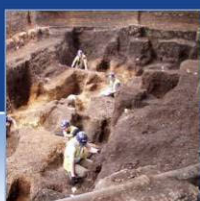


# Soay Solar Farm, Thornton, East Riding of Yorkshire Archaeological Geophysical Survey

National Grid Reference: SE 76292 46386 (Centre)

AOC Project No: 40178

Date: April 2021



ARCHAEOLOGY

HERITAGE

CONSERVATION

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# Soay Solar Farm, Thornton, East Riding of Yorkshire Archaeological Geophysical Survey

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**National Grid Reference (NGR):** SE 76292 46386 (Centre)

**AOC Project No:** 40178

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**Date of survey:** February- April 2021

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This document has been prepared in accordance with AOC standard operating procedures.

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## Contents

Contents .....	ii
List of Plates .....	iii
List of Figures .....	iii
Non-Technical Summary .....	v
1 Introduction .....	1
2 Site Location and Description.....	1
3 Archaeological Background.....	1
4 Aims .....	5
5 Methodology.....	5
6 Results and Interpretation .....	6
7 Conclusion .....	14
8 Statement of Indemnity .....	16
9 Archive Deposition .....	17
10 Bibliography .....	18
11 Plates .....	19
12 Figures .....	22
Appendix 1: Characterisation of Anomalies .....	A
Appendix 2: Survey Metadata.....	F
Appendix 3: Archaeological Prospection Techniques, Instrumentation and Software Utilised.....	G
Appendix 4: Summary of Data Processing .....	H
Processing Steps.....	H
Appendix 5: Technical Terminology.....	I
Appendix 6: XY Trace Plots .....	J

## List of Plates

- Plate 1. Field 4 looking east from southern boundary
- Plate 2. Field 12 looking east with survey in action
- Plate 3. Field 4 looking south from north-west corner
- Plate 4. Field 23 looking west from north-east corner
- Plate 5. Field 22 looking south with survey in action.
- Plate 6. Field 3 looking north from southern boundary.

## List of Figures

- Figure 1 Site Location
- Figure 2 Location of survey areas and viewports - 1:10000
- Figure 3 Overall location of minimally processed greyscale - 1:10000
- Figure 4 Overall interpretation of minimally processed gradiometer data - 1:10000
- Figure 5 Processed gradiometer survey results – greyscale plot: viewport 1 showing fields 1, 3 and 8 - 1:1250
- Figure 6 Interpretation of gradiometer survey results: viewport 1 showing fields 1, 3 and 8 - 1:1250
- Figure 7 Processed gradiometer survey results – greyscale plot: viewport 2 showing fields 3, 4 and 5 - 1:1250
- Figure 8 Interpretation of gradiometer survey results: viewport 2 showing fields 3, 4 and 5 - 1:1250
- Figure 9 Processed gradiometer survey results – greyscale plot: viewport 3 showing field 5 - 1:1250
- Figure 10 Interpretation of gradiometer survey results: viewport 3 showing field 5 - 1:1250
- Figure 11 Processed gradiometer survey results – greyscale plot: viewport 4 showing fields 3, 4, 7 and 8 - 1:1250
- Figure 12 Interpretation of gradiometer survey results: viewport 4 showing fields 3, 4, 7 and 8 - 1:1250
- Figure 13 Processed gradiometer survey results – greyscale plot: viewport 5 showing fields 5, 7 and 16 - 1:1250
- Figure 14 Interpretation of gradiometer survey results: viewport 5 showing fields 5, 7 and 16 - 1:1250
- Figure 15 Processed gradiometer survey results – greyscale plot: viewport 6 showing fields 8 and 12- 1:1250
- Figure 16 Interpretation of gradiometer survey results: viewport 6 showing fields 8 and 12 - 1:1250
- Figure 17 Processed gradiometer survey results – greyscale plot: viewport 7 showing fields 7, 15 and 16 - 1:1250
- Figure 18 Interpretation of gradiometer survey results: viewport 7 showing fields 7, 15 and 16 - 1:1250
- Figure 19 Processed gradiometer survey results – greyscale plot: viewport 8 showing fields 11, 12, 13, 14 and 17 - 1:1250
- Figure 20 Interpretation of gradiometer survey results: viewport 8 showing fields 11, 12, 13, 14 and 17 - 1:1250

- Figure 21 Processed gradiometer survey results – greyscale plot: viewport 9 showing fields 14, 15 and 16 - 1:1250
- Figure 22 Interpretation of gradiometer survey results: viewport 9 showing fields 14, 15 and 16 - 1:1250
- Figure 23 Processed gradiometer survey results – greyscale plot: viewport 10 showing fields 13 and 17 - 1:1250
- Figure 24 Interpretation of gradiometer survey results: viewport 10 showing fields 13 and 17 - 1:1250
- Figure 25 Processed gradiometer survey results – greyscale plot: viewport 11 showing fields 17, 18, 19 and 20 - 1:1250
- Figure 26 Interpretation of gradiometer survey results: viewport 11 showing fields 17, 18, 19 and 20 - 1:1250
- Figure 27 Processed gradiometer survey results – greyscale plot: viewport 12 showing fields 17 and 19 - 1:1250
- Figure 28 Interpretation of gradiometer survey results: viewport 12 showing fields 17 and 19 - 1:1250
- Figure 29 Processed gradiometer survey results – greyscale plot: viewport 13 showing fields 19 and 20 - 1:1250
- Figure 30 Interpretation of gradiometer survey results: viewport 13 showing fields 19 and 20 - 1:1250
- Figure 31 Processed gradiometer survey results – greyscale plot: viewport 14 showing fields 21 and 22 - 1:1250
- Figure 32 Interpretation of gradiometer survey results: viewport 14 showing fields 21 and 22 - 1:1250
- Figure 33 Processed gradiometer survey results – greyscale plot: viewport 15 showing fields 21 and 22 - 1:1250
- Figure 34 Interpretation of gradiometer survey results: viewport 15 showing fields 21 and 22 - 1:1250
- Figure 35 Processed gradiometer survey results – greyscale plot: viewport 16 showing field 23- 1:1250
- Figure 36 Interpretation of gradiometer survey results: viewport 16 - 1:1250 showing field 23
- Figure 37 Side by side comparison of greyscale plot of gradiometer and interpretation of field 8 1:2500
- Figure 38 Side by side comparison of greyscale plot of gradiometer and interpretation of field 12 1:2500

## Non-Technical Summary

*AOC Archaeology Group was commissioned by Arcus Consultancy Services Limited to undertake an archaeological geophysical gradiometer survey of the combined proposed Soay Solar Farm and Greener Grid Park (the Scheme), at land north of Thornton, Pocklington, East Riding of Yorkshire. The survey was conducted between February-April 2021 as part of a wider scheme of archaeological assessment in advance of the proposed development of the Site.*

*The size of the Scheme was 140 hectares, over 23 fields. Of which a total of 114 hectares were surveyed and the results of the survey have identified the following. The remaining 26ha was unsuitable for survey during the survey window because of mature crops, access, overhead interference from high voltage power cables and natural wastage due to boundary ingress.*

*A number of fields have revealed magnetically enhanced anomalies suggestive of an archaeological origin (highlighted in Table 1). Supporting evidence has clearly identified on the HER aerial photography rectification data. The clearest evidence of archaeological features has been identified within fields 8 and 23, with the anomalies in these fields suggestive of settlement and enclosure.*

*Several survey areas across the Site have been affected by either modern green waste or night soiling.*

*Throughout the majority of survey areas potential agricultural trends were recorded related to modern ploughing.*

*Evidence of strongly magnetised geological out cropping were also recording that look to represent pockets of sands and gravels.*

## 1 Introduction

- 1.1 AOC Archaeology Group was commissioned by Arcus Consultancy Services Limited (hereafter referred to as Arcus) to undertake an archaeological geophysical gradiometer in advance of the combined proposed Soay Solar Farm and Greener Grid Park (the Scheme), at land north of Thornton, Pocklington, East Riding of Yorkshire. The survey was conducted between February-April 2021 as part of a wider scheme of archaeological assessment in advance of the proposed development of the Site.
- 1.2 Archaeological geophysical survey uses non-intrusive and non-destructive techniques to determine the presence or absence of anomalies likely to be caused by archaeological features, structures or deposits, as far as is reasonably possible (ClfA, 2014).
- 1.3 The survey was undertaken to provide information on the extent, character and, where possible, the significance of potential buried archaeological remains within the proposed development Site.

