

LAND WEST OF BLOOMFIELD GARDENS, NARBERTH, PEMBROKESHIRE: GEOPHYSICAL SURVEY

PLANNING APPLICATION NUMBER – 23/0654/PA



Prepared by Dyfed Archaeological Services
For: Wales & West Housing



HENEB – DYFED ARCHAEOLOGICAL SERVICES

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**LAND WEST OF BLOOMFIELD GARDENS, NARBERTH, PEMBROKESHIRE:
GEOPHYSICAL SURVEY**

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LAND WEST OF BLOOMFIELD GARDENS, NARBERTH, PEMBROKESHIRE: GEOPHYSICAL SURVEY

CONTENTS

EXECUTIVE SUMMARY/ CRYNODEB GWEITHREDOL	1
1. INTRODUCTION	2
2. THE SITE	7
3. METHODOLOGY	9
4. RESULTS	15
5. CONCLUSIONS	16
6. SOURCES	17
7. GLOSSARY	18
 APPENDIX 1	
Trace and gridded greyscale plots	19
 APPENDIX 2	
Approved Written Scheme of Investigation, including	
Data Management Plan	24

FIGURES

Figure 1:	Location Map.	4
Figure 2:	Detailed location Map.	5
Figure 3:	Proposed development plan.	6
Figure 4:	Geophysical survey greyscale plot.	13
Figure 5:	Geophysical survey greyscale plot overlaid with an interpretive layer.	14
Figure 6:	Field A presented as a trace plot.	20
Figure 7:	Field A results presented as a greyscale plot.	21
Figure 8:	Field B presented as a trace plot.	22
Figure 9:	Field B results presented as a greyscale plot.	22
Figure 10:	Field C presented as a trace plot.	22
Figure 11:	Field C results presented as a greyscale plot.	22

PHOTOGRAPHS

Photograph 1:	Field A.	7
Photograph 2:	Field B.	8
Photograph 2:	Field C.	8

TABLE

Table 1:	Archaeological and Historical Timeline for Wales	3
Table 2:	Categories of interpretation for geophysical anomalies	11

**LAND WEST OF BLOOMFIELD GARDENS, NARBERTH, PEMBROKESHIRE:
GEOPHYSICAL SURVEY**

EXECUTIVE SUMMARY

Heneb – Dyfed Archaeological Services were commissioned to undertake a geophysical survey on land west of Bloomfield Gardens, Narberth, Pembrokeshire, ahead of proposed residential development.

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.

No definitive archaeological anomalies were recorded during the survey.

CRYNODEB GWEITHREDOL

Gwasanaethau Archaeolegol Dyfed i gynnal arolwg geoffisegol ar dir i'r gorllewin o Bloomfield Gardens, Arberth, Sir Benfro, cyn datblygiad preswyl arfaethedig.

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.

Ni chofnodwyd unrhyw anghysondebau archeolegol yn ystod yr arolwg.

1. INTRODUCTION

1.1 Project Commission

- 1.1.1 Dyfed Archaeological Services (a contracting arm of Heneb – Dyfed Archaeology) - were commissioned by Wales and West Housing to undertake a geophysical survey for proposed residential development on land west of Bloomfield Gardens, Narberth, Pembrokeshire (centred on SN 11390 11678) (Figures 1, 2, and 3, Photographs 1, 2 and 3).
- 1.1.2 The development proposals cover an area of approximately 3.4 hectares and is currently three fields laid to pasture. The site was assessed as a candidate site within the revised local development plans (ref. 033). Here, Heneb - Development Management (Heneb-DM) in their role as advisors to the local planning authority recommended that an archaeological evaluation should be undertaken to confirm the presence/absence of archaeological deposits prior to the determination of the planning decision.
- 1.1.3 The recommendation for an archaeological evaluation was due to relatively little being known about the extent of the medieval town of Narberth, and the lack of archaeological investigations in the vicinity of the relatively large development area. The results of the geophysical survey aimed to provide further information of the archaeological potential of the site through the identification of subsurface features which could be indicative of archaeology, and therefore inform whether further archaeological evaluation/mitigation was required.
- 1.1.4 Accordingly, Dyfed Archaeological Services produced a Written Scheme of Investigation (WSI) for a geophysical survey of the site (APPENDIX 2). This was approved by Heneb-DM before the survey was undertaken.
- 1.1.5 The geophysical survey was undertaken using a fluxgate gradiometer which detects subtle variations in the earth's magnetic field (magnetometry), which can indicate the presence of buried features such as ditches, pits, walls, or postholes that are not visible on the ground surface. The purpose of the geophysical survey was to provide a better indication of the archaeological potential of the site through the identification of subsurface features which could be indicative of archaeology. This would allow for an informed decision on whether any further archaeological mitigation is required or not in this area before or during the development programme.
- 1.1.6 No definitive archaeological anomalies were identified during the survey.

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). Sites recorded on the National Monument Record (NMR) held by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) are identified by their National Primary Record Number (NPRN). 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.

