# Blaby Solar Farm, Land East of Countesthorpe Road, Leicestershire

# Geophysical Survey Report

Client: ESCO NRG LTD

AB Heritage Project No:10695

Date:30/10/2015

# Blaby Solar Farm, Land East of Countesthorpe Road, Leicestershire

## Geophysical Survey Report

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| **Client** | **ESCO NRG Ltd** |
| **Project Number** | **10695** |
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| Rev Number | Description | Undertaken | Approved | Date |
|---|---|---|---|---|
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# FIGURES



# PLATES

# 1. NON TECHNICAL SUMMARY

1.1.1 AB Heritage Limited (herein AB Heritage) undertook a programme of geophysical survey from Monday 26th October 2015 to Tuesday 27 October 2015 at Blaby Solar Farm, Land East of Countesthorpe Road, Leicestershire, ahead of a proposed development.

1.1.2 The detailed magnetic geophysical survey concluded that there is a high potential for Archaeological features [**GP 1**] within the north western side of the site in relation to possible rectangular enclosures.

# 2. INTRODUCTION

## 2.1 Project Background

2.1.1 AB Heritage has been asked to undertake a geophysical survey on behalf of Esco NRG Ltd, for a proposed Solar Farm development at Blaby Solar Farm, Blaby, Leicestershire. National Grid Reference (NGR) SP 59021 96711.

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

## 2.2 Site Location & Description

2.2.1 The Proposed Development site is situated c. 700m to the north of the small settlement of Countesthorpe and c.6.5 km south of the Leicester city centre. It lies to the east of the Countesthorpe Road, the main thoroughfare between Countesthorpe and South Wigston, and adjacent to the road junction of Countesthorpe Road and Hospital Lane at NGR SP 59021 96711.

2.2.2 The proposed development site is a sub square agricultural field covering 5.6 hectares; situated to the north of the Meadows Sports Ground, and access road to the Wigston sewerage treatment works located immediately to the east. The site is bounded by mature hedged field boundaries to the south, east and west and by a ditched boundary to the north.

## 2.3 Geology & Topography

2.3.1 The British Geological Survey (BGS) indicates the superficial geology comprises Wigston Member, a sand and gravel deposit formed up to 3 million years ago in the Quaternary Period, and part of the Wolston Formation. It overlies a solid geology of Wilmcote Limestone Member, a mudstone and limestone, interbedded sedimentary bedrock formed approximately 197 to 204 million years ago in the Jurassic and Triassic Periods. This lies on the boundary of change to Blue Lias Formation and Charmouth Mudstone Formation (BGS 2015).

2.3.2 The overlying soils are slowly permeable seasonally wet but base-rich loamy and clayey soils (Cranfield Soil and Agrifood Industry 2015).

2.3.3 These forms of geology and soils are not likely to have an effect on the results of the geophysical survey, with the response being good to average.

2.3.4 The topography of the site has a slope running down from the western side of the site is at a height of c.85m Above Ordnance Datum, with a drop to the east of c.7m. The average height of the site is c.82m AOD.

# 3. AIMS & METHODOLOGY

## 3.1 Aims of Survey Works

3.1.1 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.

## 3.2 Methodology of Survey Works Summary

*Site Specific Information*

3.2.1 A geophysical survey was undertaken covering an area of c. 5.6 hectares (ha) on the 26th to 27th of October 2015.

3.2.2 The AB Heritage staff members who undertook the works were Glenn Rose (Project Officer), Tom Cloherty (Archaeological Technician).

*3.2.3* The weather conditions for the work were mainly dry and sunny throughout the survey; these conditions had no material impact upon the survey.

*Equipment*

3.2.4 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 |

3.2.5 A Trimble GeoXR GPS was used to setup the geophysical survey. This has sub-centimetre accuracy suitable to this survey.

## 3.3 Known Constraints

3.3.1 The known constraints within the survey area consisted of a singular tree situated within the centre of the site, occupying a small area that was not surveyed.

3.3.2 Also metallic fences situated around the site can cause magnetic disturbance c.1-2m from the fence.

**Plate 1 View of Tree Located on the western side of the field**

# 4. RESULTS

4.1.1 For the purposes of this detailed magnetic survey, results for the geophysics data have been shown within Figure 2 and 3, with interpretations shown in Figures 4 and 5.

4.1.2 Below is a factual account of the results.

Possible Archaeology [**GP 1 (1-10)**]

4.1.3 *Feature [GP 1 (1)]*- is identified as a positive Linear up to c. 50m in length situated in a north south direction, with an average reading of 2-4nanoteslas (nT).

4.1.4 *Feature [GP 1 (2)]* is two linear features 40-50m in length joined at a 'right angle' with reading readings between of 1-4nT.