## 2 Site Location and Description

- 2.1 The proposed Scheme is located approximately 4.5 kilometres to the south-west of the nearby town of Pocklington, North Yorkshire, and 1 kilometre directly north and east of the village of Thornton SE 76292 46386 (Figure 1).
- 2.2 The Scheme covers approximately 140 hectares (ha) across 23 fields consisting of a mixture of pasture and arable (Figure 2). It is situated across a gently sloping terrain, from an aOD (above Ordnance Datum of 15m in the north to 10m aOD in the south. Whilst field 3, has a distinctive undulation, overall each field is flat at an average aOD of 10m).
- 2.3 The bedrock recorded geology within the Scheme consists of Mercia Mudstone Group - Mudstone. These are overlain by superficial Drift deposits of the Bielby Sand Member - Sand, Silty, Gravelly. (BGS, 2021).
- 2.4 These are overlain by the soils classified as Soilscape 15: Naturally wet very acid sandy and loamy soils and Soilscape 10: Freely draining slightly acid sandy soils (Soilscales, 2021).

## 3 Archaeological Background

- 3.1 The archaeological background below is drawn from the Heritage Impact Assessment (HIA) of the Scheme, undertaken in 2021 (ARCUS, 2021). This should be used for further information about historic naming conventions importance of the Scheme within a wider context. The archaeological background here, summarised from the HIA focuses upon HER identified anomalies using remote-sensing techniques (such as aerial photography) and builds upon the work of previous archaeological investigations (geophysics, excavation and building survey) immediately within the Scheme and a 1km radius.
- 3.2 Where appropriate archaeological features will be located, in relation, to the numbering system used by AOC (Fig. 2).

### Prehistoric

- 3.3 Within the East Yorkshire Ridings, the Yorkshire Wolds have a vast prehistoric archaeological landscape, including multiple prehistoric monuments, settlements and linear earthworks, indicating intensive settlement and land use within this area.

- 3.4 The HER also records MHU 7691 as three linear cropmarks identified from aerial photography located 640 m to the south of the Scheme's boundary to the north-west of Woodhouse Farm (Figure 2). To the south-south-east and outside of the Scheme parameters lies MHU 22539 which comprised four potential Lower Palaeolithic to Post-Medieval Boundary Ditches. Finally, 930 m to the north-west of the Scheme lies MHU 22432 which is comprised of 22 potential Early-Neolithic to Roman enclosures, field system or settlement assets.
- 3.5 From assessment of the HER data provided by the client, 483 cropmarks, identified from aerial photography are thought to exist to the north and south-west of Warren House sandwiched between fields 11, 13 and 17 (Figure 2). These cropmarks appear to form a series of enclosures, trackways and boundary ditches, however no previous invasive archaeological works have been undertaken on these features, to provide dating evidence of validity of their substantial existence. Due to the large number of potential prehistoric cropmarks, the Scheme recorded in and around the proposed Scheme boundary, there is a suggestion that there could be a high potential for finding prehistoric remains, however as these features have not been tested, the current assessment is that there is a low potential, because of the sustained and intense agricultural nature of the Scheme.

### **Iron-Age and Roman Periods**

- 3.6 There are no Iron-Age or Romano-British assets recorded within the Scheme boundary.
- 3.7 The wider Pocklington area has a rich archaeological heritage with finds of national significance. During excavations in 2017 a chariot burial, potentially relating to the Arras culture was discovered within Pocklington alongside two Iron-Age barrows which have produced finds dating to the La Tene period. These finds were similar to a previous chariot burial also recovered within Pocklington in 2014, where high quality finds of weaponry alongside multiple burials indicated that Pocklington was a substantial centre for the Iron-Age culture. The Iron-Age culture, known as Arras relates to the unusual practice of burying individuals within square barrows, as observed at Pocklington. The East Ridings of Yorkshire has several nationally significant Arras Sites, including the chariot burial at Wetwang Slack.
- 3.8 The Eboracum (York) to Peturia (Brough) Roman Road is recorded 1.77 km to the north-east of the Scheme. This Roman Road was the principal road from the Roman Fortress at York to the Roman Fortress at Brough. This road is part of the Ermine Street route, which traversed from Eboracum, across to the current location of Pocklington and then down to Lindum Colonia (Lincoln).
- 3.9 There are a series of potential assets dating from the Iron-Age to the Roman period located 43 m to the south. MHU 22538 is comprised of four rectilinear enclosures or trackways, potentially indicating Iron-Age to Roman settlement within the area. Scheduled Monument NHLE 1005209 'Rectilinear Enclosures' which lies beyond the 1 km Study Area, 1.60 km to the north-west of the Scheme, potentially relates to further Iron-Age or Roman activity within the area.
- 3.10 There are also five further records associated with the Roman Period. MHU 22551 and MHU 22552 lie 630 m to the south-west of the Scheme and are identified as a rectilinear enclosure or trackway. Record MHU 6886 lies on the western periphery of the Scheme, to the north of field 10 and 11, 203 m to the north-west of Warren House and is identified as a rectilinear enclosure, field system and trackway. Event MHU 56 lies 90 m on the northern boundary of the Scheme and is identified as a findspot of Roman Pottery, while MHU 7690 lies 346 m to the south south-east of the Scheme and is identified as a potential Romano-British settlement Site.



- 3.11 Due to the potential cropmarks within the 1 km study area combined with the known occupation at Pocklington and nearby Roman Road, there is high potential for Iron-Age to Romano-British to be present within the Scheme.

### **Early Medieval to Late Medieval Period**

- 3.12 The Domesday Book records two settlements within the 1 km Study Area:  
Waplinton Hall located 738 m east of field 16; and  
Thornton located 881 m south-west of field 17.
- 3.13 Waplinton (Hall) had a recorded population of two households in 1086, while Thornton had no recorded population or households in 1086, but was recorded to have three ploughlands.
- 3.14 Naming evidence within and immediately around the Scheme indicates that the periphery lands were likely used for agricultural and grazing with Allerthorpe Common to the northern periphery of the Scheme, Thornton Common to the south-west of field 17 and a Rabbit Warren (MHU15402) within fields 5 and 6. Within the north of the village Thornton (998 m south-west) lies the deserted medieval settlement of Thornton (MHU 9710) which includes a 17th century ditch and associated earlier finds (MHU 19935).
- 3.15 With the strategic Roman Road and access to riverine resources, the town of Pocklington by 1066 had 13 villagers and 53 ploughlands. A Deserted Medieval Village was identified (MHU 57) as the Waplinton DMV within the south-east of the 1 km Study Area, alongside two find spots. MHU 17285 was noted to be a medieval girdle hanger, brooch and coin found towards the north-west of Low Farm in 1994, and MHU 18065 which includes a medieval buckle brooch found on Allerthorpe Golf Course in 1993.
- 3.16 Within the Scheme, there are three potential Ridge and Furrows locations (MHU 22540) across the north-eastern and the south-eastern aspects of the Scheme supporting the notion of a landscape under perpetual agricultural use during the medieval period. Ridge and Furrows are a common feature of medieval and post-medieval agricultural practices, and as such indicate a pattern of mixed-use agriculture (grazing and arable).
- 3.17 Medieval rabbit warrens are above-surface 'pillow mounds' often found within woodland. No surface evidence is visible of the warren as the field has later ploughing and arable crops planted, so that other than naming evidence, little is expected to survive for this feature.
- 3.18 However, the HLC identified the Warren to potentially have a medieval to post-medieval date. HHU2930 'The Warren' and HHU2931 'Warren House' are recorded within the HER as dated to the post-medieval period. It is highly likely these tracts of land were named after the Rabbit Warren, indicating the landscape to be used for rabbit farming from the medieval period, prior to the change in agricultural practices to arable farming.
- 3.19 The land to the east of Warren House Farm (Fields 17 to 20) is labelled at "The Holds" on 1855 map. Beyond the redline boundary, to the north-east of "The Holds", there is the potential for evidence of Norse activity, based on the definition of Keld, meaning spring/ source of water.
- 3.20 Fields 10 and 23 are referred to as Inn Carr and Hold Carr, respectively. Carr is a derivative of the Old Norse, suggesting a former wetland habitat.
- 3.21 There are two major patterns emerging within the 1 km Study Area. Land use associated with settlements was identified by the late medieval Site of Waplinton Hall and Fishpond (MHU61). Within the vicinity of this monument was a findspot (MHU 314) consisting of medieval to post-medieval coins.