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	

Table 1: Archaeological and Historical Timeline for Wales

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

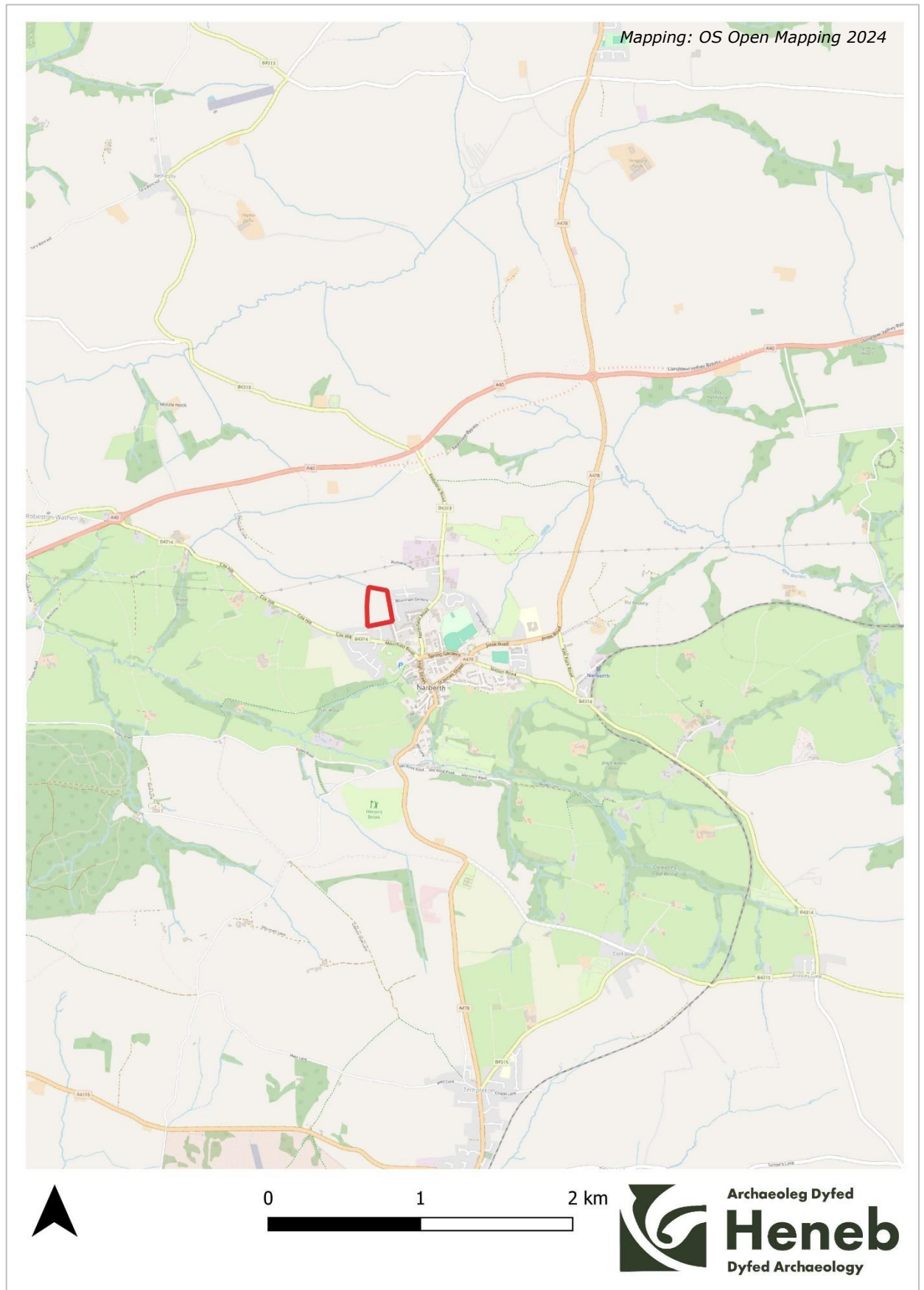


Figure 1: Location map. Development area outlined in red. (Map data ©2024 Google).



Figure 2: Detailed location map. Development area outlined in red (Map data ©2024 Google).

*Land West of Bloomfield Gardens,
Narberth: Geophysical Survey*



Figure 3: Proposed development plan on land west of Bloomfield Gardens, Narberth, Pembrokeshire. Provided by client.

2. THE SITE

- 2.1. The proposed development area lies on the outskirts of the small town of Narberth in southeastern Pembrokeshire (Figure 1). The development is situated on the northwestern edge of Narberth and comprises three fields laid to pasture bounded by established hedgerows (Figure 2 - A, B and C, Photographs 1-3). The proposed development aims to increase housing provision in the area.
- 2.2. The development area gradually slopes to the north across all three of the fields. At the northern edge of the site lies a small tributary of the eastern Cleddau.
- 2.3. No historic assets are recorded on the Historic Environment Record within the development area or in proximity to the development area. Little is known about the origins of Narberth. A full account of what is known about the town was produced by Dyfed Archaeological Trust on behalf of Cadw in 2021 so is not included here (Murphy 2021)., but in summary:
- Narberth was a small and relatively insignificant medieval settlement. Its origins are obscure, but it probably developed organically in the twelfth and thirteenth centuries in the vicinity of the church and castle. A fair is recorded in 1282, but a market was not granted until 1652. The granting of a market was a spur for development and the town grew rapidly during the seventeenth and subsequent centuries.*
- 2.4. The British Geological Survey records the bedrock beneath the development area as part of the Portfield Formation and Haverford Mudstone Formation Mudstone. Sedimentary bedrock formed between 449 and 433.4 million years ago during the Ordovician and Silurian periods. No superficial geology is noted.



Photograph 1: Field A. Looking northeast from southwestern corner of the field.



Photograph 2: Field B. Looking northwest from southeastern corner of the field
Note electricity substation in southeastern corner.



Photograph 3: Field C. Looking northwest from southwestern corner of the field.

3. METHODOLOGY

Data Collection

- 3.1 The geophysical surveys were 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-striping" 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 topographical features, 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, 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. However, a broader categorisation of interpretation is sometimes required, as outlined in Table 2. 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.

