Project code: CAFD18

Client: Fingal County Council

Date: 4 February 2019

Geophysical (fluxgate magnetometry) survey at Cappaghfinn, Cappagh Road, Finglas, Dublin 11.

Report Author: Enda O'Flaherty

Licence No: 19R0019

RUBICON HERITAGE

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EXECUTIVE SUMMARY

This report presents the results of a geophysical survey undertaken on behalf of Fingal County Council by Rubicon Heritage Services Limited on lands in the townland of Cappoge, in the Parish of Castleknock, in Co. Dublin (Figure 1). The geophysical survey forms part of pre-planning preparations ahead of a potential housing development in the townland.

The purpose of the archaeo-geophysical survey was to identify any geophysical anomalies of possible archaeological origin within the specified survey area.

One RMP was located within the proposed development boundary DU014-029: Ringfort. The results of the Geophysical Survey showed the presence of geophysical responses in close proximity to DU014-029 that have a high potential to represent buried archaeological deposits. The survey area comprised 2.28 Ha of rough ground, and the clarity of the geophysical results were greatly compromised by the presence of significant amounts of ferrous material across the site.

Further investigation in the form of test trenching or similar would be needed in order to confirm the nature, date and extent of the identified features.

1 INTRODUCTION

This report presents the results of a geophysical survey undertaken on behalf of Fingal County Council by Rubicon Heritage Services Limited on lands in the townland of Cappoge, in the Parish of Castleknock, in Co. Dublin (Figure 1). The geophysical survey forms part of pre-planning preparations ahead of a potential housing development in the townland.

The archaeo-geophysical survey was undertaken by Enda O'Flaherty of Rubicon Heritage on January 29th and 30th 2019. The archaeo-geophysical survey site covered an area of approximately 2.28 ha.

The survey area comprised flat scrub/heath lands with significant, and represented 2.28 of the 7.8 Ha total potential development area. Suitable geological conditions allowed for a fluxgate magnetometry survey to be undertaken at the site. Fluxgate magnetometry survey was used because of its ability to identify a wide range of both negative (ditches, pits, etc.) and positive (structural, hard-pack, etc.) archaeological features. A full interpretation of these results is included in Figures 4 and 5 and is discussed in Sections 5 and 6.

2 AIMS AND OBJECTIVES

The aims of archaeo-geophysical survey were to:

- Identify any geophysical anomalies of possible archaeological origin within the specified survey area
- Accurately locate these anomalies and present the findings in map form
- Describe the anomalies and discuss their likely provenance in a written report
- Provision of a full report incorporating the results of the above work

3 SITE BACKGROUND

3.1 Site location and topography

The proposed development site is located in the townland of Cappoge, in the Parish of Castleknock, in Co. Dublin (Figure 1). The site is bounded to the south by Heathfield housing estate and to north by the M50. The nearest urban settlement is the town of Finglas, the centre of which is less than 2 km southwest of the proposed development site. The proposed development covers an area of 7.8 HA of which 2.28 ha were deemed suitable for geophysical survey. A sample of the western portions of the potential development site was also subjected to a fluxgate magnetometry survey, the results of which revealed the lands to comprise redeposited/dumped spoil and unsuitable for further survey.

The topography of the area surveyed comprises relatively level scrub/heath lands sloping gently from west to east at 78-74 m OD. There is one RMP located within the proposed development area DU014-029 and a further four RMPs located within 500 m of the proposed development boundary:

RMP	Classification	Townland
DU014-029	Ringfort	Cappoge
DU014-028	Habitation Site	Cappoge
DU014-117	Burial Ground	Cappoge
DU014-027	Castle	Cappoge
DU014-116003	Structure	Cappoge

DU014-029----Class: Ringfort

Townland: Cappoge

Description: Situated within rough grazing, on flat land which slopes away slightly to the south west, now bounded to south by Heathfield housing estate and to north by the M50. This site comprises a circular platform (diam. 34m; H 1-1.8m). The bank has not survived and there are no traces of an external fosse.

DU014-028----Habitation Site

Townland: Cappoge

Description: Investigations on the NE Gas Pipeline, Phase 1 Report identified remains of a habitation site of uncertain date at this location.

