



GEOPHYSICAL SURVEY  
REPORT

LAND NORTH OF POINT LANE,  
COSHESTON, PEMBROKESHIRE

prepared for  
ECUS Ltd  
on behalf of  
One Planet Developments Limited

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Client ECUS Ltd on behalf of One Planet Developments Limited  
Location Land to the north of Point Lane, Cosheston, Pembrokeshire  
Grid Ref SM 9940 0395  
Planning authority Pembrokeshire County Council



# LAND NORTH OF POINT LANE, COSHESTON, PEMBROKESHIRE

## GEOPHYSICAL SURVEY REPORT

### TABLE OF CONTENTS

1.0	Introduction	1
2.0	Location, topography and geology	1
3.0	Archaeological and historical background	1
4.0	Aims and objectives	2
5.0	Methodology	3
6.0	Results	4
7.0	Conclusions	6
	References	8
	Appendix A Technical information	10
	Appendix B Data processing information	12
	Appendix C Data visualisation information	13
	Appendix D Raw data plot	17

### FIGURE LIST

Figure 1: site location

Figure 2: Parish of Cosheston, Pembrokeshire, tithe map of 1841 overlain with field names and site field labels

Figure 3: gradiometer survey grids

Figure 4: processed greyscale plot of gradiometer survey results

Figure 5: interpretation of gradiometer survey results

Appendix Figure D1: raw greyscale plot

### **Geophysical survey disclaimer**

The results of geophysical survey may not reveal all potential archaeology and therefore do not provide a comprehensive map of the sub-surface. Only archaeological features that contain soils of a sufficiently different magnetic nature to that of the general background soils will be visible. Geological, agricultural and modern responses may mask archaeological features. Only clear features have been interpreted and discussed in this report.

# LAND NORTH OF POINT LANE, COSHESTON, PEMBROKESHIRE

## GEOPHYSICAL SURVEY REPORT

### *Summary*

*Northern Archaeological Associates Ltd., now part of ECUS was commissioned by One Planet Developments Limited to undertake a geophysical survey of land north of Point Lane, west of Cosheston, Pembrokeshire (NGR: SM 9940 0395). The survey was required to assess the archaeological potential of the site and help inform any subsequent archaeological mitigation. The survey was carried out between 14-17 February 2022 and covered an area of approximately 9.7 hectares within three pasture fields.*

*No designated sites exist within or in the immediate vicinity of the survey area. The Dyfed Archaeological Trust Historic Environment Record lists three sites within the survey area, two relating to place name evidence of former field names and one for a WWII Barrage Balloon Site near the easternmost field boundary. The word 'castles' appears in the names recorded on an 1841 parish tithe plan of all the fields within the survey area and one adjacent field to the north, this is seen as evidence of both a possible fortification in or near the area and of medieval open fields. No evidence of any fortification is visible in the survey data. One faint anomaly could be argued as having some potential to be an enclosure, though it is very weak. The 'medieval open field' interpretation of the field names is also difficult to corroborate with the survey data, as while the curving nature and strip form of many field boundaries around Cosheston are indicative of medieval agriculture in the area, little clear evidence of curving medieval ridge and furrow can be seen in the greyscale plot. The Barrage Balloon Site is described as 'now demolished' and was recorded in 1993 as an array of concrete tether blocks around a central block, though elements have since been buried. Dipolar anomalies within the eastern field could relate to iron fittings associated with the balloon site.*

*The survey identified a small number of magnetic anomalies which could relate to previously unrecorded field systems and some isolated pits. Due to the partial masking effect of large amounts of background magnetic disturbance, of a probable geological origin, clear identification of smaller pit type anomalies has not been possible, along with the classification of fainter more diffuse anomalies and trends. Former recorded field boundaries are visible within the data, though to varying degrees of clarity. This may relate to their form as a hedgerow only, with little evidence of accompanying ditches. Agricultural ploughing trends of relatively modern origin are also visible.*

## *Crynodeb*

*Northern Archaeological Associates Ltd., sy'n ballach yn rhan o ECUS sydd wedi cael ei gomisiynu gan One Planet Developments Limited i gynnal arolwg geoffisegol o'r tir i'r gogledd o Point Lane, sydd i'r gorllewin o Cosheston, sir Benfro (NGR: SM 9940 0395). Roedd angen yr arolwg i asesu potensial archeolegol y safle ac helpu i lywio unrhyw fesurau lliniaru archeolegol dilynol. Cynhaliwyd yr arolwg rhwng 14-17 Chwefror 2022 ac roedd yn gorchuddio arwynebedd o tua 9.7 hectar o fewn tri chae porfa.*

*Nid oes unrhyw safleoedd dynodedig yn bodoli o fewn neu yng nghyffiniau ardal yr arolwg. Mae Cofnod Amgylchedd Hanesyddol Ymddiriedolaeth Archeolegol Dyfed yn rhestru tri safle o fewn ardal yr arolwg, dau yn ymwneud â thystiolaeth enwau lleoedd o enwau caeau blaenorol ac un ar gyfer Safle Balŵns Morglawdd o'r Ail Ryfel Byd ger ffin fwyaf dwyreiniol y cae. Mae'r gair 'cestyll' yn ymddangos yn yr enwau a gofnodwyd ar gynllun degwm plwyf 1841 o'r holl gaeau o fewn ardal yr arolwg ac un cae cyfagos i'r gogledd, gwelir hyn fel tystiolaeth o amddiffynfa bosibl yn yr ardal neu gerllaw ac o'r cyfnod canoloesol caeau agored. Nid oes tystiolaeth o unrhyw atgyfnerthu i'w weld yn nata'r arolwg. Gellid dadlau bod gan un anghysondeb gwan rywfaint o botensial i fod yn lloc, er ei fod yn wan iawn. Mae'n anodd hefyd ategu'r dehongliad 'cae agored canoloesol' o enwau'r caeau â data'r arolwg, oherwydd tra bod natur grwm a ffurf stribedi llawer o ffiniau caeau o amgylch Cosheston yn arwydd o amaethyddiaeth ganoloesol yn yr ardal, ychydig o dystiolaeth glir o gefn ganoloesol grom a rych sydd i'w gweld yn y plot graddlwyd. Disgrifir Safle Balŵns y Morglawdd fel un 'sydd bellach wedi'i ddymchwel' ac fe'i cofnodwyd ym 1993 fel amrywiaeth o flociau clymu concrit o amgylch bloc canolog, er bod elfennau wedi'u claddu ers hynny. Gallai anomaledau deubegynol yn y cae dwyreiniol ymwneud â ffitiadau haearn sy'n gysylltiedig â safle'r balŵns.*

