Monk Fryston Substation, Selby, North Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey was undertaken on approximately 4 hectares of land located to the east of Rawfield Lane, west of Monk Fryston, Selby, North Yorkshire. Anomalies of a possible archaeological origin have been detected including a possible enclosure, linear trends and pit-like responses. Ridge and furrow cultivation has also been detected along with a former field boundary, modern ploughing and field drains. Magnetic disturbance in the north of the survey area is likely to be associated with the adjacent substation. Based on the interpretation of the geophysical survey the archaeological potential of this Site is deemed to be moderate.

WYAS Archaeological Services

Report Information

Client:	Arcus Consultancy Services Ltd
Address:	1C Swinegate Court East, 3 Swinegate, York, YO1 8AJ
Report Type:	Geophysical Survey
Location:	Monk Fryston, Selby
County:	North Yorkshire
Grid Reference:	SE 48355 28887
Period(s) of activity:	?Prehistoric/medieval/modern
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1 Introduction

Archaeological Services ASWYAS has been commissioned by Arcus Consultancy Services Ltd to undertake a geophysical survey at land at Monk Fryston, Selby, North Yorkshire. This was undertaken in line with current best practice (CIfA 2014; Schmidt *et al.* 2015). The survey was carried on the 27th August 2021 to provide additional information on the archaeological resource of the Site.

Site location, topography and land-use

The Site is located at SE 48355 28887, comprising *c*. 4ha within one field to the west of Monk Fryston (see Fig. 1). The Site is situated to the east of Rawfield Lane with land consisting of arable ground. It is bounded to the north by Monk Fryston Substation, to the east and south by agricultural land, and to the west by a dirt track, farm buildings and yards. The elevation varies across Site, lying at 34m aOD (above Ordnance Datum) to the north and west, and at 39m aOD to the east and south.

Soils and geology

The recorded bedrock geology comprises Brotherton Formation a dolomitic limestone, which is a sedimentary bedrock formed approximately 252 to 272 million years ago in the Permian Period. Superficial deposits have been recorded as part of the Harrogate till formation comprising clay, sandy and gravelly deposits formed up to 2 million years ago in the Quaternary period. A band of glaciofluvial deposits (sand and gravel) extends across the western side of the Site (BGS 2021). Soils are described as Aberford Association (511a) which are freely draining lime-rich loamy soils vulnerable to leaching of nitrate (SSEW 1983).

2 Archaeological Background

The following archaeological background is taken from Heritage Gateway, using a search radius of 1km. It is designed to give a broad indication of the archaeological potential within the survey boundary and also the wider area. The Site sits within the belt of Magnesian limestone that is known for widespread cropmarks (Roberts *et al*. 2010).

A possible Iron Age/Roman ditched enclosure (Monument Number 1403121) is visible as cropmarks on aerial photographs taken in the field immediately northwest of the Site. The south-eastern corner of the feature is the most visible. Southwest of the Site are more features of Iron Age/Roman occupation (Monument Number 1403136). An Iron Age/Roman ditched enclosure, field boundaries and ditches are visible as cropmarks on aerial photographs. The entirety of the enclosure is not visible.

A sub-circular enclosure and associated pits of prehistoric/Roman date are visible as cropmarks on aerial photographs 800m southeast of the Site. The enclosure has two clear entrances and an Iron Age/Roman ditched boundary cutting across it (MNY9953). To the south of these features lies a trackway and further field boundaries, visible as cropmarks on aerial photographs (MNY9954). Further features to the west (MNY 9955) suggest this may be an extensive area of enclosures, trackways and field systems that are not all visible on the aerial photographs.

A small area of indistinct cropmarks are visible 800m west of the Site. These appear as field boundaries that are possibly Iron Age/Roman in date (MNY9961).

In the field to the immediate south of the Site a possible double ditch enclosure or two overlapping single ring ditches are visible (MNY9959). There is possibly a central pit inside the feature.

Monk Fryston Lodge (List Entry Number 1167647), a Grade II Listed building lies approximately 700m northeast of the Site. This is an 18th-century building with 19th and 20th-century additions and alterations.

A 19th- century Milestone lays 900m to the east of the Site. This is a Grade II Listed stone (List Entry Number 1167492) and it marks the distance to Doncaster (18 miles), Pontefract (5 ¾ miles), York (18 ¾ miles), and Tadcaster (9 ¼ miles).