DU014-117----Burial Ground

Townland: Cappoge

Description: Excavation (Licence no. 06E0288) was undertaken at the site in advance of the Premier Business Park development. Located to the SE was a much-disturbed burial ground. At least sixteen individuals were aligned E-W and enclosed by a deep ditch and orientated in a NE-SW direction, but only a short section of this ditch survived. Another burial was found c. 75m to the NE of the main burial-ground: that individual was facing southwards.

DU014-116003----Castle- Tower House

Townland: Cappoge

Description: A Gabriel Beranger drawing from 1776 shows a three-storey tower at the south-eastern corner of a walled enclosure. In 1778 Cappoge Castle stood as a three-storey tower house with corner turret in the SE and it was associated with the Woodcock family from the 13th to the 16th century. It was demolished before 1860, with no visible remains present at ground level. Excavations (Licence nos. 06E0228ext and 08E0032ext) were undertaken north of the site of Cappogue castle in advance of the Ballycoolin Road Realignment. The standing remains of a structure appear to have incorporated part of the remains of the gatehouse of the castle, but no definite remains of the tower house were identified on this site and it is highly likely that the stone from this structure was re-used after it fell into disuse in the 17th century.

DU014-028----Structure

Townland: Cappoge

Description: Excavation (Licence nos. 06E0288ext. and 08E0032ext.) undertaken at the site in advance of the Ballycoolin road realignment indicated that the area close to the 'site of' Cappogue Castle (DU014-027----) was used for domestic occupation and agricultural activity during the medieval period. This monument was one of several possible structures identified and comprised foundations trenches that formed a rectangular building (11.7m x 6m) on an E-W axis. Pottery recovered from the vicinity indicates occupation during the 12th – 14th centuries.

3.2 Site geology

The subsurface geology of the proposed development area is Tober Colleen Formation; a Calcareous shale, limestone conglomerate, dating to the Carboniferous period. As such this geology is favourable to the deployment of Fluxgate Magnetometery and should not adversely affect the readings.

3.4 Cartographic record

The cartographic record for the area surrounding the proposed development site was examined. Both the First Edition Ordnance Survey 6-inch sheet, and the First Edition Ordnance Survey 25-inch sheet show that there has been significant change to land use within the proposed development site through the 19th and 20th century. However, the lands and field boundaries included within the geophysical survey area have remained unchanged in layout.

4 METHODOLOGY

4.1 Legislative framework, statement of indemnity and guidelines

Rubicon Heritage Services Ltd conducts geophysical surveys to the highest professional standards, as detailed in *Geophysical Survey in Archaeological Field Evaluation, English Heritage Research and Professional Services Guideline No. 1*, 2nd ed. (English Heritage 2008) and *The Use of Geophysical Techniques in Archaeological Evaluations*, Institute of Field Archaeologists Paper, No. 6 (IfA 2002). All data provided by Rubicon Heritage Services Ltd, is treated in accordance with the guidelines laid out in *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Geophysical surveys rely on observations about the physical properties of the archaeological remains they attempt to locate. Through experience, it becomes possible for geophysicists to identify features with reasonable accuracy by the physical traces these features leave. It must be noted however, that interpretation of geophysical anomalies is subjective and no hypotheses offered should be treated as fact, until tested and proved by intrusive investigation.

4.2 Fluxgate Magnetometry Methodology

A cart-mounted Bartington Grad 601-2 dual magnetic gradiometer (magnetometer) was used to conduct the magnetic gradiometer survey. The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1nT. This unit comprises two horizontally aligned sensors 1m apart.

Mounting the instrument on a cart reduces the incidence of operator induced errors caused by excessive jostling of the instrument when walking over rough terrain, or by the operator having a 'beat' to their walk.

A Trimble R6 Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) navigation is fixed to one end of a cart and the magnetic gradiometer is connected to the other end at a fixed distance. This allows each data point to be collected with sub-cm accurate GPS coordinates, thus negating the need to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey. Both the GPS and magnetic gradiometer data is sent to an external mobile

computer (Trimble Nomad) *via* a serial connection. The data is then downloaded from the unit on a daily basis, using a laptop PC and the data streams are subsequently combined.

