AB HERITAGE
ARCHAEOLOGICAL CONSULTANCY

Cirencester to Fairford

Geophysics Survey Report

Client: ADAS UK LTD

AB Heritage Project No: 10553

Date: 20/05/15

Cirencester to Fairford

Geophysical Survey

Client	**ADAS UK Ltd**
Project Number	**10553**
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1. INTRODUCTION

1.1 Project Background

1.1.1 AB Heritage has been asked to undertake a geophysical survey on behalf of ADAS UK LTD, covering land at Cirencester to Fairford.

1.1.2 The purpose of this work is to identify potential surviving archaeological remains.

1.2 Site Location & Description

1.2.1 The proposed development site c.10ha (hereafter referred to as the site) centred at SP 07978 00342 is located c.5.8km south east of Cirencester and c.2.2km south west of Fairford, lying 1km south of the A417 road, and is currently covered by pasture.

1.2.2 Also adjacent to the northern boundary of the site is a Scheduled monument (1021448), which represents a Roman Villa and earlier settlement, remains.

1.3 Geology & Topography

1.3.1 The bedrock consists of the Cornbrash Formation – Limestone is Sedimentary Bedrock formed approximately 161 to 168 million years ago in the Jurassic Period. Local environment previously dominated by shallow carbonate seas. No superficial geology is noted within the site on the mapping examined (BGS 2015). This form of geology is not known to cause major variations within geophysical data;

1.3.2 The site rises to the west and sits at a height of c.95m Above Ordnance Datum AOD with a drop c.3m to the lowest point in the east along the Ampney Brook.

2. AIMS & METHODOLOGY

2.1 Aims of Survey Works

2.1.1 Geophysical survey is a programme of non-intrusive archaeological work. The aims of this 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; and
- Provide recommendations for any further archaeological work(s) necessary to contribute to the mitigation of the impacts of proposed development on these potential features.

2.2 Methodology of Survey Works Summary

Site Specific Information

2.2.1 A magnetometry survey was undertaken covering an area of c. 10ha, between the 5th to the 7th of May 2015.

2.2.2 The AB Heritage staff members who undertook the works were Tom Cloherty (Archaeological Technician) and Samuel Burn (Site Technician).

2.2.3 The weather conditions for the work were overcast with strong winds and intermittent rain, although hampering there were no relative adverse effects to the data collection.

Equipment

2.2.4 The magnetic survey equipment used was two Bartington Grad-601 (fluxgate magnetometers). Please see Appendix A, which contains a detailed methodology for the works undertaken; however, briefly, Table 1, below, shows site specific information on how the magnetometer was set up:

Table 1: Setting Parameters of Magnetometer

Grid Size	30x30 metres
Data Capture Distances	1m x 0.25m
Sensors	2
Sensitivity	0.1nT

2.2.5 A GPS was used to setup the geophysical survey was a Trimble GeoXR has a sub-centimetre accuracy suitable for this survey.

2.3 Known Constraints

2.3.1 The known constraints that are not likely to inhibit the geophysical survey were the areas of dense vegetation located in the south eastern corner of the site, along the Ampney Brook River, shown in Figure 5 making the area inaccessible at time of survey.

3. RESULTS & INTERPRETATIONS

3.1 Geophysical Survey Results

3.1.1 The raw and geophysical survey data have been plotted on Figure 2 and 3 respectively, with the interpretation of these results on Figure 5. For cross-referencing purposes the interpretation results have been labelled **[GP]** numbers.

*Possible Archaeological Features [**GP 1-2**]*

3.1.2 Four positive linear features [**GP1-a**] run in east to west direction parallel to each other, with the two northern most linears separated by c.10m, the features have a reading of 1-4nt (nanoteslas). The longest linear is located c.90m further to the south and is approximately 220m long.

3.1.3 Another positive linear feature runs on a north northwest south southeast direction, perpendicular to the other features [**GP1-a**] and is c.110m in length.

