields surveyed.

- **Response 13 (2):**

This response marks the area where the Via Julia Maritima Roman road is visible in the LiDAR coverage of the area. In Field 13, the road runs adjacent to the hedge bank and is visible as a distinct earthwork. However, it is difficult to discern in the geophysical survey, with only faint disturbances detected. Further discussion of this response is reserved for the main discussion section, where the road is addressed as a whole.

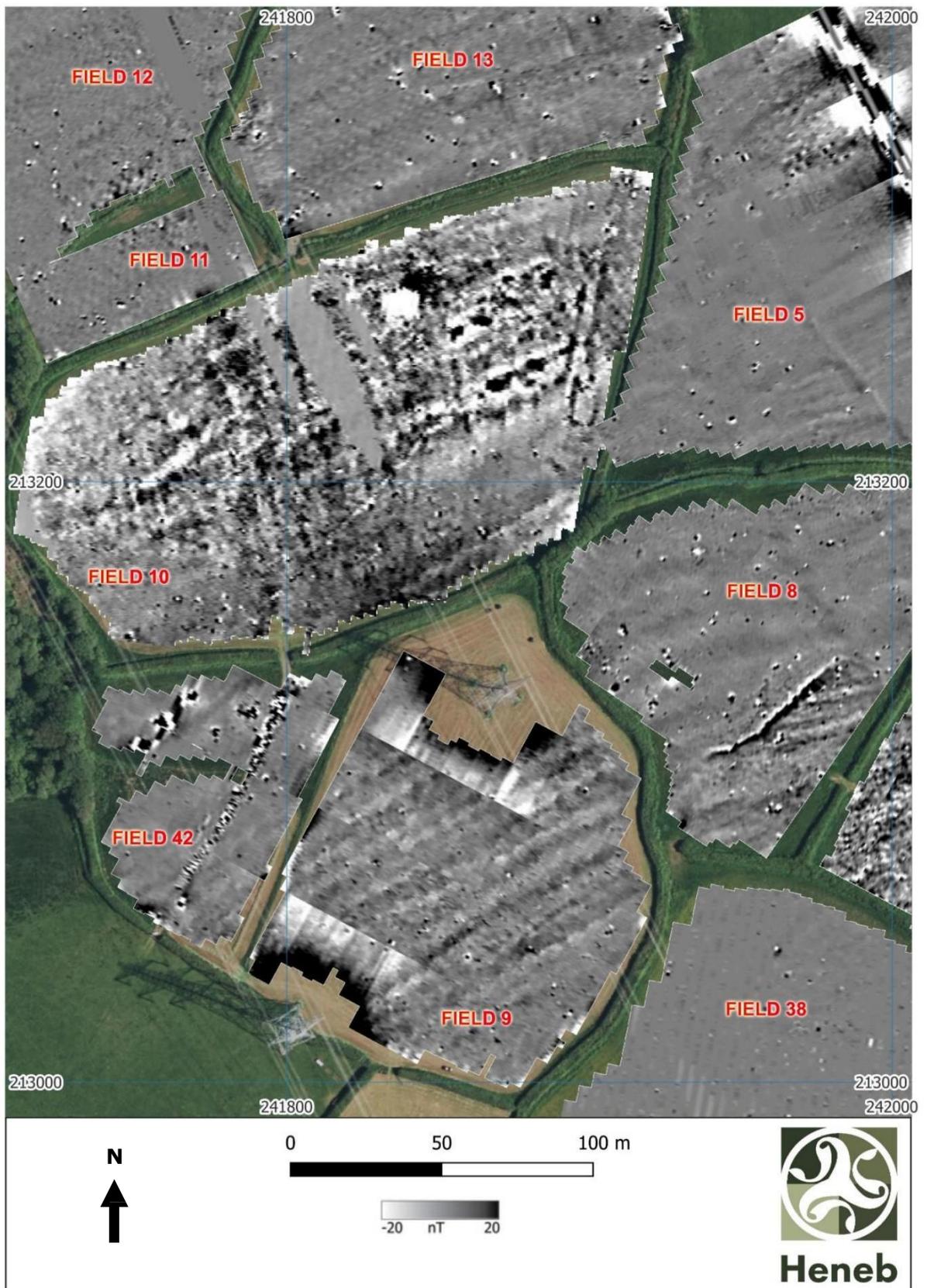


Figure 10: Greyscale plot of geophysical survey in Fields 10, 42 and 9 overlain on satellite mapping(©Bing)

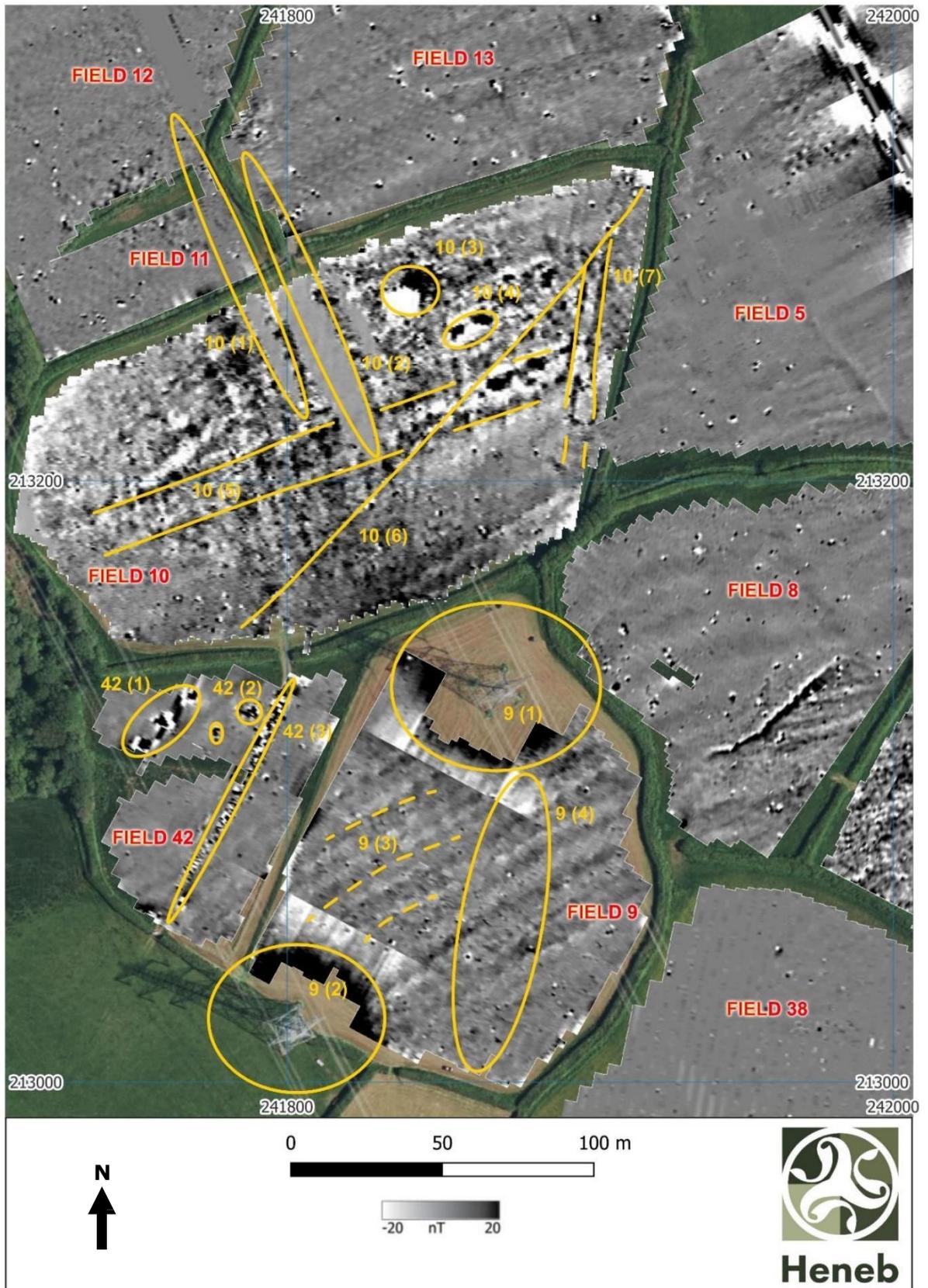


Figure 11: Greyscale plot of geophysical survey in Fields 10, 42, and 9 with interpretive overlay (Background mapping ©Bing).

4.8 Field 10 (Figures 10 and 11)

4.8.1 Field 10 is located in the southwestern part of the survey area, to the south of Fields 11 and 14 and to the north of Fields 9 and 42. The field lies on flat ground at the base of the valley, similar to Field 13. It is currently under rough pasture and is bounded on all sides by established hedgerows.

4.8.2 This field was magnetically enhanced. This is likely the result of modern agricultural practices or disturbance, though other possibilities such as higher activity in antiquity should be considered.

4.8.3 The following responses were identified:

- **Responses 10 (1-2):**

These responses were caused by the overhead cables traversing the area northwest/southeast.

- **Responses 10 (3-4):**

Large, discrete magnetic dipole anomalies, likely caused by ferrous objects in the topsoil.

- **Response 10 (5):**

A response caused by a modern trackway, which can be seen crossing the area.

- **Response 10 (6):**

A faint negative anomaly running northeast/southwest across the width of Field 10. This is almost certainly a modern service, also observed in the western part of Field 42 to the south. In Field 10, this anomaly is much fainter due to the enhanced magnetic activity in the field.

- **Response 10 (7):**

A pair of parallel positive responses running northeast/southwest alongside the eastern hedge bank of Field 10, approximately 8m apart. This represents by far the clearest section of the Via Julia Maritima Roman road, which is known to cross the survey area. Curiously, despite being highly visible in the geophysical survey, unlike Field 13 to the north it is not visible within the LiDAR coverage of the area.

These anomalies are almost certainly the remains of the *fossa*—ditches running along each side of Roman roads to aid with drainage. Between the ditches, there is a faint negative response that may be the remains of the *agger*—the raised, curved road surface itself.

Further discussion of the results relating to the Roman road will be reserved for the main discussion section, where the road can be addressed as a whole.

4.9 Field 42 (Figures 10 and 11)

4.9.1 Field 42 is located in the southwestern part of the survey area, to the south of Field 10 and to the west of Field 9. The southern part of the field slopes gently towards the north, with a wide drainage ditch running east/west across its central point. The northern part of the field, beyond the drainage ditch, flattens into the alluvial plain, which is also seen in Field 10.

4.9.2 The following responses were identified:

- **Response 42 (1):**

A linear, highly magnetic anomaly running northeast/southwest. This is thought almost certainly to be some form of modern service, also observed as Response 10 (7) in Field 10 to the north.

- **Response 42 (2):**

Positive magnetic readings, likely the result of disturbance during the excavation of either Response 42 (1) or Response 42 (3).

- **Response 42 (3):**
A highly magnetic linear anomaly running northeast/southwest through the survey area. It is almost certainly a modern service.

4.9.3 No archaeologically significant responses were identified in this area.

4.10 Field 9 (Figures 10 and 11)

4.10.1 Field 9 is located in the south-western corner of the survey area, with Field 42 to the west and Field 10 to the north. The field is laid to improved pasture and is bounded by established hedgerows to the south, north, and east, with only a stock fence separating it from Field 42 to the west. The field gently slopes towards the north, rising from the alluvial plain seen in Fields 10, 11, and 13.

4.10.2 The following responses were identified:

- **Responses 9 (1-2):**
Large, highly magnetic responses caused by two large pylons located in the south-western and northern corners of the field.
- **Response 9 (3):**
Faint geological banding running northeast-southwest, a feature observed in many of the fields surveyed.
- **Response 9 (4):**
This response marks the area where the Via Julia Maritima Roman road is thought to cross the field. It is not particularly identifiable within this field, though there is perhaps some subtle magnetic disturbance within the data. Further discussion surrounding the Roman road will be reserved for the main discussion.



Figure 12: Greyscale plot of geophysical survey in Field 38 overlain on satellite mapping(©Bing)



Figure 13: Greyscale plot of geophysical survey in Field 38 with interpretive overlay (Background mapping ©Bing).

4.11 Field 38 (Figures 12 and 13)

4.11.1 Field 38 is the southernmost point of the survey area. It is located to the southeast of Field 9 and to the southwest of Field 7. The field slopes steeply towards the north, leading to the valley bottom seen in Fields 8 and 10. It is currently seen as improved pasture and is bounded by established hedgerows reinforced with a barbed wire stock fence. A pylon stands at the top of the hill.

4.11.2 The following responses were identified:

- **Response 38 (1):**

An anomaly caused by the overhead power pylons traversing the fields in a northeast/southwest direction.

- **Response 38 (2):**

A highly magnetic response caused by the Pontiets to Bancyfelin Gas Pipeline, which crosses the survey area in a north/south direction.

4.11.3 Field 38 did not yield geological banding similar to that observed in Field 9 to the west or Field 7 to the east. The reason for this is not entirely clear, though one possibility is that colluvial silts may be obscuring archaeological remains. Alternatively, differing agricultural practices could be causing the variation in responses.



Figure 14: Greyscale plot of geophysical survey in Field 7 overlain on satellite mapping (©Bing)

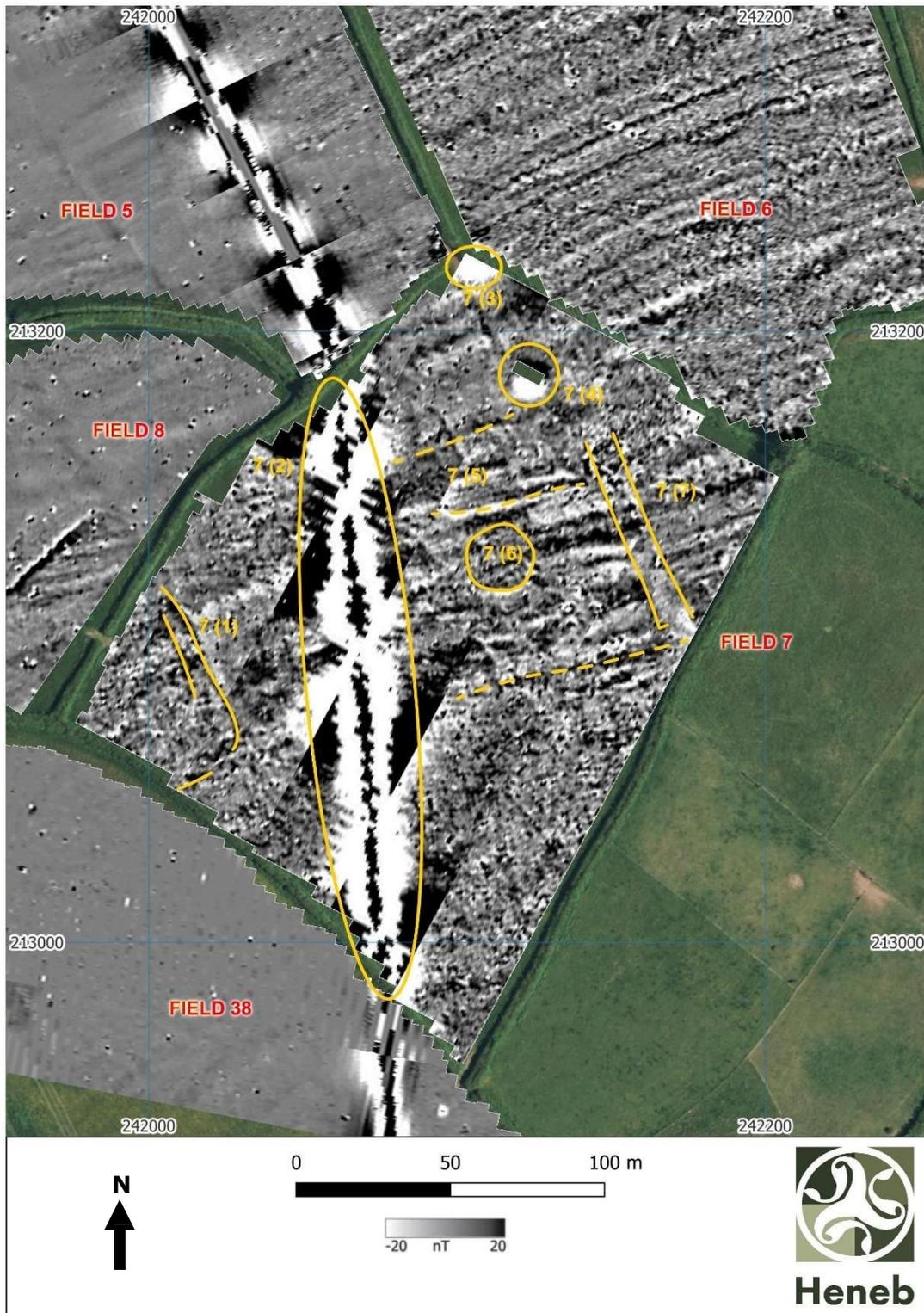


Figure 15: Greyscale plot of geophysical survey in Field 7 with interpretive overlay (Background mapping ©Bing).

4.12 Field 7 (Figures 14 and 15)

4.12.1 Field 7 is located to the northeast of Field 38 and to the west of Field 6. Similar to Field 38, this field slopes steeply towards the north and east, flattening into the valley bottom only at its northwest tip. It is currently under improved pasture and is bounded by established hedgerows reinforced with stock fencing.

4.12.2 The following responses were identified:

- **Response 7 (1):**
One, possibly two, faintly positive linear anomalies likely representing ditches. As these features appear to be associated with responses seen in Field 8, they will be described more fully there.
- **Response 7 (2):**
A highly magnetic response caused by the Pontiets to Bancyfelin Gas Pipeline, which crosses the survey area in a north/south direction.
- **Responses 7 (3-4):**
Discrete, highly magnetic negative responses, likely caused by ferrous material within the topsoil (7 (3)) and a gated geotechnical test pit (7 (4)).
- **Response 7 (5):**
Geological banding, particularly visible in this field. This is likely the result of the geological formation processes of the valley side combined with heavy agricultural practices.
- **Response 7 (6):**
A faint, mostly negative, curvilinear response forming the suggestion of an arc and appearing to create an incomplete circle with a diameter of 28m. This response is most likely the result of the surrounding geological banding (Response 7 (5)), though due to its location on high ground, the possibility of a ring ditch should not be discounted.
- **Response 7 (7):**
A faint, ephemeral linear response approximately 5m wide, running northwest/southeast through Field 7. This may result from deformation in the geological banding but could also represent a slight hollow caused by a former trackway.

4.12.3 None of the features described in Field 7 are visible on historic mapping. The Pontiets to Bancyfelin Gas Pipeline is visible in the LiDAR coverage of the area.