This 'irregular xy' data is then exported from the data collection software and imported into the data processing software, where it is converted to 'regular xy' data at user defined sample intervals (in this case 1 m by 0.125 m). From there, it was processed as standard magnetometer data, such as that collected from a traditional pre-defined grid survey.

The data was collected at a resolution of 1m x 0.125m. This sample density is recommended for site evaluation (English Heritage 2008).

5 THE RESULTS

5.1 Fluxgate Magnetometry Survey

For the purpose of this report, the following classifications are applied to geophysical anomalies of archaeological potential:

Table 1 Geophysical Classifications

High Archaeological Potential (RED) – Identifiable, known archaeological features, often, (but not always), with additional evidence exists to support identification of *High Archaeological Potential* anomalies. This classification may also be applied to definable anomalies with no obvious alternative provenance, in an area that is known to be archaeologically rich. *Moderate Archaeological Potential (GREEN)* – Geophysical anomalies that may represent possible archaeological features based on the appearance, pattern and strength of the magnetic response. *Low Archaeological Potential (YELLOW)* – Known or possible archaeological feature types that are or are likely to be of low archaeological significance. Anomalies caused by modern features/materials or related to know field boundaries are shown in blue. Ferrous disturbance is show in black.

The greyscale data plot (Figure 4) from which the results are derived is characterised by positive anomalies (black areas) and negative anomalies (white areas).

The geophysical anomalies identified during the survey and presented in Figures 4 are labelled by archaeological potential. The prefixes 'H', 'M' and 'L' represent anomalies of a high, moderate and low potential category respectively. Each category is further numbered sequentially.

Table 2 Response Classifications

Negative anomaly – A negative anomaly possesses negative magnetism (as distinct from the archaeological meaning of a negative feature e.g. pit). Negatively magnetic anomalies can be caused by walls, rubble, etc. These anomalies appear as white areas in the data plot.
Positive Anomaly – A positive anomaly possesses positive magnetism (as distinct from the archaeological meanings of a positive feature e.g. bank). Positively magnetic anomalies can be caused by features, such as pits, ditches, etc. These anomalies appear as black areas in the data plot.

The following anomalies (see Figure 5) were deemed to have archaeological potential:

Table 3 Geophysical Survey Results Table

Identifier	**Response description**	**Interpretation**
H:01	Strong, dipolar magnetic response c. 33 m Ø	Mound/Raised rath
H:02	Strong, positively magnetic curving linear response c. 45 m	
H:03	Strong, positively magnetic curving linear response c. 55 m	
H:04	Strong, positively magnetic curving linear response c. 25 m	
H:05	Strong, positively magnetic curving linear response c. 30 m	
H:06	Strong, positively magnetic angular linear response c. 45 m	
H:07	Strong, positively magnetic angular linear response c. 40 m	
H:08	Strong, positively magnetic response c. 5 m Ø	

Identifier	Response description	Interpretation
H:09	Weak, positively magnetic penannular response c. 10 m Ø	
H:10	Weak, positively magnetic penannular response c. 10 m Ø	
H:11	Strong, positively magnetic linear response c. 10 m	
H:12	Strong, positively magnetic response c. 5 m Ø	

Besides the anomalies listed in Table 3, there was some ferrous debris noted throughout the site, represented by strong dipolar responses in the greyscale geophysical survey plot.

5.2 Reliability of the results

The geophysical plot for Cappoge shows a lack of magnetic homogeneity across the areas of the site. The results of the survey are greatly compromised by the extensive disturbance and dumping present throughout the site, with large amounts of ferrous materials visible, particularly along the survey area boundary. Nonetheless, likely anthropogenic responses are discernible, particularly at the western limit of the survey extents.