3.1.4 Positive linear features labelled [**GP1-d**] and [**GP1-h**] follow an east to west direction with a reading of 1-4nt and are c.10m apart, running parallel. Two of the positive linear features further to the south [**GP1-d**] run in a southeast to northeast direction; and have lower readings of 0.5-1nt, running parallel c.5m apart. These features may be in a series and follow a similar pattern to the features identified as [**GP1-a**].

3.1.5 Within the site [**GP1-h**] there is also a sub-circular feature with a diameter of c.5m butting up to the edge of the boundary of the Scheduled monument site, surrounded by several linears running in an east to west direction [**GP 1-h**] .

3.1.6 In the southern end of the survey area another weaker positive linear feature runs in a south-west to north-east direction with a reading of between +0.5 to +1.5nt. The linear is approximately 80-90m in length and to the west of the feature a circular anomaly [**GP2-e**] cuts the line on the southernmost corner.

3.1.7 Two positive linear features have been identified [**GP1-c**] running centrally within the site. The eastern linear of the two has a stronger positive polarity of 4nt and runs on a north north-west to south south-east direction and is approximately 150m in length. A circular feature crosses the eastern linear in the south of the survey area [**GP2-e**]. The western positive linear [**GP 1 – c**] has a lower polarity reading of 2 to 3nt, and runs on a north-west to south-east direction.

3.1.8 A series of three separate linear features follow a north-south direction which are c.10m in length in [**GP1-f**]. Each has an approximate positive reading of between 2 to 4nt.

3.1.9 To the south of the Scheduled monument there is a group of separate linear and curvilinear features [**GP1-g**] located in the east of the survey area.

3.1.10 Over 20 circular features [**GP2-b**] have been identified with a variation in size, c.1-2m, and readings between1-3nt. The circular features are scattered in an amorphous pattern. Also identified within [**GP2-b**] approximately 15m to the east is a large circular feature, c.3-5m in diameter, with a bipolar reading of -6 to 20nt.

3.1.11 Another collection of more than 20 small circular features, ranging from 0.5-2m in diameter, can be observed [**GP2-e**] with a positive reading of between 0.5 to 3nt. The features are spread across the field. Of note is a circular feature to the south, on the north-south linear feature [**GP1-c**], which has a larger diameter of c.2m and has a reading of -5nt to 45nt. In addition to this circular there is another smaller circular feature c.10m to the east following an east-west linear feature with a strong dipolar reading of -34 to +96nt.

Other Features [**GP3-5**]

3.1.12 The area, in the centre of the site, contains a series low positive linear features [**GP 3**] running in a north to south direction which have a reading of 0-0.2nt. Di polar [**GP 6**] anomalies are located throughout this area.

3.1.13 Also a positive linear feature with an associated negative response is situated running on a north to south traverse in the western side of the site [**GP5]**.

3.1.14 In the most north-eastern corner of the survey area, there is a an area of magnetic disturbance [**GP4**], which has a varied response of +/-3nt.

3.2 Geophysical Survey Interpretation

3.2.1 Interpretation of the results of geophysical survey is based on professional judgement as to the likely/probable cause of an anomaly or reading. For example, strong dipolar discrete anomalies of small size are often associated with ferrous debris or similarly magnetic debris. In addition, where a positive linear anomaly is recorded, which has a negative anomaly associated alongside either side of it, is often likely to relate to the line of a modern service.

Table 2: Interpretation of Geophysical Anomalies

AB No	Appearance	Potential Cause
GP 1	Positive Linear Features	Possible Archaeology
GP 2	Positive Circular features	Possible Archaeology (Pits)
GP 3	Positive Parallel Linear features	Possible Agricultural Features
GP 4	Magnetic Disturbance	Possible building activity or disturbed ground
GP 5	Bi-Polar Anomaly	Utility/Modern Service
GP 6	Amorphous magnetic debris	Di-polar Anomalies

3.2.2 The majority of the archaeological features identified [**GP1-a, c, d, & f-h]** within the site are likely to be a collection of ditches and field boundaries that are typical of a Romano-British agricultural landscape, which may relate to the Roman Villa Scheduled Monument (1021448) located adjacent to the northern boundary . Also in the north west of the site two positive linears [**GP 1-a**] which run parallel, could relate to the possible line of a Roman road.