*Nododd yr arolwg nifer fach o anomaledau magnetig a allai ymwneud â systemau maes nas cofnodwyd yn flaenorol a rhai pyllau ynysig. Oherwydd effaith guddio rhannol nifer fawr o aflonyddwch magnetig cefndirol, o darddiad daearegol tebygol, ni fu'n bosibl adnabod anghysondebau math pwll llai yn glir, ynghyd â dosbarthiad anomaledau a thueddiadau llewch, mwy gwasgaredig. Mae ffiniau caeau a gofnodwyd gynt yn weladwy o fewn y data, er i raddau amrywiol o eglurder. Gall hyn ymwneud â'u ffurf fel gwrych yn unig, heb fawr o dystiolaeth o ffosydd cysylltiedig. Mae tueddiadau aredig amaethyddol o darddiad cymharol fodern hefyd i'w gweld.*



## **1.0 INTRODUCTION**

- 1.1 Northern Archaeological Associates Ltd. (NAA), now part of ECUS, was commissioned by One Planet Developments Limited to undertake a geophysical gradiometer survey of land immediately north of Point Lane, west of Cosheston, Pembrokeshire (hereafter referred to as 'the site'). The survey was required to assess the archaeological potential of the site and help inform subsequent archaeological mitigation. The survey was carried out between the 14<sup>th</sup> and 17<sup>th</sup> February 2022 and covered an area of approximately 9.7ha.

## **2.0 LOCATION, TOPOGRAPHY AND GEOLOGY**

### **Location**

- 2.1 The site is located along the north side of Point Lane, some 300m west of Cosheston, Pembrokeshire (Fig 1) (NGR: SM 9940 0395). The site comprised three fields, currently used for pasture which were defined by hedgerows containing barbed wire fences on all sides.

### **Geology and soils**

- 2.2 The solid geology of the site consists of Sandstone of the Cosheston Group with no recorded superficial deposits (BGS 2022). The sandstone generally has a lower magnetic field than igneous rock and can be affected by dissolvent agents, such as water and other eroding factors. The soils are mapped as typical brown earths of the Neath Association (Soil Survey of England and Wales 1983), consisting primarily of freely draining and slightly acid loamy soils (Jarvis et al. 1984, 145; Soilscales [www.landis.org.uk/soilscales](http://www.landis.org.uk/soilscales)).

### **Topography and land-use**

- 2.3 The topography of the site includes a hilltop standing to around 66m above Ordnance Datum (aOD) towards its northern edge, with the ground sloping down to around 55m aOD to the west and 50m aOD to the south along Point Lane.

## **3.0 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND**

- 3.1 The area surrounding the site has been subject to an ASIDOHL2 assessment report (James, 2012). This report shows no designated sites within or in the immediate vicinity of the site but does list three archaeological/historical assets from the Dyfed Archaeological Trust Historic Environment Record within the site (PRNs 4519, 38318



and 26192). Asset 4519 links six adjacent fields, five within the site and one immediately to the north, that have the word 'castles' in their field names and suggests they are evidence of a former medieval open field or fields. Asset 38318 uses the 'castles' name literally and infers there may have been a former fortified site in the area. It is equally possible that the word is used to denote ownership and may associate the fields with a nearby castle, farm or possibly to a family of that name. Asset 26192 is described as a Barrage Balloon Site, now demolished. The recorded elements comprised a central main concrete block and cable loop surrounded by eight evenly spaced tethering blocks. The assessment report states that all above ground infrastructure has previously been cleared, presumably for agricultural purposes.

- 3.2 Historic mapping depicts a few former field boundaries within the site, discussed below.
- 3.3 The Parish of Cosheston, Pembrokeshire, tithe map dating to 1841 (Jones 1841) (Fig 2) depicts the site as five separate fields. One north south field boundary splits Field 3 into roughly equal halves, while another east west boundary across the centre of Field 2 divides it in two. The southern half of Field 2 is further split by another centrally located north south boundary.
- 3.4 First edition Ordnance Survey maps of 1869 only show two north south field boundaries dividing the site, both depicted on the 1841 tithe map. The eastern boundary still exists as a hedgerow and separates Fields 2 and 3. The western field boundary is depicted on maps until at least 1971 (National Library of Scotland 2022). The boundary between Fields 1 and 2 does not appear until after 1993.

#### **4.0 AIMS AND OBJECTIVES**

- 4.1 The aim of the geophysical survey was to map and record potential buried features located within the site. Through detailed analysis of the results of the geophysical survey, NAA has provided an interpretation that assesses the archaeological potential of the site.
- 4.2 The objectives of the survey were to:
  - undertake a geophysical survey across areas deemed suitable for data collection within the site;

- attempt to identify, record and characterise any subsurface remains within the survey boundary;
- assess the archaeological significance of identified anomalies;
- identify possible concentrations of past activity in order to inform the requirement for any further archaeological investigation at the site.

## **5.0 METHODOLOGY**

- 5.1 The geophysical survey was undertaken as a gradiometer survey using the Bartington Grad601-2 dual magnetic gradiometer system with data logger. The readings were recorded at a resolution of 0.01nT and data were collected with a traverse interval of 1m and a sample interval of 0.25m. All recorded survey data was collected with reference to a site survey grid comprised of individual 30m x 30m squares (Fig 3). The grid was established using Real Time Kinematic (RTK) differential GPS equipment and marked out using non-metallic survey markers. All grid nodes were set out with a positional accuracy of at least 0.1m as per existing guidelines (English Heritage 2008; ClfA 2020; Schmidt *et al.* 2015) and could be re-located on the ground by a third party.
- 5.2 The processing was undertaken using Geoplot 3.0 software and consisted of standard processing procedures. Details of processing steps applied to collected data are shown in Appendix B.
- 5.3 On the greyscale plot (Fig 4), positive readings are shown as increasingly darker areas and negative readings are shown as increasingly lighter areas.
- 5.4 The interpreted data uses colour coding to highlight specific readings showing patterning with increased magnetic responses (Fig 5). In this report, the word anomaly is used to refer to any outstanding high or low readings forming a particular shape or covering a specific area. Appendix C details the terminology and characterisation of anomalies used for interpreting data.