6 INTERPRETATION AND CONCLUSION

The results of the Geophysical survey undertaken at Cappoge identified a number of magnetic responses that have a high potential to represent buried archaeological deposits. H:01 represents the DU014-029, a known RMP within the survey area. The results of the Fluxgate Magnetometry survey did not identify any discernible enclosing fosse associated with DU014-029. However, the area does show strong positively magnetic responses that are irregular in form and likely to be of an anthropogenic origin, perhaps representing internal structures associated with DU014-029. H:02 represents a strong, positively magnetic curving linear response measuring c. 45 m in length. This area was heavily disturbed and partly obscured by furze and heather which impacted greatly on the quality of the survey. However H:02 may represent a curving fosse possibly associated with an adjoining enclosure to DU014-029. H:03, H:04 and H:05 are located to the north of DU014-029 appear to represent part of a pair of parallel possible curving cut features, possibly indicative of a routeway

or other enclosed space. H:06 and H:07 represent two angular, positively magnetic responses located to the southeast of DU014-029, possibly indicative of an approach way to DU014-029.

H:08 represents a strong, positively magnetic response measuring c. 5 m in diameter. It may represent a pit or other cut-feature.

H:09 and H:10 represent a pair of weak, positively magnetic penannular responses c. 10 m in diameter and located in close proximity to each other. The may potentially represent an enclosed space such as a hut site.

H:11 and H:12 represent a pair of strong, positively magnetic linear responses that are possibly representative of a cut feature such as a ditch.

Further investigation in the form of test trenching or similar would be needed in order to confirm the nature, date and extent of the identified features.

7 TECHNICAL INFORMATION

7.1 Data Archive

The site archive will contain the following, as a minimum standard:

Item	**Quantity**
Raw geophysical data files (xyz/txt)	06
Processed geophysical data files (asc)	2
Archaeological interpretation (shp)	1
Final report text (pdf)	1
Final report graphics (pdf)	1

Storage of the archive in a suitable format and location is required in order to provide for any future archaeological research. A physical and digital archive has been prepared and both are currently stored in the offices of Rubicon Heritage Services Ltd, Unit 2 Europa Business Park, Midleton, Co. Cork, Ireland.

7.2 Data processing and presentation

Clip – The clipping process will clip extreme values from the data set and increase the contrast in the data values closer to the mean. As most data within a data set is concentrated around the mean clipping can produce a better visualisation of standard data sets, particularly very weak signals that tend to be lost in a myriad of grey shades.

De-slope – The de-slope process uses a computational process to remove or minimise the distortion caused by large iron objects such as fences or pipelines within the data set. Often, data near highly magnetic sources is obscured by its proximity to the extreme values and this process can sometimes remove the extremes and recover this otherwise obscured data.

De-spike – The de-spike process will **ONLY** clip isolated extreme values from the data set. Extreme values are usually caused by surface iron of non-archaeological origin. This process will remove statistical outliers from the data set and consequently remove them from any further computational processes.

De-stagger – Sometimes data collected in 'zig-zag' mode can show a staggered effect cause by slightly different walking speeds on the inward versus the outward traverse. De-stagger can adjust the positioning of traverses by specified intervals to ensure that traverses "match" and detail is not obscured by the staircase effect stagger can sometimes produce.

De-stripe – The de-stripe process can reduce the occurrence of a striping effect sometimes known as "heading error". This error occurs when working in "zig-zag" data collection mode and is caused by the different readings being obtained by the sensors when data is collected in opposite directions. This can also be caused by problems during the initial calibration of the instrument at the start of a survey.

Some degree of heading error is inevitable when using a fluxgate gradiometer with such an acute sensitivity to the direction of travel in bi directional manner *i.e. zigzag* traverses. The error displays as a series of alternating lighter and darker stripes in the traverse direction and the function assesses and corrects the mean for each line of data to bring them in to the same mean range.

High/Low Pass Filters – The low pass filter, when applied to a 'noisy' data set *i.e.* a data set displaying too much variation that it obscures detail, will smooth the data, removing the noise and revealing anomalies that were obscured. Conversely, high pass filtering accentuates differences in subtle data sets and can increase the visibility in data set, often uncovering very weakly magnetic anomalies.

Two Dimensional Fast Fourier Transform (2D FFT) – The 2D FFT algorithm examines the data set for repetitive signature that occupy the same wavelength. This is often used to mitigate the interference caused by plough furrows or other regular phenomenon.