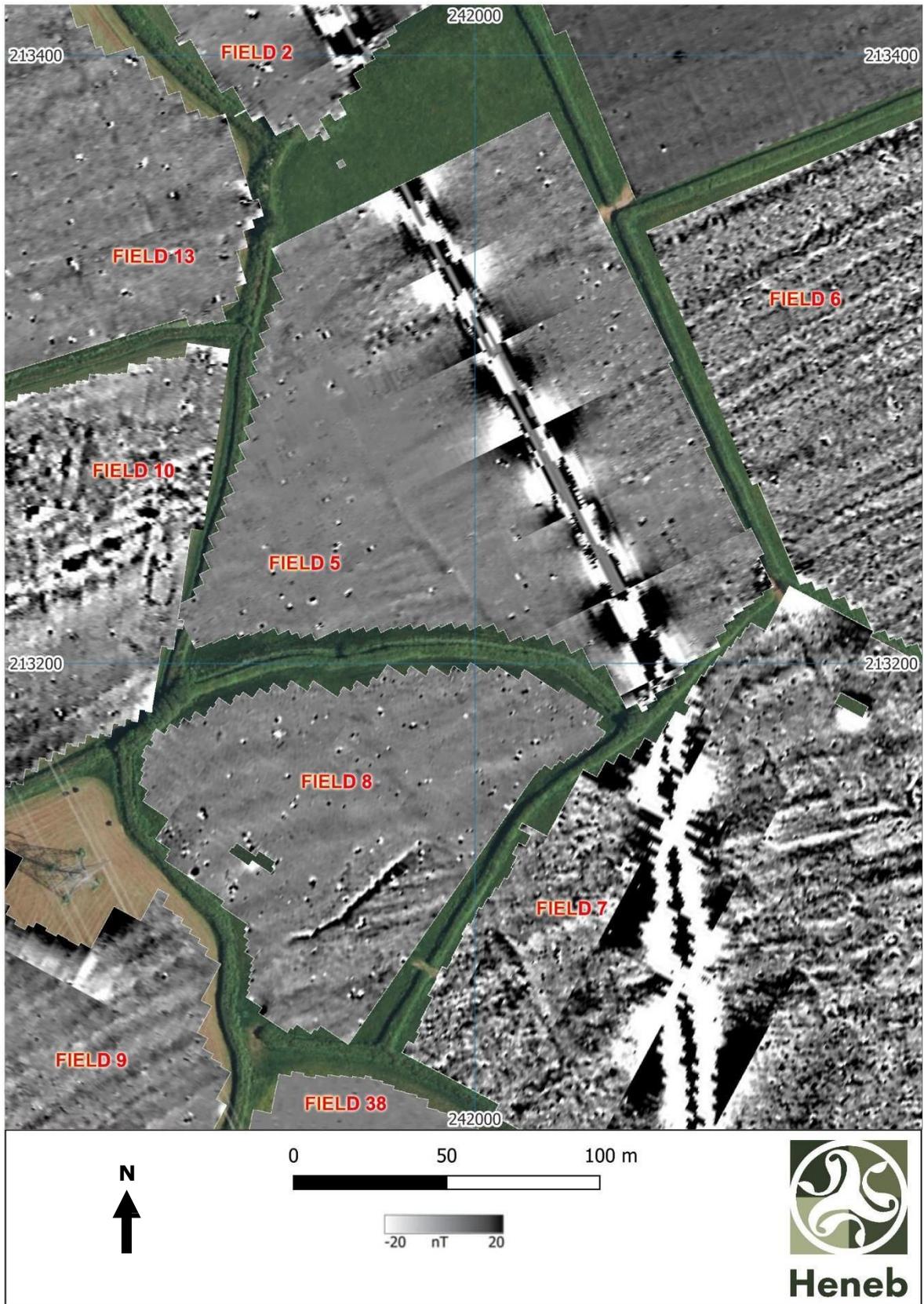


Figure 16: Greyscale plot of geophysical survey in Fields 5 and 8 overlain on satellite mapping(©Bing)

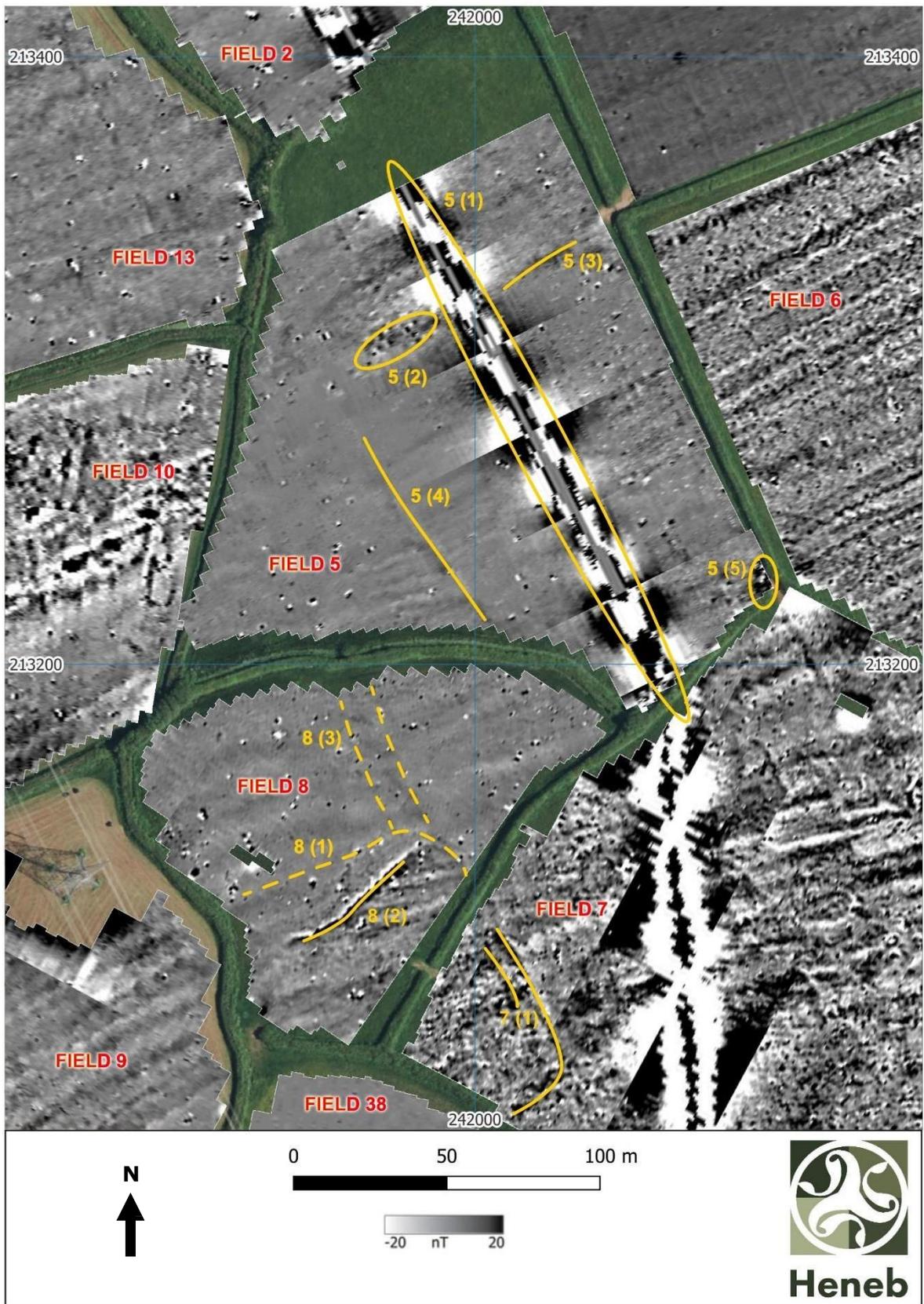


Figure 17: Greyscale plot of geophysical survey in Fields 5 and 8 with interpretive overlay (Background mapping ©Bing).

4.13 Field 8 (Figures 16 and 17)

4.13.1 Field 8 is located to the northwest of Field 7 and to the south of Field 5. It is roughly triangular in shape and is one of the smaller fields surveyed. This field lies at the base of the valley and is roughly flat, becoming very marshy and wet in its northern half. It is possible that the northern part of the field contained alluvium/colluvium which may reduce the ability of magnetometry to detect archaeological remains.

4.13.2 The following responses were identified:

- **Response 8 (1):**

This marks the edge of a significant change in topography within the field. The area to the south of the dotted line was raised by about a metre or so, becoming flat and dry. It is most likely that this area is the result of made ground.

- **Response 8 (2):**

A strong positive linear response within the raised area in the southern part of Field 8 (Response 8 (1)). This feature is presumed to be a large, backfilled drainage ditch. Though its highly magnetic response is more likely to be the result of the material which filled it rather than necessarily reflective of its overall form. This feature conforms to a field boundary seen in the tithe mapping and 1st edition OS mapping of the area. By the 2nd edition OS mapping, the field boundary had moved to its present location.

When viewed in conjunction with Response 7 (1) in Field 7, it is also possible that Responses 8 (1-2) represent an earlier enclosure, which was later incorporated into the field boundary. This enclosure would measure 86m northwest/southeast by approximately 55m northeast/southwest and be roughly rectangular in form.

- **Response 8 (3):**

A faint negative response approximately 4.5m wide. This is possibly the result of channelling within the boggy northern section of the field. Another explanation could be a slight hollow caused by a former trackway.

4.14 Field 5 (Figures 16 and 17)

4.14.1 Field 5 is centrally located within the survey area, situated to the north of Field 8 and to the west of Field 6. The field is predominantly flat, with a gentle slope towards the south. Currently, it is maintained as improved pasture, bordered by established hedgerows reinforced with stock fencing. The results suggest that the western portion of the field may contain alluvial deposits, which could limit the effectiveness of magnetometry in detecting archaeological remains. The northern section of the field was not surveyed due to inaccessibility.

4.14.2 The following geophysical responses were identified:

- **Response 5 (1):**

A highly magnetic response corresponding to the Pontiets to Bancyfelin Gas Pipeline, which runs in a north/south direction across the survey area.

- **Responses 5 (2-3):**

These responses may represent the remains of a former field boundary crossing the area, roughly aligning with the existing boundary between Fields 4 and 6.

Response 5 (2) is observed as a faint, roughly linear positive anomaly, surrounded by larger discrete responses.

Response 5 (3) is also a faint positive linear anomaly. It is unclear why these responses may differ, but interference from the adjacent pipeline (5 (1)) could be a factor.

Although a field boundary is not recorded at this location on historic maps, ephemeral remains of one are visible in the LiDAR coverage of the area.

- **Response 5 (4):**
Another faint linear anomaly, potentially representing the remains of a former field boundary. This feature is also not recorded in historic mapping.
- **Response 5 (5):**
A highly magnetic response, likely caused by a ferrous gate located in the corner of the field.

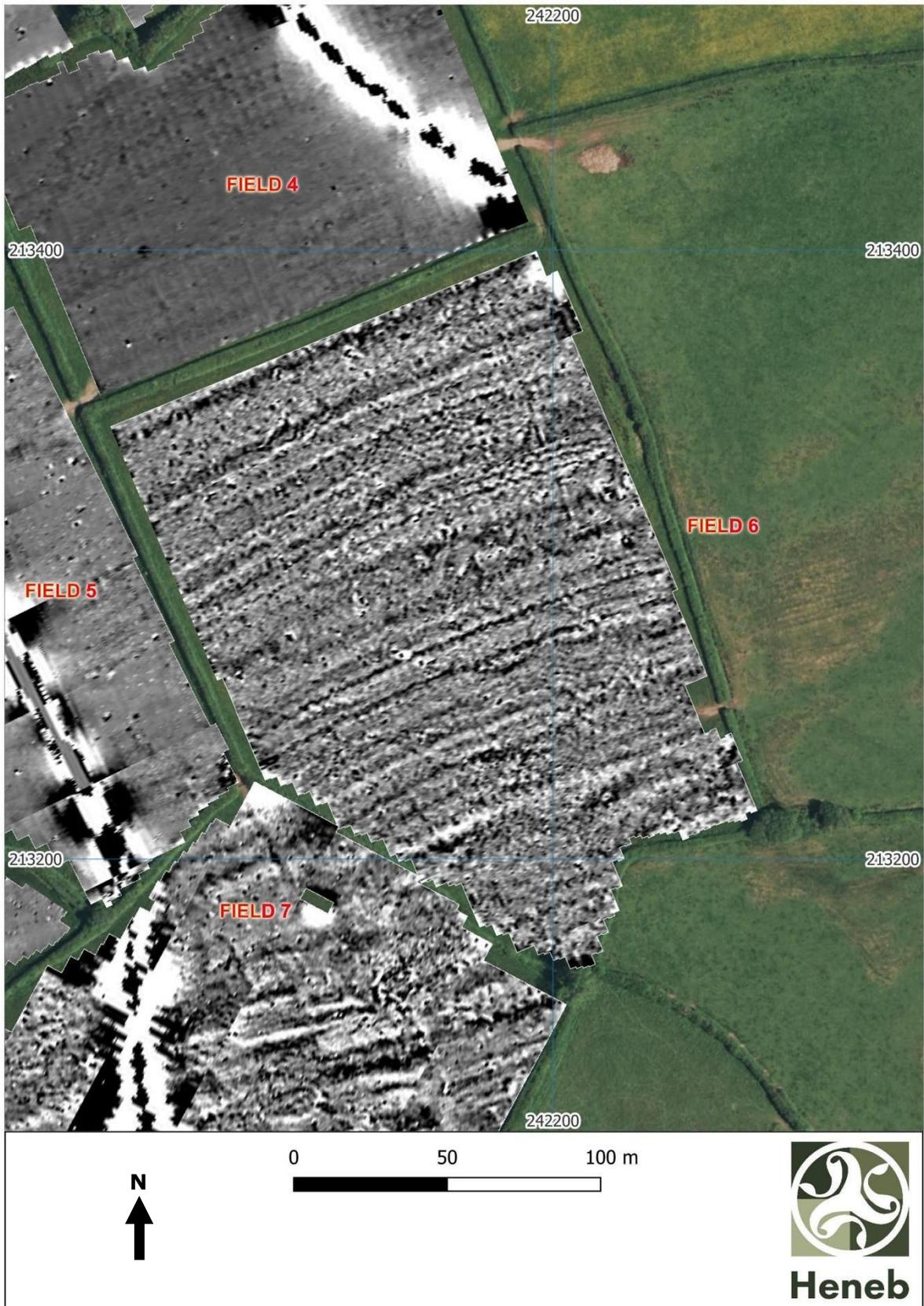


Figure 18: Greyscale plot of geophysical survey in Field 6 overlain on satellite mapping(©Bing)

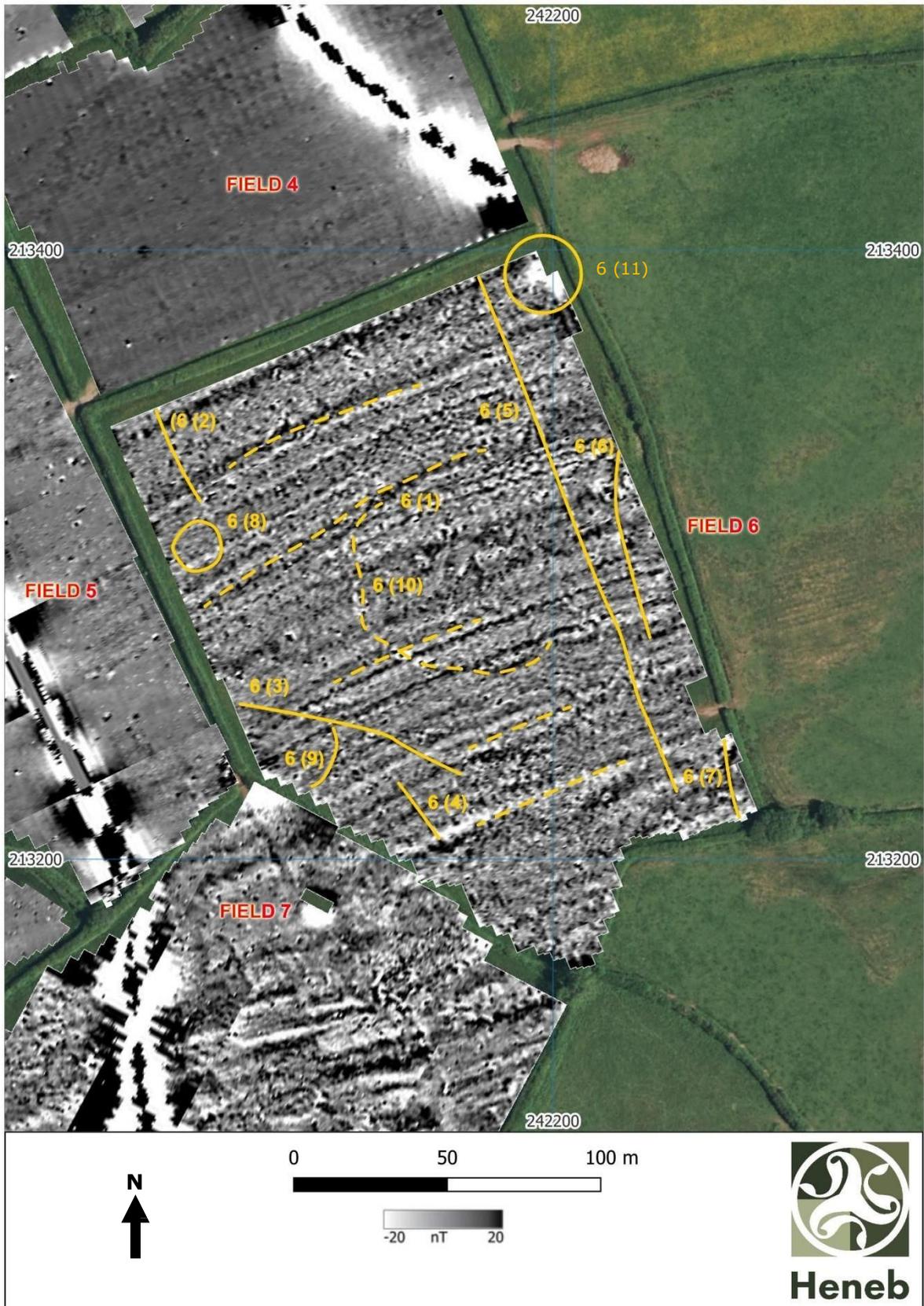


Figure 19: Greyscale plot of geophysical survey in Field 6 with interpretive overlay (Background mapping ©Bing).

4.15 Field 6 (Figures 18 and 19)

4.15.1 Field 6 is situated on the southeastern edge of the survey area, to the east of Field 5 and south of Field 6. The field slopes gently to the southeast, where the terrain descends into the Loughor Valley. It is currently maintained as improved pasture, bordered by established hedgerows and stock fencing. The field becomes wetter towards its southern end due to the gradient and proximity to the valley bottom.

4.15.2 The following geophysical responses were identified:

- **Response 6 (1):**
Geological banding, similar to that observed in Field 7, is prominently visible in this field. This is likely caused by the natural geological formation processes of the valley side, further influenced by heavy agricultural activity.
- **Response 6 (2):**
A faint positive linear anomaly running roughly north/south. This is most likely the remains of a former field boundary. The feature can be traced extending beyond its marked limits in the LiDAR coverage of the area, although it does not appear on any historic mapping consulted.
- **Responses 6 (3-4):**
These faint positive linear anomalies are located in the southwestern part of the field. They are also likely to represent former field boundaries. However, these features do not appear on historic maps and lack a coherent form.
- **Responses 6 (5-7):**
Faint positive linear anomalies running along the eastern edge of the field, appearing to create a funnel-like shape. These responses may be former field boundaries, potentially marking the edges of an old trackway. These are not visible on historic map sources of LiDAR coverage.
- **Responses 6 (8-9):**
Two faint dipolar curvilinear responses forming incomplete arcs, each less than 20m in diameter. Although faint, their elevated position makes the possibility of ring ditches worth consideration. Alternatively, they may be explained by disturbance within the geological banding. Response 6 (9) is a stronger candidate for a ring ditch compared to Response 6 (8), though both remain possibilities.
- **Response 6 (10):**
A faint dipolar disturbance interrupting the otherwise regular geological banding. This is most likely caused by hill slippage; however, an anthropogenic origin cannot be ruled out.
- **Response 6 (11):**
A highly magnetic response corresponding to a section of the pipeline that crosses the corner of the field or ferrous material in the field boundary.

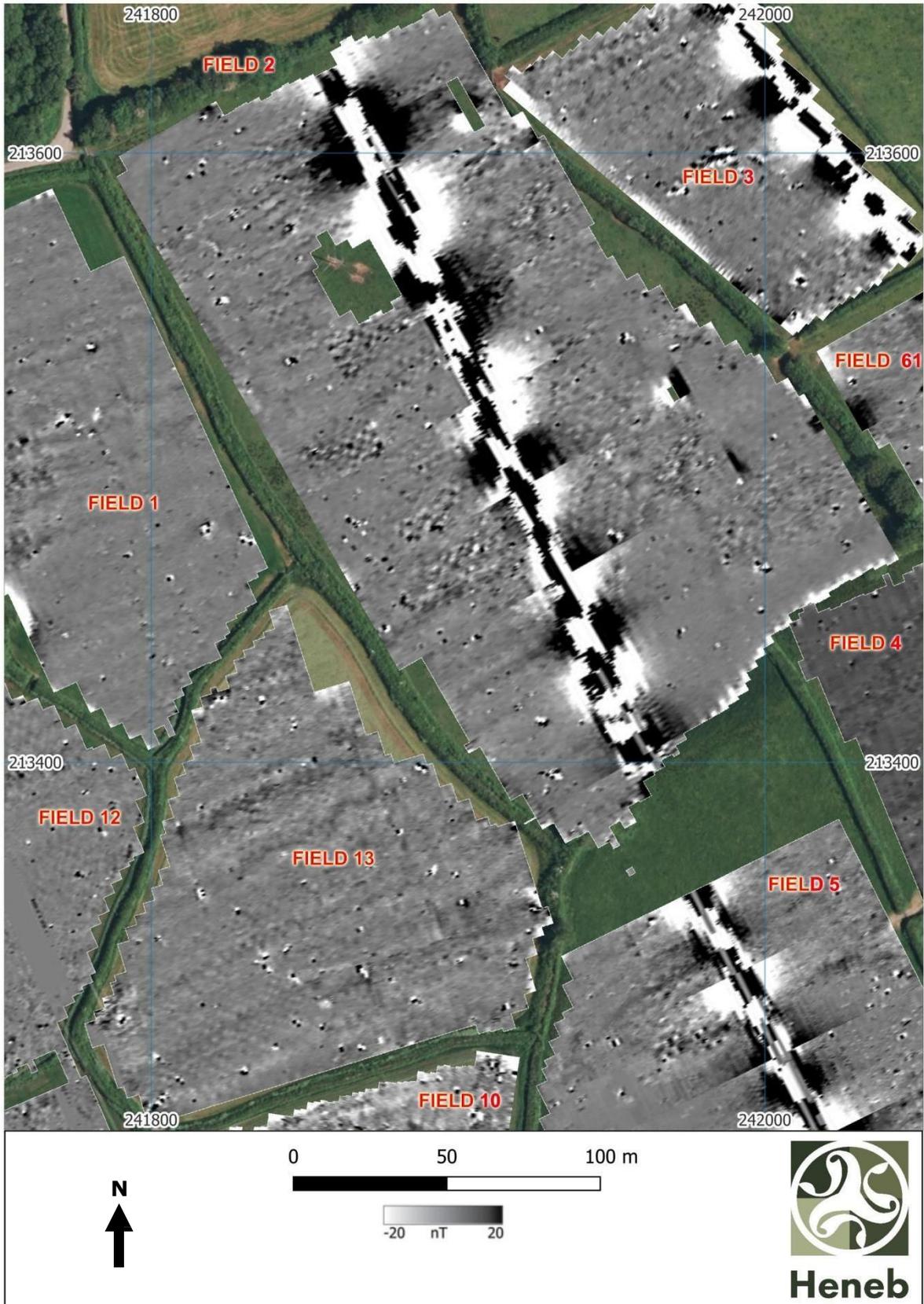


Figure 20: Greyscale plot of geophysical survey in Field 2 overlain on satellite mapping(©Bing)