### **Surface conditions and other mitigating factors**

- 5.5 The site comprised three fields divided by hedgerows containing barbed wire fencing.
- 5.6 Metal gates within the hedgerows were used for access into the various fields.

- 5.7 It is necessary to avoid all visible metal objects to ensure that magnetic responses do not overly impinge on the survey results and mask potential buried features. To this end, a buffer was left around the edges of the fields to attempt to minimise magnetic interference in the dataset, however an element of interference is still visible along the eastern boundary of the site.
- 5.8 At the time of survey, the surveyors experienced high winds and heavy rain, but it did not adversely affect the survey data.

## **6.0 RESULTS**

- 6.1 The gradiometer survey was successful and recorded readings demonstrating previous use of the site and geological features, however these geological features have the potential to mask archaeological features. No definitive evidence of a potential fortification referred to in HER record 4519 can be seen in the results. A number of smaller dipole anomalies exist in Field 1, it is possible that a grouping towards the south of the field could relate to HER record 26192 but this is uncertain.

### **Description and interpretation**

- 6.2 A small number of possible archaeological anomalies, **1-7**, are visible within the dataset, mostly towards the central area of the survey, but they are partially masked by strong probable geological responses inhibiting clear identification. Anomalies **1-3** appear to represent discontinuous elements of former field enclosures predating cartographic record from 1841 onwards. Their orientation differs from the extant and historic boundaries, being more NW SE and also differs from the background geology. The anomalies form a non-joining T shape with no branch of the T longer than 20m. The western end of anomaly 3 blends in with and may be part of a geological anomaly continuing to the west.
- 6.3 Anomalies **4-7** loosely align with **1-3** and could be part of a wider enclosure network, though the shorter nature of **5**, **7** and **8** could suggest an interpretation of pits or possibly tree throws. Anomaly **4** is a slightly larger almost curving feature of potential archaeological interest located towards the top of the hill.
- 6.4 Anomaly **9** is a more diffuse magnetic effect of uncertain origin. It presents as a curving L shaped linear anomaly bounding the east and south sides of anomaly **4**. The eastern arm runs counter to the underlying geology while the southern arm aligns with the geology. This makes it unclear whether it is of archaeological interest or purely

geological in nature. The same is true of anomaly **10** towards the south eastern corner of the site, this feature more closely aligns with the underlying geology but is a straighter, slightly stronger anomaly which could possibly represent a trackway surface.

- 6.5 Former historically recorded field boundaries **11-13**, are visible within the dataset. These boundaries are all visible on a Cosheston Parish tithe map dating to 1841, along with the two surviving boundaries between the fields and those surrounding them. The current boundaries are hedgerows with no clear sign of ditch or bank, which helps to explain their relatively poor, discontinuous appearance in the dataset. The former east west boundary (**13**) presents a much clearer positive anomaly, probably representing a ditch, with a corresponding negative anomaly, probably representing the remnants of a bank, running along the southern edge of its western half before terminating at the former north south boundary, anomaly **12**.
- 6.6 Anomaly **14** appears to be a northern continuation of former field boundary **12**, though it must have been removed prior to 1841.
- 6.7 Various faint linear trends (**15**) are visible within the dataset, these could relate to weaker archaeological responses or possibly to field drains, though their location on a hillside may render the latter interpretation unlikely.
- 6.8 Narrow curving fields shown on the 1841 tithe map to the north, east of and within the site appear to fossilise earlier medieval strip fields, though no clear evidence of any reverse S ridge and furrow is visible within the survey data. However, groups of closely spaced linear anomalies (**16**) do appear to represent probable post medieval/modern ploughing regimes which could have removed evidence of earlier agriculture.
- 6.9 The geological responses (**17**) affect most of the site and take the form of large sinuous alternating positive and negative anomaly bandings towards the northern, uphill side of the site, fading and widening towards the south as the ground falls towards Point Lane. The negative bandings comprise numerous small anomalies, which present as individual anomalies, or linear and amorphous groups. The frequency of these geological bands makes it difficult to definitively identify anomalies of potential archaeological origin.

6.10 Two slightly larger/clearer dipoles are recorded in Field 2, these may relate to ferrous or magnetically susceptible objects buried in the topsoil, or to heat affected objects or areas. Additional dipoles are visible in Field 1, at the north end of the field they are close to modern fence lines and may relate to interference, but they have been highlighted as they are in the proximity of the Barrage Balloon Site (HER record 26192). A group of smaller anomalies at the southern end of the field could equally relate to the Barrage Balloon Site, though they are similar in magnitude to the numerous anomalies within the geological effects which have not been individually picked out.

6.11 Strong responses caused by above ground features external to the site, such as metal fencing and gates have been characterised as magnetic disturbance.

## **7.0 CONCLUSIONS**

7.1 NAA was commissioned to undertake a geophysical survey of land north of Point Lane, west of Cosheston, Pembrokeshire. The survey was required to assess the archaeological potential of the site and help inform subsequent archaeological mitigation.

7.2 The survey has demonstrated that anomalies of probable archaeological and geological origin are susceptible to the technique.

7.3 The data shows no evidence of a hilltop fortification or clear evidence of the Barrage Balloon Site (HER records 4519 and 26192). Uncertain linear anomaly **9** could be argued as a potential candidate for an enclosure ditch, but a very tentative one. Dipole anomalies towards the southern side of Field 1 could be related to the Barrage Balloon Site though they are of a similar magnitude to the anomalies within the geological effects prevalent across the site, again rendering the association tentative.

7.4 A small number of stronger anomalies that have a different alignment and character to the background geology and noise have been identified as having higher archaeological potential.

7.5 Widespread geological anomalies are creating a masking effect, making smaller archaeological features more difficult to identify.