4.1.5 *Feature [GP 1 (3)]* - a singular linear extending in a north to south direction at a length of 25m and a variation of readings between 2-5nT.

4.1.6 *Feature [GP 1 (4)]* - A strong positive area 16nT covering a small area of c.20$m^2$ , adjacent to negative area -40nT.

4.1.7 *Feature [GP 1 (5)]* - A collection linears running in multiple directions with the longest extending up to c. 50m in length and they appear to be adjoining features, with a variation of readings between 1-5nT.

4.1.8 *Feature [GP 1 (6)]* - A collection of linears located to the west of feature 5. It consists of an incomplete square enclosure, with linears below running in multiple directions. The feature covers an area of c.3600$m^2$ with a variation of readings between 1-6nT.

4.1.9 *Feature[GP 1 (7)]* – A singular linear, which extends in a north east to south west direction up to a length of c.10m with readings of 9-14nT.

4.1.10 *Feature [GP 1 (8)]*- A singular linear which is situated in a north east to south west direction up to a length of c. 15m with reading of 1-5nT.

4.1.11 *Feature [GP 1 (9)]*- A weak sub-rectangular feature covering c. 1800$m^2$ with readings of 1-4nT, the feature is missing the top linear to complete the rectangular shape .

4.1.12 *Feature [GP 1 (10)]*- A sub-rectangular shape located to the east of feature 9 covering a smaller area of c.225$m^2$ with readings of between 1-4nT.

Geological Features [**GP 2** (**11-13**)]

4.1.13 Feature [GP 2 (11-13)] shows areas of positive readings varying from 0nT to 2nT with the largest area 11 covering c.450$m^2$.

Magnetic Disturbance [**GP 3**] and Di Polar Anomalies [**GP 4**]

4.1.14 The majority of magnetic disturbance [**GP 3**] is located to the western side of the tree and also the western and eastern edge of the field.

4.1.15 Di Polar anomalies [**GP 4**] are located throughout the site with a higher concentration within the eastern side of the site.

# 5. INTERPRETATIONS AND DISCUSSION

5.1.1 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.

5.1.2 GP numbers have been used to place interpretations into categories. Below is a discussion of the results, there has also been applied a confidence rating to the features identified (See Appendix 3). As with English Heritage 2008 guidelines for geophysical survey for archaeological field evaluation, this is an acceptable additional option only on the clear understanding that such ratings are subjective and potentially fallible assessments which can only really be tested through excavation.

**Table 2: Interpretation of Geophysical Anomalies**

| AB No | Appearance | Potential Cause |
|---|---|---|
| **GP 1 (1-10)** | Positive Features | Possible Archaeology |
| **GP 2 (11-13)** | Low Positive Areas | Geological |
| **GP3** | Area of strong negative and positive readings | Magnetic disturbance, caused by disturbed ground or nearby metallic objects |
| **GP 4** | Di-polar Anomalies | Amorphous Magnetic Debris |

5.1.3 The majority of possible archaeological features [**GP 1**] identified within the site are mainly situated to the north west. These features have been identified as mainly positive linear features [**GP1-(1, 3, 5, 7-8)**], with sub-rectangular features [**GP1-(2,4,6,9,10)**] also noted within the area.

5.1.4 Features [**GP1 (1-6)**] identified in the northern area of the site; could relate to possible rectangular enclosures covering a fairly substantial area (c. 125m). There is a moderate confidence that these features represent possible archaeology; while some linears could relate to agricultural activity, sub-rectangular features warrant further investigation along with the linear features.

5.1.5 From the eastern side of the site to the western side of the site there appears to be a change in the amount of di-polar anomalies [**GP 4**] this could be caused by a variation in the geology of the site, with possible geological features identified in the eastern side of the site [**GP2 (11-13)**]. The confidence of this interpretation though is low to moderate due to the mapping of a geological change on the British geological viewer (BGS 2015) outside of the boundary of the site; the feature could be also due to a change in the topography of the site.

5.1.6 The site has been extensively farmed, with a high level of magnetic disturbance [**GP 3**] and di-polar anomalies [**GP 4**] likely associated with agricultural activity. The site at one point also

noted on the 1887-89 Ordnance survey map was split into two fields, with the known former field boundary also identified within the geophysics results extending in an east to west direction across the centre of the site.

# 6. CONCLUSION

6.1.1 A geophysical survey was undertaken by AB Heritage Limited at the proposed site for Blaby Solar Farm, taking place over 2 days, from the 26th to the 27th of October 2015.

6.1.2 The purpose of this work was to understand the potential for any archaeological remains to survive within the site, and, where possible, identify the form, function and extent of any potential remains.