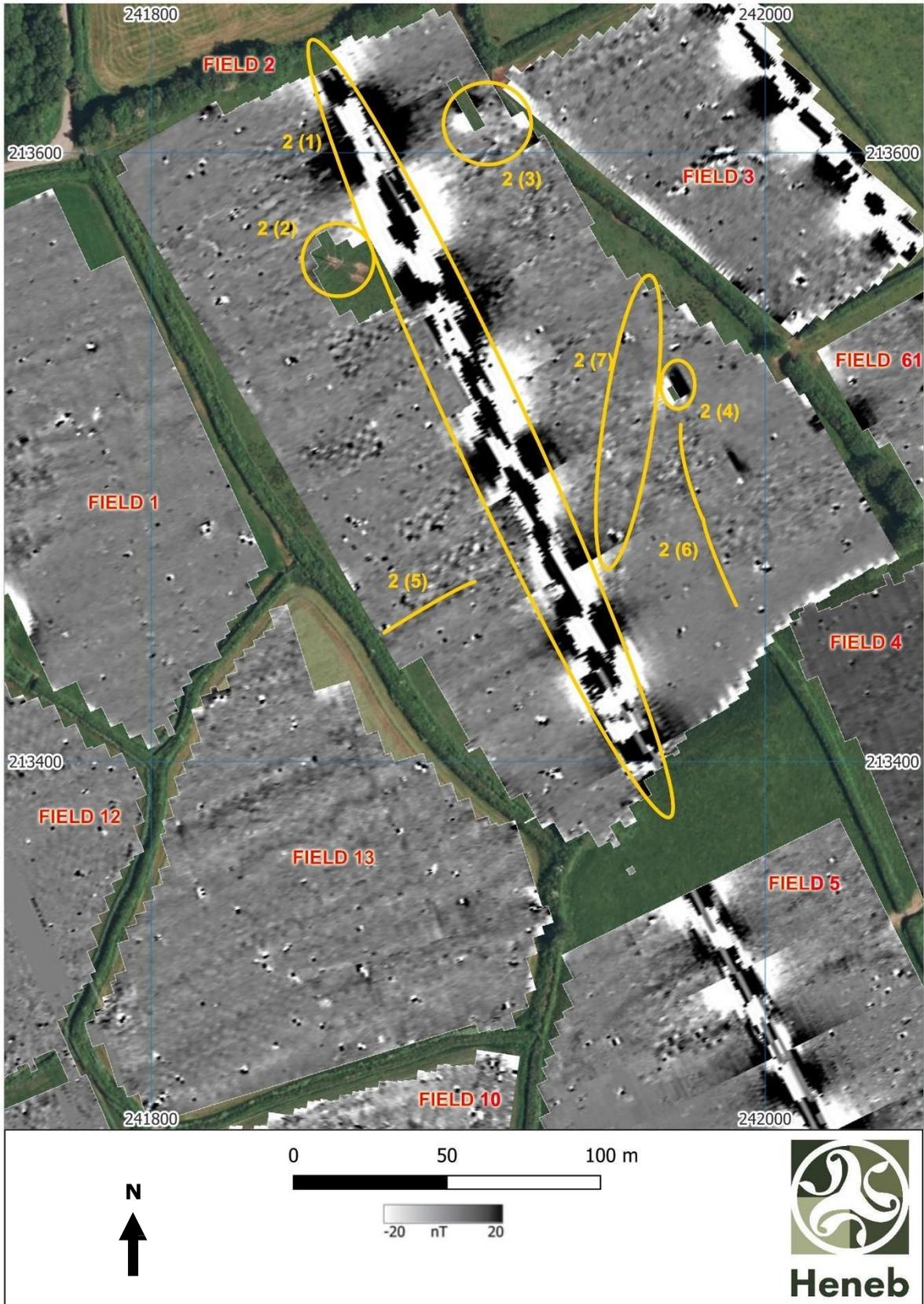


Figure 21: Greyscale plot of geophysical survey in Field 2 with interpretive overlay (Background mapping ©Bing).

4.16 Field 2 (Figures 20 and 21)

4.16.1 Field 2 is located to the north of Field 5 and east of Field 1. It is among the largest fields surveyed, with a roughly rectangular form oriented northwest/southeast. Currently, the field consists of improved pasture, with noticeably boggy sections in its midsection. It is bounded by mature hedgerows reinforced with stock fencing.

4.16.2 The following geophysical responses were identified:

- **Response 2 (1):**
A highly magnetic response corresponding to the Pontiets to Bancyfelin Gas Pipeline, which runs in a north/south direction through the survey area.
- **Response 2 (2):**
A highly magnetic response caused by the presence of a pylon within the field.
- **Responses 2 (3-4):**
High magnetic responses resulting from geotechnical pit apparatus located within the field.
- **Response 2 (5):**
A faint positive linear anomaly, likely marking the location of a former field boundary. This boundary is depicted on both the tithe map and the 1st and 2nd edition Ordnance Survey (OS) maps of the area.
- **Response 2 (6):**
Another faint positive linear anomaly, also likely representing a former field boundary. This feature is not recorded on historic maps or visible in the LiDAR coverage of the area.
- **Response 2 (7):**
A faint negative linear response indicating the known route of the Via Julia Maritima Roman road. This feature is more distinctly visible in Field 10 and appears more faintly in Field 13. Within Field 2, it is visible as a faint positive anomaly that would be difficult to identify without prior knowledge of its location.

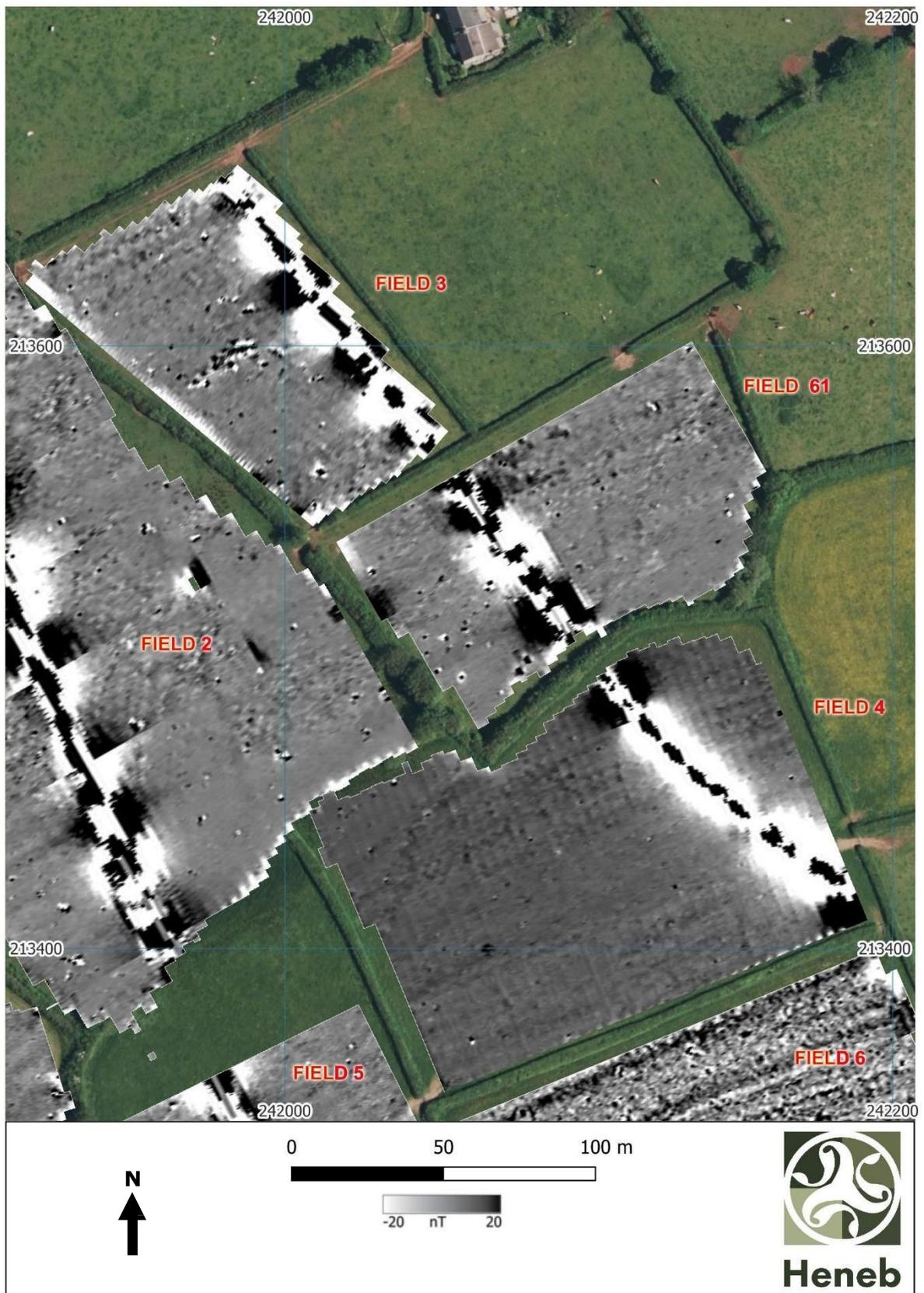


Figure 22: Greyscale plot of geophysical survey in Field 6 overlain on satellite mapping(©Bing).



Figure 23: Greyscale plot of geophysical survey in Field 2 with interpretive overlay (Background mapping ©Bing).

4.17 Field 3 (Figures 22 and 23)

4.17.1 Field 3 is a small, sub-rectangular field located in the northeastern corner of the survey area, east of Field 2 and north of Field 61. The field is mostly flat, laid to improved pasture, and surrounded by established hedge banks.

4.17.2 The following geophysical responses were identified:

- **Response 3 (1):**
Magnetic disturbance likely caused by ferrous material within the plough soil.
- **Response 3 (2):**
A highly magnetic dipolar linear response corresponding to the known route of a modern pipeline crossing the survey area.
- **Response 3 (3):**
A highly magnetic discrete response, likely caused by ferrous fencing surrounding the field.
- **Response 3 (4):**
A faint negative linear response marking the known route of the Via Julia Maritima Roman road. Within Fields 2 and 3, it appears as a faint positive anomaly, which would be difficult to discern without prior knowledge of its location.

4.18 Field 61 (Figures 22 and 23)

4.18.1 Field 61 is situated in the northeastern part of the survey area, south of Field 3 and north of Field 4. The field slopes gently towards the south, descending into a small valley, with the opposing slope formed by Field 4 itself.

4.18.2 The following geophysical responses were identified:

- **Response 61 (1):**
A highly magnetic discrete positive anomaly that crosses into Field 2. This is assumed to result from a ferrous object.
- **Response 61 (2):**
A highly magnetic dipolar linear response marking the known route of the pipeline.
- **Response 61 (3):**
An area of magnetic disturbance likely caused by the installation of the adjacent pipeline (Response 61 (2)). This feature is not considered archaeologically significant.

4.19 Field 4 (Figures 22 and 23)

4.19.1 Field 4 is located in the eastern part of the survey area, south of Field 61 and north of Field 6. The field slopes gently towards the north and is currently under improved pasture, bounded by established hedgerows reinforced with stock fencing.

4.19.2 The following geophysical responses were identified:

- **Response 4 (1):**
Geological banding, similar to that observed in Field 6, though less prominent. This is likely the result of differing agricultural practices.
- **Response 4 (2):**
A highly magnetic dipolar linear response corresponding to the known route of the pipeline.
- **Response 4 (3):**
A discrete anomaly approximately 2m wide. This could represent a quarry pit, though other geological processes are equally plausible.

5. INTERPRETATION AND DISCUSSION

5.1 General

- 5.1.1 The survey faced challenging ground conditions, with significant waterlogging particularly affecting the central part of the survey area. Despite these difficulties and the time of year in which the survey was conducted, a good coverage of the survey area was achieved.
- 5.1.2 Background geological responses and banding were notably strong in the southern part of the survey area, particularly in Fields 6, 7, 9, and 38. These factors may have obscured more subtle features. However, the identification of potential features across many surveyed areas suggests that significant archaeological features, which are typically easily detected using magnetometry, are unlikely to have been overlooked.
- 5.1.3 In the central part of the survey area, colluvial and alluvial deposits are thought to exist within the gently sloping valley running east-west through the survey area. If present, these deposits could obscure any underlying archaeological remains. Fields potentially affected include 4, 5, 6, 8, 10, 11, 14, 42, and 61.
- 5.1.4 Magnetic disturbance was another significant factor influencing the survey results. Large transmission pylons running north-south across the site, smaller but still highly magnetic distribution pylons, and two pipelines traversing the area also produced notable interference. This disturbance may obscure archaeological remains in close proximity, particularly in Fields 2, 3, 4, 5, 7, 9, 14, 38, and 61.
- 5.1.5 It is important to note that geophysical surveys such as this cannot detect all potential archaeological features. The interpretations presented below should be regarded as preliminary, and more intrusive archaeological investigations will be necessary to confirm the findings.

5.2 Field Boundaries

- 5.2.1 Linear anomalies, which are likely former field boundaries, were identified in Fields 2, 4, 5, 7, 8, 14, and 32. Cross-referencing these anomalies with historic maps, including the tithe maps of the 1840s and Ordnance Survey maps from the 1880s onward, confirmed the presence of boundaries in Fields 2 and 8. The remaining boundaries in Fields 4, 5, 7, 14, and 32 are therefore likely to predate these mapping records.
- 5.2.2 These field boundaries sometimes appear as positive linear responses flanked by negative responses, while in other instances, the pattern is reversed. The variation in responses may be due to the specific morphology of the boundaries, as they are no longer extant and are subject to changes over time. In most cases, the current boundaries in the area consist of banks with slight ditches on either side, often planted with hedges. This form would likely produce the negative linear anomalies flanked by positive responses.
- 5.2.3 Despite not appearing on historic mapping these features are still presumed to be mostly post-medieval in date and of limited archaeological significance.

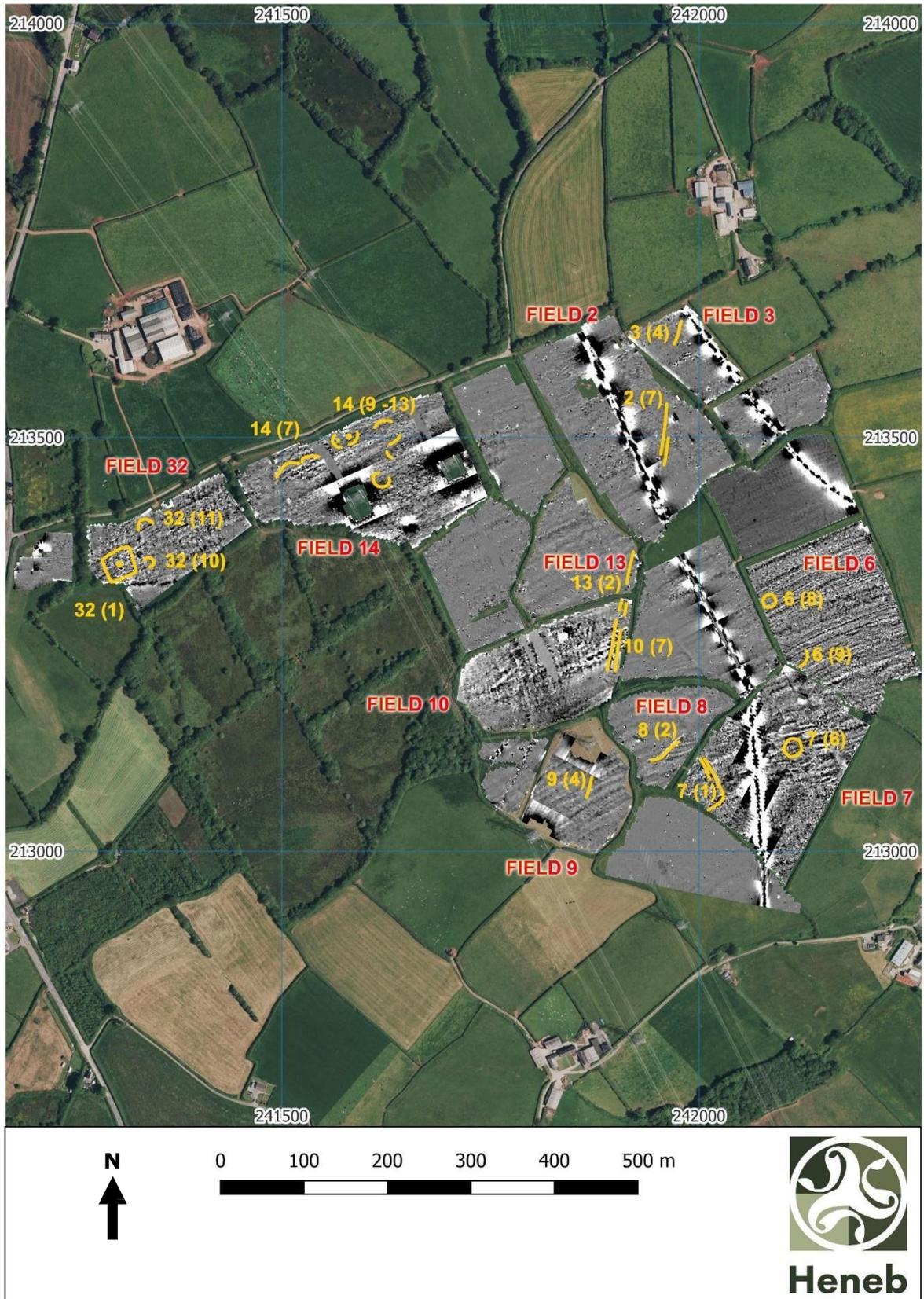


Figure 24: Overview of features discussed in interpretation and discussion.

5.3 Potential Ring Ditches (Figure 24)

- 5.3.1 Ring ditches are a common archaeological feature identified in geophysical surveys and typically have two primary interpretations. The first interpretation is as round barrows, burial mounds dating to the Bronze Age (circa 2500–750 BC). These barrows often contain one or more burials or cremations and are usually located on elevated ground overlooking adjacent valleys. In geophysical surveys, the detected anomalies are usually the ditches that encircle the barrows, created during their construction.
- 5.3.2 The second interpretation is as roundhouses, structures most commonly dating to the Iron Age (circa 750 BC–43 AD), though some examples may originate in the Bronze Age. These were residential buildings that could be isolated in the landscape (more typical in the Bronze Age) or part of defended settlements (more typical in the Iron Age). In geophysical data, the anomalies correspond to the drainage ditches or gullies that surrounded these structures. In rare cases of excellent preservation, central features like hearths or postholes may also be detected.
- 5.3.3 Across the survey area, there are several potential candidates for ring ditches. It must be emphasized that none of these are definitive, as the data generally show only partial arcs. These features are distributed across high ground in the northern and southern parts of the survey area. Based on their prominent locations, they are interpreted by the author as more likely representing round barrows; however, the possibility that some may be roundhouses cannot be excluded.
- 5.3.4 The fields containing possible ring ditches are Fields 6, 7, 14, and 32. In the northern part of the survey area, the anomalies in Field 32 (Responses 9–13) and Field 14 (Responses 10–11) are considered stronger candidates due to their clearer form. In contrast, the interpretations in Fields 6 (Responses 6, 8–9) and 7 are more speculative, as geological banding in these fields complicates interpretation.
- 5.3.5 The most convincing of these potential ring ditches is Field 14, Response 7. This feature forms a regular discrete arc with magnetic levels consistent with an archaeological feature. Unfortunately, its proximity to Pylon 14 (Response 1) obscures the western part of the feature.

5.4 Possible Enclosures (Figure 24)

- 5.4.1 Three possible enclosures were identified within the survey area, located in Fields 32, 14, 7, and 8.

Field 14

- 5.4.2 In Field 14, the possible enclosure (Response 14(7)) consists of two strong clearly anthropogenic curvilinear positive responses in the north-western part of the survey area. These two features run approximately east west and appear to break and curve into an entrance at their midpoint. Within the entrance, there is an area of enhanced magnetic activity (Response 14(8)).
- 5.4.3 As noted in the results, the form of this section of ditch is compelling and suggests the entrance of a small later prehistoric enclosure. The western extent of this feature is thought possibly obscured by alluvial deposits (Response 14(14)) or possibly truncated, while the eastern extent is hidden by the pylons (Responses 14(1-2)).
- 5.4.4 Later prehistoric enclosures are common in West Wales, typically dating to the Iron Age (750 BC–43 AD). They are often considered to be defended settlements or villages, usually situated on higher ground. Smaller enclosures like this one are likely to date to the later Iron Age, although an earlier date is also possible (Murphy and Murphy 2010).
- 5.4.5 This interpretation, however, should be treated with caution, although mitigating factors such as alluvial deposits are suggested and provide some basis for considering it as a potential enclosure, this interpretation should be considered speculative.