3.2.3 Possible archaeological pits [**GP2-b,c**] are also likely to be related to agriculture activity within the site, though they have no correlating pattern and are relatively small in diameter (1-2m). Two larger possible archaeological pits [**GP2-b,c**] are likely to have a more modern origin due to their high negative and positive readings.

3.2.4 An area of Magnetic disturbance [**GP 4**] located within the north eastern side of the site could possibly relate to disturbed ground through building activity, or can be due to disturbance created from a mass movement of ground within this area.

3.2.5 A modern utility [**GP 4**] also runs through the western side of the site, in a north to south direction.

3.2.6 Other features identified within the site relate to further agricultural activity, which include multiple positive parallel features [**GP3**] identified within the centre of the site. Also a limited distribution of magnetic debris [**GP6**] likely caused by modern farming activity.

4. CONCLUSION

4.1.1 A geophysical survey was undertaken by AB Heritage Limited, Cirencester to Fairford survey area. The purpose of this work was to understand the potential for any archaeological remains to survive undisturbed and, where possible, identify the form, function and extent of any potential remains.

4.1.2 The potential for archaeological features in relation to the geophysical data is likely to be higher due the close proximity of the Roman Villa scheduled monument (1021448) located adjacent to the northern boundary.

4.1.3 The geophysical survey identified possible archaeological features; [**GP1 a, c-d, f-h**], possible archaeological pits [**GP2 b-e**], an area of ground disturbance [**GP 4**], and agricultural activity [**GP 3**] within the boundaries of the site.

4.1.4 Based on the findings of this geophysical survey and the close proximity of the Roman Villa site, it is likely the site contains extensive archaeological remains dating to Roman period and possibly earlier.

5. ARCHIVE

5.1.1 The Site Archive will contain the following, as a minimum:

Table 3: Site Archive Data

Archive	Format
Raw Geophysical Data files	XYZ and Text
Processed geophysical data files	JPEG, BMAP
Archaeological Interpretation	Shape Files ARC GIS
Final Report	PDF
Final Images	PDF

5.1.2 A physical and digital archive will be stored in a suitable format at AB Heritage Limited offices in Taunton, Somerset.

6. REFERENCES

BGS (British Geological Society) 2015.*Geology of Britain viewer.* http://mapapps.bgs.ac.uk/geologyofbritain/home.html.

IFA, 2011.Standard and Guidance for archaeological geophysical survey.

Jones, D.M. (ED) 2008. Geophysical Survey in Archaeological Field Evaluation. English Heritage.

Schmidt, A. 2002. Geophysical Data in Archaeology*: a Guide to Good* Practice. Oxford. Oxbow.

Appendix 1 Technical Information on Geophysical Survey

FLUXAGTE MAGNETOMETRY SURVEY

The magnetic survey is carried out using a fluxgate gradiometer, which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field, whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

Survey equipment

The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1 nanotesla (nT).

Sample interval and depth of scan

The magnetometer data is collected in 30mx30m grids at a resolution of 1m x 0.25m. This sample density is recommended for site evaluation (English Heritage, 2008). This equates to 3600 points per 30mx30m grid. The magnetometer has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects are buried within the site.

Data capture and processing

The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

GPS METHODOLOGY

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to sub-cm accuracy, a far greater accuracy than a standard GPS unit. An RTK system uses a base station receiver and a number of mobile units (rovers). The base station takes measurements from satellites in view and then broadcasts them along with its known position to the rover receivers. The rover receiver also collects measurements from the satellites in view and processes them with the base station data. The rover then computes its location relative to the base.

During such a survey a Trimble GeoXR Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) is used to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey. The data is then downloaded from the unit on the day, using a USB stick.