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Ordnance Survey of Ireland, 1912, Map of Co. Dublin, Sheet 14. Second Edition. 25 inch series: 1 mile. Ordnance Survey of Ireland, Dublin

Figure 1 - Cappaghfinn, Finglas, Dublin 11: Site location and Survey extents.

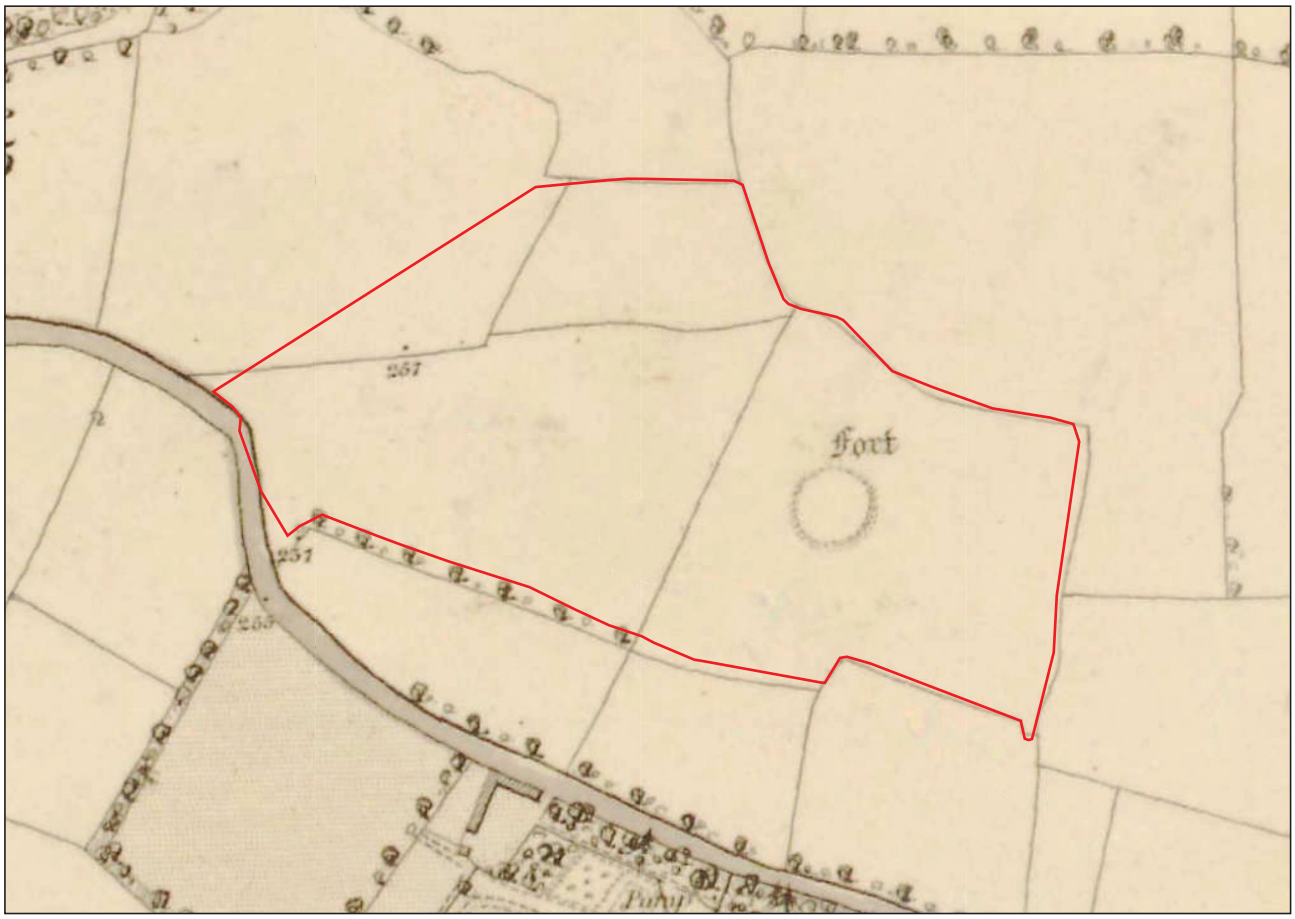


Figure 2 - First Edition 6-inch Ordnance Survey Sheet.