Fields 7 and 8

- 5.4.6 In Fields 7 and 8, a possible enclosure is formed by Response 8(1), located on the higher ground in the southern part of Field 8, and Response 7(1), found in the western part of Field 7.
- 5.4.7 Response 8(1) consists of a strong positive linear anomaly, presumed to be a large, backfilled drainage ditch. This feature corresponds with a field boundary seen in the tithe and 1st edition OS mapping of the area. By the 2nd edition OS mapping, the field boundary had shifted to its present location.
- 5.4.8 The portion of the possible enclosure seen in Field 7 (Response 7(1)) is less certain due to the geological banding present in the field (Response 7(5)) though it does appear to form a coherent, albeit faint, L-shape.
- 5.4.9 Together, both responses form a small, sub-rectangular enclosure, measuring approximately 86m northwest/southeast by 55m northeast/southwest. If correct, this enclosure would predate the tithe mapping of the area (1843), though it is still thought most likely to be of historic date.

Field 32

- 5.4.10 Field 32 contains a small roughly square enclosure (Response 32(1)), measuring 36 m northeast/southwest by 31 m northwest/southeast. At the centre of the feature is a discrete, positive magnetic response, most likely the remains of a large pit.
- 5.4.11 As mentioned in the results, the responses forming this possible enclosure are somewhat diffuse, making this interpretation tentative. Nevertheless, its form is extremely coherent. If the interpretation as a possible enclosure is correct, it is most likely of medieval or post medieval origin, although predating the 1843 tithe map, and forming part of a wider system of boundaries (Responses 32(2-9)).

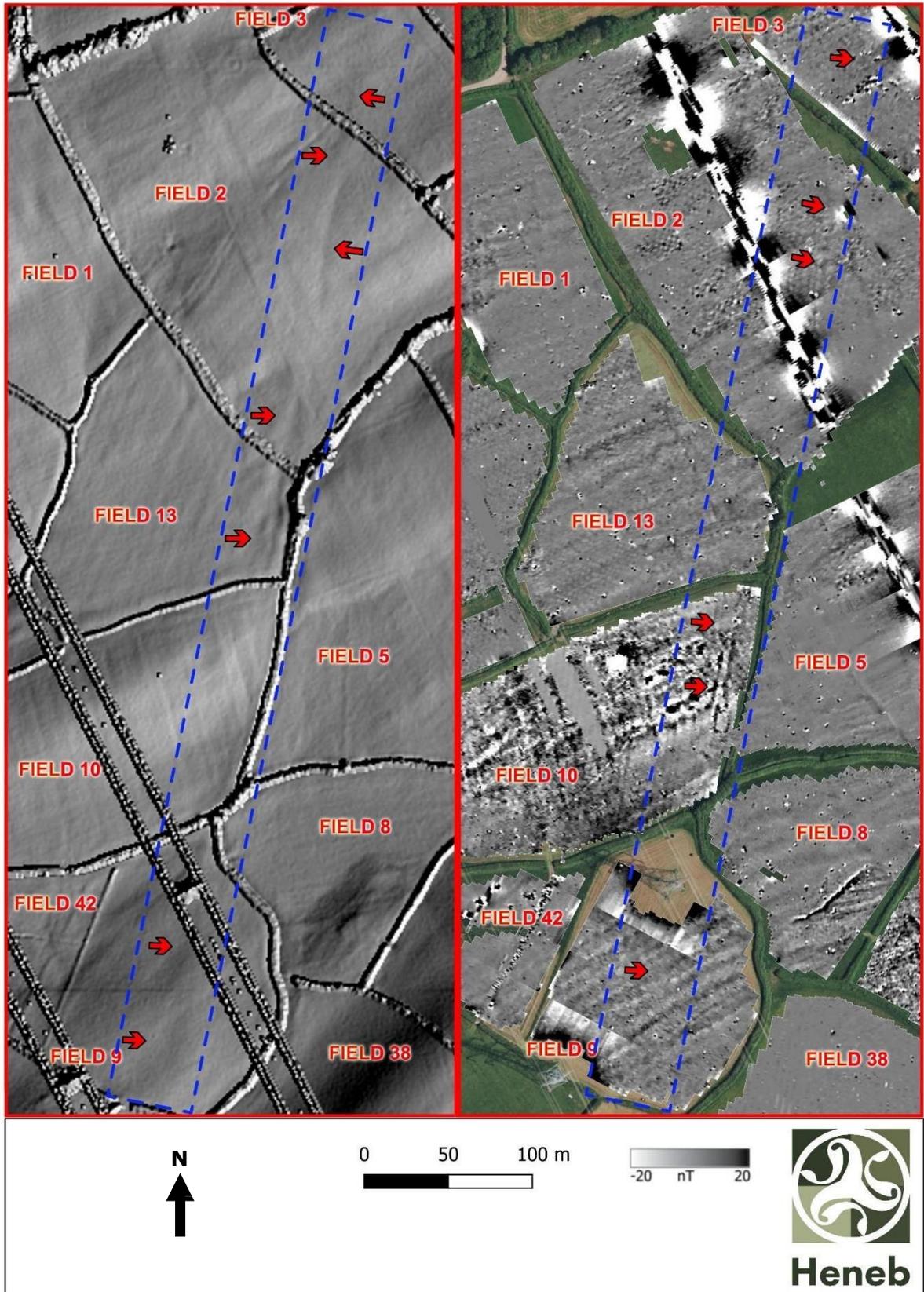


Figure 25: LiDAR coverage and geophysical survey comparison of the route of the Via Julia Maritima Roman Road

5.5 The Via Julia Maritima Roman Road (Figures 24 and 25)

- 5.5.1 The Via Julia Maritima Roman Road was first identified through aerial observations during the drought of 2018 (Driver et al., 2020). The road connects the Flavian fort at Carmarthen to the northwest and the fort at Loughor to the southeast.
- 5.5.2 The closest recorded location of the road is noted on the National Monuments Record 120m to the northeast of the survey area (NPRN 415842). It is also referenced in the Dyfed Historic Environment Record 590m to the northeast (PRN 13303).
- 5.5.3 The projected route of the road runs through the survey area in a northeast/southwest direction. LiDAR sources appear to confirm this, with the road clearly visible as it traverses Fields 3, 2, 13, 10, and 9. In Fields 3, 2, and 13, it is particularly apparent as a slight depression, suggesting that the road may have been terraced into the rising ground. In the central lowland area of the survey, particularly in Field 13, the road is visible as a distinct positive earthwork, with a later hedge bank built alongside. In Field 10, the road is less visible, although the later hedge bank continues along its projected course. In Field 9, the road is again faintly visible as a slight depression, somewhat terraced into the rising ground at the southern end of the site.
- 5.5.4 The geophysical survey further contributes to our understanding of the road's route. It is faintly visible as a positive anomaly crossing Fields 3, 2, and 13, though detecting it without prior knowledge of the route would be challenging.
- 5.5.5 The road is most clearly seen in Field 10, located in the low ground at the centre of the survey area. In this field, two distinct positive linear anomalies are visible, running northeast/southwest along the eastern boundary. These anomalies are almost certainly the remains of *fossa*—drainage ditches that flanked Roman roads. Between the ditches, a faint negative magnetic response is visible, which likely indicates the remains of the *agger*—the raised, curved road surface.
- 5.5.6 The clarity of the road in Field 10, compared to other Fields, can be attributed to several factors. Firstly, Field 10 is located in low ground that does not appear to have been heavily cultivated in modern times, which would have helped preserve the road. Additionally, the road's proximity to an adjacent hedge bank likely contributed to its better preservation. It is also probable that, in this lower ground area, the Roman road would have been more substantial, and more certain to have flanking ditches for drainage.
- 5.5.7 At the southern end of the survey area in the geophysical survey in Field 9, the road is faintly visible, but it would be again difficult to detect without prior knowledge of its location.
- 5.5.8 When considering the geophysical and LiDAR data together, it is possible to gain a clear understanding of the route and preservation of the road. In Fields 3 and 2, it can be seen as a slight depression in the LiDAR data and a faint response in the geophysical survey, suggesting that buried archaeological deposits may have been preserved and protected from modern agricultural practices. In Field 13, it is visible as a positive earthwork, while in Field 10, it is well-defined in the geophysical survey, further indicating that the road may be well-preserved due to less intensive agricultural practices in these fields. In Field 9, the road appears as a slight depression, again likely suggesting good preservation.

6. CONCLUSIONS

- 6.1 A geophysical survey was conducted by Heneb- Dyfed Archaeology for Stantec Ltd on behalf of National Grid Transmission in the area proposed for an Air Insulated Substation (AIS) at Llandyfaelog, Carmarthenshire. The survey area measured 37 ha which is currently subdivided into 19 fields under pasture.
- 6.2 Identified features included potential ring ditches, enclosures, and the course of the Via Julia Maritima Roman Road.
- 6.3 Linear anomalies, likely representing former field boundaries, were identified in Fields 2, 4, 5, 7, 8, 14, and 32. These features are likely to be post-medieval in date and are not considered archaeologically significant.
- 6.4 The survey also identified several potential ring ditches across Fields 6, 7, 14, and 32. Ring ditches have two common interpretations: as either Bronze Age (2500–750 BC) burial mounds/round barrows or roundhouses of either Bronze Age or Iron Age (750 BC – 43 AD) date. In this instance, it is thought more likely that the ring ditches represent burial mounds. However, as all detected anomalies are partial arcs, this interpretation should be considered tentative.
- 6.5 Three possible enclosures were identified within the survey area. Two possible sub-rectangular enclosures were located in Fields 7–8 and Field 32. Both of these features are formed by diffuse anomalies, and while their shape and form are compelling, their interpretation should also be considered tentative.
- 6.6 The third enclosure was located in Field 14, consisting of two strong curvilinear positive anomalies in the north-western part of the survey area. While western extent of the feature is obscured by power lines, its form suggests it could be a prehistoric enclosure. However, this interpretation remains speculative, as the anomaly does not form a complete enclosure.
- 6.7 The most definitive archaeological feature identified in the survey was the Via Julia Maritima Roman Road. The road, which connects the Roman forts at Carmarthen and Loughor, was visible in several fields, with the most distinct evidence observed in Field 10, where positive linear anomalies suggest the remains of the fossa (drainage ditches) flanking the road. The faint negative anomaly between these ditches is likely the remains of the agger, the raised road surface.
- 6.8 When combined with the LiDAR coverage of the scheme, a clear impression of the route of the road is possible. In the north-eastern and south-western parts of the survey area it can be seen as a clearly defined depression in the LiDAR coverage of the area. In the central part of the survey area, there is upstanding remains in Field 13, whilst the geophysical survey shows well-defined flanking ditches (*fossa*) and a possible raised road surface (*agger*) in Field 10. Throughout the survey area a good level of preservation is thought likely.
- 6.9 As with all geophysical surveys, it is important to note that geophysical surveys cannot detect all potential archaeological features. The interpretations presented here should be regarded as preliminary, and more intrusive archaeological investigations may be necessary to confirm the findings. Any such decisions are solely for Heneb – Development Management in their role as advisors to the Local Planning Authority (LPA).

6. SOURCES

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7. GLOSSARY

Fluxgate Gradiometer	An instrument used to measure magnetism to search for areas of disturbed ground that may be associated with subsurface archaeological features.
nanoTesla (nT)	A unit of measurement of a magnetic field.
Ferrous object	Metals and alloys that contain iron.
Dipole	An anomaly consisting of a single positive response with an associated negative response forming a 'halo effect'. The negative and positive response is of equal magnitude but opposite polarity and are caused by the same feature. Dipole anomalies are very commonly observed across a range of sites, particularly agricultural land. Generally, unless the dipoles form part of a larger pattern or feature they are regarded as not significant. They are usually the result of modern ferrous rich debris such as brick and tile fragments as well as objects such as horseshoes or broken ploughshares, which lie within the topsoil.

**APPENDIX 1: Geophysical survey results
presented as trace plots and minimally
processed greyscale plots.**

Shown in order described in text.

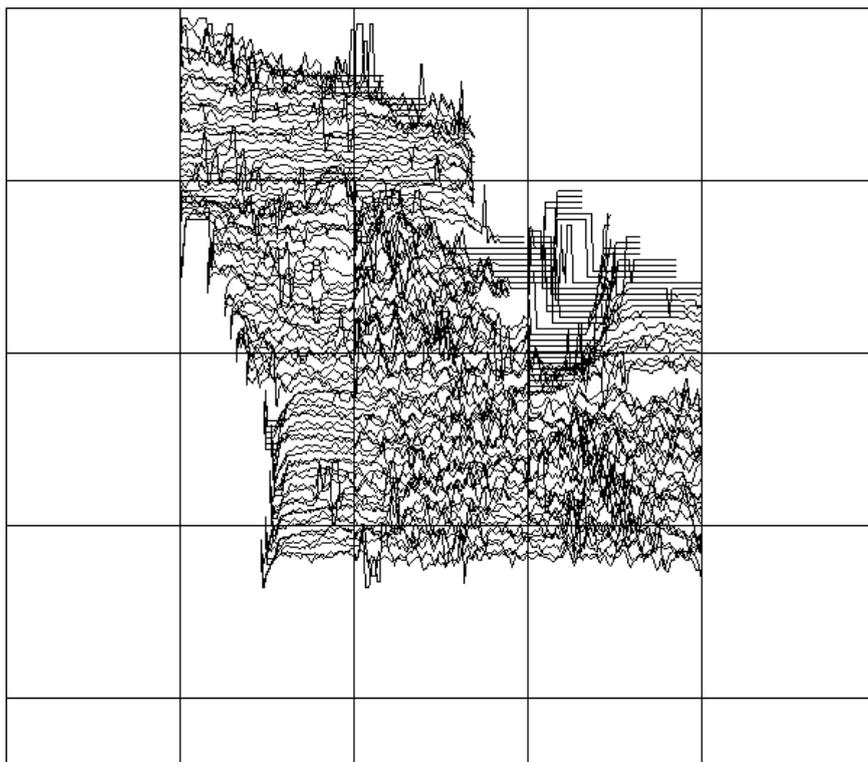


Figure 26: Field 31 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

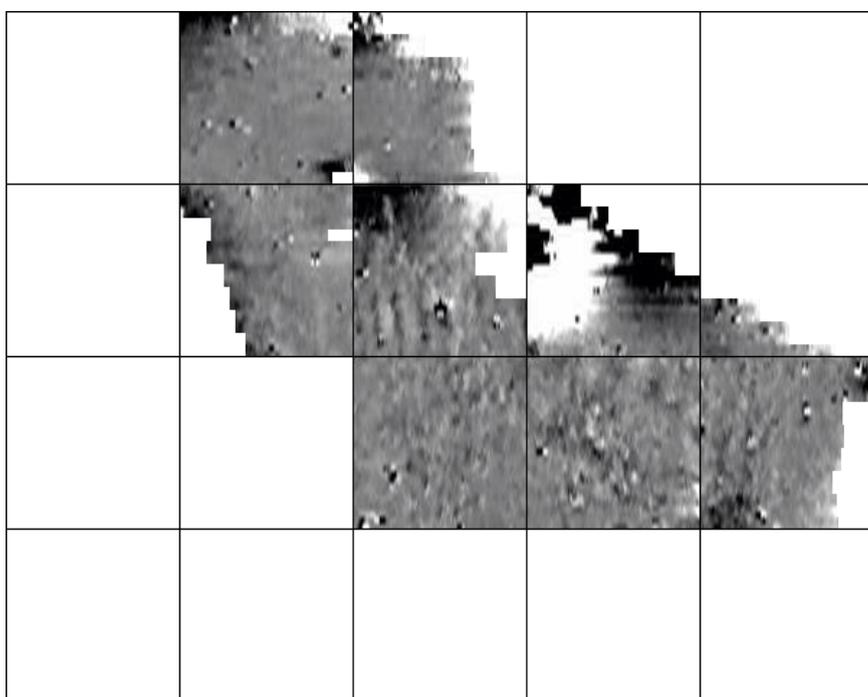


Figure 27: Field 31 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

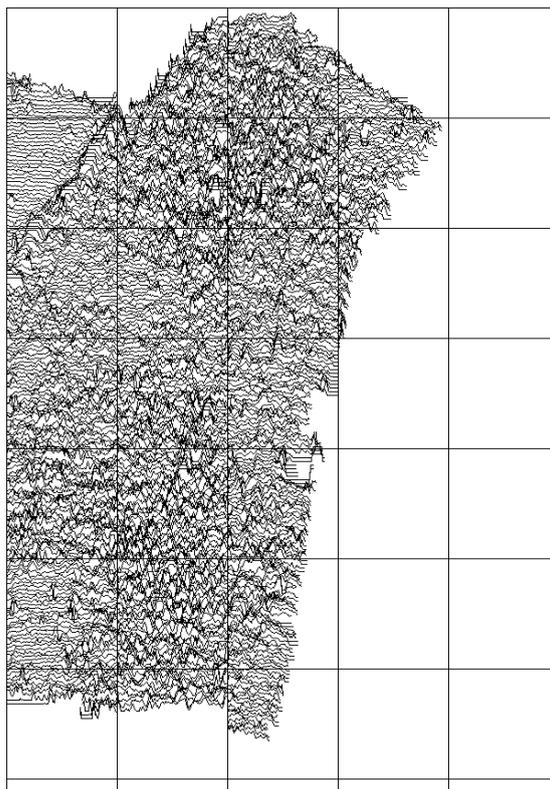


Figure 28: Field 32 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

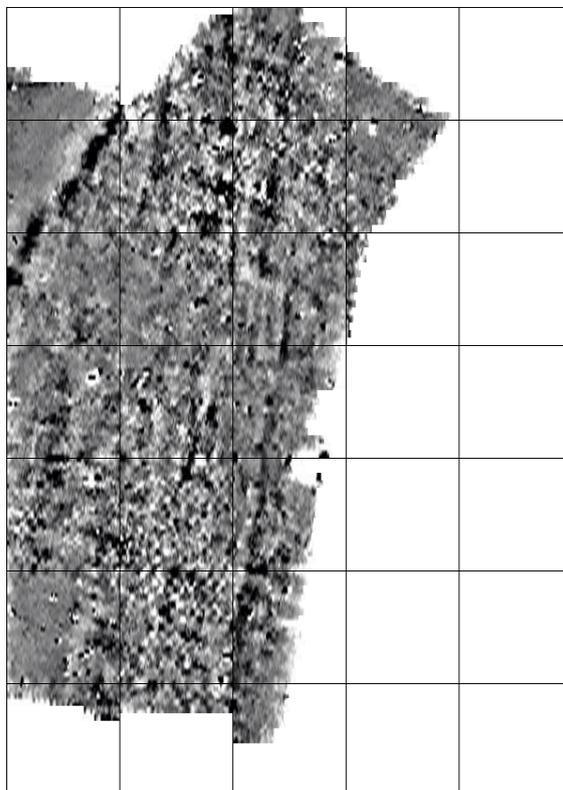


Figure 29: Field 32 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

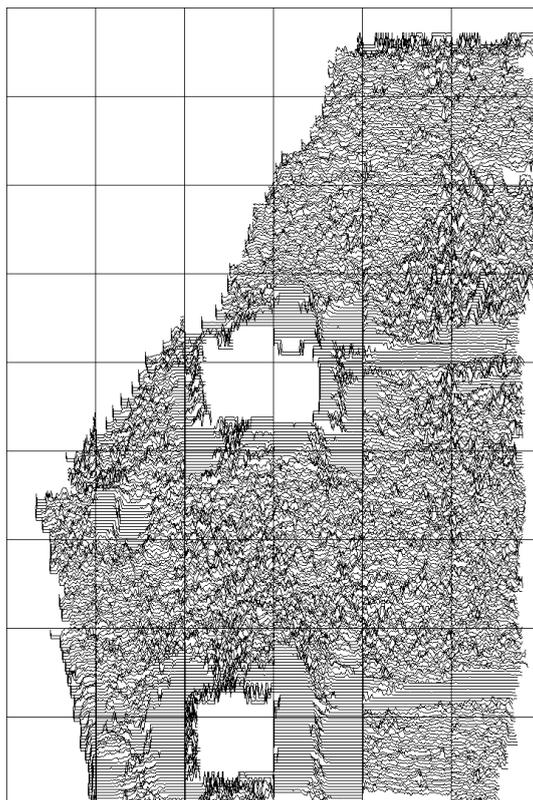


Figure 30: Field 14 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

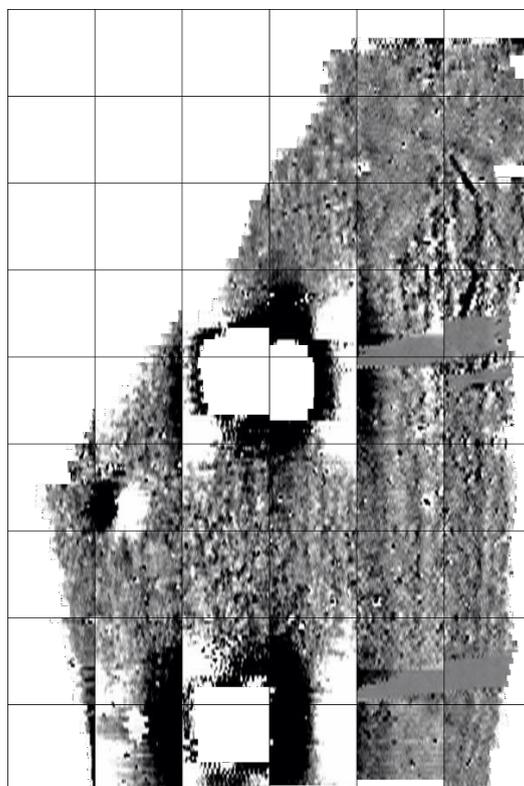


Figure 31: Field 14 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

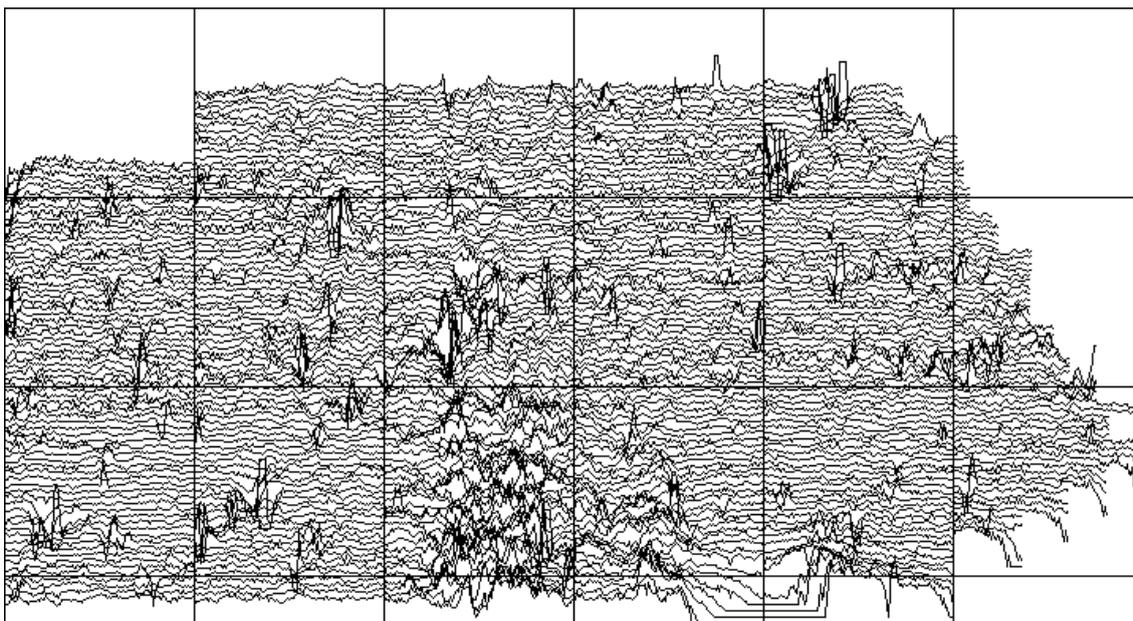


Figure 32: Field 1 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the left.