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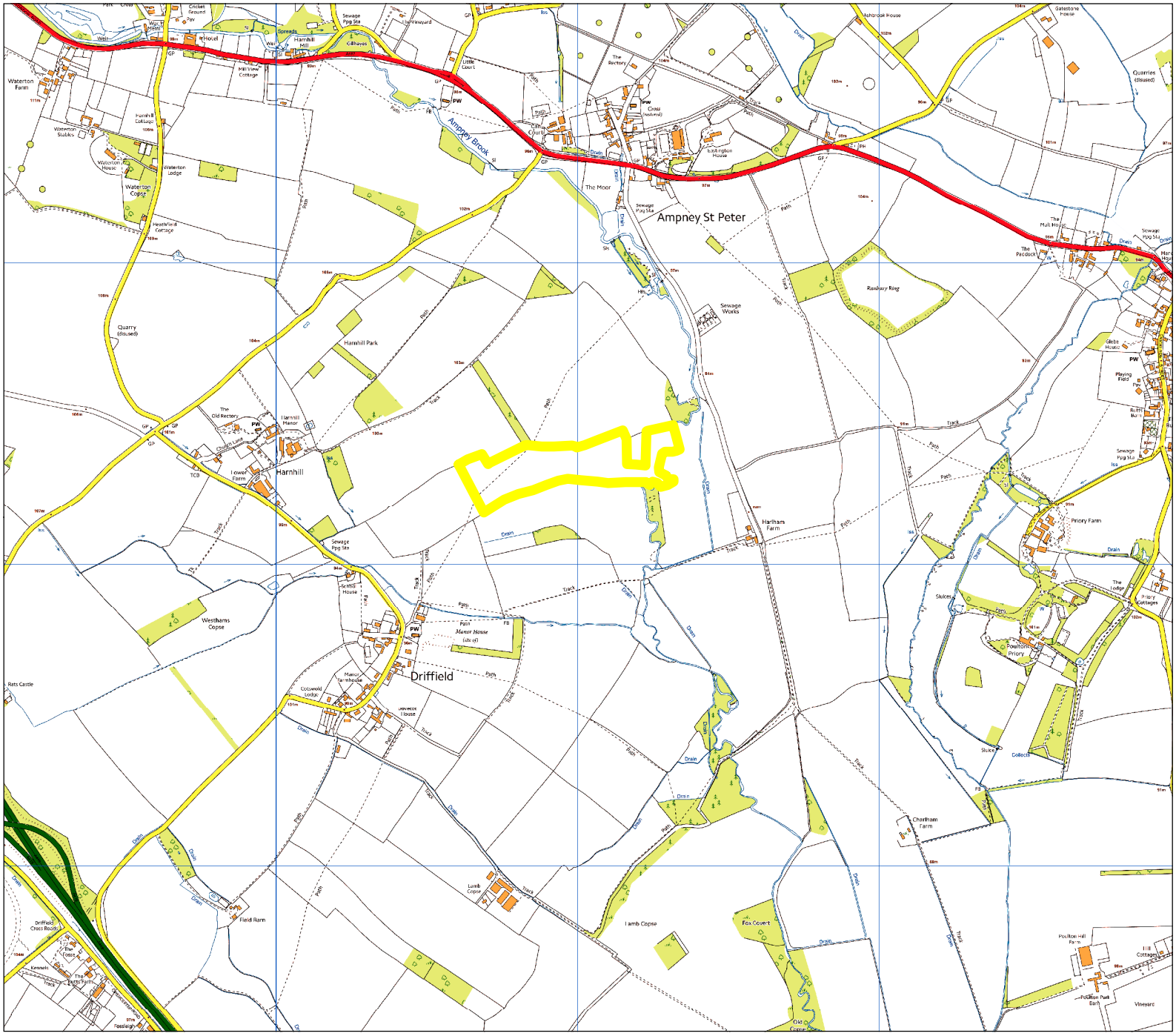