## **8.0 STORAGE AND CURATION**

- 8.1 The records of the geophysical survey are currently held by NAA. All material will be appropriately packaged for long-term storage in accordance with national guidelines (English Heritage 2008; ClfA 2020; Schmidt *et al.* 2015). An online OASIS form will be completed on the results of the works within three months of the completion of the project under the reference number northern1-505346 this will include submission of a pdf version of the final report to the Archaeology Data Service via the OASIS form.
- 8.2 A digital pdf version of the report will be forwarded to the client and copies sent to the LPA and regional HER.



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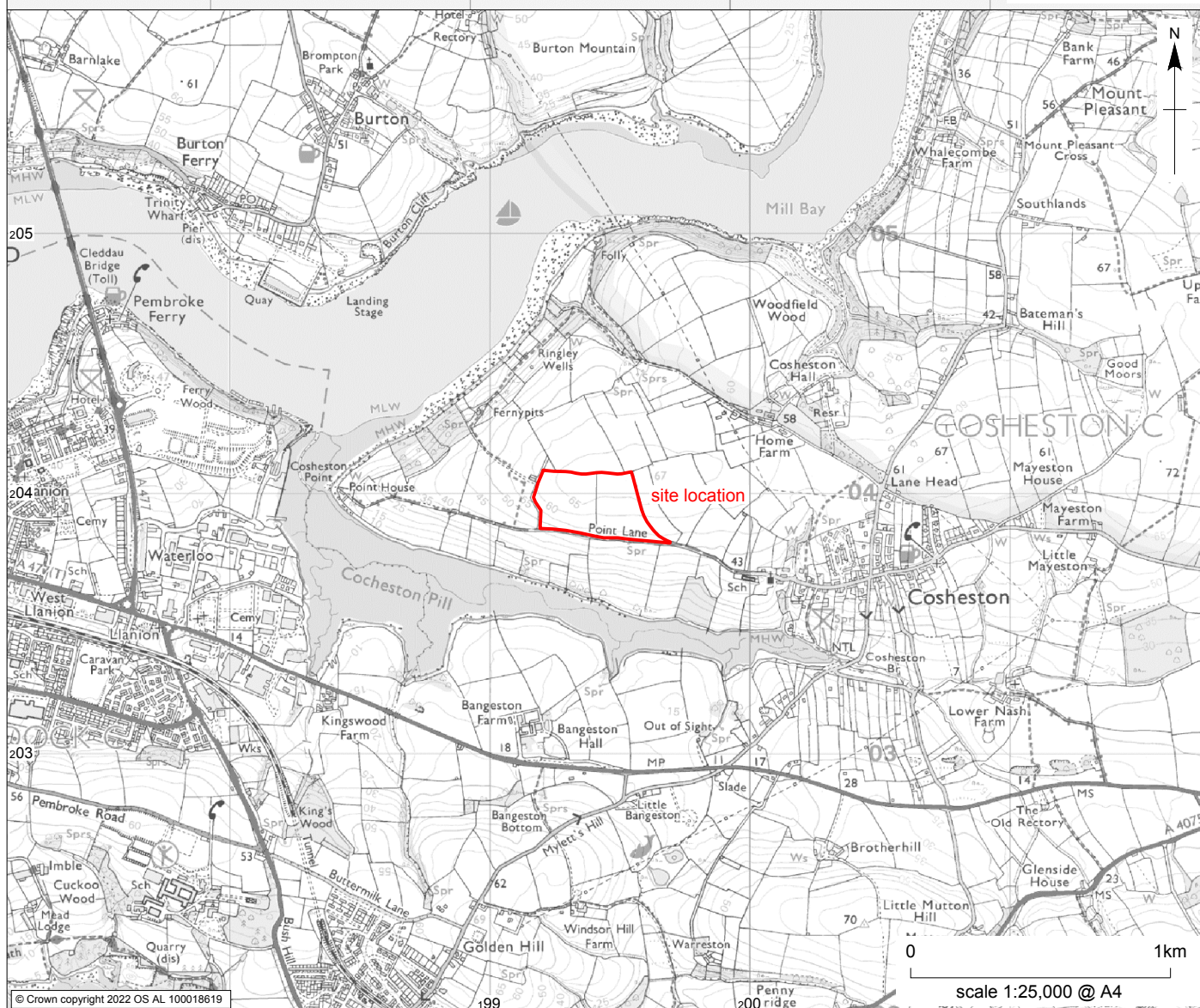
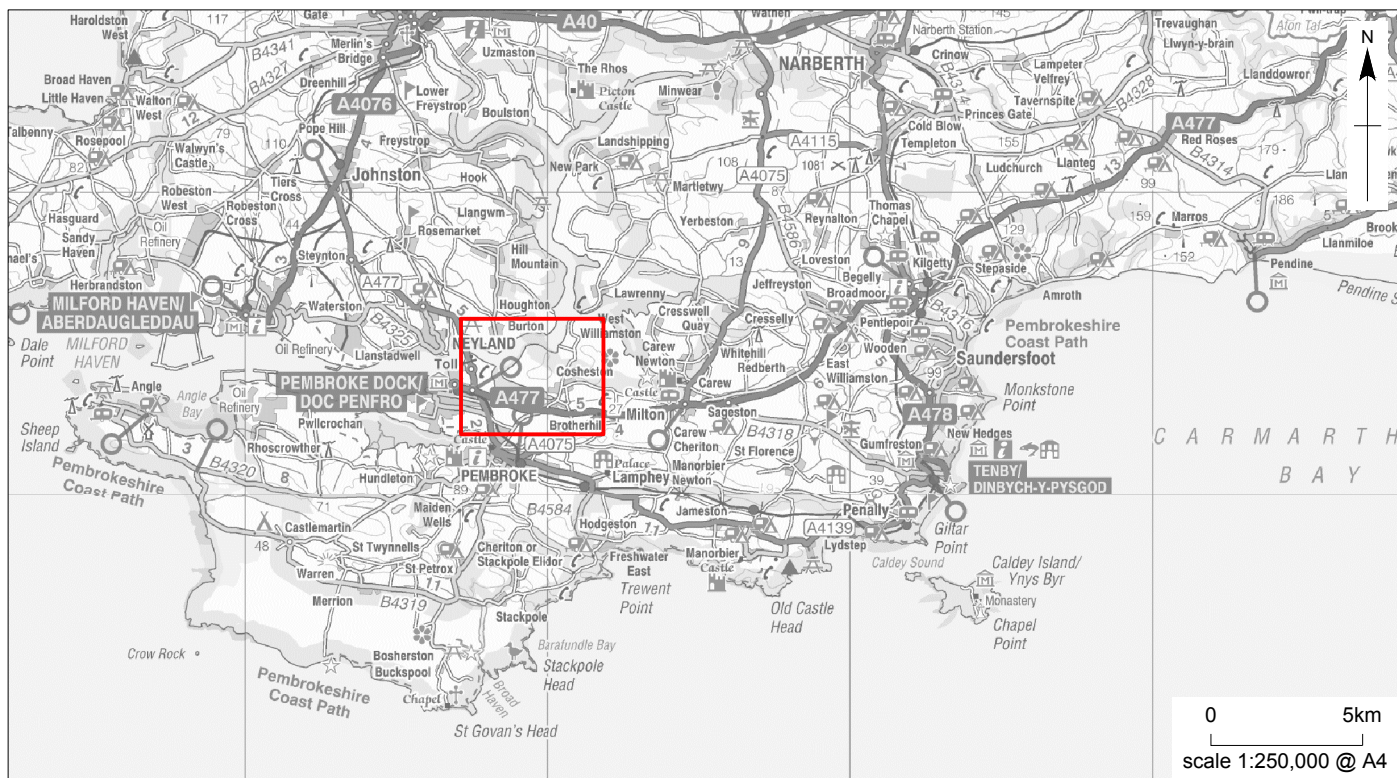
## Online sources