- 3.22 The land use not associated with settlements consist of:
- 15 records of medieval Ridge and Furrows (MHU 22540) 885 m south-east of field 21
  - A further 9 medieval Ridge and Furrows (MHU 22525) 950 m south of field 20
  - 1 record of a medieval rectilinear enclosure (MHU 22549) 547 m south of field 20
  - 1 record of a medieval trackway (MHU 22542) 1 km north-east of field 6 and
  - Two Sites of windmills (MHU 59 and MHU 301) 717 m north-east of field 6.
- 3.23 As such there is high potential for further unknown assets relating to the medieval to the post-medieval period to be recovered, particularly within the eastern edge of the Scheme, with high likelihood of isolated findspots to occur.

### **Post-Medieval Period**

- 3.24 Within the 1 km Study Area there appears to be multiple post-medieval assets, predominantly non-designated buildings or structures relating to the growing expansion of the surrounding villages, beyond the 1 km Study Area. These consist of:
- MHU 15584, the Site of the Rectory House 1 km south-west of the Scheme;
  - MHU 15555 Site of Vicarage House 652 m north-east of the Scheme;
  - MHU 291 which is identified as being a Quaker Friends Burial Ground 652 m to the north-east of the Scheme; and
  - MHU 2603 Road which lies 600 m to the south of the Scheme and connected the villages of Thornton and Bielby.
- 3.25 Siter of Brickyard (MHU 15491) has a recorded date assigned of the post-medieval period, indicating that the construction of the Pocklington canal begun within this timeframe. This lies 30 m to the east-south-east of the Scheme between Fields 20 and 21.
- 3.26 As such there is medium potential within the wider 1 km Study Area for further Post-Medieval Assets to be recovered, likely to be from the continued expansion of the villages within the 1 km Study Area and the further agricultural landscape. As such beyond findspots and auxiliary buildings, further assets of post-medieval date have a limited potential to be recovered.

### **Modern Era**

- 3.27 There are no modern assets within the Scheme. Within the 1 km Study Area there is one non-designated asset recorded dating from the Second World War. MHU 22550 is a search light battery located 600 m south-west outside of the Scheme within the hamlet of Byholme to the north of the village of Thornton.
- 3.28 The modern era is generally well documented via maps and aerial photography so that any modern features of significance are either readily recorded or still visible in the landscape. As the Scheme is known to have continued use into the modern period as agricultural, there is low potential to encounter modern deposits of significance.

### **Previous Archaeological Investigations**

- 3.29 To the east of Townend Farm, a watching brief (EHU914) was undertaken by Humber Field Archaeology in 2003, which detected a number of post-medieval features. An additional watching brief

in 2003, was also undertaken by Humber Field Archaeology at Common End Farm (EHU1098) which did not find any archaeological features.

- 3.30 A watching brief to the east of Village Far (EHU1012), undertaken by MAP Archaeological Practice Ltd in 2003 did not detect any archaeological features. An archaeological evaluation (EHU2203) at Soay House Farm by Humber Field Archaeology in 2011 revealed a number of tree boles, reflecting a plantation but no archaeological features were recorded.
- 3.31 A watching brief and site walkover, conducted by AMEC in 2015 (EHU2431 and EHU2432) respectively for a proposed Overhead Line refurbishment at Creyke Beck did not identify any archaeological assets.

## 4 Aims

- 4.1 The aim of the geophysical survey was to identify any potential archaeological anomalies that would enhance the current understanding of the archaeological resource within the proposed survey area.
- 4.2 Specifically, the aims of the gradiometer survey were;
- To locate, record and characterise any surviving sub-surface archaeological remains within the survey area,
  - To provide, where possible, an assessment of the potential significance of any identified archaeological remains in a local, regional and (if relevant) national context,
  - To produce a comprehensive Site archive (Appendix 2) and report.

## 5 Methodology

- 5.1 The geophysical survey was undertaken between February and April 2021.
- 5.2 All geophysical survey work was carried out in accordance with recommended good practice specified in the European Archaeological Council (EAC) guideline documents published by Historic England (Schmidt et al. 2016) and the Chartered Institute for Archaeologists Standard and Guidance for archaeological geophysical survey (2014).
- 5.3 Parameters and survey methods were selected that were suitable for the prospective aims of the survey and in accordance with recommended professional good practice (Schmidt et al. 2016).
- 5.4 Each field was numbered by the sub-contractor to facilitate survey discussions and logistics (Fig. 2). A breakdown of the survey conditions and findings can be seen in Table 1.
- 5.5 Digital photographs of every survey parcel were taken before, during and after geophysical survey to show any changes to field conditions following the programme of works. The photos were downloaded and stored off Site.
- 5.6 The gradiometer survey was carried out using a Bartington Non-Magnetic Cart. The cart system utilises two Grad-01 fluxgate gradiometer sensors mounted upon a carbon fibre frame, along with data logging equipment and batteries (see Appendix 3). Before each session of use, the cart system was balanced around a single set up point within the Site specifically chosen for being magnetically quiet. In balancing the machine around this point, it produces a more uniform dataset throughout and allows all data to be plotted with ease.
- 5.7 Data was collected using zig-zag traverses alongside a constant stream of GPS data collected through a Trimble R10 GPS, enabling the collected data to be spatially georeferenced without the need for a pre-determined grid system. The data was collected through a laptop mounted to the cart using Geomar MLGrad601 software.

- 5.8 A total of 114ha, of the 140ha redline boundary, were surveyed using the Bartington cart. A remaining 26 ha was unavailable for survey at the time of mobilisation made up of fields 2, 6, 9 and 10.
- 5.9 Care was taken to attempt to avoid metal obstacles present within the survey area, such as metal fencing around hedge boundaries as gradiometer survey is affected by 'above-ground noise' and avoiding these improves the overall data quality and results obtained.
- 5.10 The data was downloaded from MLGrad601 and converted into a .xyz file in Geomar MultiGrad601 before being processed along with the GPS data in TerraSurveyor v3.0.34.10. The details of these processed can be found in Appendices 3 and 4.
- 5.11 Interpretations of the data were created in ArcGIS Pro and the technical terminology used to describe the identified features can be found in Appendix 5.

## **6 Results and Interpretation (Figs 5 – 36)**

- 6.1 Gradiometer survey is suggested to provide a variable response over Mudstone and sands, especially (David *et al.* 2008, 15). In this case, the clarity of the geophysical results was good. Where anomalies were visible, they were clearly defined, and the local geology was deemed not to have had a detrimental effect on the visibility of trends within the dataset.
- 6.2 The gradiometer survey results have been visualised as greyscale plots. plotted at -1nT to 2nT. An interpretation of the data can be seen in Figures 5 to 36 and an individual characterisation of the identified anomalies can be seen in Appendix 1.
- 6.3 Minimally processed XY trace plots have been included in Appendix 6. As there is substantial disturbance and green waste across the Site, focus has been given creating XY trace plots solely for the areas which have significant archaeology.
- 6.4 The results from the Site have been discussed field by field and discussed as a whole in the conclusion.
- 6.5 For the most part, only trends of a possible archaeological or historical origin have been assigned an anomaly number on the interpretation figures. Trends that are integral to the discussion have also been assigned anomaly numbers.
- 6.6 Throughout all the data sets isolated dipolar anomalies (ferrous / iron spikes) are visible throughout which are likely modern in origin.