Table 2: Categories of interpretation for geophysical anomalies.

Archaeological features	
<i>Archaeology</i>	Archaeological origins can be clearly determined in cases where the response's character and form are evident, or supporting evidence exists (e.g., historical sources, excavation, etc.). These features typically comprise linear, curvilinear or rectilinear anomalies and may include pits with a recognisable arrangement, grouping, or association with an archaeological feature to suggest an archaeological origin.
<i>Industrial/area of burning</i>	In instances where an abnormality exhibits a robust magnetic reaction indicative of kilns or hearths, among other features, an interpretation aided by the shape, form, and context may be feasible. It is prudent to exercise circumspection, as contemporary ferrous materials may often produce a comparable response
Possible archaeological feature/uncertain origin	
<i>Possible archaeology</i>	In cases where an archaeological response is preferred, yet the resulting findings are insufficient and do not exhibit any unique attributes comparable to an archaeological feature, this classification encompasses potential pits lacking identifiable organization, clustering, or correlation with archaeological features. Although they could potentially be of archaeological provenance, it is equally probable that they constitute natural formations, such as the remnants of tree throws (the former root boles of trees or shrubs).
<i>Area of enhanced magnetic activity</i>	This refers to a region characterized by elevated magnetic fluctuations lacking any perceptible structure or aetiology. Such phenomena may be attributable to archaeological factors or geological anomalies.
Agricultural features	
<i>Former field boundary</i>	Generally, a linear anomaly, frequently manifesting as a positive response resembling a bank and flanked on either side by negative response ditches, can typically be ascribed to former boundaries depicted on historical maps.
<i>Ridge and furrow</i>	A sequence of regular, linear anomalies displaying a uniform, broad distance between them. It may indicate recent activity if their

	orientation parallels that of extant field boundaries.
<i>Plough lines</i>	A series of regular linear anomalies exhibiting a uniform narrow spacing. It may indicate recent activity if their orientation parallels that of extant field boundaries.
<i>Field drains</i>	A series of regularly spaced linear anomalies.
Non-archaeological features	
<i>Magnetic interference</i>	An extraneous influence that impacts survey data, typically transpires at the periphery of surveys proximate to fences containing ferrous materials, around pylons, and subsurface utilities.
<i>Ferrous</i>	While these anomalies might be linked to an archaeological artifact of interest, they are typically deemed insignificant unless they form a pattern or constitute part of a larger feature. These anomalies are usually attributed to miscellaneous, contemporary ferrous-rich debris, including fragments of brick and tile, as well as objects such as horseshoes or broken ploughshares, which are situated within the topsoil and yield a dipole response.
<i>Natural / Geology</i>	These natural variations can yield substantial magnetic discrepancies in readings.



Figure 4: Geophysical survey greyscale plot overlaid on Google satellite imagery (Map data ©2024 Google).



Figure 5: Geophysical survey greyscale plot overlaid with an interpretive layer as discussed in section 4 overlain on google satellite imagery.

4. RESULTS

- 4.1 The geophysical survey was conducted over 2 days between 26th and 27th March 2024.
- 4.2 The total surveyed area measured 3.1 hectares across Fields A, B and C, and included all the area suitable for geophysical survey within the proposed development area (measuring 3.4 hectares).
- 4.3 A variety of anomalies were identified in the survey results. Modern ferrous anomalies produced some strong results, but none of these anomalies are thought likely to have archaeological potential.
- 4.4 The survey results have been 'clipped' to +/- 20nT and presented as a greyscale plot overlain on satellite mapping in Figure 4. Figure 5 shows an interpretation of the survey results, which are discussed by category below. Additionally, a trace plot and gridded greyscale plot are included in APPENDIX 1.

Potential archaeological remains.

- 4.5 None of the anomalies identified were thought to be archaeological.
- 4.6 As with all geophysical surveys the presence of further archaeological remains cannot be dismissed. It may be that significant archaeological remains survive but that they do not trigger a magnetic response.

Linear feature – dipole (red)

- 4.7 Running east/west through the southern end of the Field C is a highly magnetic linear anomaly. This feature appears to turn towards the south in the eastern part of Field B though the modern hedge bank obscures the survey results in this area.

The feature is causing dipoles along its length suggesting that this likely to be a ferrous feature, probably evidence of a modern service pipe. This feature is highly unlikely to be of archaeological significance.

Ferrous material

- 4.8 In gradiometer surveys dipole anomalies are commonly seen across a range of sites, presented on the greyscale plot as small discrete points of strong dark and light responses together. Unless they form a pattern or part of a larger feature, they are not thought to be archaeologically significant. They are usually the result of miscellaneous modern ferrous-rich debris, often agricultural in nature such as machinery parts, horseshoes, ploughshares, or highly fired material such as brick and tile fragments, which lie within the topsoil. In rare instances, isolated dipole anomalies may reflect features of archaeological interest, but only further intrusive investigation can verify this.

Area of Disturbance (blue)

- 4.9 In the southern part of the survey area spanning Fields B and C was a significant area of magnetic disturbance. This is visible as an area of vegetation covered hardstanding likely associated with the installation of the electricity transformer located in the southeastern part of Field B. This disturbance is not thought to be of archaeological interest.

Geological banding (dashed green)

Fields A and B contained geological banding. These faint anomalies are quite common and the result in differences in the composition of the bedrock or superficial geology. They are highly unlikely to be the result of archaeological activity.