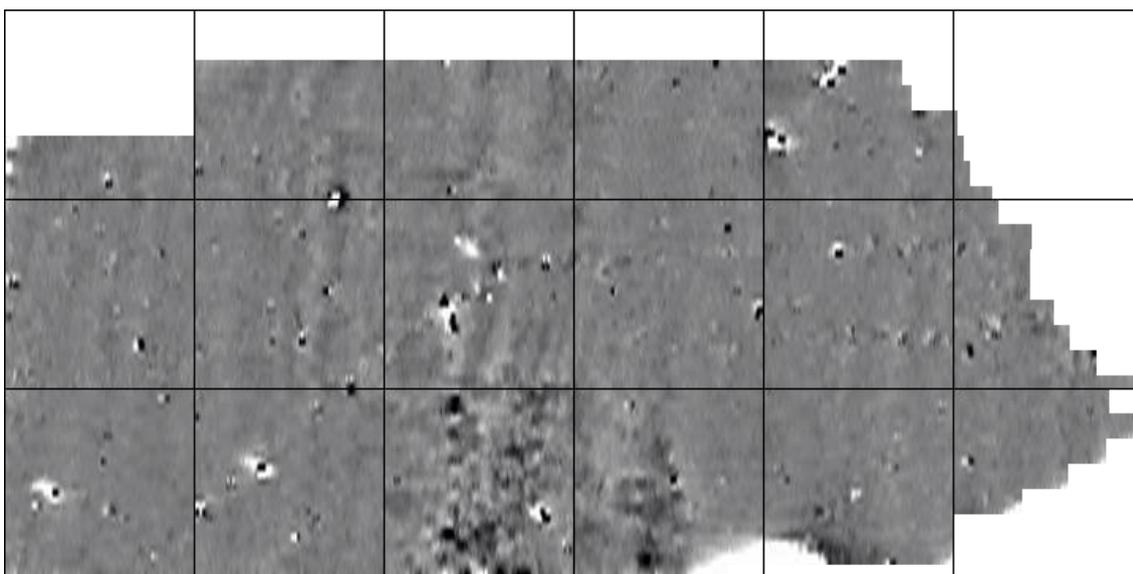


Figure 33: Field 1 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the left of the page.

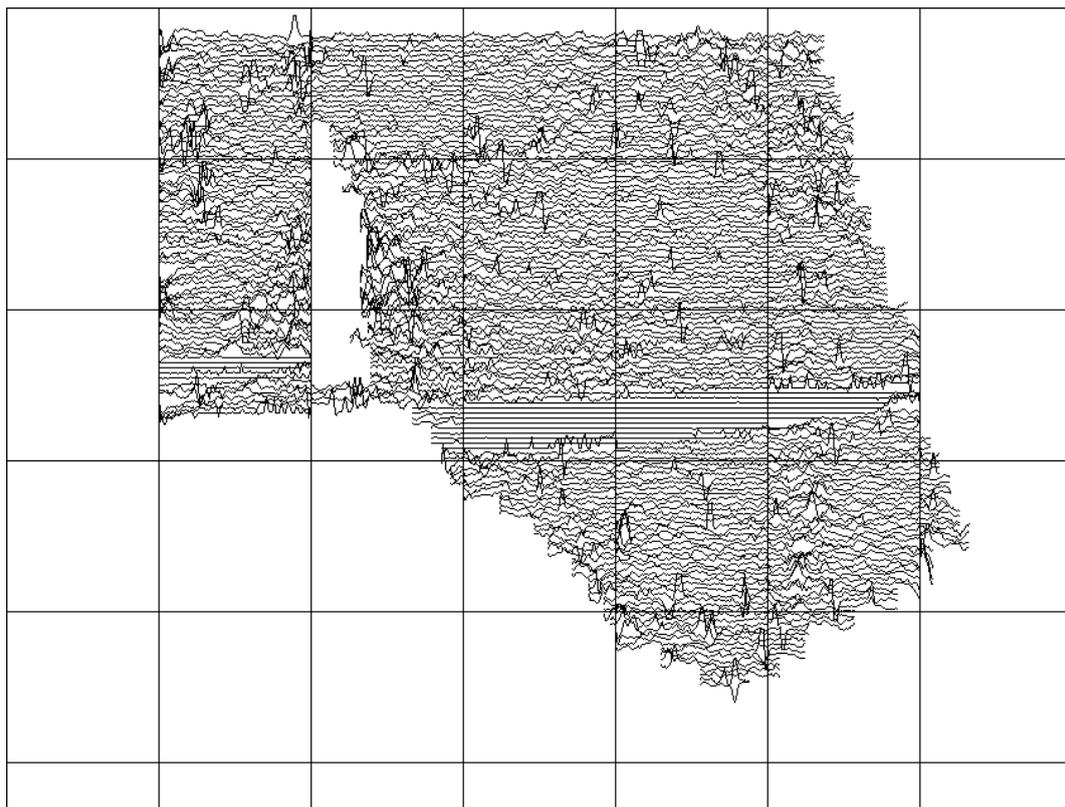


Figure 34: Field's 11 and 12 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

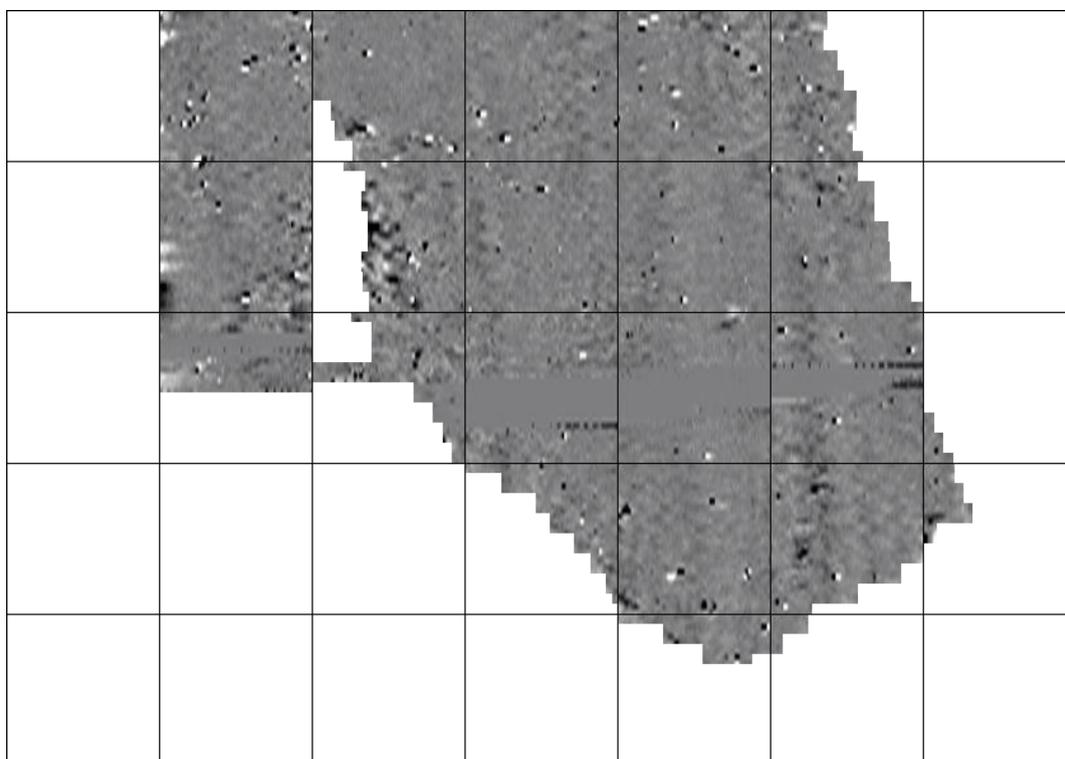


Figure 35: Fields 11 and 12 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