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Legend

Survey Area

0 375 750 1,500 m

Figure 1: Site Location and Field Identification

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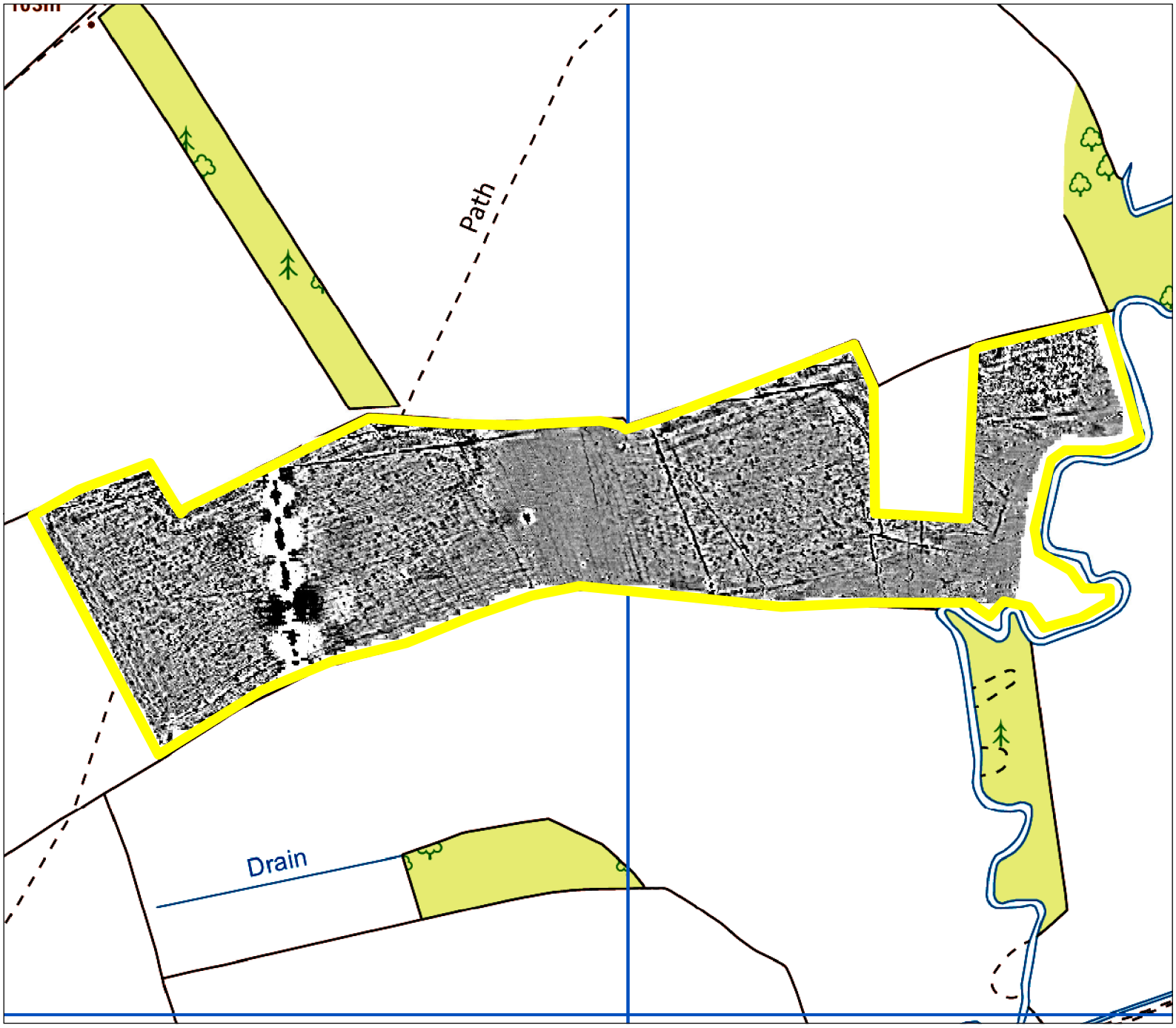