### **Field 1 (Fig 6)**

- 6.7 The results in this area have located very few anomalies with no anomalies looking archaeological in origin. The central portion of the Site was made up of existing pig pens which in turn have been detected in the results as clear magnetic disturbance.
- 6.8 A single linear anomaly running south-west to north-east has been identified in the north. This has been classed as unclear, but it is most likely related to agricultural origins (**1A**).
- 6.9 Furthermore, a number of magnetic linear trends running north-west to south-east are likely a result of previous ploughing regimes in the area.
- 6.10 In the north-east and south-west corners of this survey area, several pit-like anomalies have been identified which are likely related to geological pockets of sands and gravels.
- 6.11 Although not as clearly distinguishable as elsewhere on the Site, such as field 3 to the east, these do not appear to form a recognisable pattern, nor are they clearly defined in the XY trace plots as being clear pit features. Therefore, a geological origin appears to be most likely.

- 6.12 Along the northern boundary clear magnetic disturbance has been located and would appear most likely to be related to modern disturbance around the field edge.

#### **Field 2 (Fig. 8)**

- 6.13 A crop of cabbages prevented this area from being surveyed.

#### **Field 3 (Figs 8 and 12)**

- 6.14 This field has been affected by potential green waste / night soiling over the northern half of the field. whilst in the southern portion of the field the results are clearer as a result of the quieter magnetic background.
- 6.15 In the east and south-east corner of field 3 geological variations are particularly evident due to the quieter background magnetism. It might be that other geological anomalies are located in the northern portion of the Site but are less clear due to the magnetic disturbance.
- 6.16 However, in the quieter areas in the south some linear trends of potential archaeological origin have been identified, some of which may relate to potential trackway features noted on the HER from aerial photography rectification (**3A**) (Fig. 12).
- 6.17 Furthermore, two other linear responses are also seen running south into field 8 below (**3B** and **3C**). These are also noted on HER aerial rectification, suggesting an archaeological origin.
- 6.18 Tentative linear trends are also visible in the data set in this area, potentially associated with some of the probable archaeological classified anomalies 3 A, 3B and 3C (**3D** and **3E**).
- 6.19 A number of uncertain unclear trends (**3F**) have been identified across this survey block. These cannot be clearly interpreted due to the magnetic noise and disturbance. They are made up of a group of magnetically enhanced linear and curvilinear trends located centrally that potentially are related to **3B**.
- 6.20 Two other groups are made up of unclear linear and rectilinear trends in the northern part of the area (**3G**), and a further curvilinear trend in the east (**3H**).
- 6.21 A number of modern agricultural trends related to ploughing and cultivation are also noted running east to west along the southern boundary, and north-west to south-east across the majority of the data set.
- 6.22 Modern disturbance is noted around the periphery of the survey area related to disturbances in the field boundaries.
- 6.23 A single area which was non-surveyable in the north-west is related to an area of waterlogged ground at the time of survey.

#### **Field 4 (Fig. 8)**

- 6.24 This field has been affected by potential green waste / night soiling over the majority of the field. Geological variations which are more clearly seen in the field 4 to the west, and field 8 to the south-west do appear to be partially visible in this location running from the south-west corner north-eastwards.
- 6.25 Furthermore, some magnetically enhanced linear and curvilinear trends are also visible in the dataset which might suggest some potential archaeological remains in the location especially when compared with the HER aerial photography rectification.
- 6.26 Magnetic disturbance in the area is so of a substantially magnetically enhanced nature, that accurately cross-referencing these anomalies to the HER is difficult. Therefore, the linear responses that have

been identified, are all classified as unclear, as alternative origins such as geological and/or agricultural could also be potential causes.

- 6.27 Two unclear trends comprising of large potential curvilinear anomalies, that could form an undated enclosure (**4A** and **4B**) have been identified. A number of adjoined rectilinear trends in south that fall within a similar area to possible archaeological features noted in the HER (**4C**).
- 6.28 The final two linear features are a small rectilinear shaped trend (**4D**) and a long linear trend which are located centrally towards the west but are more tentative in appearance (**4E**).
- 6.29 Potential agricultural ploughing trends are visible throughout the area running north-west to south-east.

A set of high voltage pylons split this area. Their electro-magnetic signature would have been detected, obscuring the dataset by introducing a high average, which would obscure subtle features under the ground. Therefore areas beneath the cables were excluded from survey.

#### **Field 5 (Figs 10 and 14)**

- 6.30 This field has been affected by potential green waste / night soiling over the majority of the field. Unlike other areas within the Site this field has been particularly affected.
- 6.31 A number of unclear linear and rectilinear trends are tentatively visible in the dataset that might suggest some potential archaeological remains in the location. A tentative interpretation is based upon the location of these anomalies to similar locations recorded on the HER aerial photography rectification features.
- 6.32 Three of these linears are noted at the northern end of the field running west to east which are in a similar location to those marked on the HER (**5A**).
- 6.33 A further potential rectilinear trend is noted along the eastern edge of the field also in a similar location to a more well defined rectilinear recorded on the HER aerial photography (**5B**).
- 6.34 In both cases the trends are still classed as unclear because, even though they match the HER they are not suitably clearly enough defined in the results to be categorised as definitively archaeological in origin.
- 6.35 An area of geological variation is potentially visible running from the south-east to the north-west corners of the survey area, although again these are not as clearly defined as elsewhere on the Site due to the very disturbed background magnetism.
- 6.36 Hints of modern, agricultural ploughing, can be seen running along a north-west to south-east orientation, along the dominant direction of the field.
- 6.37 A set of high voltage pylons cross this area in the south-west and were highly magnetic hence their exclusion from survey.

#### **Field 6**

- 6.38 A crop of cabbages prevented this area from being surveyed.

#### **Field 7 (Fig. 14)**

- 6.39 This field has been extensively affected by potential green waste / night soiling over the majority of the field.
- 6.40 No clear trends or potential features, of either archaeology, geology or even agricultural origin have been identified.

- 6.41 However, an inference can be made to a number of tentative linear trends that can potentially be comparable to data recorded on the HER aerial rectification. This could therefore validate the results of the clearer recorded HER data, as being their origin being archaeological in nature (**7A-C**). However, given their unclear nature, a geological or agricultural origin cannot be dismissed
- 6.42 A set of high voltage pylons cross the eastern edge of this area and were highly magnetic hence their exclusion from survey.

#### **Field 8 (Figs 12 and 16)**

- 6.43 This area appears to be one of the most clearly defined in the Site. The amount of magnetic disturbance is limited with the suggestion that there has not been any potential green waste / night soiling over this area.
- 6.44 In the south-west corner of this survey area, clear archaeological settlement evidence has been identified, supported with HER aerial rectification anomalies in this location. The results would suggest a trackway (**8A**) with three potential square enclosures adjoined it, running north and south of it (**8B**, **8C** and **8D**).
- 6.45 A further linear trend in the north-east of the area would appear to be a continuation of anomaly **3C** from field 3 also noted on the HER (**8E**).
- 6.46 A number of magnetic linear trends of possible archaeological origin are also noted across the area (**8F-8i**). These are either likely associated with archaeological anomalies **8A-8E** or are appear similar in form without additional evidence from HER records.
- 6.47 Geological variations have been clearly detected running from the north-east corner of the areas south and westward across the area. They would appear to form large pit-like anomalies most likely comprising sands and gravels. A second less well-defined linear spur runs north westward through the central part of the survey area, which matches a slight topographic change in the field.
- 6.48 Clear agricultural trends running east-west have been identified in this field such is the clarity of the results. These would be suggestive of modern ploughing trends.
- 6.49 An unsurveyable in the west is the result of a large manure heap located in the survey area.

#### **Field 9**

- 6.50 A crop of parsnips prevented this area from being surveyed.

#### **Field 10**

- 6.51 A crop of carrots prevented this area from being surveyed.

#### **Field 11 (Fig. 20)**

- 6.52 This area appears to be one of the most clearly defined with limited amounts of disturbance and no clear potential green waste / night soiling.
- 6.53 A number of linear features have been identified, however cross-referencing the HER data, none appear to match clearly. Furthermore, some of the HER results may in fact reflect drainage and geological variations rather than having archaeological origins.
- 6.54 These are however not extensive; the majority of the visible linear trends would appear to be associated with field drainage and agricultural features, including potential herringbone drainage in the north-west corner. The ploughing trends predominantly run north-west to south-east throughout.