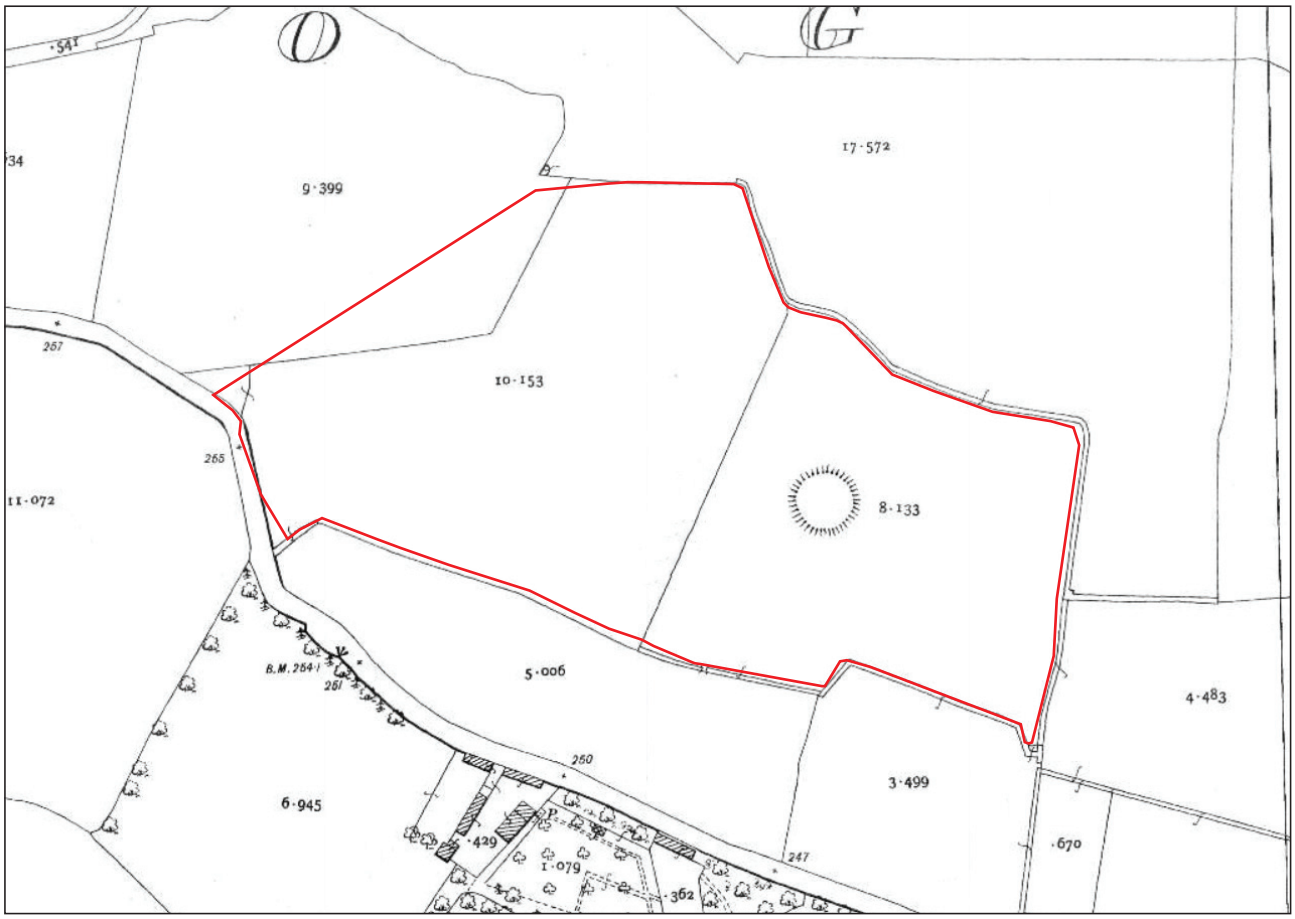