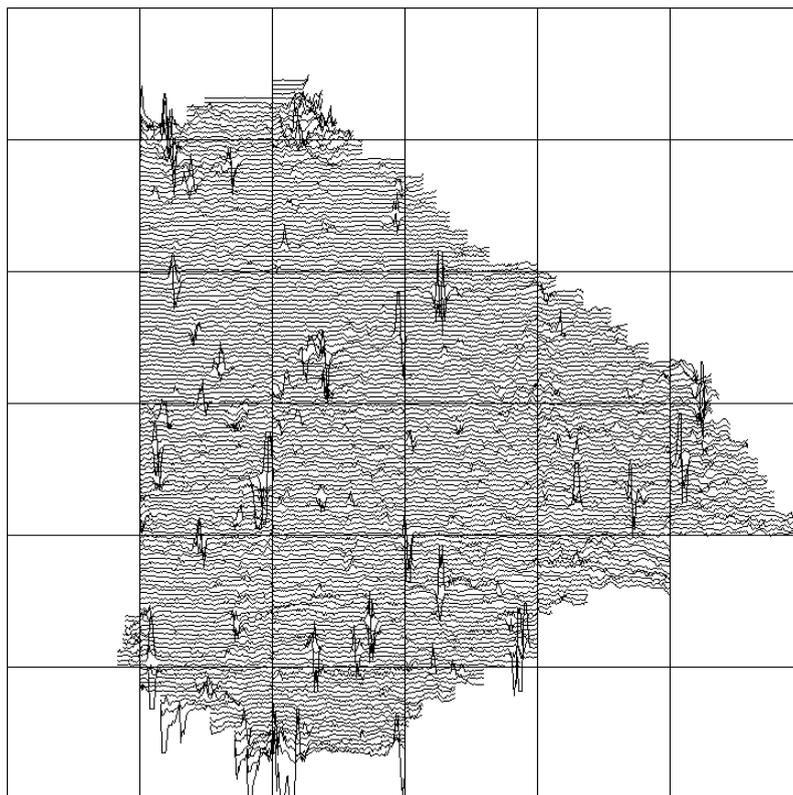


Figure 36: Field 13 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

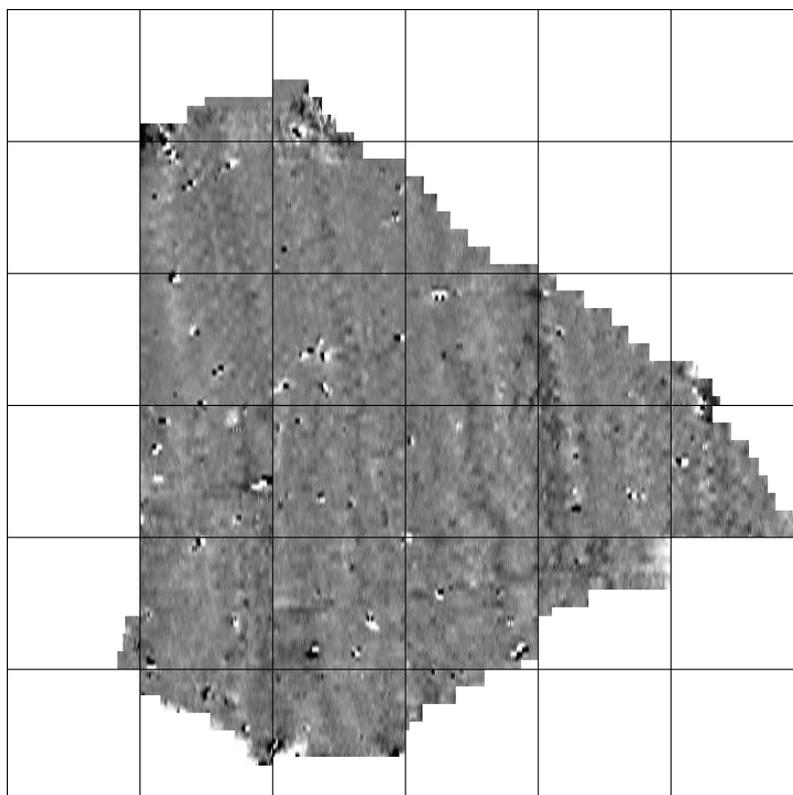


Figure 77: Fields 13 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

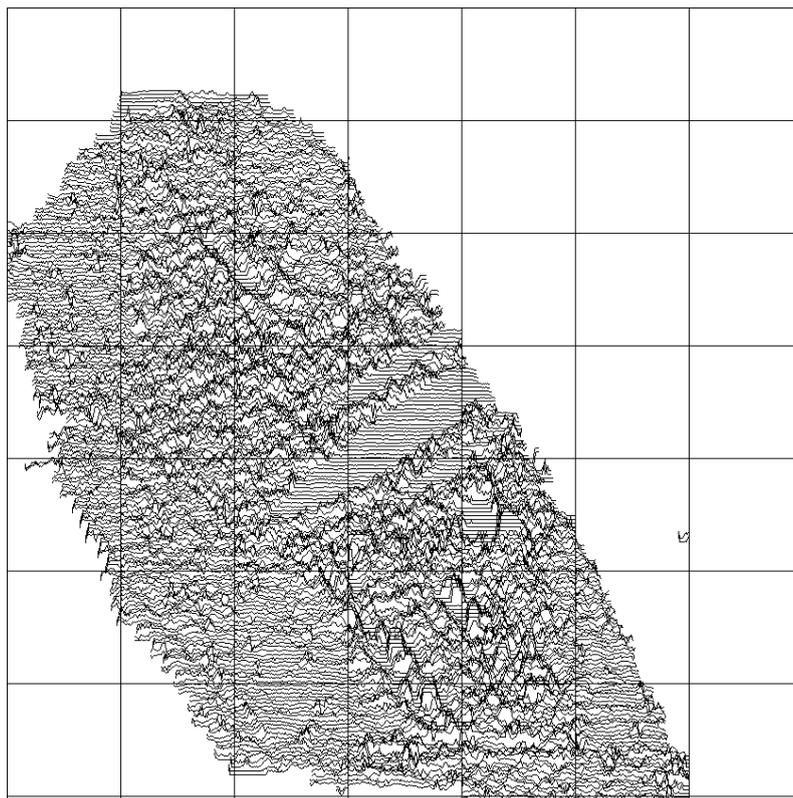


Figure 38: Field 10 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

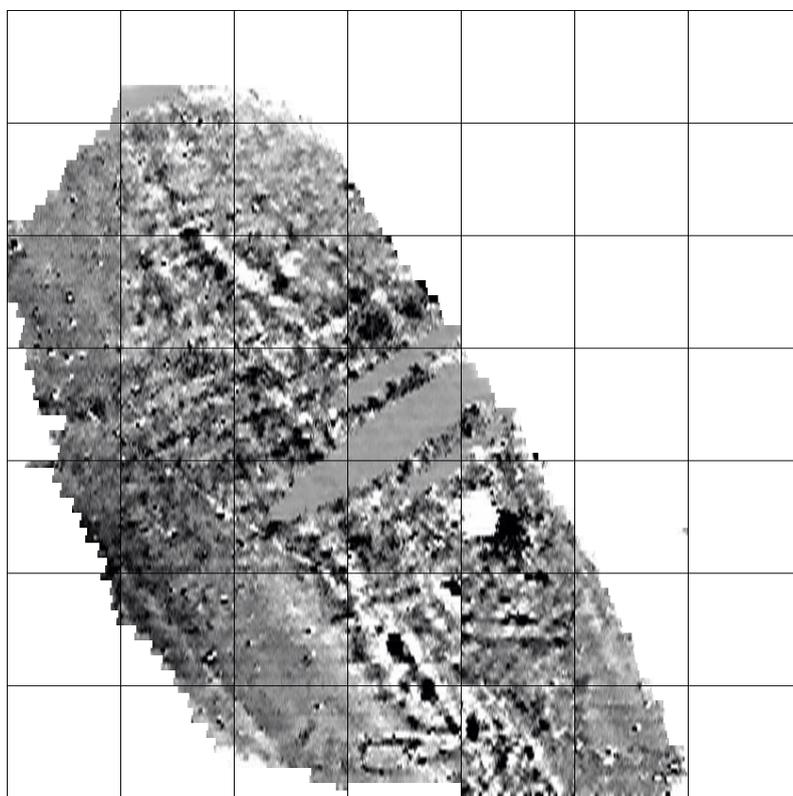


Figure 39: Field 10 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

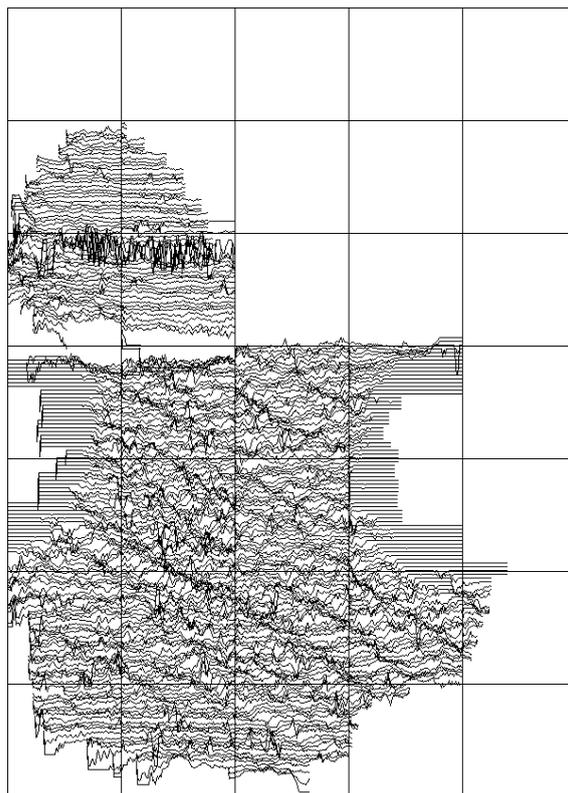


Figure 40: Fields 42 and 9 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

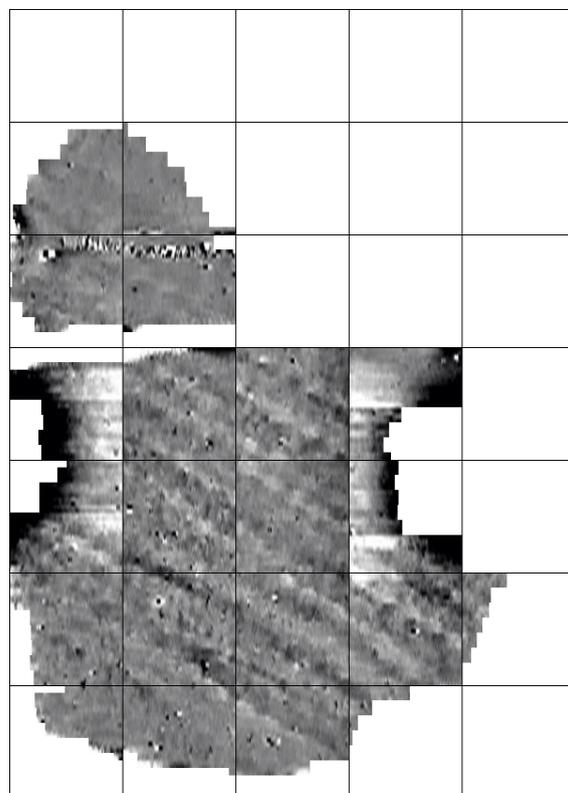


Figure 41: Fields 42 and 9 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

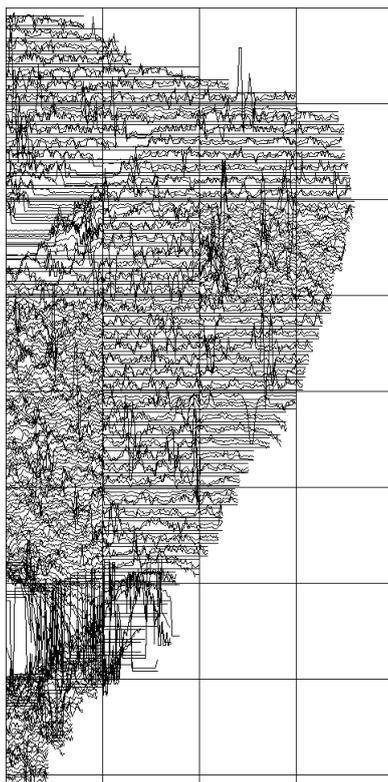


Figure 42: Field 38 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

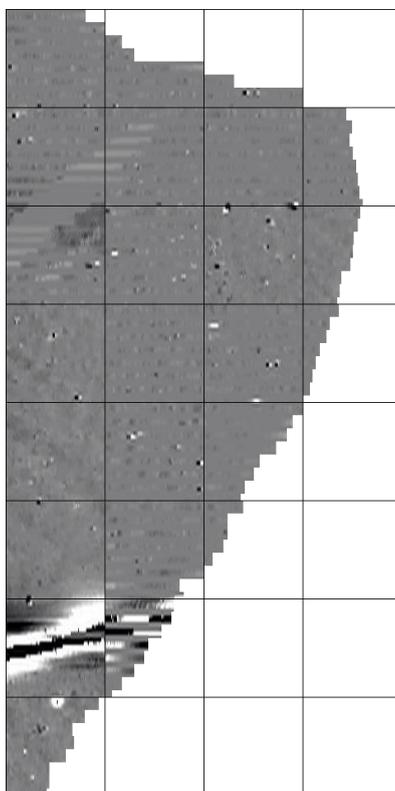


Figure 43: Field 38 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

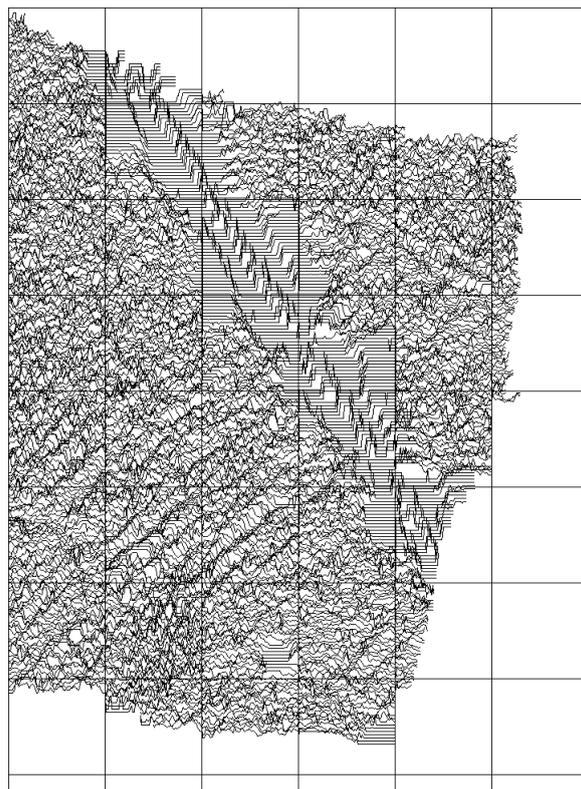


Figure 44: Field 7 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

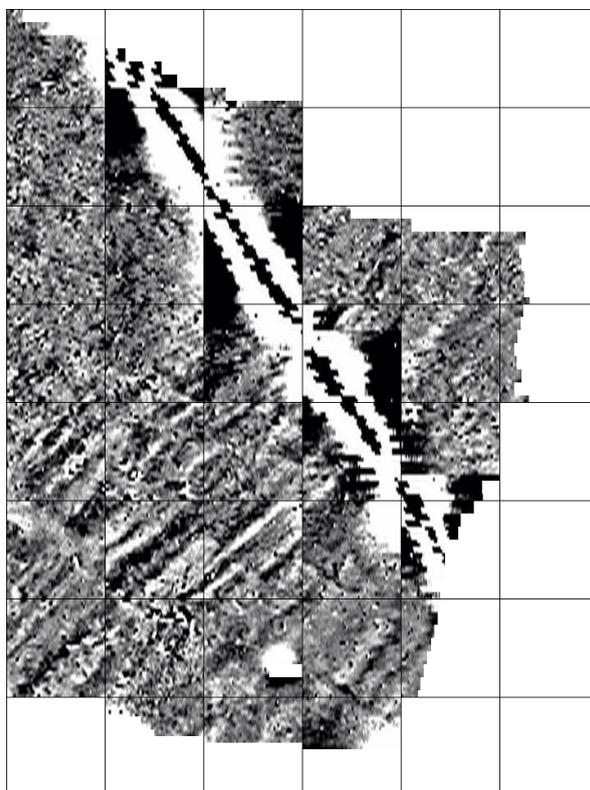


Figure 45: Field 7 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

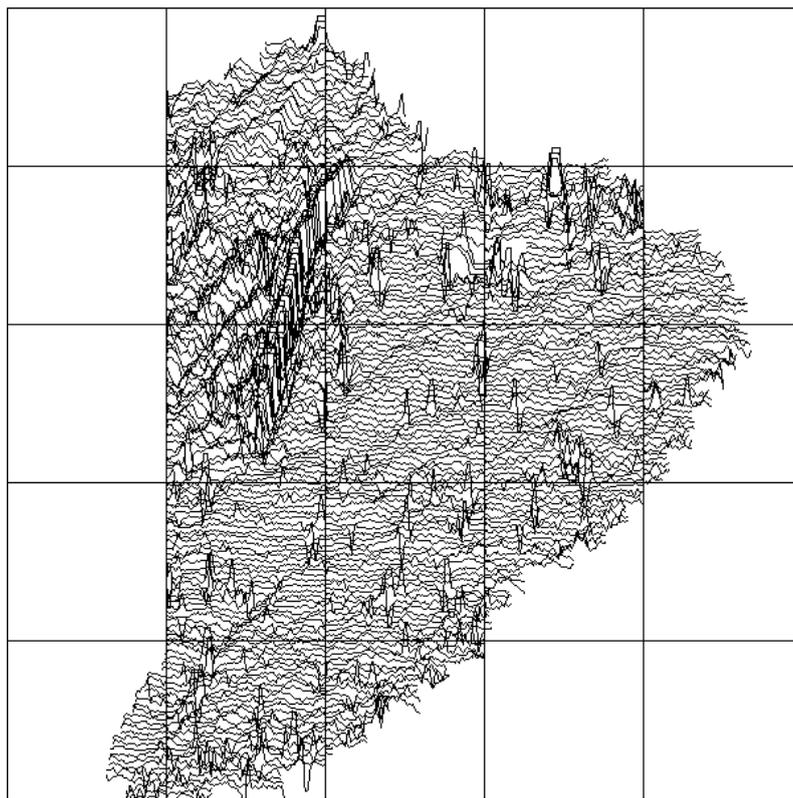


Figure 46: Field 8 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

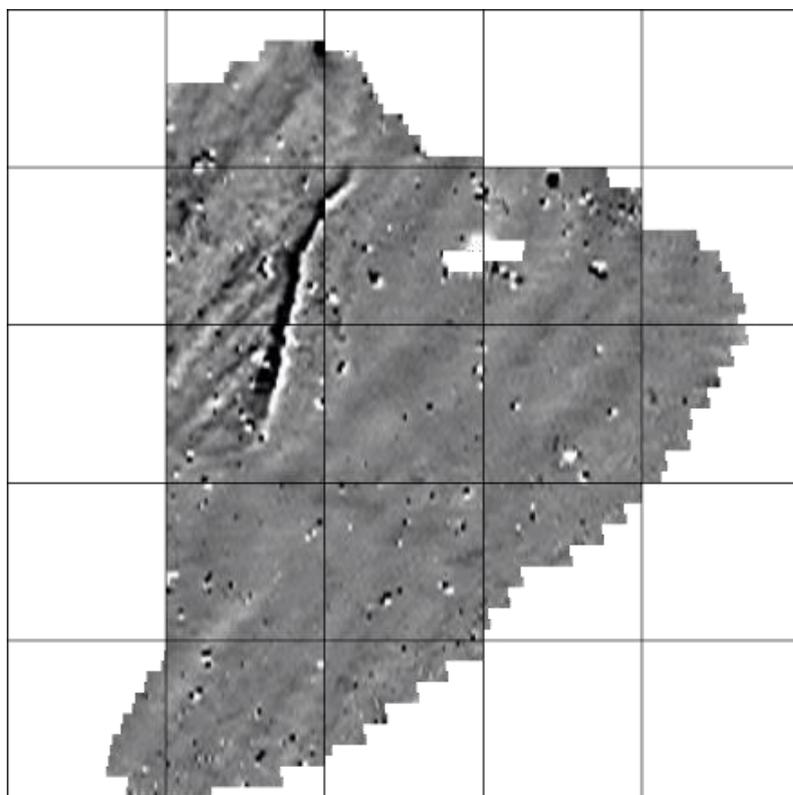


Figure 47: Field 8 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

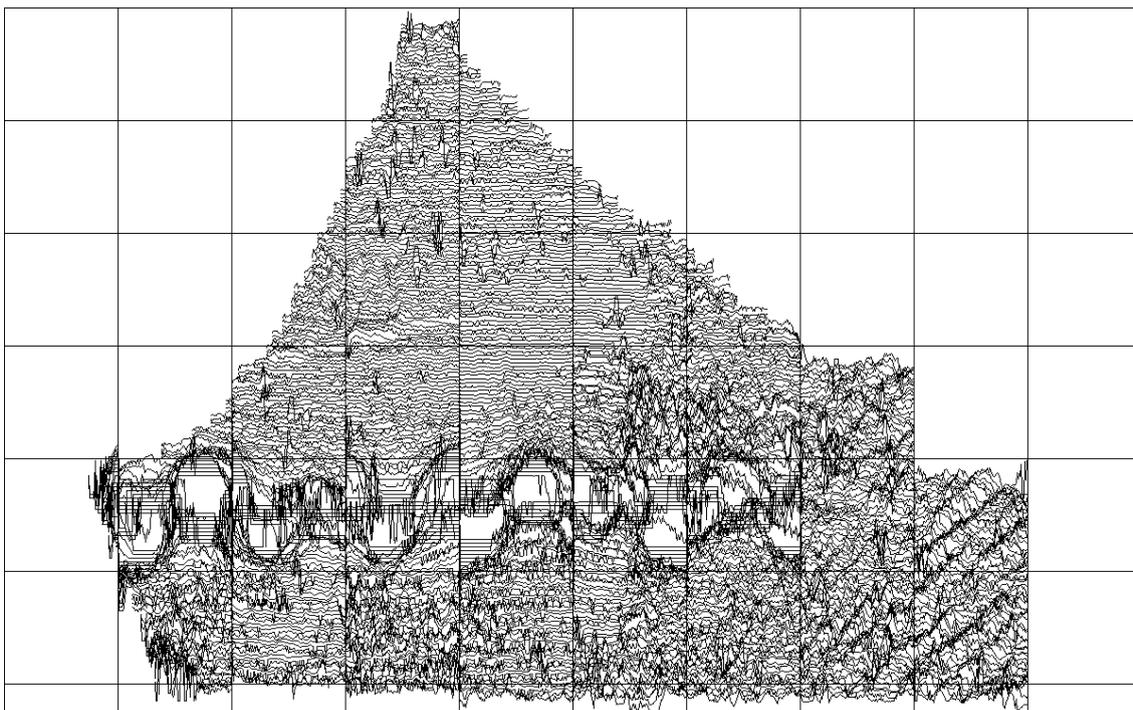


Figure 48: Field 5 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

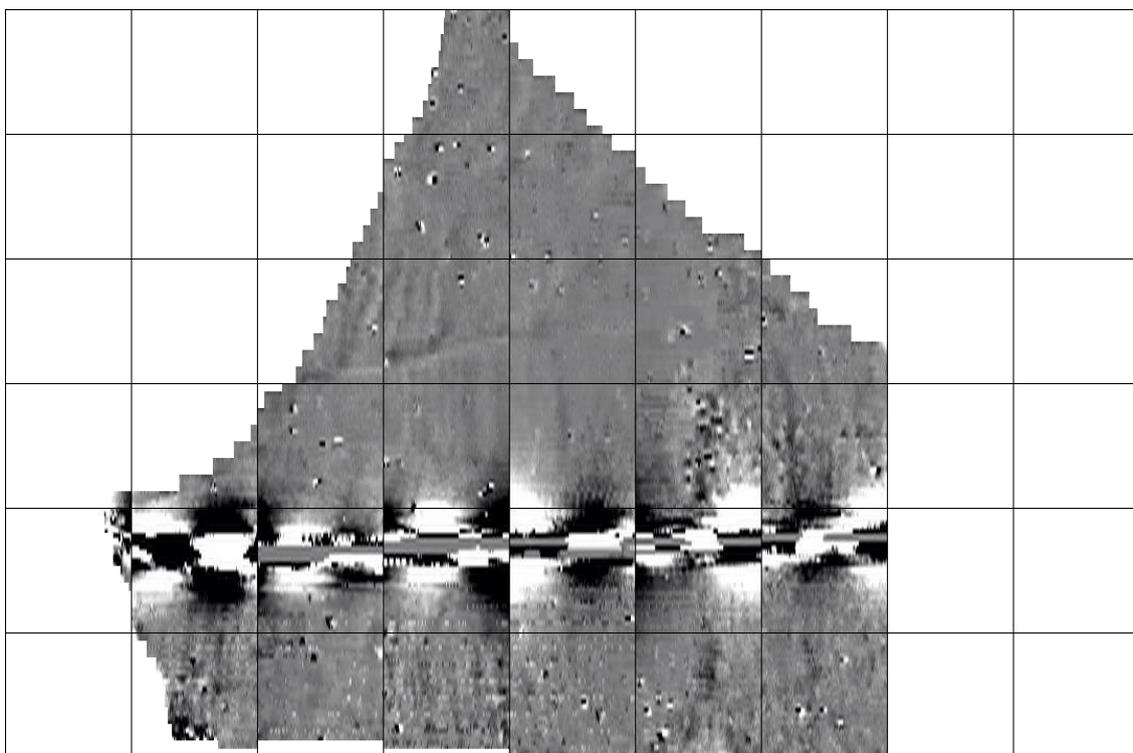


Figure 49: Field 5 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

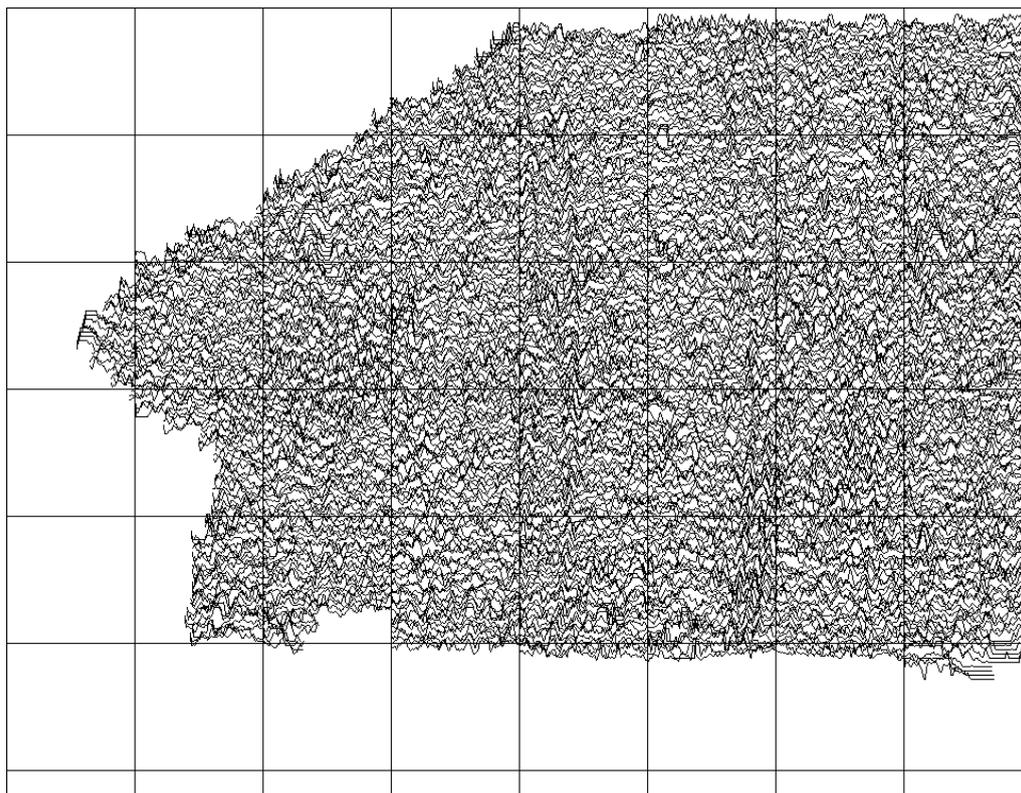


Figure 50: Field 6 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

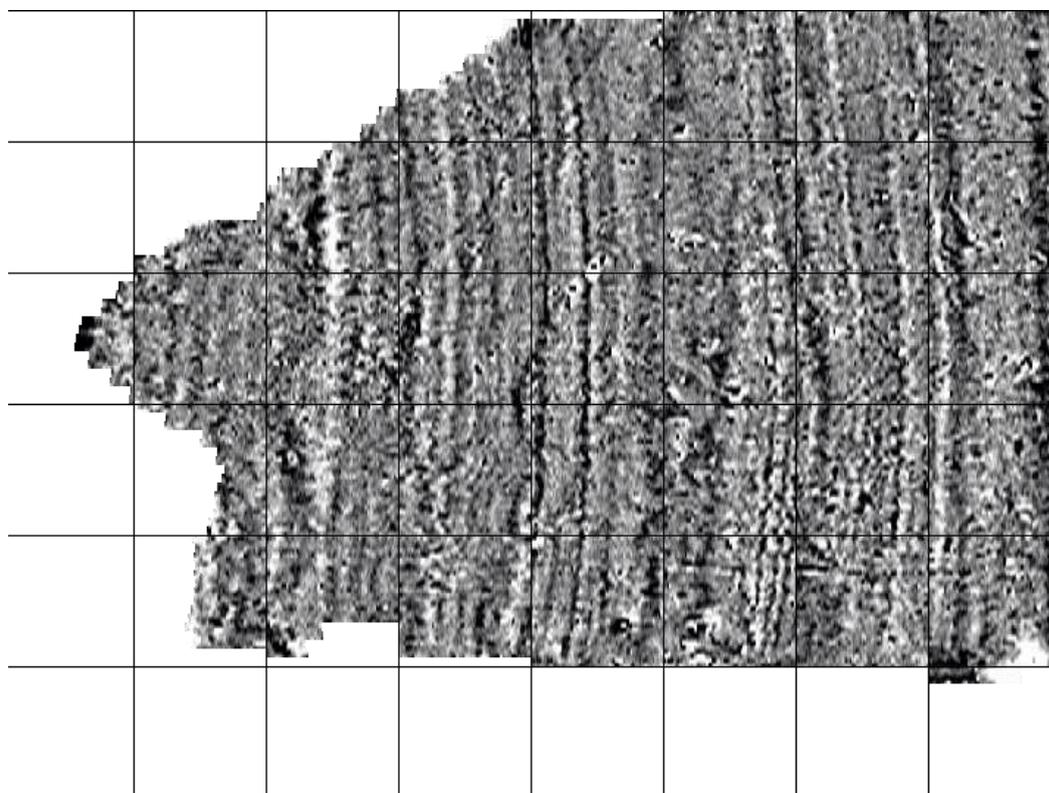


Figure 51: Field 6 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

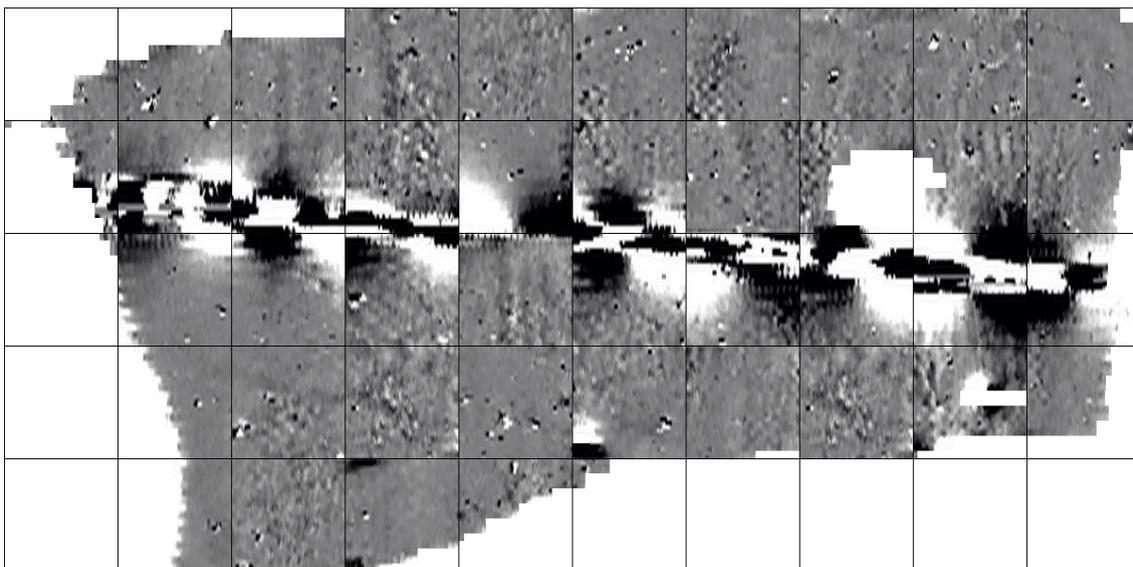


Figure 52: Field 2 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

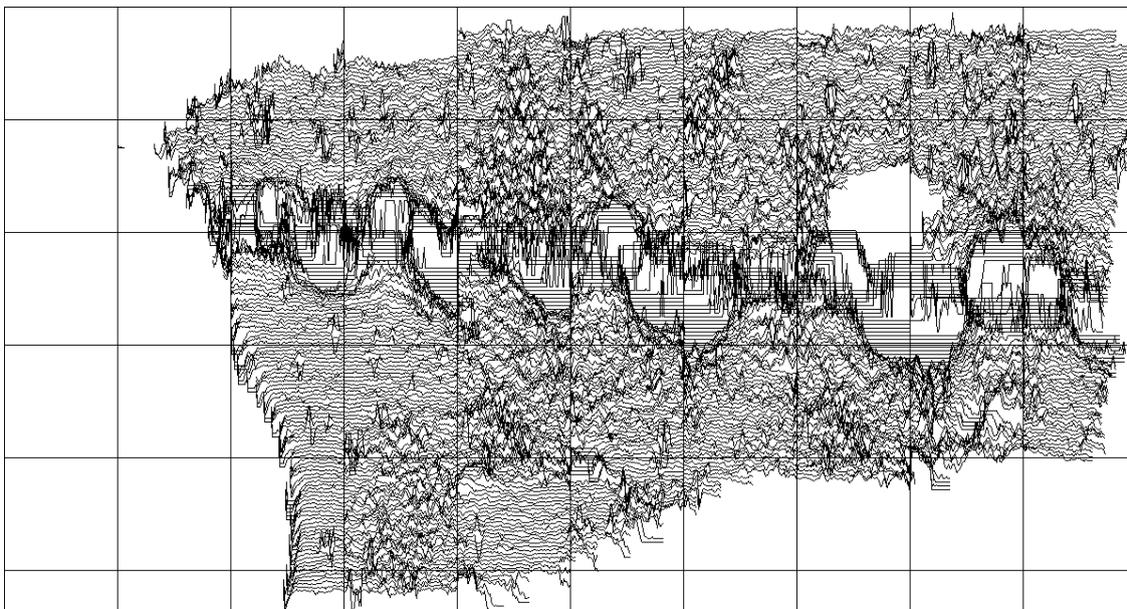


Figure 53: Field 2 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

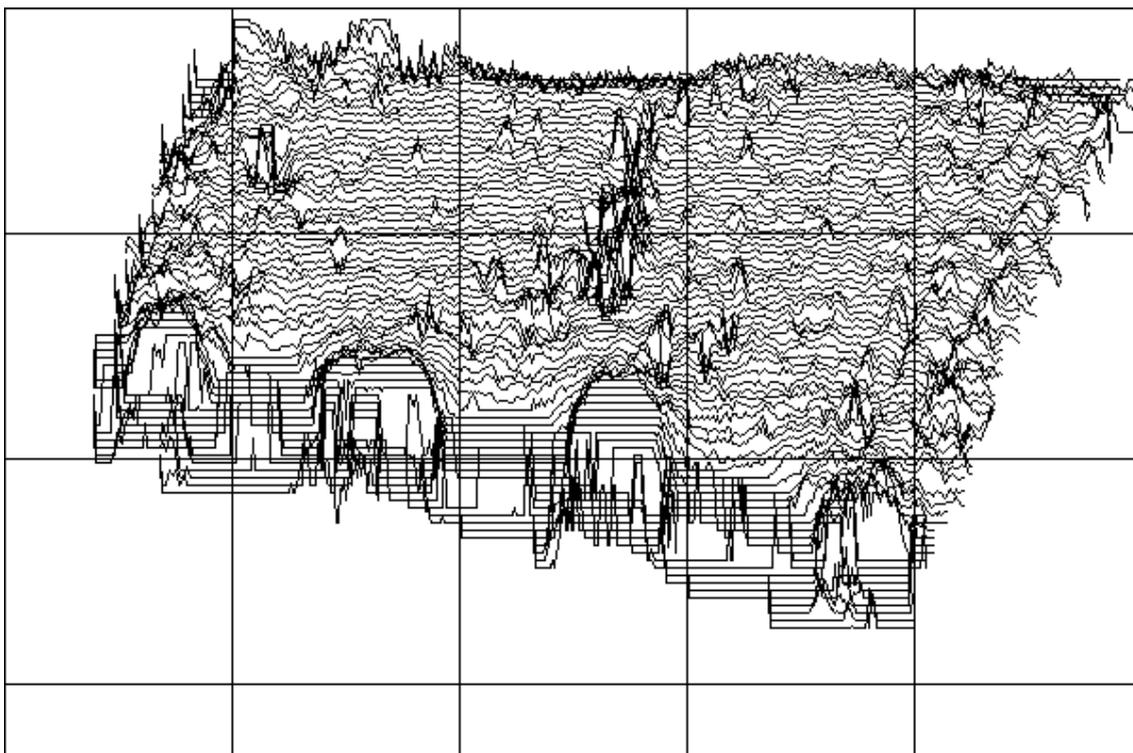


Figure 54: Field 3 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

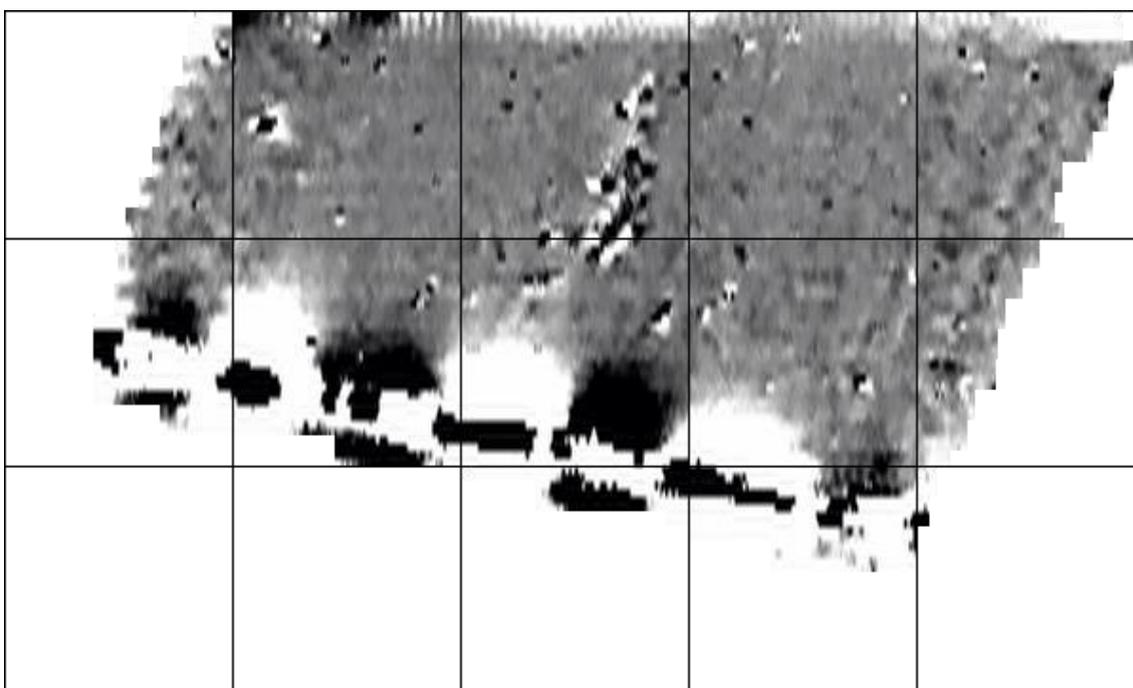


Figure 55: Field 3 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

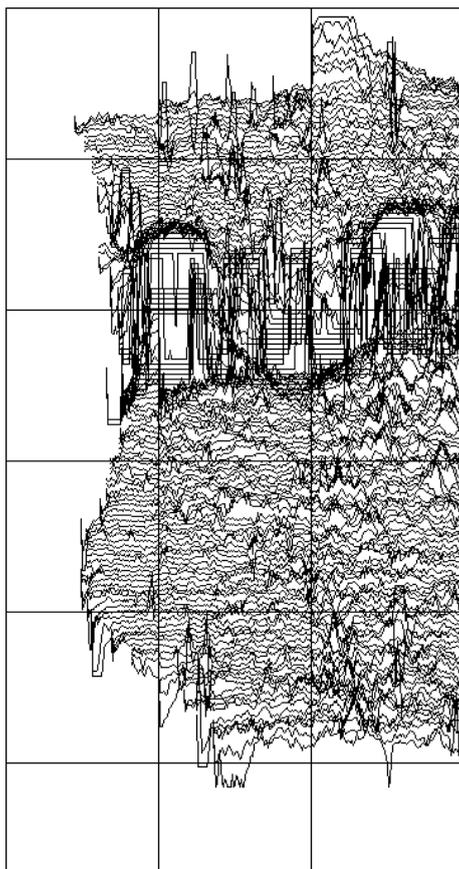


Figure 56: Field 61 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

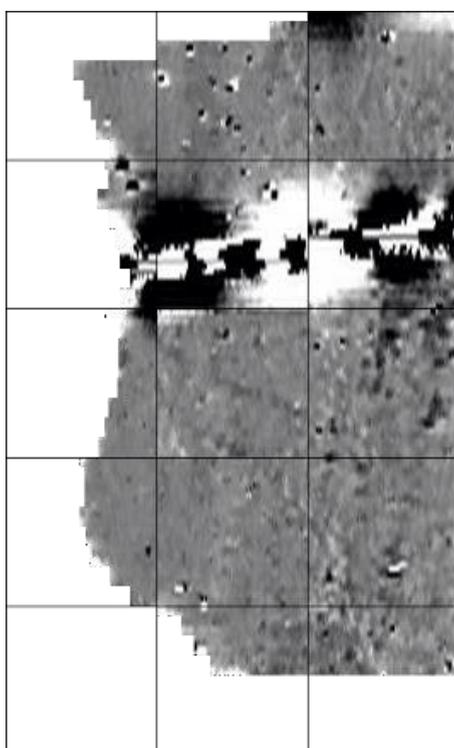


Figure 57: Field 61 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

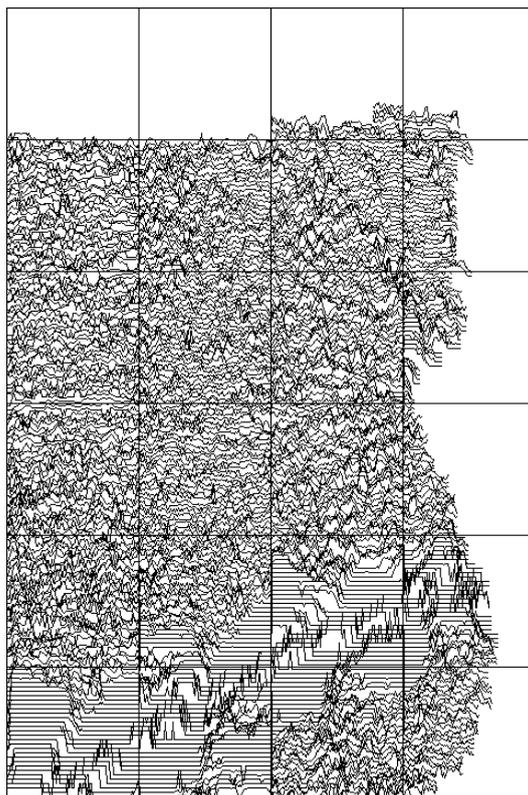


Figure 58: Field 61 geophysical survey results presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid North is to the right.

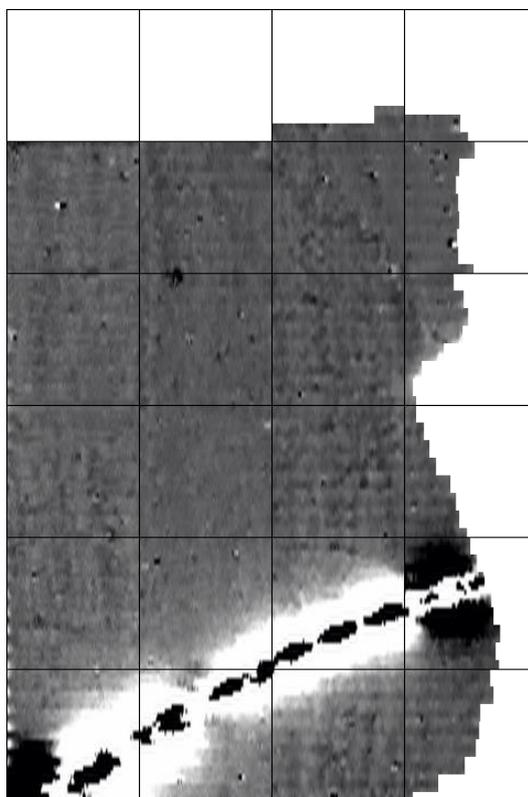


Figure 59: Field 61 geophysical survey results presented as a minimally processed greyscale plot. Each square is represented a 30m² grid, north is to the right of the page.

APPENDIX 2: Written Scheme of Investigation

LLANDYFAELOG, CARMARTHENSHERE:

WRITTEN SCHEME OF INVESTIGATION FOR GEOPHYSICAL SURVEY

1 Introduction

- 1.1 Dyfed Archaeological Services, a contracting arm of Heneb – the Trust for Welsh Archaeology, was commissioned by Stantec Ltd on behalf of National Grid Electricity Transmission (the Client) to provide a methodology for a geophysical survey on land proposed for a new electrical substation near Llandyfaelog, Carmarthenshire (centred on NGR SN 41921 13396, Figures 1-3).
- 1.2 The proposed development area was subject to a Historic Environment Desk-Based Assessment (Robinson-Hooper 2023). The assessment found limited evidence for Prehistoric remains within the development area. The site is in an elevated position near a water source, a position preferable for prehistoric activity, therefore although potential for prehistoric remains is low, it cannot be ruled out.
- 1.3 The study highlighted potential for Romano-British remains, mainly associated with the Via Julia Maritima Roman road (PRNs 3401, 7459). The road was identified during aerial observations in the drought of 2018 (Toby et al. 2020) and can be identified on LiDAR running northeast-southwest across the study area (Figure 4).