- 6.55 Along the northern boundary geological anomalies have been recorded comprising broad magnetic trends running west to east.
- 6.56 A potential service pipe is also visible running slightly off north-south in direction along the eastern boundary. A second potential curvilinear trend in the centre of the field could also be a service.

#### **Field 12 (Fig. 16)**

- 6.57 This field has been affected by potential green waste / night soiling over the majority of the field. This is further exacerbated by geological variations which are particularly evident in the central portion which appear to run south-east from field 8 directly to the north to fields 14 and 15 to the direct south.
- 6.58 There are some archaeological trends in the north-west where visible archaeology, to the north, in field 8 appears to continue in this area (**12A** and **12B**). Magnetic disturbance in the field means only the strongest trends can be seen, although even these cannot be accurately interpreted.
- 6.59 Very few other trends can be assigned a definitive interpretation due to the magnetic background disturbance. Those unclear trends which have been interpreted are inferred with supporting evidence from the HER data (**12C-12H**). However, none of these unclear trends have distinctively definable characteristics.

#### **Field 13 (Fig. 24)**

- 6.60 This area appears to be one of the more clearly defined in the Site and may have detected some potential archaeological trends. It has limited disturbance suggesting it has had little or no potential green waste / night soiling present on it.
- 6.61 A number magnetically enhanced linear trends of a possible archaeological origin have been recorded. These appear to form two linear/rectilinear features; A possible trackway (**13A**) and part of a small enclosure (**13B**). An area of potential archaeological disturbance has been noted in the centre of the survey area(**13C**) with another magnetically enhanced linear trend running west to east (**13D**). Although HER aerial rectification shows features in this area, none clearly correlate with those identified.
- 6.62 Along the northern boundary the broad visible magnetic enhancements are likely related to geological variations and modern disturbance close to the field edges rather than having archaeological origins.
- 6.63 Tentative potential agricultural trends of previous ploughing may also be visible running north-west to south-east throughout.

#### **Field 14 (Figs 22 and 24)**

- 6.64 This field has been affected by potential green waste / night soiling over the entire field. This is further exacerbated by potential geological variations appearing to continue from the areas to the north into this location in the far north.
- 6.65 That said there are several strong magnetic unclear trends in this location, which could be archaeological in nature(**14A-14E**). This interpretation is further validated via the potential based on the inferred HER data, although no strong interpretation can be clearly defined, due to the high level of disturbance throughout.
- 6.66 One particularly magnetically enhanced curvilinear trend (**14A**) in the north-east which appears to head northwards into field 15 could potentially be archaeological, given its enhanced magnetic strength. However again the disturbance in the area means only a tentative interpretation can be provided.



### Field 15 (Figs 18 and 22)

- 6.67 Field 15 is very similar to fields 14 and 16 and has been affected by potential green waste / night soiling over the entire field. This is further exacerbated by potential geological variations appearing to continue from the areas to the north into this location particularly in the south-west.
- 6.68 A noticeable strong linear trend in this location may form an archaeological enclosure (**15A**). Several other unclear trends are also visible which could potentially be archaeological, although they are less well supported by HER data (**15B-15F**).
- 6.69 In the far north a potential archaeological enclosure is visible which may continue into field 16 to the north-east (**15A**). Magnetic disturbance in the area means only the strongest trends can be seen, which cannot be accurately interpreted. Although in this case it would appear to correlate with a feature noted on the HER aerial photography rectification.
- 6.70 A curvilinear trend in the south-east which extends southwards out of this field into field 14 could potentially be archaeological as it matches the magnetic strength of 15A (**15B**). However, unlike 15A it does not have any supporting HER evidence.
- 6.71 Other trends in the central part of the area could also be related although again unlike the possible enclosure 15A these do not appear to match the HER data with any certainty either (**15C-15F**).
- 6.72 An area along the southern boundary, centrally located, was not surveyable due to an area of flooding at the time of survey. A further area along the northern boundary was unsurveyable due to the presence of a manure heap.

### Field 16 (Fig. 18)

- 6.73 This field has been affected by potential green waste / night soiling over the majority of the field.
- 6.74 There are three unclear trends noted although none of these relate to any other known source (**16A-16C**).
- 6.75 In the far north-west where possible archaeology trends appear to extend from field 15 run into this location an unclear trend has been detected (**16A**). It has been classified as unclear as it is magnetically weak and tentative when compared to those in field 15. The data suggested that there might be a limited continuation.
- 6.76 Two further unclear trends have been identified but again the definition of these anomalies is only tentative (**16B** and **16C**).
- 6.77 A set of high voltage pylons cross this area and were highly magnetic hence the area was excluded from the survey. A small area of flooding at the time of survey was also visible along the western boundary.

### Field 17 and 18 (Figs 24, 26 and 28)

- 6.78 Field 17 and 18 have been affected by potential green waste / night soiling over the majority of the fields. Although noted as a separate field, field 18 has been surveyed as part of field 17 as there is no boundary separation between these fields.
- 6.79 There are some possible archaeological trends noted in the south-east part of field 17 where a potential enclosure can be made out (**17A**). These appear to match trends noted on the HER aerial photography rectification in the area.
- 6.80 An unclear magnetic trend is noted to the south of this also with field 17 (**17B**). Both trends **17A** and **17B** could potentially form part of an archaeological settlement which runs eastward into fields 19 and 20 to the south and east.

- 6.81 Two further unclear linear trends are noted in field 18 again they form no clear identifiable feature and could be the result of many differing origins (**17C**).

#### **Field 19 (Figs 26 and 28)**

- 6.82 This field has been affected by potential green waste / night soiling over the majority of the field.
- 6.83 There are some potential archaeological trends within the central area where a curvilinear trend potential forms a potential enclosure (**19A**). Strong magnetic disturbance in the area means only the strongest trends can be differentiated, and these cannot be definitively interpreted as archaeological as a result. These trends hint at an archaeological settlement running through this area into field 18 (west) and field 20 (east).
- 6.84 Two further unclear trends are also noted in the area, but again they appear to form less distinguishable forms compared to those trends associated with 19A (**19B** and **19C**).

#### **Field 20 (Figs. 26 and 30)**

- 6.85 This field has been affected by potential green waste / night soiling over the majority of the field.
- 6.86 There are eight linear trends making up five areas of unclear trends which potentially could be archaeological running across the area (**20A-20E**). However magnetic disturbance in the area means only the strongest trends can be seen, and these cannot be accurately interpreted as archaeological.
- 6.87 As identified in field 19, a possible archaeological settlement running through this area, westward into fields 18 and 19. The trends identified might be associated but are much more tentative and less clearly defined.

#### **Field 21 (Fig. 32)**

- 6.88 This area appears to be one of the more clearly defined in the Site and have detected a small area of potential archaeological settlement/activity in the west and centre.
- 6.89 A potential archaeological trackway has been identified in the north-west of the dataset which appears to be comparable to the HER data in the area (**21A**).
- 6.90 Seven linear trends related to possible archaeology have been identified close to the trackway, again located in the north and western part of the area (**21B-21H**).
- 6.91 Three unclear trends have been identified these would appear to be potentially archaeological again, but they could also reflect former boundaries/field divisions (**21i-21K**).
- 6.92 A former historic boundary noted on first edition historic OS mapping orientated north to south through the survey area and is identifiable in the data (**21L**).
- 6.93 Geological variations have been identified across the majority of the central portion of the area. These pit-like anomalies are less clearly defined than in other areas such as field 3. Although an archaeological origin cannot be ruled out it is most likely that these relate to geology and pockets of sands and gravels.
- 6.94 A number of linear trends of agricultural ploughing are seen running east to west.
- 6.95 The eastern portion of this field has had some magnetic interference /feedback from the electrical substation to the south-east.
- 6.96 As a note a set of high voltage pylons cross this area in the east and were highly magnetic hence the area of excluded from the survey.

**Field 22 (Fig. 34)**

- 6.97 This field has been affected by potential green waste / night soiling over the majority of the field. Furthermore, it has been significantly impacted by magnetic interference /feedback from the electrical substation to the east.
- 6.98 An area of the survey block was excluded from the survey because of magnetic interference from overhead power cables.
- 6.99 There are two unclear trends that are tentatively seen in the data (**22A** and **22B**). Although HER data is shown in similar locations the data does not provide strong enough results to make any comparison.