British Geological Survey (2022) <https://mapapps.bgs.ac.uk/geologyofbritain/home.html>

National Library of Scotland (2022) <http://maps.nls.uk/geo/>

Promap Historical Maps (2022) <https://www2.promap.co.uk/#/>

The National Library of Wales (2022) <https://places.library.wales/browse/>



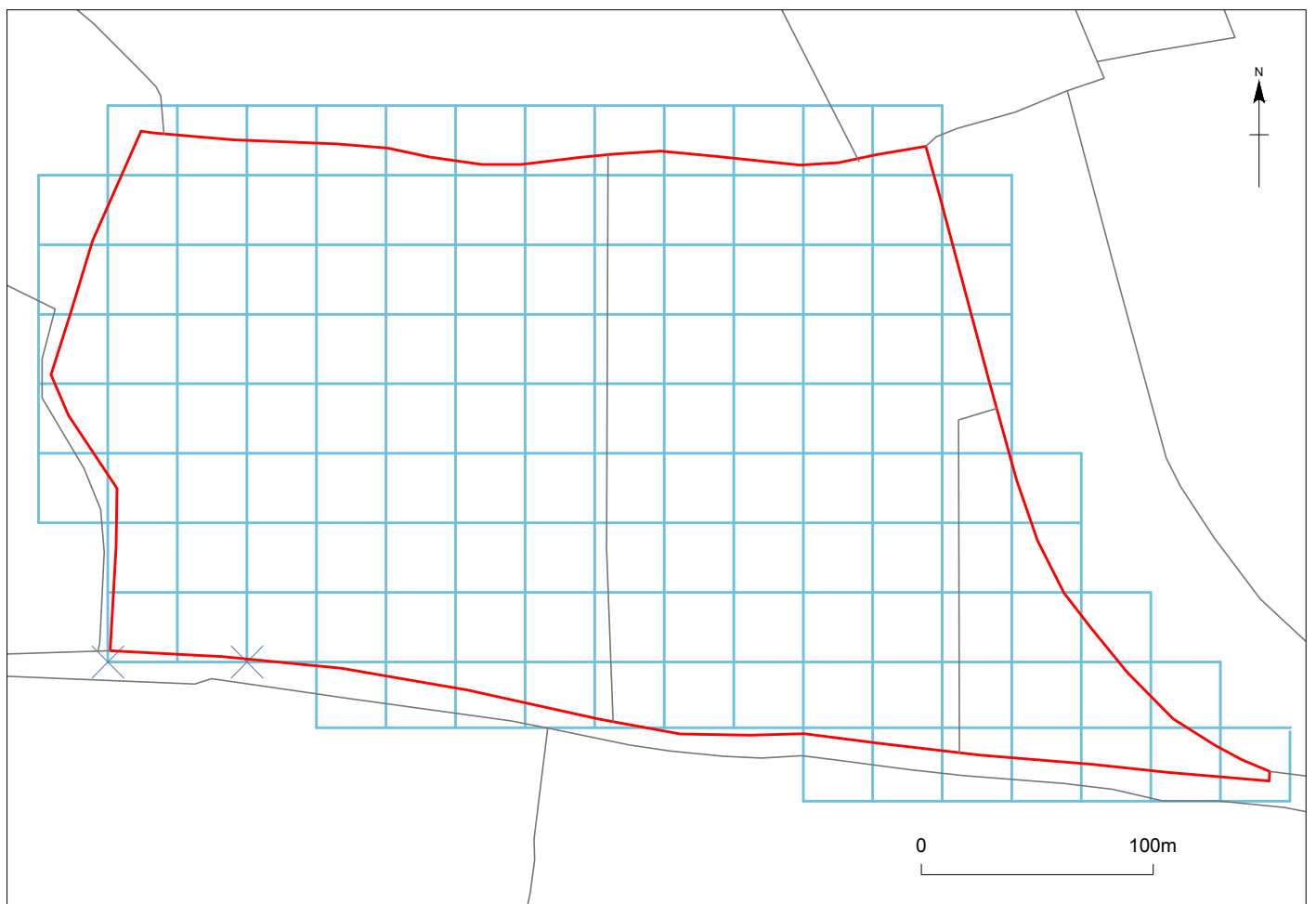




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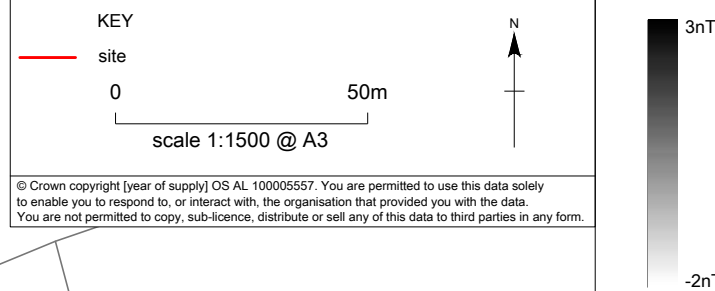
Figure 2