- 1.4 Only two archaeological events are recorded within the study area, a desk-based assessment (Crane 2000) and an archaeological watching brief (Crane 2002) both associated with the Pontyates to Bancyfelin Gas pipeline. The gas pipeline is identifiable on LiDAR (Figure 4) which shows that it crosses the proposed development area and the line of the Via Julia Maritima Roman road. The gas pipeline was constructed in 2002 before the Roman road had been identified and unfortunately no archaeological mitigation was carried out.
- 1.5 The results of the geophysical survey should provide further information on the archaeological potential of the site by identifying subsurface features that could be indicative of archaeology.
- 1.6 The geophysical survey will involve using a fluxgate gradiometer to conduct a rapid scan of the site area. This instrument measures tiny variations in the earth's magnetic field, which can indicate the presence of buried features such as ditches, pits, walls, or postholes that are not visible on the ground surface. Readings will be taken at medium resolution on traverses 1.0m wide and every 0.25m within a 30m x 30m grid across the field. A Trimble GNSS system will be used to tie the survey grid into the British coordinate system. This resolution allows for a relatively speedy survey (using a single gradiometer and a team of two) while providing good results, assuming that the area's geology is conducive to gradiometer survey and that the site does not contain obstructions that would hinder an even walking pace.
- 1.7 This Written Scheme of Investigation adheres to the Chartered Institute for Archaeologists (CIfA) Standard and Guidance for archaeological geophysical surveys (CIfA 2020) and CIfA Standard and Universal Guidance for Archaeological Field Evaluation (CIfA 2023).
- 1.8 Dyfed Archaeological Services operates according to best professional practice. Heneb-The Trust for Welsh Archaeology has its own Health and Safety Policy, and all works are covered by appropriate Employer's Liability and Public Liability Insurances. Copies of these documents are available upon request.

- 1.9 Heneb-The Trust for Welsh Archaeology is a CIfA Registered Organisation.

2 AIM AND OBJECTIVES OF THE PROJECT

- 2.1 This document provides a scheme of works for:

The implementation of a geophysical survey by Dyfed Archaeological Services within the area proposed for a new electrical substation near Llandyfaelog, Carmarthenshire (centred on NGR SN 41921 13396). A report and archive of the results will be prepared.

- 2.2 The specific aims of the investigation are:

- To undertake a geophysical survey using gradiometer of the entire development area,
- To determine the likely presence or absence of any archaeological remains within the proposed development area,
- To establish the character and extent of any potential archaeological remains within the site area that could be affected by the proposed works,
- To inform the need (or otherwise) for any future archaeological works on the site by means of an illustrated report on the geophysical survey.

- 2.3 The objectives of the project are:

- To undertake work in accordance with national best practice and guidelines,
- To archaeologically record through geophysical survey, any deposits, features or structures of significance,
- To analyse any remains with reference to the existing documentary evidence for historical development and land use,
- To produce a written account to include: summary; site description; anomaly descriptions, possible interpretation and conclusions,
- Provide an ordered archive.

- 2.4 The following tasks will be completed:

- Provision of a Written Scheme of Investigation to outline the methodology for the geophysical survey which Dyfed Archaeological Services will undertake (this document).
- To identify the presence/absence of any potential archaeological deposits through gradiometer survey.



Figure 1: Site location (red dot).

Map data from OpenStreetMap (OSM) <https://www.openstreetmap.org/copyright> 01/10/2024.

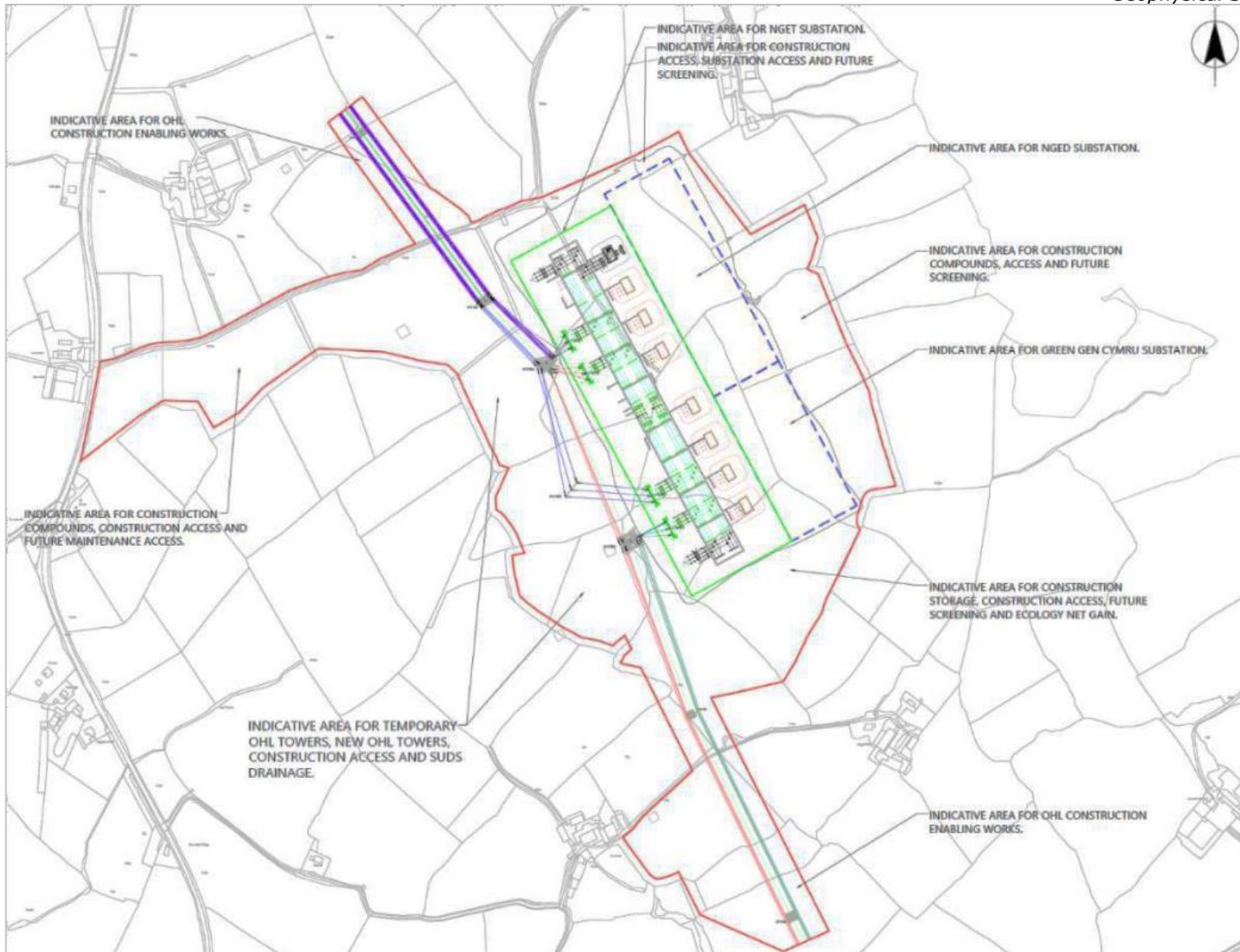


Figure 2: Current development plan. Supplied by client. Not to original scale.