**Field 23 (Fig. 36)**

- 6.100 This area appears to be one of the most clearly defined in the Site and has detected a potential archaeological settlement.
- 6.101 This is made up of a potential set of small enclosures which running north-east and a very well-defined double-ditch square enclosure (central) (**23A**).
- 6.102 This is potentially the most interesting archaeological remains detected during the survey. to the shape and characteristics of these anomalies potential echo a Romano British military site or later medieval moated manor.
- 6.103 Potentially associated with this to the north-east are too possibly adjoining enclosures (**23B**).
- 6.104 A second tentative large enclosure to the north-west has been identified (**23C**).
- 6.105 A set of unclear trends associated with 23A have been identified which potentially form a return to this double-ditched feature (**23D**).
- 6.106 A further unclear trend has been identified which potentially forms an association with the north-west enclosure 23C (**23E**).
- 6.107 Another unclear linear trend running south-west to north-east through the double-ditch enclosure 23A possibly related to a former field division/boundary (**23F**).
- 6.108 A short magnetic liner trend noted in the data relates to a former historic boundary as seen on first edition OS mapping (**23G**). Mapping suggests that this continues further, however any sub-surface remains may have been eroded or destroyed by the time of the survey.
- 6.109 Agricultural ploughing trends of modern date have been detected running east-west across the survey area.
- 6.110 Geological changes match a slight topographic change in the field are noted in the north-west. They also represent slightly lower lying ground in this location. These pit-like anomalies are likely to relate to pockets of sands and gravels in the area.
- 6.111 High voltage pylons cross this area from north-south directly to the west of this survey area. On a subsequent visit, ploughing made the half hectare of survey area to the west unsuitable for survey.
- 6.112 Furthermore, modern magnetic disturbance was located on the western and eastern edges of the surveyed area likely related to the pylons and substation in the west, and the road in the east.

## 7 Conclusion

7.1 The gradiometer survey has identified several anomalies or features of a possible archaeological origin. Coupled with the HER records for the site the below table summarises the field conditions, if survey took place, the effect of Magnetic disturbance from nights soil / Green waste and potential archaeology of each area. which can be seen in Table 1

Field Number	Field Condition	Surveyed (S)/ Unsurveyed (US)	Magnetic disturbance present/type	Potential Archaeology based on Geophysics and HER data
1	Cabbage/Pigs	S	Magnetic Disturbance - Unclear	Unclear
2	Cabbage/Pigs	US	N/A	N/A
3	Stubble	S	Magnetic Disturbance – Night Soil	Potentially related to prehistoric fields systems
4	Stubble	S	Magnetic Disturbance – Night Soil	Unclear possible Prehistoric /Roman field system/settlement
5	Harvested	S	Magnetic Disturbance – Night Soil and Green waste	Unclear
6	Cabbages	US	N/A	N/A
7	Stubble	S	Magnetic Disturbance – Night Soil and Green waste	Unclear possible Prehistoric /Roman field system/settlement
8	Stubble	S	None	Potential Prehistoric/Roman ladder settlement enclosures and field systems
9	Parsnips	US	N/A	N/A
10	Carrots	US	N/A	N/A
11	Grass	S	None	Unclear possible Prehistoric /Roman or Medieval field system
12	Stubble	S	Magnetic Disturbance – Night Soil and Green waste	Potential continuation of Prehistoric/Roman settlement enclosures and field/ladder systems
13	Grass	S	None	Unclear possible Prehistoric /Roman or Medieval field system and settlement
14	Stubble	S	Magnetic Disturbance – Night Soil and Green waste	Unclear possible Prehistoric /Roman field system
15	Stubble	S	Magnetic Disturbance – Night Soil and Green waste	Potential Prehistoric/Roman settlement enclosures and field systems

16	Stubble	S	Magnetic Disturbance – Night Soil and Green waste	Unclear possible Prehistoric /Roman field system
17	Stubble	S	Possible archaeology and Disturbance	Potential Prehistoric/Roman settlement enclosures and field systems
18	Stubble	S	Magnetic Disturbance – Green waste	Unclear possible Prehistoric /Roman field system
19	Stubble	S	Magnetic Disturbance – Green waste	Potential Prehistoric/Roman settlement enclosures and field systems
20	Stubble	S	Magnetic Disturbance – Green waste	Unclear possible continuation of Prehistoric/Roman field systems
21	Sheep grazing	S	None	Potential Prehistoric/Roman settlement enclosures and field systems
22	Stubble, then ploughed	S	Disturbance from substation	Unclear possible Prehistoric /Roman field system
23	Ploughed	S	None	Clear double ditched feature - potentially Roman site or Medieval Manor?  Potential Prehistoric/Roman settlement enclosures and field systems

Table 1: Summary of survey findings and potential.

- 7.2 Several survey areas across the Site have however been affected by either modern green waste or night soiling. Modern green waste is normally stronger and more obvious, the most comparable data here being seen in the results of fields 7, 12, 14, 15 and 16. Whereas fields 3 and 4 maybe the result of soil movement/night soiling and agricultural deep ploughing practices rather than a spread of modern green waste.
- 7.3 Survey results throughout the Site are likely to be compounded by particular magnetic geological responses which are clearly seen in field 8. Therefore, even if the magnetic green waste / night soiling has not taken place there is still likely to have been significant disturbance.
- 7.4 A number of agricultural ploughing trends have also been identified throughout which reflect the very intensive arable agriculture in the area.
- 7.5 Several areas of magnetic disturbance of a likely modern date were also detected especially around the pylons and the substation areas.

- 7.6 Anomalies identified as archaeology across the Site, fields which have seen the least disturbance, all appear to show the greatest potential for archaeological responses. These are fields 3, 8, 11, 13, 21 and 23; and in fields 8 and 23 these clearly form identifiable archaeological remains.
- 7.7 A number of these trends have been clearly identified on the HER aerial photography rectification data. Therefore, these archaeological features have further supportive evidence for being definitively archaeology. It is suggestive of a landscape of prehistoric, Roman and Medieval settlement and field systems throughout.
- 7.8 Due to the success in the magnetically clearer areas, it would suggest that in the areas where magnetic disturbance exists there could also be potential for archaeological remains which may be detected through the utilisation of additional geophysical survey techniques.
- 7.9 Non-intrusive geophysical techniques in the form of earth resistance could be used to compare the archaeological potential of these targets in more magnetically disturbed areas. However, the geological trends in some locations might make this less useful/conclusive.
- 7.10 It is suggested that the identifiable archaeological remains are comparable / relate to a Prehistoric/Roman, and in the case of field 23, possibly medieval settlement / activity. Comparing the results in the wider area they are likely to reflect remains typical of this region of Yorkshire.
- 7.11 In assessing the results of the geophysical survey against the specific aims set out in Section 4;
- The survey has succeeded in locating, recording and characterising surviving sub-surface remains within the Site, though more remains may be present that are not suitable for detection through magnetometry due to the disturbance across the Site;
  - The survey has provided evidence that remains of an archaeological origin are most likely present on Site, and has provided a number of targets for further investigation;
  - It is not possible to provide an assessment of the potential significance of the identified remains in a local, regional or national context as it has not been possible to definitively characterise the nature of the anomalies identified through survey alone;
  - The survey has resulted in a comprehensive report and archive.
- 7.12 The geophysical survey has produced good quality gradiometer results in areas clear of magnetic disturbance which have successfully helped to clarify whether archaeological or uncertain remains are present across those areas.

## **8 Statement of Indemnity**

- 8.1 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.
- 8.2 The success of a geophysical survey in identifying archaeological remains can be heavily influenced by several factors, including geology, seasonality, field conditions and the properties of the features being detected. Therefore, the geophysical interpretation may only reveal certain archaeological features and not produce a complete plan of all the archaeological remains within a survey area.