*Point Lane, Cosheston, Pembrokeshire: Parish of Cosheston, Pembrokeshire  
tithe map of 1841 overlain with field names and site field labels*



*Point Lane, Cosheston, Pembrokeshire: gradiometer survey grid*

Figure 3

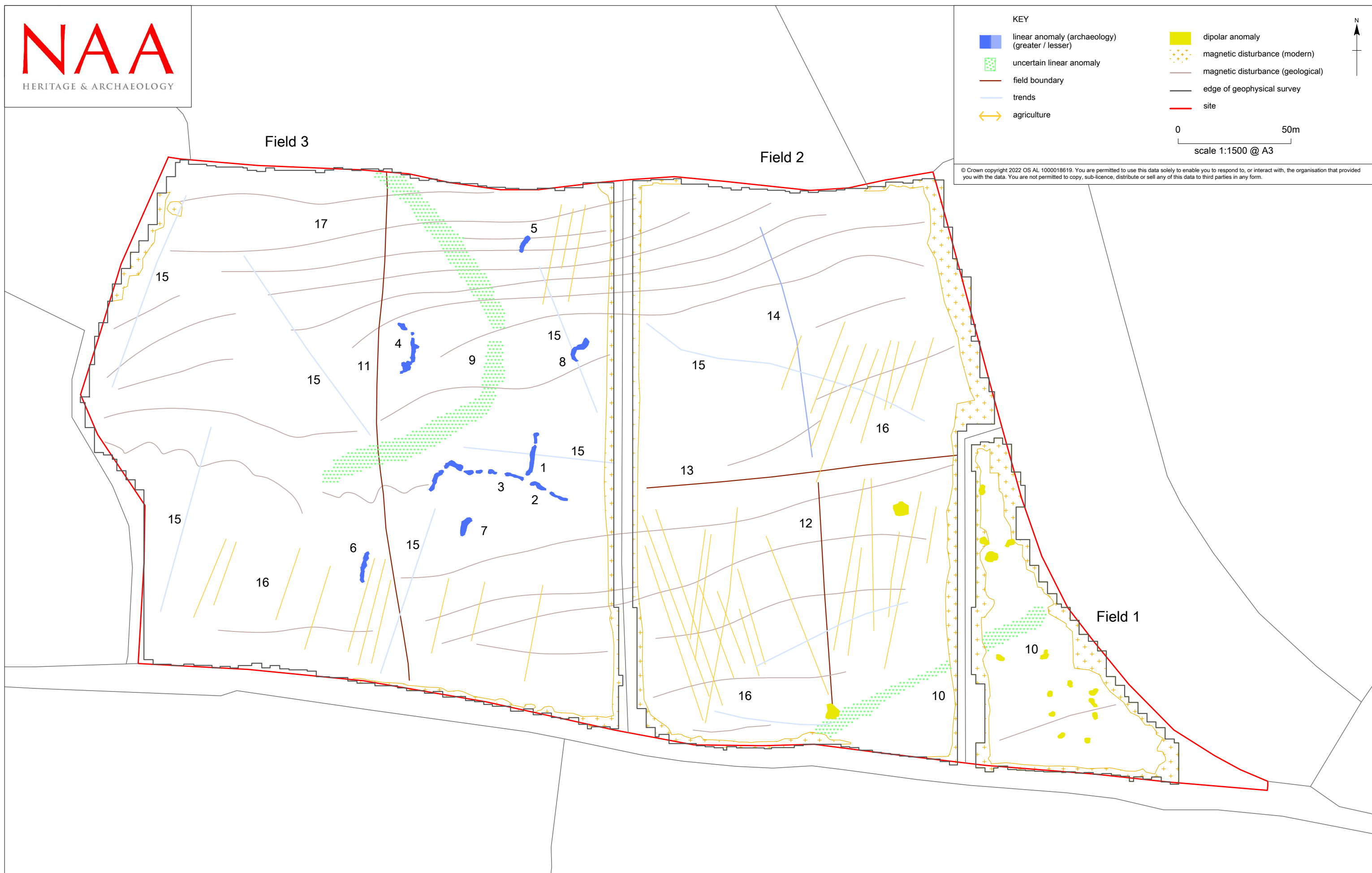
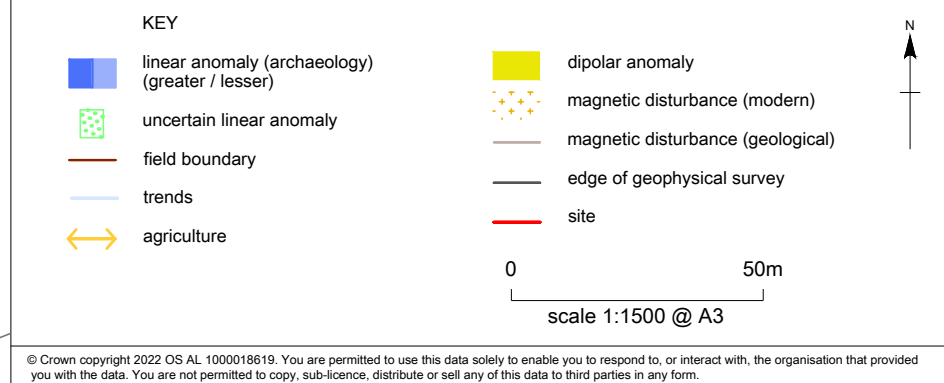


Field 3

Field 2

Field 1







## APPENDIX A

### TECHNICAL INFORMATION

#### GRADIOMETER SURVEY

Magnetic surveys measure distortions in the earth's magnetic field caused by small magnetic fields associated with buried features (Gaffney and Gater, 2003: 36) that have either remanent or induced magnetic properties (Aspinal et al. 2008: 21-26). Human activity and inhabitation often alters the magnetic properties of materials (Aspinal et al. 2008: 21) resulting in the ability for numerous archaeological features to be detected through magnetic surveys. Intensive burning or heating can result in materials attaining a thermoremanent magnetisation; examples of which include kilns, ovens, heaths and brick structures (Aspinal et al. 2008: 27; Gaffney and Gater, 2003: 37). When topsoil rich with iron oxides, fills a man-made depression in the subsoil, it creates an infilled feature, such as a pit or ditch, with a higher magnetic susceptibility compared to the surrounding soil (Aspinal et al. 2008: 37-41; Gaffney and Gater, 2003: 22-26). Magnetic surveys can also detect features with a lower magnetically susceptibility than the surrounding soil, an example of which is a stone wall.