6.1.3 The geophysical survey identified high amount of magnetic disturbance [**GP 3-4**], likely due to modern agricultural activity. It also identified archaeological potential [**GP 1**] within the site, in the form of multiple linear and sub-rectangular features, which could relate to possible enclosures. Along with a known former field boundary identified in the 1887-1889 Ordnance survey map.

6.1.4 Overall the potential for possible archaeology is high within the north western corner of the site, based on the interpretation of the geophysical survey.

# 7. FURTHER RECOMMENDATIONS

7.1.1 The geophysical survey has found potential archaeological features, further work is recommend in the form of archaeological evaluation trenching to understand the form, significance and possible date of any features, paying particular attention to sub-rectangular features [**GP1 (1-2,4,6,9,10)**] and linear features [**GP1-(1, 3, 5, 7-8)**] identified within the site.

# 8. ARCHIVE

8.1.1 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 |

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

# 9. REFERENCES

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

CIFA, 2014.Standard and Guidance for archaeological geophysical survey.

Cranfield Soil and Agrifood Industry, 2015. *Soilscapes viewer*, http://www.landis.org.uk/soilscapes/

Garwood, A. An Historic Desk Based Assessment Blaby Solar Farm, Land East, of Countesthorpe Road. Pre-Construct Archaeology

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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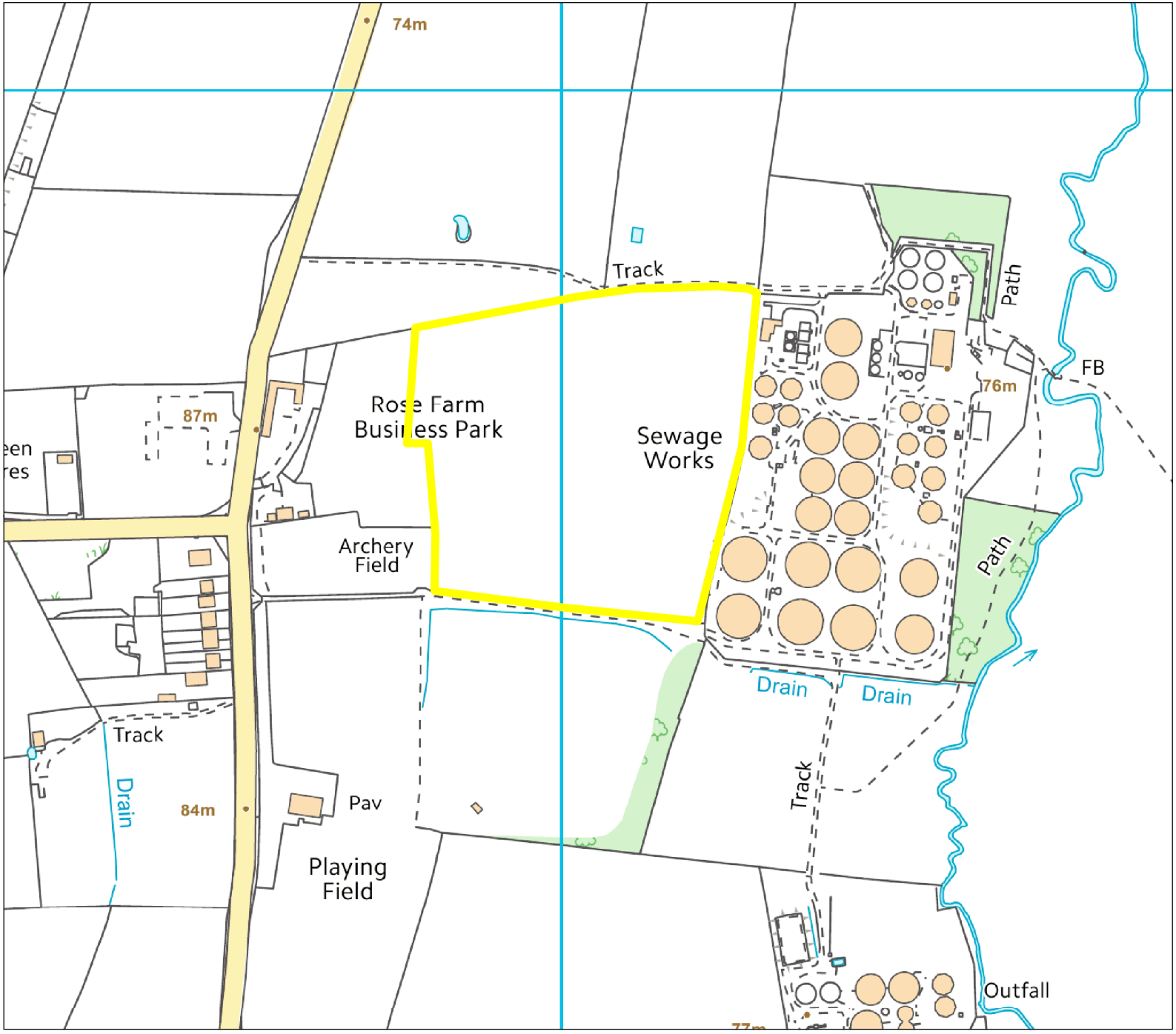