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Legend

Survey Area

+1

Plotting Perameters

-1

0 87.5 175 350 m

Figure 2: Raw Geophysical Data

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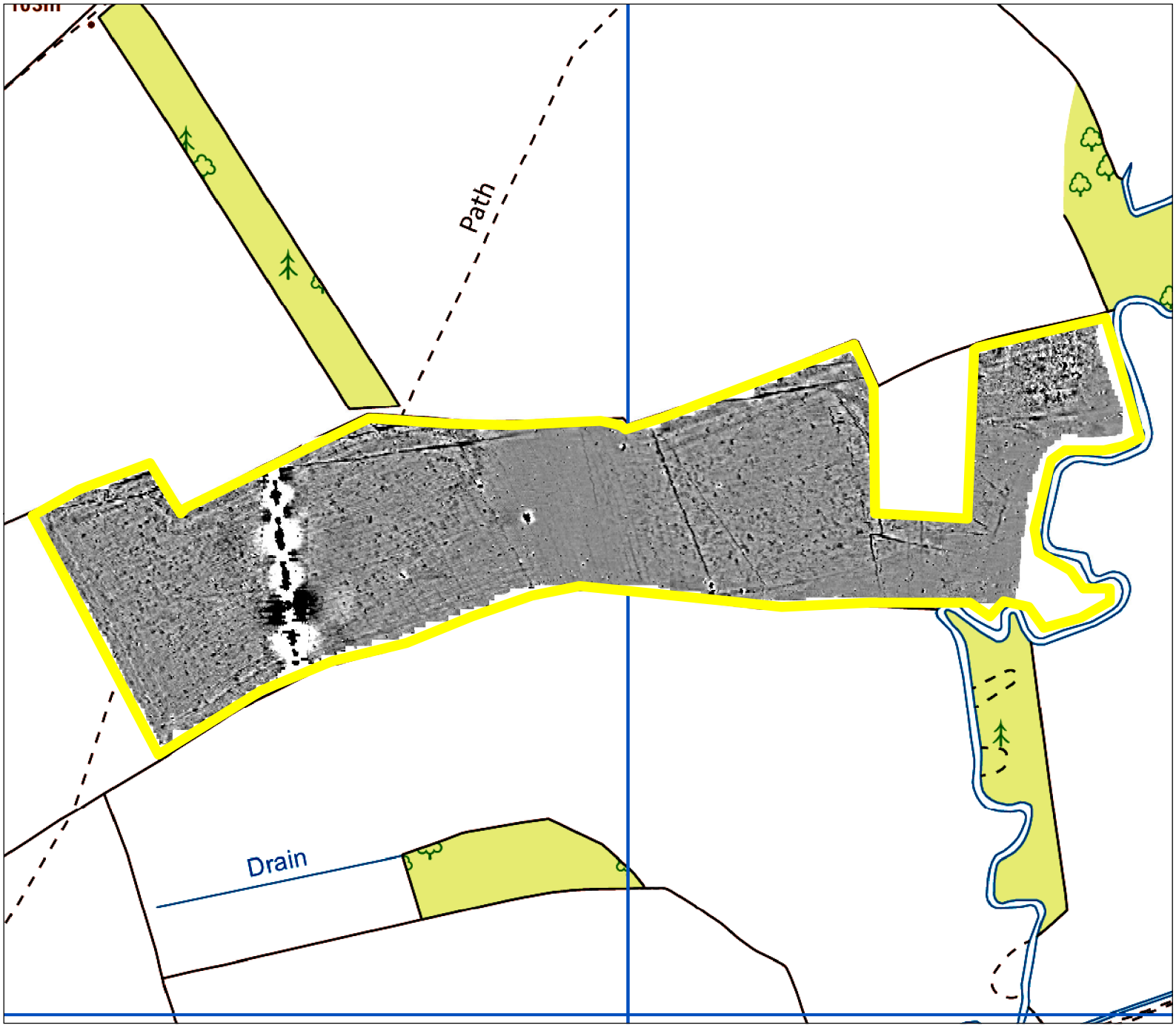