5. CONCLUSIONS

- 5.1 Generally the quality of the survey data was good, with little interference from external influences and underlying geological layers appeared conducive to gradiometer surveying. All the areas affected by the proposed development were surveyed.
- 5.2 One linear anomaly was seen in the development area. This appears to be ferrous and caused most likely by a modern service.
- 5.3 In the southern part of the development area was an area of ground disturbance likely caused by the installation of an electricity transformer.
- 5.4 A general spread of discrete readings are noted throughout the survey area, but such a spread of responses is often typical of such survey results and are not in themselves indicative of archaeological features.
- 5.5 No clear further features of potential archaeological interest or significance were noted within the survey results. However, their presence can not be dismissed without further intrusive archaeological work.

6. SOURCES

Published

CIfA, 2014 *Chartered Institute of Field Archaeologists Standards and Guidance for Archaeological Geophysical Survey*

Murphy, 2021 *The Archaeology of The Medieval Towns of Southwest Wales Narberth*. Dyfed Archaeological Trust

National Standard and Guidance for Collecting and Depositing Archaeological Archives in Wales 2017.

<http://www.welshmuseumsfederation.org/en/news-archive/resources-landing/Collections/national-standard-and-guidance-for-collecting-and-depositing-archaeological-archives-in-wales-2017.html>

Online resources

British Geological Survey [online] Date Accessed 15/02/2024 2023. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.

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

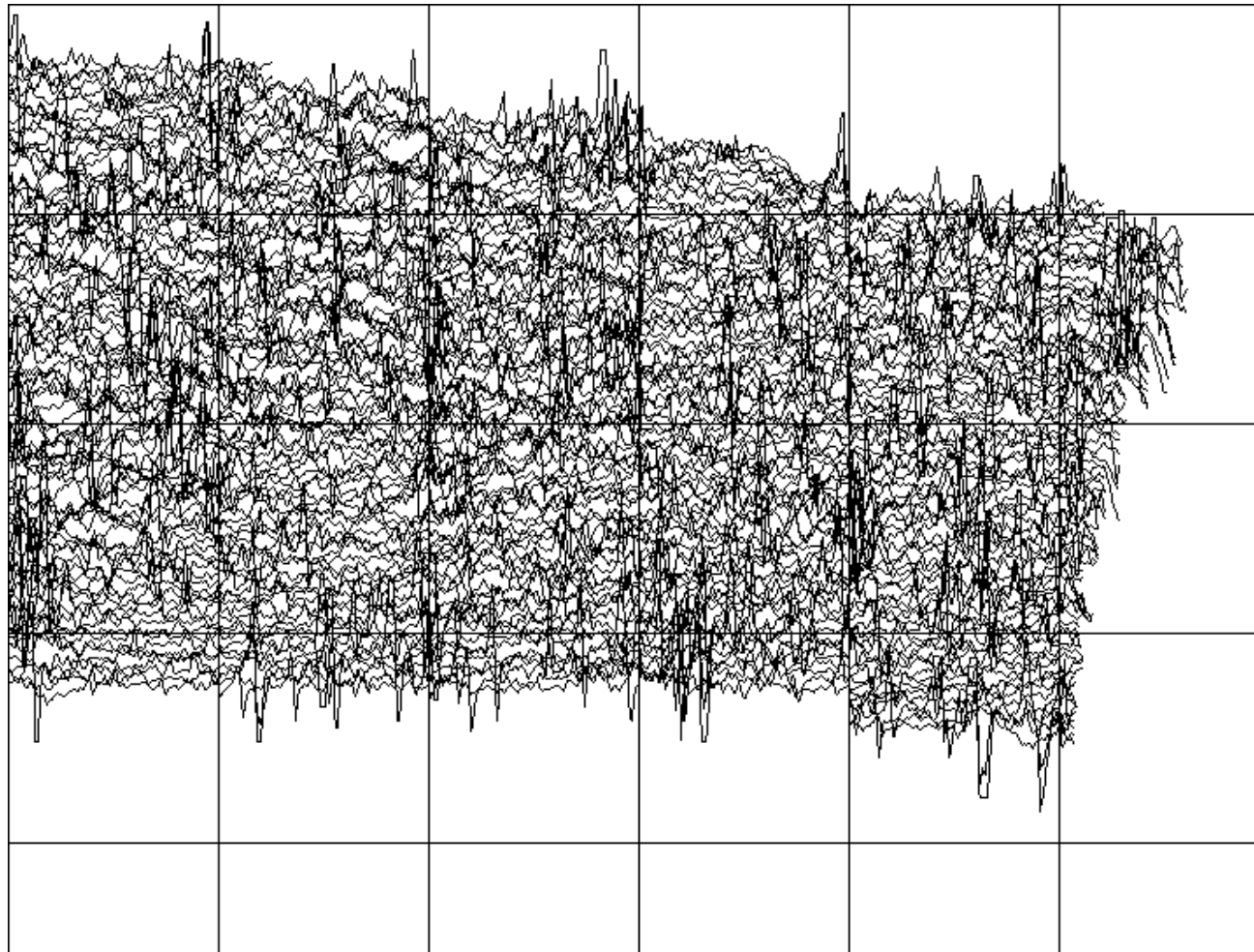


Figure 6: Field A presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid, north is to the right.