Erected in 1924, Fairburn War Memorial (List Entry Number 1462330) lies 1km southwest of the Site. This First World War memorial is Grade II Listed, and following the Second World War, a matching inscription was added to commemorate the servicemen who died in that conflict.

3 Aims, Methodology and Presentation

The aims and objectives of the programme of geophysical survey were to gather sufficient information to establish the presence/absence, character and extent, of any archaeological remains within the specific area and to inform an assessment of the archaeological potential of the Site. To achieve this aim, a magnetometer survey covering all amenable parts of the Site was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and

- to prepare a report summarising the results of the survey.

Magnetometer survey

The survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays the location of the Site with processed magnetometer data at a scale of 1:2000 Processed and minimally processed data, together with interpretation of the survey results are presented in Figures 3 to 5 inclusive at a scale of 1:1250.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by the European Archaeological Council (Schmidt *et al*. 2015) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The figures in this report have been produced following analysis of the data in processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

4 Results and Discussion (see Figures 3 to 5)

Ferrous anomalies and magnetic disturbance

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for

an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

The northern and western parts of the survey area is dominated by magnetic disturbance and is likely to be associated with the adjacent substation and overhead power lines. Historic mapping dating from 1888 (NLS 2021) states an old quarry in this area which may also have some influence on the magnetic disturbance response if it has been infilled with ferrous materials.

Magnetic disturbance along the limits of the survey areas are due to metal fencing within the field boundaries,

Bisecting the southern portion of the survey area, a linear dipolar trend has been recorded which is likely to be a buried service.

Agricultural anomalies

A former field boundary (**FB1**) has been detected oriented north to south and located in the northern part of the survey area. This boundary is recorded on first edition Ordnance Survey mapping dating from 1888 (NLS 2021), but by the 1984 map (OM 2021) the boundary has been removed.

Parallel linear trends on an approximate northwest to southeast alignment can be seen throughout and are likely associated with medieval ridge and furrow cultivation. Linear trends running on a southwest to northeast alignment are modern ploughing and reflect the cultivation seen on aerial images.

A handful of linear trends with a ferrous magnetic signature may be associated with field drains. The most prominent of these is located on the eastern side of the survey area and follows the alignment of the current field boundary.

Possible archaeological anomalies

Anomalies of a possible archaeological origin have been recorded within the dataset. The most prominent of these is a ‘teardrop’ shaped enclosure (**P1**). The enclosure measures approximately 67m by 45m and consists of fragmented ditches and trends. The fragmented nature of the anomalies is likely to be a result of disturbance by the ploughing trends that pass through them. Romano-British enclosures are known with the area (see Archaeological Background) which adds weight to this being of an archaeological origin. However, the magnetic strength of the anomaly is also similar to what would be expected from geological responses and caution must be taken with the interpretation. A large pit (**P2**) and ditch

response (**P3**) are visible within the south of the 'enclosure' and could also on this basis have an archaeological origin.

A linear trend (**P4**) is visible bisecting **P1**. It is possible that this relates to part of a field division pre-dating the historic mapping. Another trend (**P5**) has been recorded in the north of the survey area and as it does not reflect the current or historic cultivation trends, the same interpretation of a former field boundary has been assigned. These would also be consistent with later prehistoric land use identified in the wider landscape that contains field systems and enclosures (Roberts *et al*. 2010).

In the south of the dataset a large pit-like response has been recorded (**P6**). An archaeological origin is preferred given its proximity to the 'enclosure', but there is also the possibility that is represents a deeply buried ferrous object.

5 Conclusions

The geophysical survey has detected a number of magnetic anomalies associated with possible archaeological origins in the forms of a potential enclosure, pits and linear trends.

Probable medieval ridge and furrow cultivation has been recorded along with a former field boundary, modern ploughing and field drains. Magnetic disturbance in the north can be attributed to the interference from the adjacent substation and power lines whilst other areas of disturbance around the periphery of the fields are due to metal fencing within the boundaries. A service pipe has also been detected in the south.

Based on the interpretation of the geophysical survey the archaeological potential of this Site is deemed to be moderate.

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey an eight channel Sensys MX V3 system containing eight FGM650 sensors was used which was towed across the area using an ATV. Readings were taken every 20MHz (between 0.05 and 0.1m). Data was be recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

Appendix 2: Survey location information

The data was geo-referenced using the Carlton differential Global Positioning System (Carlton BX6 model). The accuracy of this equipment is better than 0.01m. The survey results were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the North Yorkshire Historic Environment Record).

Appendix 4: Oasis form

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