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Survey Area

+3

Plotting Perameters

-3

0 87.5 175 350 m

Figure 3: Processed Geophysical Data

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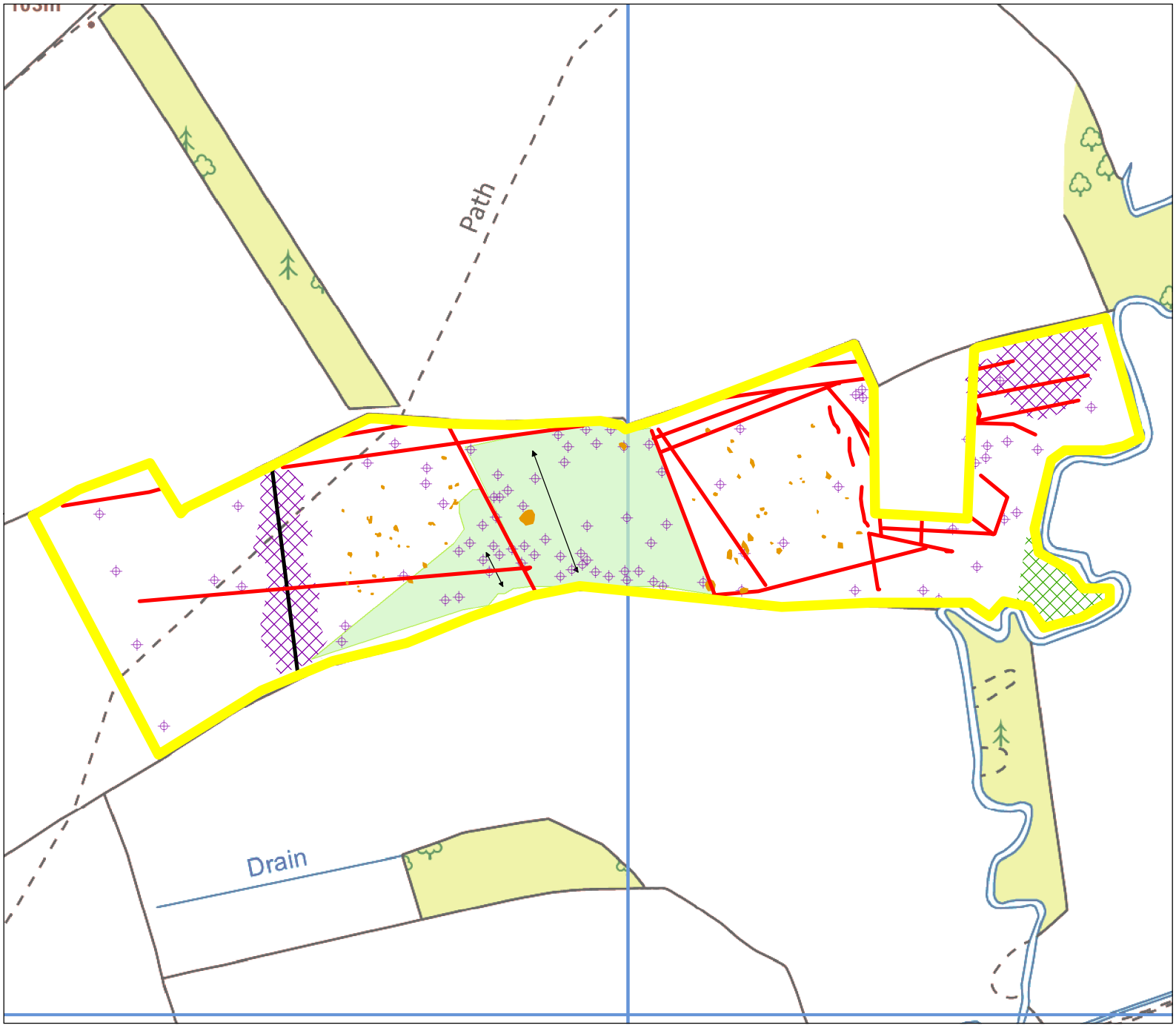

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Legend

- Possible Archaeology [GP1]
- Possible Pits [GP2]
- Possible Agricultural Features [GP3]
- Magnetic Disturbance [GP4]
- Utility [GP5]
- Di-Polar Anomalies [GP6]
- Overgrown Area
- Survey Area