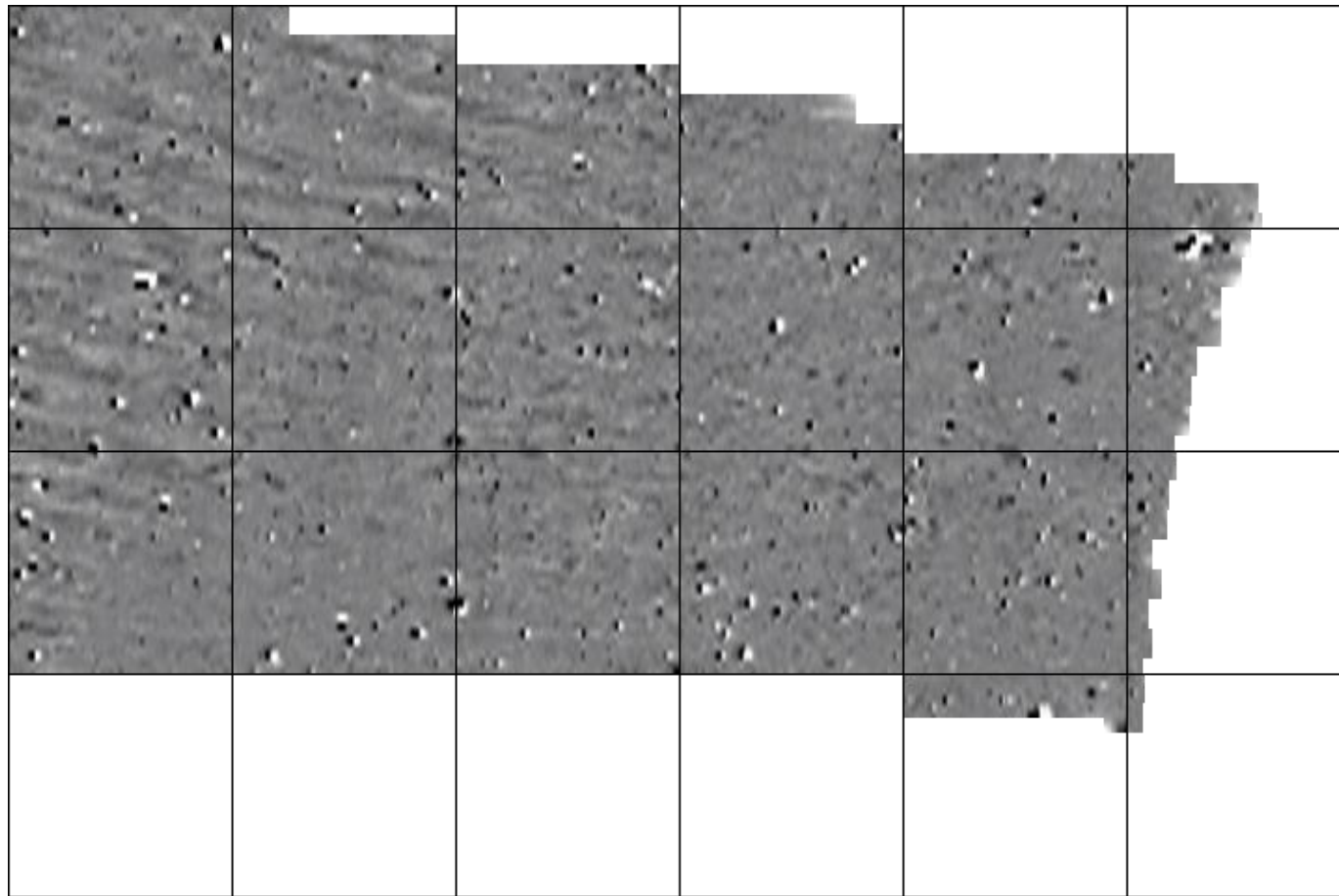


Figure 7: Field A results presented as a greyscale plot.
Each square is represented a 30m² grid, north is to the right.

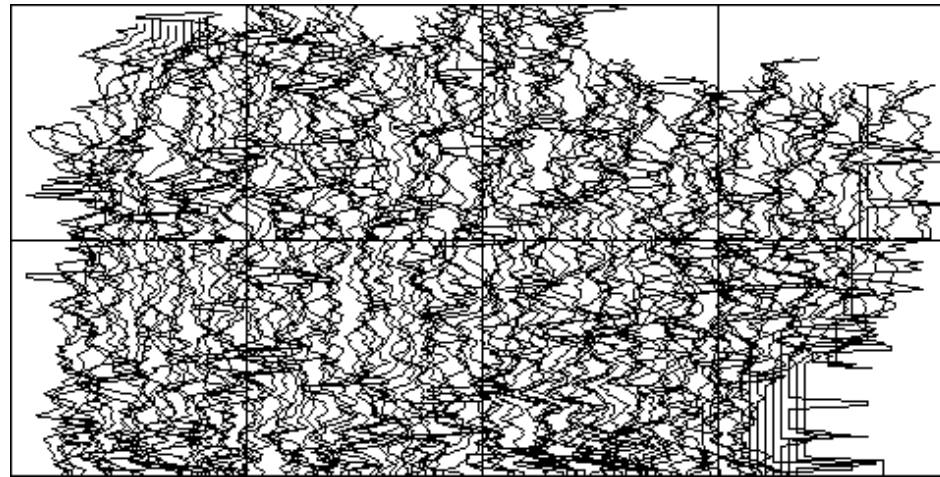


Figure 8: Field B presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid, north is to the right.