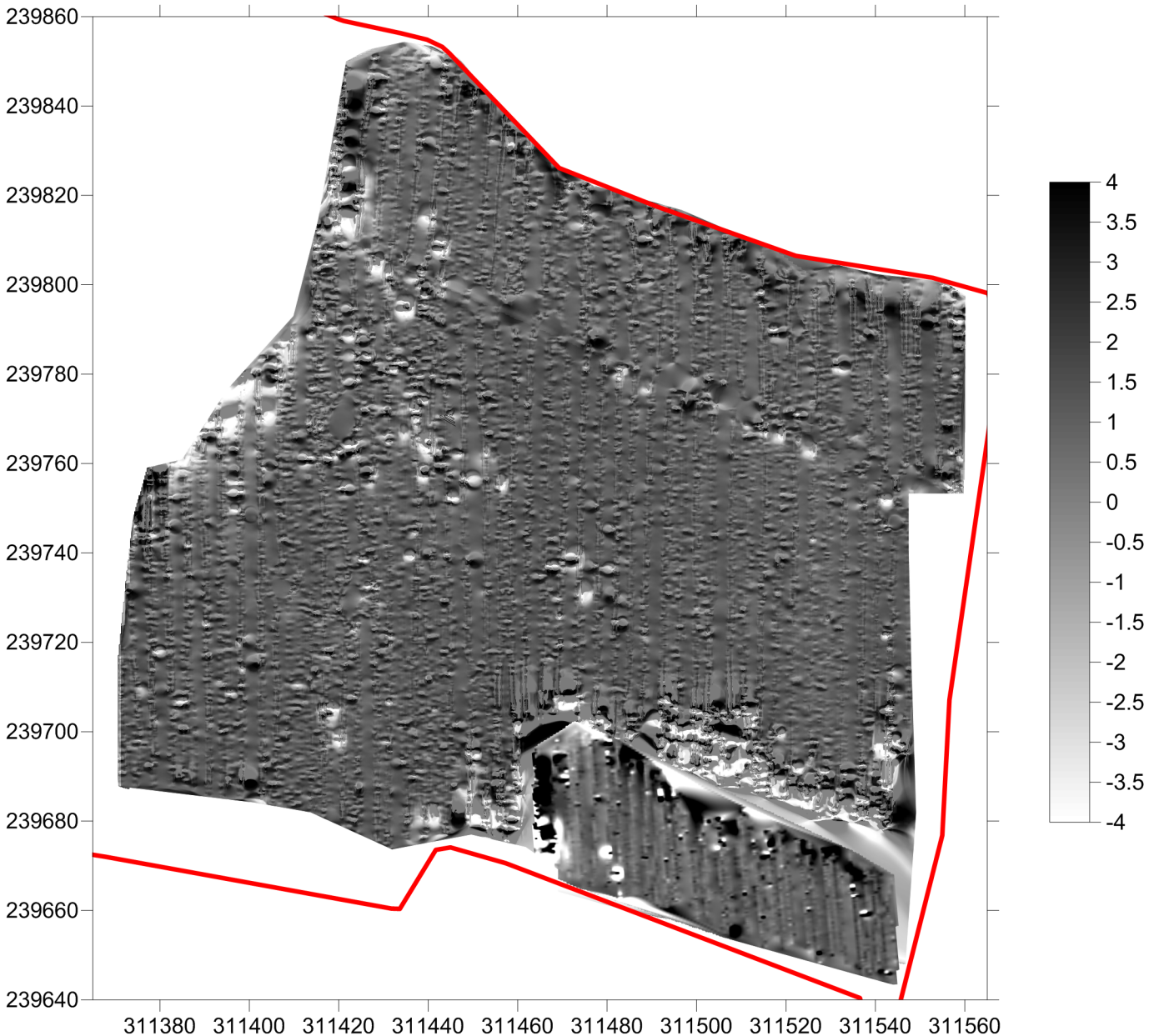