#### LIMITATIONS

Poor results can be due to several factors including short lived archaeological occupation/use or sites with minimal cut or built features. Results can also be limited in areas with soils naturally deficient in iron compounds or in areas with soils overlying naturally magnetic geology, which will produce strong responses masking archaeological features.

Overlying layers, such as demolition rubble or layers of made ground, can hide any earlier archaeological features. The presence of above ground structures and underground services containing ferrous material can distort or mask nearby features.

Particularly uneven or steep ground can increase the processing required, or distort results beyond the capabilities of processing. It is also possible in areas containing dramatic topographical changes that natural weathering, such as hillwash, often in combination with intensive modern ploughing, will reduced the topsoil on slopes and towards the peaks of hills and possibly destroy or truncate potential archaeological features. Conversely features at the bottom of slopes may be covered by a greater layer of topsoil and so if buried features are present they appear faint within the results, if at all.

Over processing of data can also obscure or remove features, especially if they are on the same orientation as the direction of data collection traverses. Consequently, where possible, attempts are made to ensure data is not collected on the same orientation as known potential features and that data capture quality is sufficient to minimise data processing.

#### INSTRUMENTATION

The data was collected using handheld Bartington Grad 601-2 fluxgate gradiometers. The Bartington 601-2 is a single axis, vertical component fluxgate gradiometer comprising a data logger battery cassette and two sensors. The sensors are Grad-01-1000L cylindrical gradiometer sensors mounted on a rigid carrying frame; each sensor contains two fluxgate magnetometers with 1m vertical separation.

The difference in the magnetic field between the two fluxgates in each sensor is measured in nanoTesla (nT). NAA gradiometer data is recorded with a range of  $\pm 100\text{nT}$ , which equates to a resolution of  $0.01\text{nT}$ . It should be noted that the actual resolution is limited to  $0.03\text{nT}$  as a consequence of internal instrumental noise (Bartington Instruments Ltd: 23).

The gradiometer records two lines of data on each traverse, the grids are walked in a zig-zag pattern amounting to 15 traverses. The gradiometers are calibrated at the start of every day and recalibrated whenever necessary.

## **SURVEY DETAILS**

*Table A1: Survey summary*

	Survey
Grid size	30mx30m
Traverse interval	1m
Reading interval	0.25m
Direction of 1st traverse	North
Number of Grids	132
Area covered	9ha

*Table A2: Baseline co-ordinates*

Grid point (gp) A	Grid point (gp) B
NGR: SM 99192 03860	NGR: SM 99252 03860

*Table A3: Site information and conditions*

Item	Detail
Geology	Sandstone of the Cosheston Group
Superficial deposits	Non recorded
Soils	Brown soil
Topography	South facing slope
Land use	Pasture
Weather / conditions prior to and during survey	Windy, occasional shower

## APPENDIX B

### DATA PROCESSING INFORMATION

Gradiometer survey data is downloaded using the Bartington Grad 601 software and the processing was undertaken using Geoplot 3.0 software.

*Table B1: Commonly applied techniques*

Process	Effect
Zero mean traverse	Removes stripping which can occur as a consequence of using multi sensor arrays or a 'zigzag' data collection method by setting the mean reading for each traverse to zero.
Destagger	Removes stagger in the data introduced through inconsistency data collection pace and often exacerbated through the 'zig-zag' methodology.
Clip	Clips data above or below a set value to potentially enhance potential weaker anomalies.
Despike	Removes random spikes or high readings to reduce the appearance of dominant readings, often created by modern ferrous objects that can distort the results.
Low pass filter	Removes low frequency waves or broad anomalies such as those caused by strong or large gradual variations in the soil's magnetic susceptibility often caused by geological or natural changes in the substrata.
Interpolation	Used to smooth or reduce the blocky appearance of data by improving the spatial density and balance the quantity of data points in the X and Y directions.

*Table B2: Processing steps*

Minimal Processing	Increased Processing
<ul style="list-style-type: none"> <li>Zero mean traverse +5/-5</li> <li>Destagger:</li> </ul>	<ul style="list-style-type: none"> <li>Low Pass Filter</li> <li>Interpolate Y, Expand - Linear, x2</li> </ul>

## APPENDIX C

### DATA VISUALISATION INFORMATION

#### FIGURES

The data was used to produce a series of images to demonstrate the results of surveys these are detailed below:

- Greyscale/Colourscale Plot – This visualises the results as a shaded drawing with highest readings showing as black, running through different shades to lowest showing as white.
- Interpreted Plot – Through detailed analysis anomalies have been interpreted and possible features identified. Interpretation drawings are used to show potential features and in particular to reinforce and clarify the written interpretation of the data. Anomalies have been characterised using the terminology detailed in the following section, and have been assigned colour coding outlined in keys found on the relevant figures associated with this report.
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#### MAGNETIC ANOMALIES AND TERMINOLOGY

*Table C1: Lexicon of terminology*

Terminology	Detail
Anomaly	Any outstanding high or low readings forming a particular shape or covering a specific area with the survey results.
Feature	A man-made or naturally created object or material that has been detected through investigation works and has sufficient characteristics or supporting evidence for positive identification.
Magnetic susceptibility	The ability of a buried feature to be magnetically induced when a magnetic field is applied
Magnetic response	<p>The strength of the changes in magnetic values caused by a buried feature with either a greater or lesser ability to be magnetised compared with the soil around it.</p> <p>Anomalies are considered to either have strong / weak or positive / negative responses.</p> <p>The strength of magnetic response (along with patterning) can be essential in determining the nature of an anomaly, but it should be noted that the size or strength of the magnetic response does not correlate with the size of the buried feature.</p>
Patterning of an anomaly	The shape or form of an individual anomaly
Thermoremanence	The affect caused when a material has been magnetically altered through a process of heating. Thermoremanent magnetisation occurs when an object or material is heated passed the Curie Point and acquires a permanent magnetisation that is associated with the magnetic field that they cooled within (Gaffney and Gater 2003:37)

Different anomalies can represent different features created by human, agricultural or modern activity, or natural pedological or geological changes in the substrata.