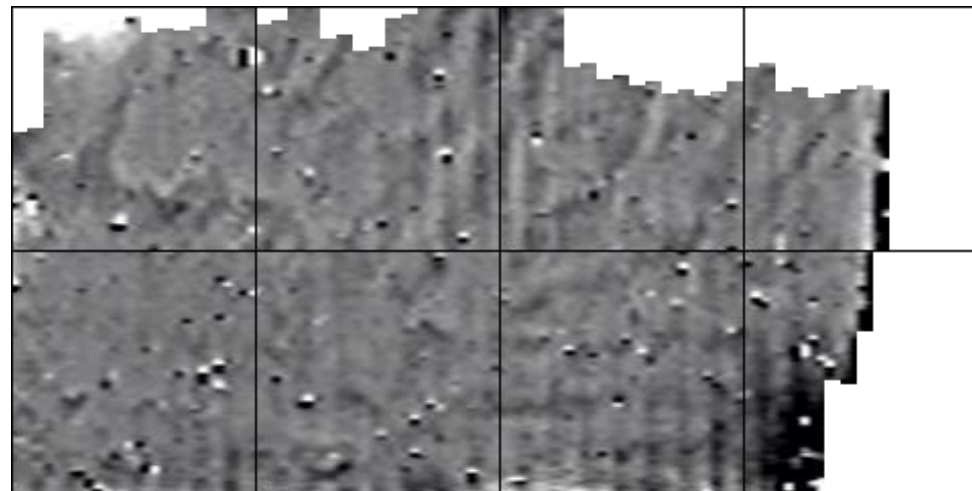


Figure 9: Field B results presented as a greyscale plot. Each square is represented a 30m² grid, north is to the right.

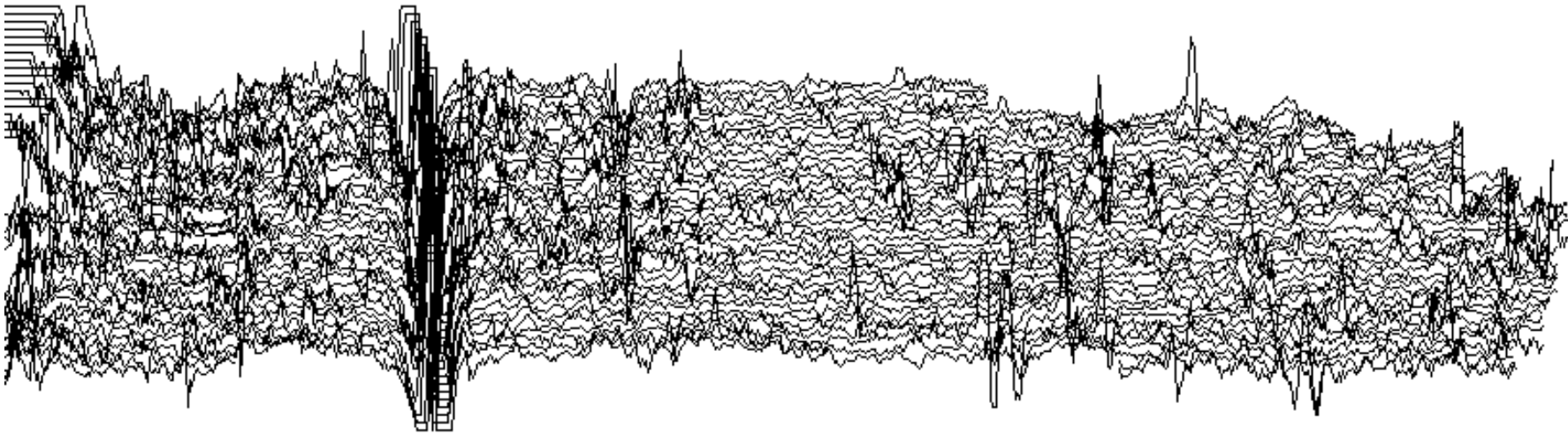


Figure 10: Field C presented as a trace plot giving an indication of the strength of responses. Each square is represented a 30m² grid, north is to the right.

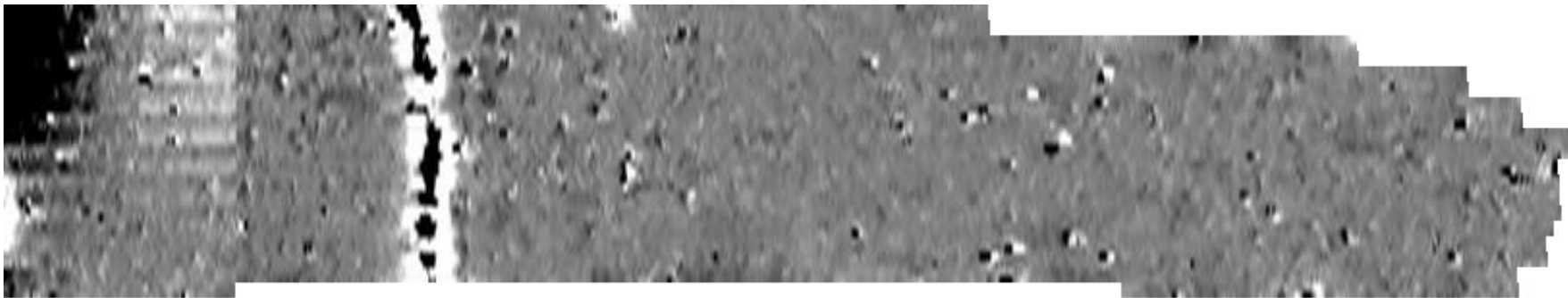


Figure 11: Field C results presented as a greyscale plot. Each square is represented a 30m² grid, north is to the right