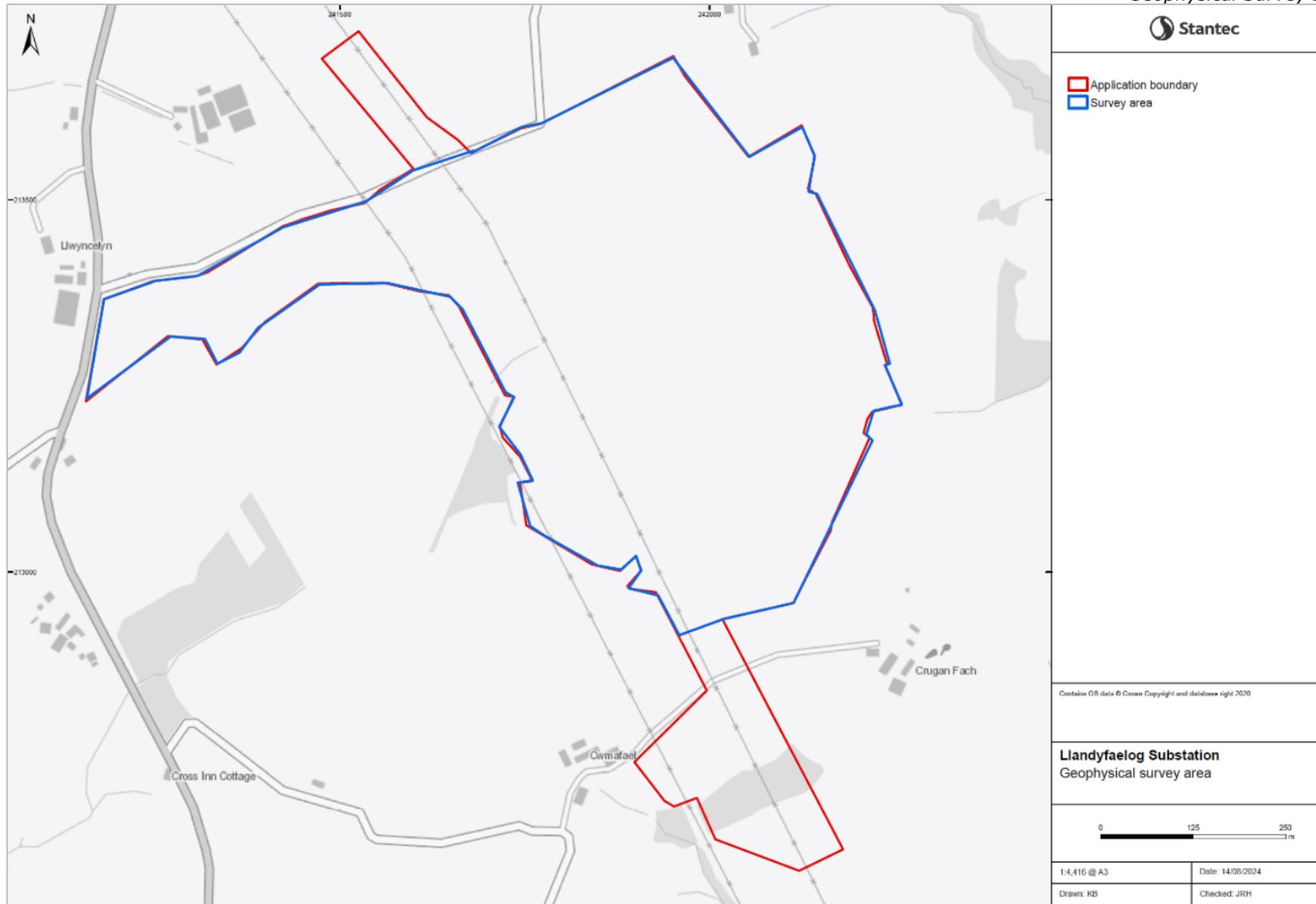


Figure 3: Proposed geophysical survey area outlined in blue. Supplied by client. Not to original scale.

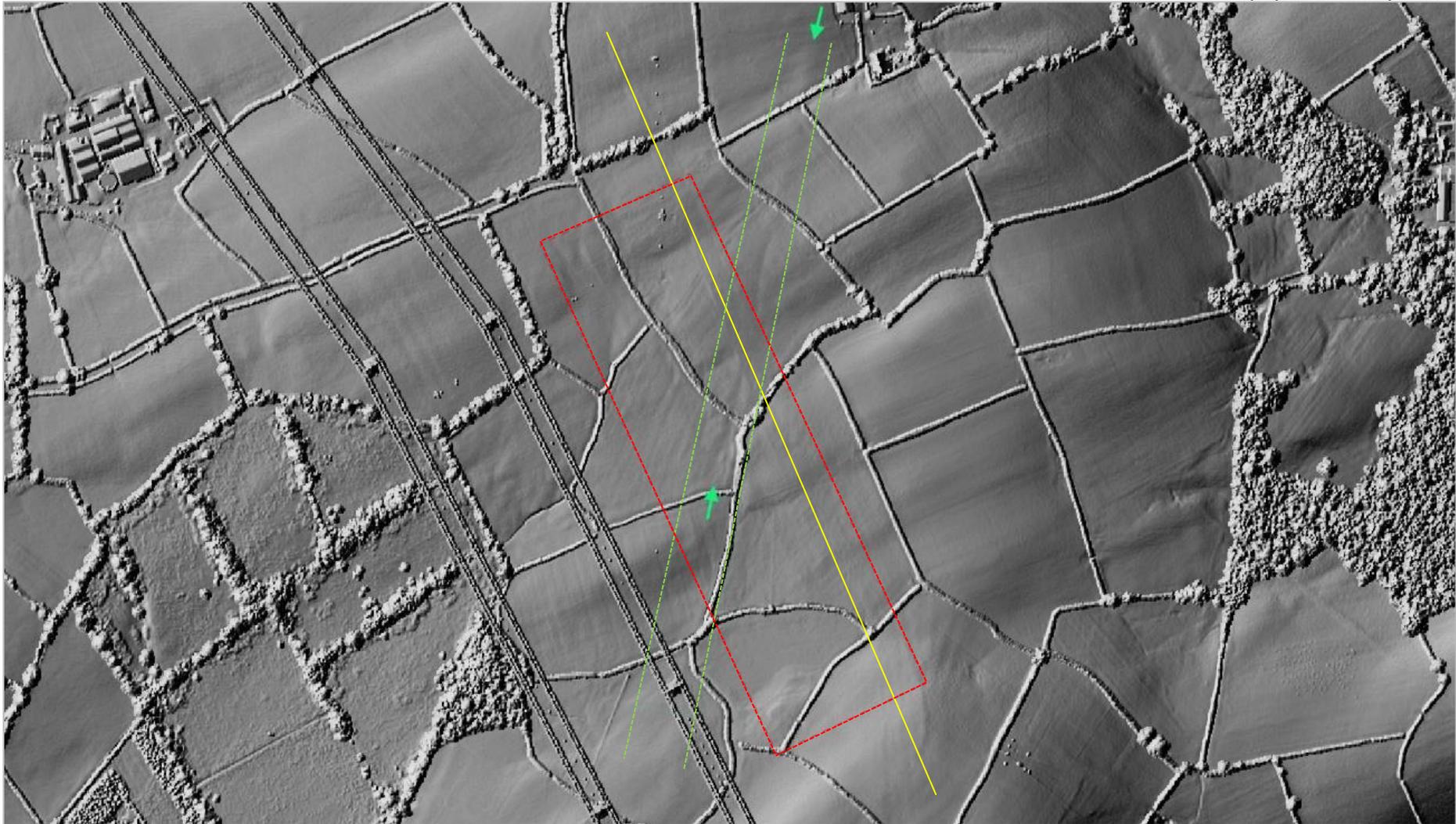


Figure 4: LiDAR 1m DSM. Location of proposed electrical substation (red dashed line). Via Julia Maritima Roman road (between green dashed lines). Pontiets to Bancyfelin Gas Pipeline (yellow line) Image modified from datamapwales. Accessed: 01/10/2024.

3 GEOPHYSICAL SURVEY METHODOLOGY

- 3.1 The results of the geophysical survey should provide further information of the archaeological potential of the site through the identification of subsurface features which could be indicative of archaeology. The aim of the survey is to assess, characterise and locate surviving below ground archaeology.
- 3.2 A localised site grid using 20m x 20m or 30m x 30m grids will be established and marked out physically on the ground to within 0.1m+/- accuracy. The survey grid will be tied into the Ordnance Survey (OS) grid using a Trimble R8s integrated GNSS system with TC3 controller.
- 3.3 A fluxgate gradiometer will be used for the survey, which detects subtle variations in the earth's magnetic field. Technical information is given in Appendix I at the end of this document.
- 3.4 Data is collected using the zigzag traverse method within each grid with a sample interval (x-axis) of 0.25m (four readings per meter) and a line separation (y-axis) of 1.0m. The line separation is reduced to 0.5m traverses if greater resolution is required.
- 3.5 Ground coverage is important to aid with interpretation and as large of a survey area as practicable possible will be surveyed. But efforts will be made to keep a suitable distance from external ferrous sources that could impact adversely upon the results.
- 3.6 The data will be processed using *Terrasurveyor 3.0.36.1* and presented with a minimum of processing as a grey-scale plot. The main magnetic anomalies will be identified and plotted onto the local topographical features.
- 3.7 The survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.
- 3.8 All measurements given will be approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.
- 3.9 The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological investigation is necessary in this area.
- 3.10 The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological mitigation is necessary in this area, following discussions with the archaeological advisor to the planning authority.

4 POST-FIELDWORK REPORTING AND ARCHIVING

- 4.1 An archive will be prepared if it meets the requirements of the Dyfed Archaeological Services archive retention policy (2018). If it does, then data recovered during the evaluation will be collated into a site archive structured in accordance with the specifications in Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation (Brown 2011), and the procedures recommended by the National Monuments Record, Aberystwyth. Digital archives will be collated using the Royal Commission on the Ancient and Historical Monuments of Wales systems (2015) and deposited with the RCAHMW (2022). The Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) shall be followed.
- 4.2 A Data Management Plan (DMP) (Appendix II) for this project has been produced in accordance with the Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives (CIfA 2020).
- 4.3 The results of the fieldwork will be assessed in local, regional and wider contexts.
- 4.4 The results will be used to inform subsequent design considerations of the proposed development so that they can aim to avoid impacts upon any archaeological remains or that further archaeological mitigation can be implemented before such remains are disturbed.
- 4.5 With permission from the client, a summary of the project results, excluding any confidential information, may be prepared for wider dissemination (e.g. Archaeology in Wales and special interest and period-specific journals).
- 4.6 The report will be prepared to follow the Standard and Guidance for Archaeological Geophysical Survey (CIfA 2020) and the CIfA Standard and Universal Guidance for Archaeological Field Evaluation (CIfA 2023).
- 4.7 Digital copies of the report will be provided to the client and the consultant Stantec who will provide a copy to Heneb - Development Management (Dyfed Region).

5 STAFF

- 5.1 The project will be managed by Fran Murphy, Head of Dyfed Archaeological Services.
- 5.2 The on-site works will be undertaken by experienced geophysicists from Dyfed Archaeological Services.

6 QUALITY ASSURANCE

- 6.1 Dyfed Archaeological Services has considerable experience of undertaking all categories of archaeological fieldwork and always operates to best professional practice; adhering to CIfA guidelines where appropriate. The Trust is a Registered Organisation with CIfA, and all staff abide by their code of conduct and adhere to their relevant standards and guidance.
- 6.2 Dyfed Archaeological Services operate robust internal monitoring procedures that ensure that the standard of each project is maintained from commencement to completion.

7 MONITORING

- 7.1 The fieldwork may require monitoring by the archaeological advisor to the planning authority, Heneb – Development Management (Dyfed Region), who should be told of the commencement of the works. The fieldwork may also need to be monitored by the Head of Dyfed Archaeological Services.

8 HEALTH AND SAFETY

- 8.1 Service information should be obtained prior to the start of the works.
- 8.2 A health and safety risk assessment must be prepared prior to the works commencing to ensure that all potential risks are minimised.
- 8.3 The site staff will go through the health and safety risk assessment prior to works commencing and all site staff must sign the document to confirm that they have read, understood and will comply with the document.
- 8.4 All site inductions, H&S procedures, H&S constraints and site rules of the client or any on-site contractor should be made known to the archaeological staff at the start of the works.
- 8.5 All relevant health and safety regulations must be followed, including compliance with Welsh Government guidelines on working practices and guidance issued by CIfA.
- 8.6 High visibility vests and boots are to be used by all site personnel as necessary. The developer will make all site staff aware of any other PPE that may be required.

9 ARBITRATIONS

- 9.1 Any dispute or disagreement arising out of a contract in relation to this work shall be referred for a decision to the Chartered Institute of Archaeologist's arbitration scheme.

10. SOURCES

- Bridger, K. 2024. *Tender Specification and Scope of Works: Llandyfaelog Substation*. Stantec.
- Brown, D. H. (2011). *Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation*. Archaeological Archive Forum.
- CIfA, 2020. *Standard and guidance for archaeological geophysical survey*. CIfA.
- CIfA, 2020. *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives*. CIfA.
- CIfA, 2023. *Standard and guidance for archaeological field evaluation*. CIfA.
- Crane, P. 2000. *Pontiets to Bancyfelin Gas Pipeline Route: Archaeological Assessment*. Cambria Archaeology. Project Record No. 40762.
- Crane, P. 2002. *Pontyates to Bancyfelin Gas Pipeline Archaeological Watching Brief*. Cambria Archaeology. Report No. 2002/7, Project Record No 42757
- Driver, T. Burnham B. and Davies, J. 2020. *Roman Wales: Aerial Discoveries and New Observations from the Drought of 2018*. Britannia. Vol 51. PP. 117-145.
- Heneb. 2021. *Disposal and Retention of Archaeological Archives*. Heneb.
- RCAHMW. 2022. National Monuments Record of Wales Collection Policy 2022–25. RCAHMW.
- Robinson-Hooper, J. 2023. *Llandyfaelog Level 1 Desktop Survey*. Stantec. In Stantec. 2024. *Llandyfaelog Substation: Pre-application Report*. Stantec. Project Ref. 331201429. Appendix F.
- Stantec. 2024. *Llandyfaelog Substation: Pre-application Report*. Stantec. Project Ref. 331201429.

TECHNICAL INFORMATION

The survey will be carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer, which uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies.

The instrument detects variations in the earth's magnetic field caused by the presence of iron in the sub-surface material. This is usually in the form of weakly magnetised iron oxides, which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil therefore contain greater amounts of iron and can therefore be detected with the gradiometer. There are also other processes and materials that can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs, which usually produce very high readings. Features such as hearths or kilns also produce strong readings because fired clay acquires a permanent thermo-remnant magnetic field upon cooling.

The Bartington Grad601 is a hand-held instrument, and readings are taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 1.0m apart. Their metal cores are driven in and out of magnetic saturation by an alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output (Clark 1996).

The gradiometer can detect anomalies down to a depth of approximately one metre. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The instrument is capable of detecting changes as low as 0.1nT.

The gradiometer includes an on-board data-logger. Readings in the surveys will be taken along parallel traverses of one axis of a grid made up of 30m x 30m squares. The traverse intervals will be set 0.5m apart. Readings are logged at intervals of 0.25m along each traverse giving 3200 readings per grid square (medium resolution on 0.5m traverses),

A Trimble GPS will be used to set out the survey grid and to tie the survey grid into the local Ordnance Survey grid. The grid will be marked out with the use of temporary bamboo canes and small plastic pegs. All markers will be removed from site once the surveys are complete.

Processing will be performed using *TerraSurveyor 3.0*. The data will be presented with a minimum of processing. The presence of high values caused by ferrous objects, which tend to hide fine details and obscure archaeological features, will be 'clipped' to remove the extreme values allowing the finer details to show through.

The processed data will be presented as grey-scale plots overlaid on local topographical features. Raw data and trace plots (x-y) will also be provided. The main magnetic anomalies will be identified and plotted onto the local topographical features as a level of interpretation.

The resulting survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features will provide a magnetic response that can be identified by the

gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.

All measurements given will be approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.

The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological mitigation is necessary in this area, following discussions with the archaeological advisor to the planning authority.

DATA MANAGEMENT PLAN

This Data Management Plan (DMP) is produced in accordance with the *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives (Chartered Institute for Archaeologists 2014, updated 2020)*. The table below is based on the Work Digital / Think Archive guidance for digital archives prepared by DigVentures, on behalf of Archaeological Archives Forum and in partnership with the Chartered Institute for Archaeologists. The project was funded by Historic England (Project No. 7796).

Section 1: Project Administration

Project Ref. No and name
FS24-032- Llandyfaelog Substation, Carmarthenshire
ERN (if known)
131132
Project Type
Geophysical Survey
Client
Stantec Ltd on behalf of NGET
Project Manager / Data Contact
Fran Murphy
Principal Archaeologist on site
Luke Jenkins
Date DMP created
01/10/2024
Date DMP last updated
01/10/2024
Related data management policies
Written Scheme of Investigation Chartered Institute for Archaeologists (CIfA) <i>Standards & Guidance</i> Heneb – Dyfed Archaeology archive retention policy Brown 2011, <i>Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation</i> NPAAW, 2017, <i>The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017</i> RCAHMW, 2015, <i>RCAHMW guidelines for Digital Archives, Version 1</i> WAT, 2018, <i>Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)</i>

Section 2: Data Collection

Data Type (Delete as appropriate)
<p>Documents</p> <p>Written Scheme of Investigation, Risk Assessment – Word doc & PDFs</p> <p>Site notes - paper copies, scanned and saved as PDFs.</p> <p>Final report – Word doc & PDF</p> <p>Illustrations – Adobe Illustrator/Affinity Designer files, PDFs</p> <p>Images</p> <p>Site photographs – Jpeg & Tiff (for archive)</p> <p>Other collected data (scans, archive material, social media images etc) – Jpegs</p> <p>Geophysical Survey</p> <p>In house survey – XGD files, XCP files</p> <p>Survey</p> <p>In house surveys - .dxf files, GIS files (see below)</p> <p>GIS</p> <p>Mapinfo files, Esri Shapefiles.</p>

Data acquisition
All data will be collected as per the methodologies and guidance stated in the WSI (Fieldwork / Methodology).

Section 3: Documentation and metadata

Documentation and metadata accompanying the data
All data recovered will be archived in accordance with the guidance stated in the WSI (Post Fieldwork Reporting & Archiving)

Section 4: Ethics and legal compliance

Management of any ethical, copyright and Intellectual Property Rights (IPR) issues
All personal data collected during the course of the project will be handled in accordance with Heneb-Dyfed Archaeology <i>Personal Data Protection Policy</i> (2018, revised 2020) and current <i>Code of Practice</i> .
Licence agreements will be established, and Copyright permissions will be sought as appropriate (eg reproduced mapping extracts, archive material, specialist reports) prior to the submission of the data and/or inclusion in the publication of the project results.

Section 5: Data Security: Storage and Backup

Data storage, accessibility, and safety during research

All site-produced data will be stored digitally at the first available opportunity. All digital information is stored on the Heneb-Dyfed Archaeology server, accessible by members of the staff. This will be checked regularly by the Project Manager. All digital data on the server is backed-up at regular intervals. The server contains ample capacity for all anticipated site data, and appropriate protocols are in place to manage any potential digital malfunction or cyber-attack.

Section 6: Selection and Preservation

Data retention, sharing, and preservation

Data will be retained as per Heneb-Dyfed Archaeology *Archive Retention Policy* (2018).

Long-term preservation plan for the dataset

The digital archive relating to the project will be deposited with the NMR, held and maintained by the RCAHMW, Aberystwyth and will be created in accordance with their practices.

The final report will be submitted to the regional Historic Environment Record in PDF format, along with any additional information they require.

If a different digital repository to the NMR is used, their own procedures will be established at the outset of a project and followed.

If a project includes artefacts to be deposited at a museum, arrangements will be made prior to the commencement of the project, and a copy of the digital archive will be sent with the artefacts.

Archiving costs are included within the project budget.

Section 7: Data Sharing

Sharing and accessibility

The dissemination of data is detailed in the WSI (Post-Fieldwork Report and Archiving).

Section 8: Responsibilities

Responsibilities

Data collection, storage and manipulation will be carried out by the site team. The Project Manager will be responsible for the implementation of the data management plan.



Heneb