## **9 Archive Deposition**

- 9.1 In accordance professional standard practice an 'Online Access to the Index of archaeological investigations' ('OASIS') record will be completed for submission to the HER and Archaeological Data Service (ADS) (Appendix 2).
- 9.2 One digital and hard copy of the report and data will be submitted to the relevant Historic Environment Record (HER) at the Client's discretion.
- 9.3 A digital copy of the report and data will also be submitted to the ADS at the Client's discretion.

## 10 Bibliography

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## 11 Plates



Plate 1. Field 4 looking east from southern boundary



Plate 2. Field 12 Looking east with survey in action



Plate 3. Field 4 Looking south from north-west corner



Plate 4. Field 23 Looking west from north-east corner



Plate 5. Field 22 Looking south with survey in action.



Plate 6. Field 3 Looking north from southern boundary.

## 12 Figures

## Appendix 1: Characterisation of Anomalies

Gradiometer survey – Field 1 (1)

Anomaly	Type of Anomaly
1A	Unclear Trend

Gradiometer survey – Field 2 (2)

Anomaly	Type of Anomaly
2A	N/A

Gradiometer survey – Field 3 (3)

Anomaly	Type of Anomaly
3A	Linear trend - Archaeology (trackway)
3B	Linear trend - Archaeology
3C	Linear trend - Archaeology
3D	Linear trend – Possible Archaeology
3E	Linear trend – Possible Archaeology
3F	Unclear linear and curvilinear trends
3G	Unclear linear trends
3H	Unclear curvilinear trends

Gradiometer survey – Field 4 (4)

Anomaly	Type of Anomaly
4A	Curvilinear – Unclear Trend
4B	Curvilinear – Unclear Trend
4C	Rectilinear – Unclear Trends
4D	Rectilinear – Unclear Trend
4E	Linear – Unclear Trend

Gradiometer survey – Field 5 (5)

Anomaly	Type of Anomaly
5A	Linear– Unclear trend
5B	Rectilinear – Unclear trend

Gradiometer survey – Field 6 (6)

Anomaly	Type of Anomaly
6A	N/A

## Gradiometer survey – Field 7 (7)

<b>Anomaly</b>	<b>Type of Anomaly</b>
7A	Rectilinear – Unclear Trend
7B	Rectilinear – Unclear Trend
7C	Rectilinear – Unclear Trend

## Gradiometer survey – Field 8 (8)

<b>Anomaly</b>	<b>Type of Anomaly</b>
8A	Linear trend – Archaeology (trackway)
8B	Linear trend – Archaeology (enclosure)
8C	Linear trend – Archaeology (enclosure)
8D	Linear trend – Archaeology (enclosure)
8E	Linear trend – Archaeology
8F	Linear trend – Possible Archaeology
8G	Linear trend – Possible Archaeology
8H	Linear trend – Possible Archaeology
8i	Linear trend – Possible Archaeology

## Gradiometer survey – Field 9 (9)

<b>Anomaly</b>	<b>Type of Anomaly</b>
9A	N/A

Gradiometer survey – Field 10  
(10)

<b>Anomaly</b>	<b>Type of Anomaly</b>
10A	N/A

Gradiometer survey – Field 11  
(11)

<b>Anomaly</b>	<b>Type of Anomaly</b>
11A	N/A

Gradiometer survey – Field 12  
(12)

<b>Anomaly</b>	<b>Type of Anomaly</b>
12A	Linear trend - Archaeology
12B	Linear trend - Archaeology
12C	Linear– Unclear trend
12D	Linear– Unclear trend
12E	Linear– Unclear trend
12F	Linear– Unclear trend

12G	Linear– Unclear trend
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12H	Linear– Unclear trend
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Gradiometer survey – Field 13

(13)

Anomaly	Type of Anomaly
13A	Rectilinear – Possible Archaeology
13B	Rectilinear – Possible Archaeology
13C	Magnetic disturbance – Possible Archaeology
13D	Linear trend – Possible Archaeology

Gradiometer survey – Field 14

(14)

Anomaly	Type of Anomaly
14A	Linear– Unclear trend
14B	Linear– Unclear trend
14C	Linear– Unclear trend
14D	Linear– Unclear trend
14E	Linear– Unclear trend

Gradiometer survey – Field 15

(15)

Anomaly	Type of Anomaly
15A	Linear trend – Possible Archaeology
15B	Linear– Unclear trend
15C	Linear– Unclear trend
15D	Linear– Unclear trend
15E	Linear– Unclear trend
15F	Linear– Unclear trend

Gradiometer survey – Field 16

(16)

Anomaly	Type of Anomaly
16A	Linear trend - Archaeology
16B	Linear trend – Possible Archaeology
16C	Ridge and furrow trends

Gradiometer survey – Field 17

and 18 (17)

Anomaly	Type of Anomaly
17A	Linear trends – Possible Archaeology
17B	Linear – Unclear trend

## 17C                      Linears – Unclear trends

Gradiometer survey – Field 19  
(19)

<b>Anomaly</b>	<b>Type of Anomaly</b>
19A	Linear trends – Possible Archaeology
19B	Linear – Unclear trend
19C	Linear – Unclear trend

Gradiometer survey – Field 20  
(20)

<b>Anomaly</b>	<b>Type of Anomaly</b>
20A	Linear – Unclear trends
20B	Linear – Unclear trend
20C	Linear – Unclear trends
20D	Curvilinear – Unclear trend
20E	Linear – Unclear trends

Gradiometer survey – Field 21  
(21)

<b>Anomaly</b>	<b>Type of Anomaly</b>
21A	Linear trend - Archaeology
21B	Linear trend – Possible Archaeology
21C	Linear trend – Possible Archaeology
21D	Linear trend – Possible Archaeology
21E	Linear trend – Possible Archaeology
21F	Linear trend – Possible Archaeology
21G	Linear trend – Possible Archaeology
21H	Linear trend – Possible Archaeology
21i	Linear – Unclear trend
21J	Linear – Unclear trend
21K	Linear – Unclear trend
21L	Linear – Historic Field Boundary

Gradiometer survey – Field 22  
(22)

<b>Anomaly</b>	<b>Type of Anomaly</b>
22A	Linear – Unclear trend
22B	Linear – Unclear trend

Gradiometer survey – Field 23  
(23)

<b>Anomaly</b>	<b>Type of Anomaly</b>
23A	Linear trend - Archaeology (Double ditch enclosure)



23B	Linear trend – Archaeology possible enclosures
23C	Linear trend – Archaeology possible enclosures
23D	Linear – Unclear trend
23E	Linear – Unclear trend
23F	Linear – Unclear trend
23G	Linear – Historic field boundary

**Appendix 2: Survey Metadata****Oasis ID: aocarcha-416785**

<b>Field</b>	<b>Description</b>
Surveying Company	AOC Archaeology
Data collection staff	A.Galt, S.O'Connor, N.Holt, F.Forrester, C.Sykes and J.Lawton
Client	Arcus
Site name	Soay Solar Farm, Pocklington
County	East Riding of Yorkshire
NGR	SE 76292 46386
Land use/ field condition	Arable and Pasture
Duration	February- April 2021
Weather	Overcast/Sunny/Rain and Cold/Frosty
Survey type	Gradiometer Survey
Instrumentation	Bartington cart survey: Bartington Non-Magnetic Cart, two Bartington Grad 601-2, Trimble R10 GNSS System
Area covered	Approx 114 ha of 140 ha
Download software	MLGrad601
Processing software	Geomar, MultiGrad601 and TerraSurveyor
Visualisation software	ArcGIS Pro
Geology	The bedrock recorded geology within the Site consists of Mercia Mudstone Group - Mudstone. These are overlain by superficial Drift deposits of the Bielby Sand Member - Sand, Silty, Gravelly. (BGS, 2021).
Soils	Soilscape 15: Naturally wet very acid sandy and loamy soils and Soilscape 10: Freely draining slightly acid sandy soils (Soilscales, 2021)
Scheduled Ancient Monument	No
Known archaeology on Site	None
Historical documentation/ mapping on Site	None
Report title	Soay Solar Farm, Pocklington, East Riding of Yorkshire Archaeological Geophysical Survey
Project number	40178
Report Author	James Lawton
Quality Checked by	Chris Sykes

## Appendix 3: Archaeological Prospection Techniques, Instrumentation and Software Utilised

### Gradiometer Survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall et al., 2008, 23; Sharma, 1997, 105). Human inhabitation often causes alterations to the magnetic properties of the ground (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremanent magnetization (Aspinall et al., 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the topsoil is generally suggested to have a greater magnetisation than the subsoil caused by human habitation. Areas of burning or materials which have been subjected to heat commonly also have high magnetic signatures, such as hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24).