Figure 3 - First Edition 25-inch Ordnance Survey Sheet.



Key

Previously Known Feature	
High Potential to represent archaeology	
Moderate Potential to represent archaeology	
Low Potential to represent archaeology	

N

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Figure 4 - Cappoge, Fingal,Co.Dublin Geophysical (Fluxgate Magnetometry) Plot

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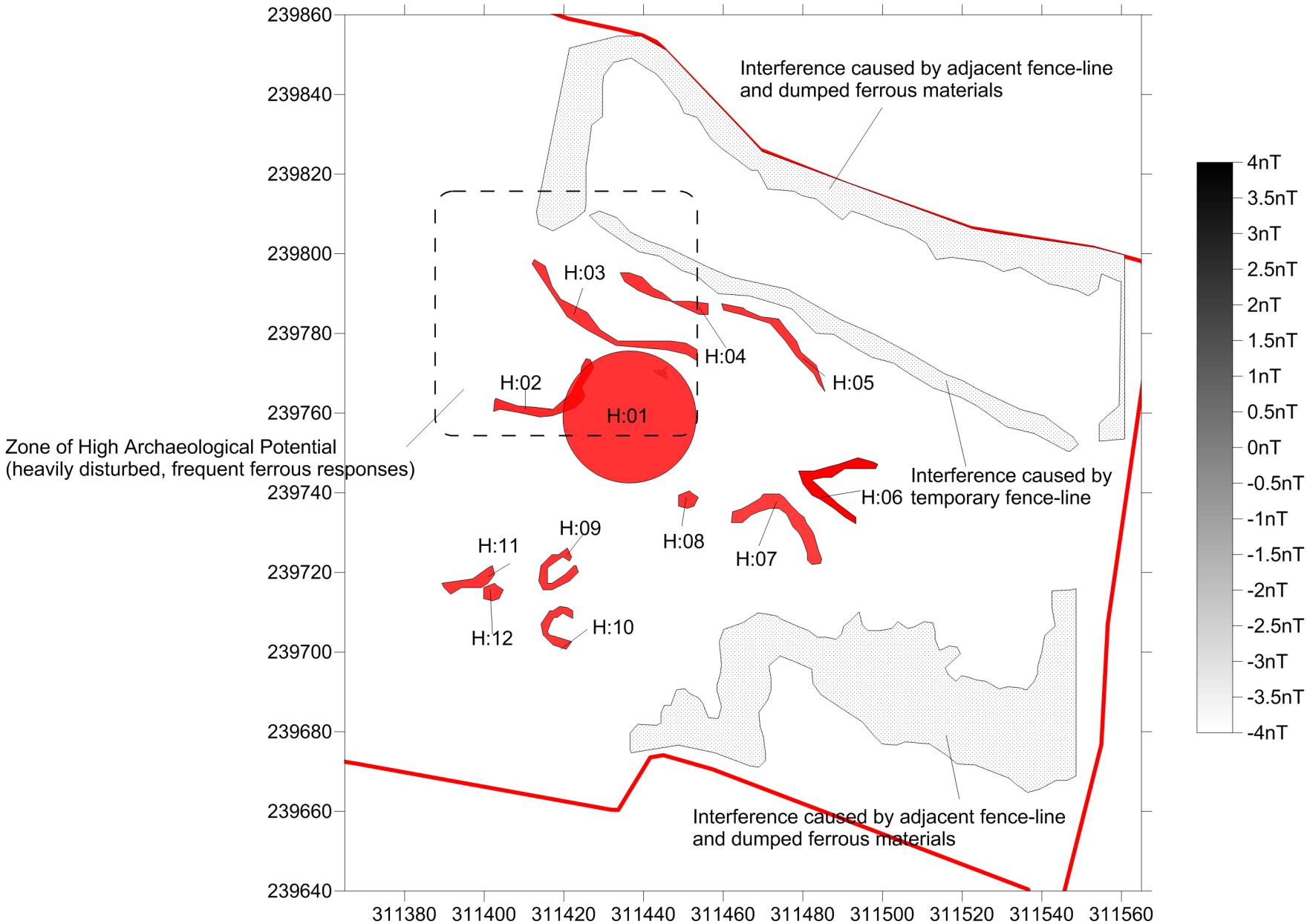

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Figure 5 - Cappoge, Fingal,Co.Dublin Geophysical (Fluxgate Magnetometry) Interpretation

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