0 87.5 175 350 m

Figure 4: Interpretation of Geophysical Data

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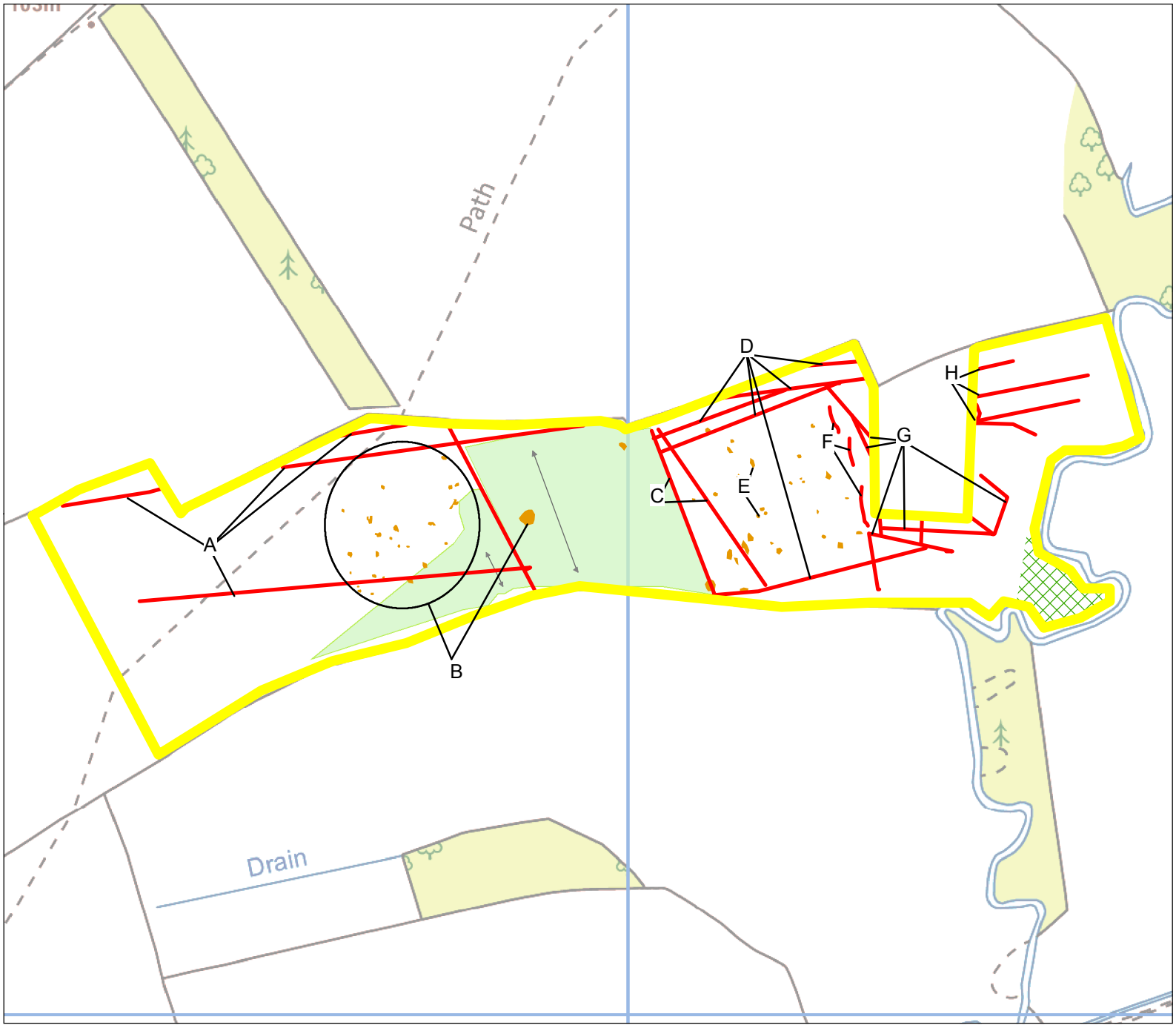

Legend

- Possible Archaeology [GP1]
- Possible Pits [GP2]
- Possible Agricultural Features [GP3]
- Survey Area
- Overgrown Area

Figure 5: Interpretation of Archaeological Features

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