APPENDIX 2

LAND WEST OF BLOOMFIELD GARDENS, NARBERTH, PEMBROKESHIRE
PLANNING APPLICATION NUMBER –23/0654/PA:
WRITTEN SCHEME OF INVESTIGATION FOR GEOPHYSICAL SURVEY

1 Introduction

- 1.1 This Written Scheme of Investigation (WSI) has been prepared by The Trust for Welsh Archaeology – Dyfed Region (henceforth known as Heneb-Dyfed Region) on behalf of Wales & West Housing to provide a methodology for a geophysical survey within the proposed development area on land west of Bloomfield Gardens, Narberth, Pembrokeshire, (centred on SN 11390 11678; Figure 1). The application is for a proposed residential development (Figure 2).
- 1.2 The site was assessed as a candidate site within the revised local development plans (ref. 033). Here, Heneb - Development Management in their role as advisors to the local planning authority recommended that an archaeological evaluation should be undertaken in order to confirm the presence/absence of archaeological deposits prior to the determination of the planning decision.
- 1.3 The recommendation for an archaeological evaluation was due to relatively little being known about the extent of the medieval town of Narberth, and no archaeological investigations being undertaken in the vicinity of the relatively large development area.
- 1.4 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, and therefore inform whether further archaeological evaluation/mitigation is required or not.
- 1.5 Using a gradiometer, a rapid scan of the site area will be undertaken, which through the measurement of tiny variations in the earth's magnetic field, can indicate the presence of buried features such as ditches, pits, walls or postholes, which are not visible on the ground surface.
- 1.6 The survey will be carried out using a fluxgate gradiometer, which detects variations in the earth's magnetic field. Readings will be taken at a 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 enables a relatively speedy survey to be carried out (using a single gradiometer and team of two) and provides good results, assuming that the geology of the area will be conducive to gradiometer survey and that the site does not contain obstructions that would make an even walking pace impossible.
- 1.7 This Written Scheme of Investigation is in accordance with the relevant Institute for Archaeologists Standard and Guidance for archaeological geophysical survey (Chartered Institute for Archaeologists (CIfA 2014).
- 1.8 HENEB Dyfed Region always operates to best professional practice. HENEB Dyfed Region Archaeological Services has its own Health and Safety Policy, and all works are covered by appropriate Employer's Liability and Public Liability Insurances. Copies of all are available on request.

- 1.9 **HENEB Dyfed Region is a CIfA Registered Organisation. All permanent staff members of the Archaeological Services are CSCS² registered.**

² *Construction Skills Certification Scheme (Health and Safety Tested)*

2 AIM AND OBJECTIVES OF THE PROJECT

2.1 This document provides a scheme of works for:

The implementation of a geophysical survey by HENEB Dyfed Region within the area proposed residential development on land west of Bloomfield Gardens, Narberth, Pembrokeshire SN 11390 11678. A report and archive of the results will be prepared.

2.2 The general aims of the overall archaeological investigations are:

- To determine the presence or absence of archaeological deposits or remains,
- To record the character, date location and preservation of any archaeological remains
- on site that are affected by the proposed new works,
- To record the nature and extent of any previous damage to archaeological deposits or
- remains on site in the area of the new works.

2.3 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.

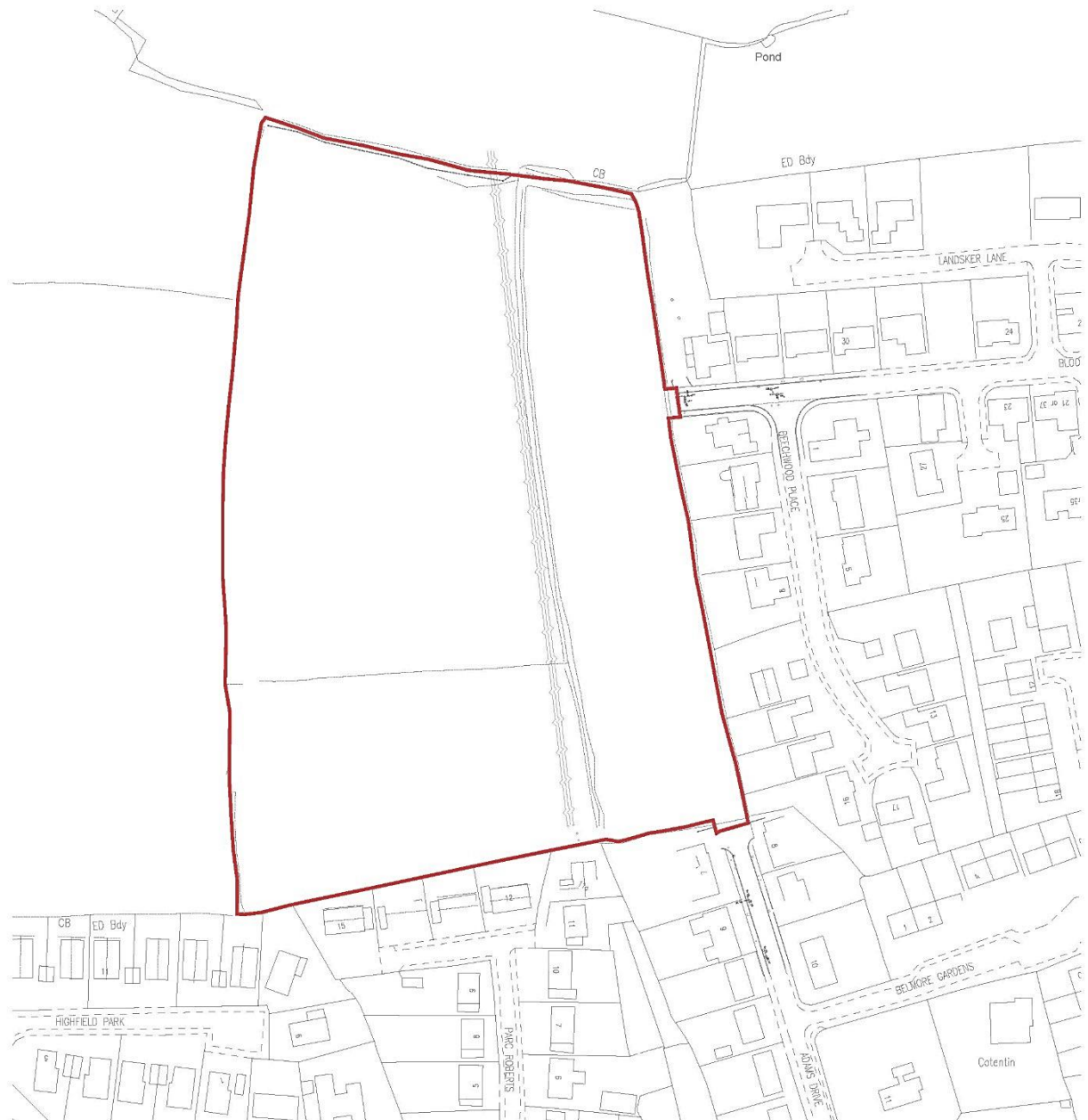
2.4 The objectives of the project are:

- 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.

2.5 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;
- To use the information obtained to design a specification for future mitigation at the site, which will enable any identified remains to be appropriately investigated and recorded where they will be affected by the proposed development.

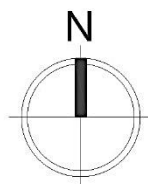
Land West of Bloomfield Gardens,
Narberth: Geophysical Survey



KEY



Site Boundary [8.69 Acre]



Scale 1:250



REV	DESCRIPTION	DATE
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CLIENT
Wales & West HA

JOB TITLE
Adams Drive, Narberth.

DRAWING TITLE
Location Plan

SCALE @ A3	DATE	DRAWN BY
1:1250	Oct '21	PC
JOB NO.	DRAWING NO.	REVISION
2137	LP-01	A



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Please note that this drawing is for information only and any
discrepancies are to be referred to Hammond Architectural Ltd. Contractors,
subcontractors and suppliers must verify all dimensions on site before
commencing any work or making any workshop drawings.

Figure 1: Location map of proposed residential development on land west of
Bloomfield Gardens, Narberth, Pembrokeshire.

[illegible]

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 HENEB Dyfed Region 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. The National Standards for Wales for Collecting and Depositing Archaeological Archives produced by the Federation of Museums and Art Galleries of Wales will also be adhered to. Digital archives will be collated using the Royal Commission on the Ancient and Historical Monuments of Wales systems (2015) and deposited with the RCAHMS. 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 2014, updated 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 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 S&G: AWB 2014).
- 4.7 Digital copies of the report will be provided to the client, as well as the Heneb Dyfed Region - Development Management.

5 STAFF

- 5.1 The project will be managed by Fran Murphy
- 5.2 The on-site works will be undertaken by experienced archaeologists from Heneb - Archaeological Services.

6 QUALITY ASSURANCE

- 6.1 Heneb - 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 Heneb - 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 Dyfed Region – Development Management, who should be told of the commencement of the works. The fieldwork may also need to be monitored by the Head of Heneb - Archaeological Services.

8 HEALTH AND SAFETY

- 8.1 All permanent members of staff should be CSCS registered.
- 8.2 Service information should be obtained prior to the start of the works.
- 8.3 A health and safety risk assessment must be prepared prior to the works commencing to ensure that all potential risks are minimised.
- 8.4 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.
- 8.5 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.
- 8.6 All relevant health and safety regulations must be followed, including compliance with Welsh Government guidelines on working practices and guidance issued by CIfA.
- 8.7 Safety helmets, 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.
- 8.8 Working with machinery: all staff must ensure that their presence on site is communicated to all relevant site contractor staff, especially the machine operator. The archaeologist observing the topsoil stripping by machine will establish a safe working procedure with the machine operator at the start of work. This will include explaining the purpose of the works itself and the method by which the trenches shall be machined. This will include ensuring that the machine driver is aware that topsoil is stripped carefully to avoid disturbing archaeology. This will also include discussing the methodology for safe working, ensuring that no machining is done without an archaeologist being present.

9 ARBITRATION

- 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.

APPENDIX I – 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 Mumetal 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.

APPENDIX II:

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
FS23-062- Bloomfield Gardens., Narberth, Pembrokeshire
ERN (if known)
TBC
Project Type
Geophysical Survey
Client
Wales and West Properties Ltd
Project Manager / Data Contact
Fran Murphy
Principal Archaeologist on site
Luke Jenkins
Date DMP created
15/03/2024
Date DMP last updated
15/03/2024
Related data management policies
Written Scheme of Investigation Chartered Institute for Archaeologists (CIfA) <i>Standards & Guidance</i> HENEB Dyfed Region, 2018, archive retention policy Brown 2011, Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation NPAAW, 2017, The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017 RCAHMW, 2015, RCAHMW guidelines for Digital Archives, Version 1 WAT, 2018, Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)

Section 2: Data Collection

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

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 Region's <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 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 Region *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 RCAHMS, 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.



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