It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared to the surrounding soil, the surrounding soil will consequently have a greater magnetization, resulting in the feature in question displaying a negative signature. For example, stone materials of a structural nature that are composed of sedimentary rocks are considered non-magnetic and so will appear as negative features within the dataset.

Ferrous objects – i.e. iron and its alloys - are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data, though it is not usually possible to determine whether these relate to archaeological or modern objects.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present or thick layers of alluvium or till. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

### Bartington Non-Magnetic Cart Instrumentation and Software

AOC Archaeology's cart-based surveys are carried out using a Bartington Non-Magnetic Cart. The cart enables multiple traverses of data to be collected at the same time, increasing the speed at which surveys may be carried out and offers the benefits of reduced random measurement noise and rapid area coverage (Schmidt et al 2015, 60-62, David et al. 2008, 21).

The cart uses a configuration of four Grad-01-1000L sensors mounted upon a carbon fibre frame along with two DL601 dataloggers and one BC601 battery cassette. The sensors are normally positioned at 1m intervals on a horizontal bar, with the datalogger taking readings every 12.5cm along each traverse, though this can be altered to increase / reduce resolution if required. The data is georeferenced via a Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS GPS which streams data throughout survey and allows the data to be recorded relative to a WGS1984 UTM coordinate system.

The gradiometer data is collected through Geomar MLGrad601 software on a laptop in real-time during the survey. The data is downloaded and converted into a .xyz file in Geomar MultiGrad601 before being processed along with the GPS data in TerraSurveyor v3.0.34.10 (see Appendix 4 for a summary of the processes used in Geoplot to create final data plots).

## Appendix 4: Summary of Data Processing

Process	Effect
Clip	Limits data values to within a specified range
De-spike	Removes exceptionally high readings in the data that can obscure the visibility of archaeological features. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground. In gradiometer survey, these can be caused by highly magnetic items such as buried ferrous objects.
De-stagger	Corrects a misalignment of data when the survey is conducted in a zig-zag traverse pattern.
Discard Overlap (TerraSurveyor)	Removes datapoints which occur too closely together and can cause digital artefacts in the data which are caused by the overlapping of parallel traverses.
Edge Match	Counteracts edge effects in grid compoSites by subtracting the difference between mean values in the two lines either side of the grid edge.
Filter (MAGNETO)	Much like a zero mean traverse, it resets the median value of each point to zero, in order to address the effect of striping in the data and counteract edge effects. In MAGNETO the individual values take into account the value of all uncorrected points within a certain distance to create its own median.
GPS Filter (MAGNETO)	Used to either remove or reduce the appearance of constant and reoccurring features that are not consistent with the GPS signal in use by the cart system.
High pass filter	Removes low-frequency, large scale detail in order to remove background trends in the data, such as variations in geology.
Interpolate	Increases the resolution of a survey by interpolating new values between surveyed data points, creating a smoother overall effect.
Low Pass filter	Uses a Gaussian filter to remove high-frequency, small scale detail, typically for smoothing the data.
Periodic Filter	Used to either remove or reduce the appearance of constant and reoccurring features that distort other anomalies, such as plough lines.
Remove Turns (TerraSurveyor)	Uses analysis of the direction of travel derived from the GNSS data to break continuous streams of data into individual traverses.
Zero Mean Grid	Resets the mean value of each grid to zero, in order to counteract grid edge discontinuities in compoSite assemblies.
Zero Mean Traverse	Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects.

## Processing Steps

Bartington Cart survey	
Process	Extent
Base Settings	Interval 0.121m, Track Radius 1.06m
Remove Turns	Threshold Angle 90°, Cut Length 5m
Discard Overlap	Threshold Distance 0.4m, Minimum Track 5, Newest
Despike	Mean Diameter 3 Threshold 12
Destripe	Mean Traverse SD 1.5
High Pass Filter	Uniform (Median) 12
Clip	-100/100

## Appendix 5: Technical Terminology

Type of Anomaly	Description
<b>Archaeology</b>	<i>Interpretation is supported by the presence of known archaeological remains or by other forms of evidence such as HER records, LiDAR data or cropmarks identified through aerial photography.</i>
Trend	Linear / curvilinear / rectilinear anomalies either characterised by an increase or decrease in values compared to the magnetic background.
Area of enhanced magnetism	A zone of enhanced magnetic responses over a localised area. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly and likely have a relationship with nearby archaeological trends.
Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is pit-like in appearance.
<b>Possible Archaeology</b>	<i>Trends are likely to have an archaeological origin, however without supporting evidence from known archaeological remains, HER records, LiDAR or aerial photography, they can only be classed as having a possible archaeological origin.</i>
Trend	Linear / curvilinear / rectilinear anomalies either characterised by an increase or decrease in values compared to the magnetic background.
Area of enhanced magnetism	A zone of enhanced magnetic responses over a localised area. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly but lacks definitive records to be classed as being archaeological.
Pit-like anomaly	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is pit-like in appearance.
Burnt area	An anomaly with a patterning on the XY trace plot that is suggestive of industrial activity such as a kiln or hearth.
<b>Unclear Origin</b>	<i>Trends are magnetically weak, fractured or isolated and their context is difficult to ascertain. Whilst an archaeological origin is possible, an agricultural, geological or modern origin is also likely.</i>
Trend	Linear / curvilinear / rectilinear anomalies which are composed of a weak or different change in magnetic values. The trends do not appear to form a patterning that is suggestive of archaeological remains, such as enclosures or trackways.
Area of enhanced magnetism	A zone of enhanced magnetic responses which lack context for a conclusive interpretation. They do not appear to have a relationship with nearby trends of an archaeological origin. Can often be caused by areas of former woodland, geological variations or agricultural activity.
<b>Agricultural</b>	<i>Trends associated with agricultural activity, either historical or modern.</i>
Old Field Boundary	These isolated long linear anomalies, most often represented as a negative or fractured magnetic trend, relate to former field boundaries when their positioning is cross referenced with historical mapping.
Historical Features	Features observed on historical mapping that correspond with anomalies or trends in the data. Areas of enhanced magnetism could relate to former buildings, trackways, quarries or ponds.
Ridge and Furrow / Rig and Furrow	A series of regular linear or curvilinear anomalies either composed of an increased or decreased magnetic response compared to background values. The wide regular spacing between the anomalies is consistent with that of a ridge and furrow / rig and furrow ploughing regime. The anomalies often present as a positive 'ridge' trend adjacent to a negative 'furrow' trend.
Ploughing Trends	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. Anomalies seen parallel to field edges are representative of headlands caused by ploughing.
Field Drainage	A series of magnetic linear anomalies of an indeterminate date, usually with a regular or herringbone patterning.
<b>Non - Archaeology</b>	<i>Trends which are likely to have derived from non-archaeological processes or activities.</i>
Geology / Natural	An area of enhanced magnetism that is composed of irregular weak increases or decreases in magnetic values compared with background readings. It is likely to indicate natural variations in soil composition or reflect variations in the bedrock or superficial geology.
Possible Modern Service	Anomalies of a linear form often composed of contrasting high positive and negative dipolar values. Such anomalies usually signify a feature with a high level of magnetisation and are likely to belong to modern activity such as pipes or modern services.
Magnetic Disturbance	A zone of highly magnetic disturbance that has been caused by or is a reflection of modern activity, such as metallic boundary fencing, gateways, roads, boreholes, adjacent buildings, rubbish at field edges or a spread of green waste material.
Isolated Dipolar Anomalies / Ferrous (iron spikes) and Ferrous Zones	A response caused by ferrous materials on the ground surface or within the subsoil, which causes a 'spike' in the data representing a rapid variation in the magnetic response. These generally represent modern material often re-deposited during manuring.

## Appendix 6: XY Trace Plots



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