Anomalies interpreted with a 'greater' categorisation are considered more likely to be of the interpreted characterisation; whereas a more tentative interpretation is applied to those with a 'lesser' categorisation as a consequence of weaker increases in magnetic response or the anomalies incomplete patterning or irregular form.

The strength and size of anomalies can vary depending on the magnetic properties of the feature, the magnetic susceptibility of the soil, the depth to which the feature is buried, and the state of preservation.

**Table C2: Characterisation of anomalies**

Characterisation	Detail
Archaeology	
Linear anomaly (archaeology)	<p>Linear anomalies with a positive or negative magnetic responses, and composed of a patterning or shape that is suggestive of a buried archaeological feature. These are often indicative of structural remains or infilled features such as ditches.</p> <p>The strength of anomaly signal can be suggestive of the properties of the feature. Negative linear anomalies represent upstanding or infilled features that are less magnetically susceptible than background readings, for example structures or ditches composed of a non-igneous stone material. Bipolar linear anomalies considered to be of an archaeological nature are indicative of material with a high magnetic susceptibility, such as a brick wall.</p>
Isolated anomaly (archaeology)	<p>Isolated anomalies or anomalies with a more amorphous form possibly represent infilled features or thermomagnetic features such as areas of heating/burning of an archaeological origin.</p> <p>Unless associated with conclusively identified archaeological remains, such as linear anomalies, absolute identification of positive responses can be problematic as it is often not possible to decipher if they are of an archaeological, modern or agricultural origin. Consequently, isolated positive responses are not shown within the interpretation unless composed of a broad form or belonging to a series of isolated positive responses.</p> <p>Bipolar responses considered likely to be of an archaeological are also interpreted as isolated anomaly (archaeology). These are considered to relate to material with a very strong magnetic susceptibility or thermoremanent magnetisation.</p>
Isolated anomaly (mining)	Isolated anomalies often composed of a bipolar response that is indicative of mining activity such as pits and shafts. A more conclusive interpretation is given to linear anomalies that correspond with the location of field boundaries recorded on historic maps.
Trends	Weak and diffuse anomalies with an uncertain origin are denoted by trends. It is possible that these belong to archaeological features, but given their weak signatures or incomplete patterning it is equally plausible that they relate to agricultural features or natural soil formations.
Agriculture	
Field boundary	Isolated linear anomalies that are likely to be indicative of former land divisions. A more conclusive interpretation is given to linear anomalies that correspond with the location of field boundaries recorded on historic maps,

Characterisation	Detail
	Aerial photos or LiDAR coverage of the site.
Ridge and furrow	Broadly spaced linear anomalies that are likely to be indicative of earlier forms of agriculture, such as ridge and furrow. These often correspond with the location of earthworks visible on the ground or identified on aerial photos or LiDAR survey coverage.
Agriculture (plough)	Regularly spaced linear anomalies, often with a narrower spacing, that conform with ploughing regime at the time of survey, or a recent regime recorded on aerial photos of the site.
Agriculture (land drain)	<p>The response and distribution of land drains varies depending on the composition of the land drain and associated ditch or channel. Consequently, land drains can be composed of weak / strong positive / negative magnetic responses and are identified as a product of either their variance in magnetic values or positioning compared with regularly spaced linear anomalies considered to relate to modern ploughing.</p> <p>Land drains can be located within former agricultural regimes, such as ridge and furrow.</p>
Agriculture	Regularly spaced linear anomalies that are likely to be of an agricultural nature. However, the lack of supporting information, weak responses, or non-uniform distribution means that it is unclear as to the nature or origin of the agricultural process they are caused by.
Agriculture?	Weak, irregularly spaced or isolated linear anomalies that possibly relate to agricultural activity. Given the tentative interpretation, the agricultural process they are caused by is also likely to be unknown.
Modern	
Bipolar response (modern)	<p>Positive anomalies with associated negative 'halo' (bipolar) denote features with a strong magnetic response are likely to be of a modern origin.</p> <p>Isolated bipolar responses of a modern nature are likely to relate to buried ferrous material or objects, such as metallic agricultural debris. If a trend is noted in the alignment or spacing of isolated bipolar responses, it is possible that they are indicative of ferrous fittings or connectors used on buried non-magnetic buried utilities.</p> <p>Linear bipolar anomalies are likely to be indicative of modern services.</p>
Dipolar response	<p>Dipolar anomalies relate to individual spike within the data and tend to be caused by ferrous objects. These responses have only been shown when located near to archaeological features.</p> <p>When the site is located in a mining landscape it is possible that identified dipolar anomalies relate to mining activity and are indicative of further pits or mine shafts.</p>
Area of increased magnetic response	Areas of increased magnetic response denote areas of disturbance containing a high concentration of dipolar and / or bipolar responses. These are generally considered to be caused by modern debris in the top soil, although it is possible that the disturbance is in part also caused by isolated archaeological material or geological or pedological changes in the substrata.
External interference	Areas of magnetic disturbance, often along the edges of survey areas are caused by standing metal structures such as fencing and buildings.
Natural	
Isolated response	Broad isolated responses that have an irregular patterning that may be



Characterisation	Detail
(geology)	<p>indicative of geological or pedological changes in the substrata.</p> <p>It should be noted that ground water can naturally dissolve or erode porous or permeable bedrock, such as limestone, and create fissures and cracks. Depending on the magnetic susceptibility of the soil it is possible for these fissures to appear as a series of contiguous rectilinear anomalies, often having a similar appearance to archaeological enclosures.</p>
Area of disturbance (geology)	<p>Areas of variable magnetic responses can demonstrate natural features or changes in geology or soil type these often correspond with topographical variations.</p>

APPENDIX D  
RAW DATA PLOT