N

Legend

Site Boundary




0 100 200 400 m

Figure 1: Site Location

Project: Blaby Solar Farm

| Date: 22/10/15 | Job Number: 10695 |
|---|---|
| Drawn by: ZE | Approved by: GR |

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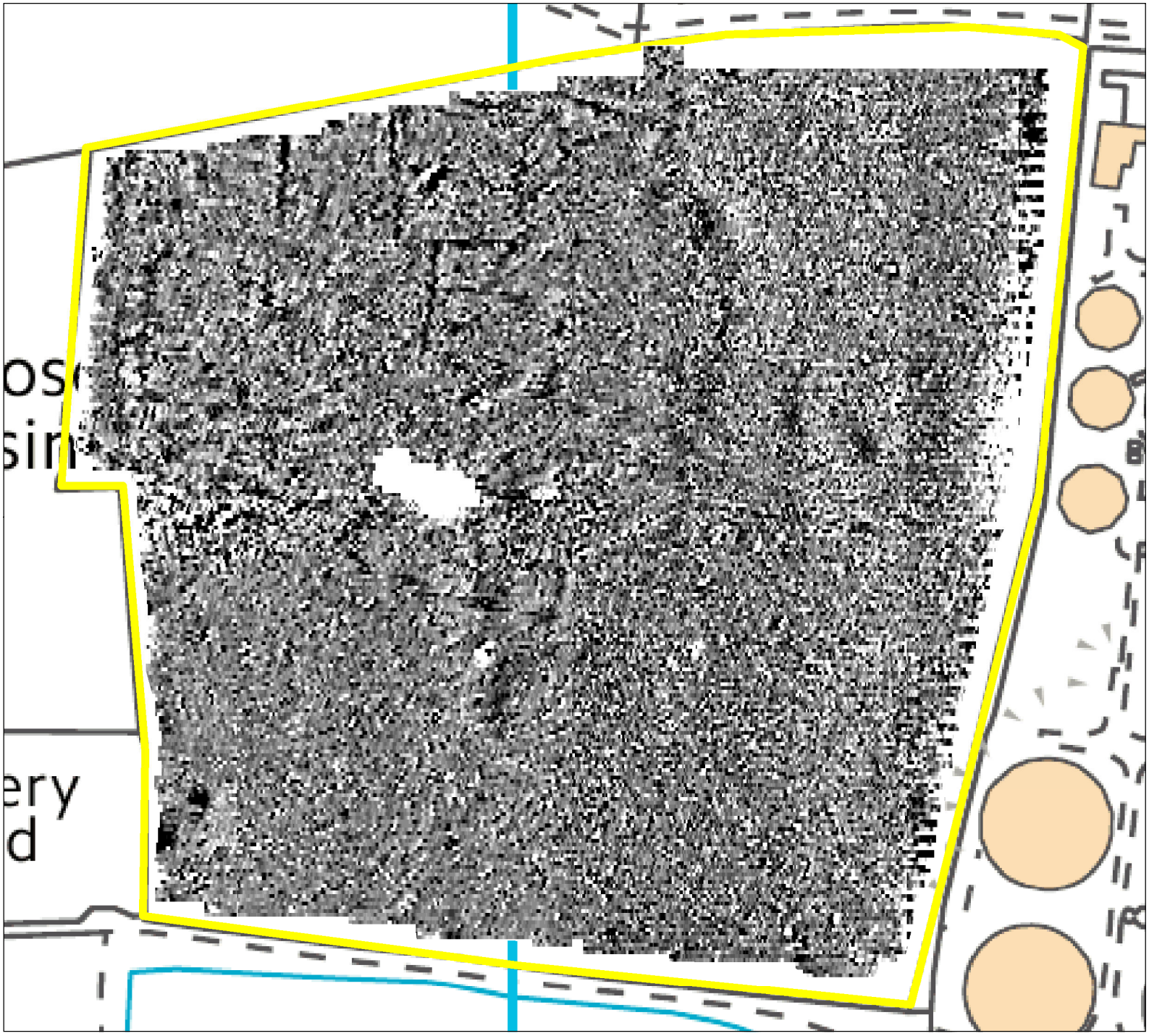




Figure 2: Raw Geophysical Data

Project: Blaby Solar Farm

| Date: 28/10/15 | Job Number: 10695 |
|---|---|
| Drawn by: ZE | Approved by: GR |

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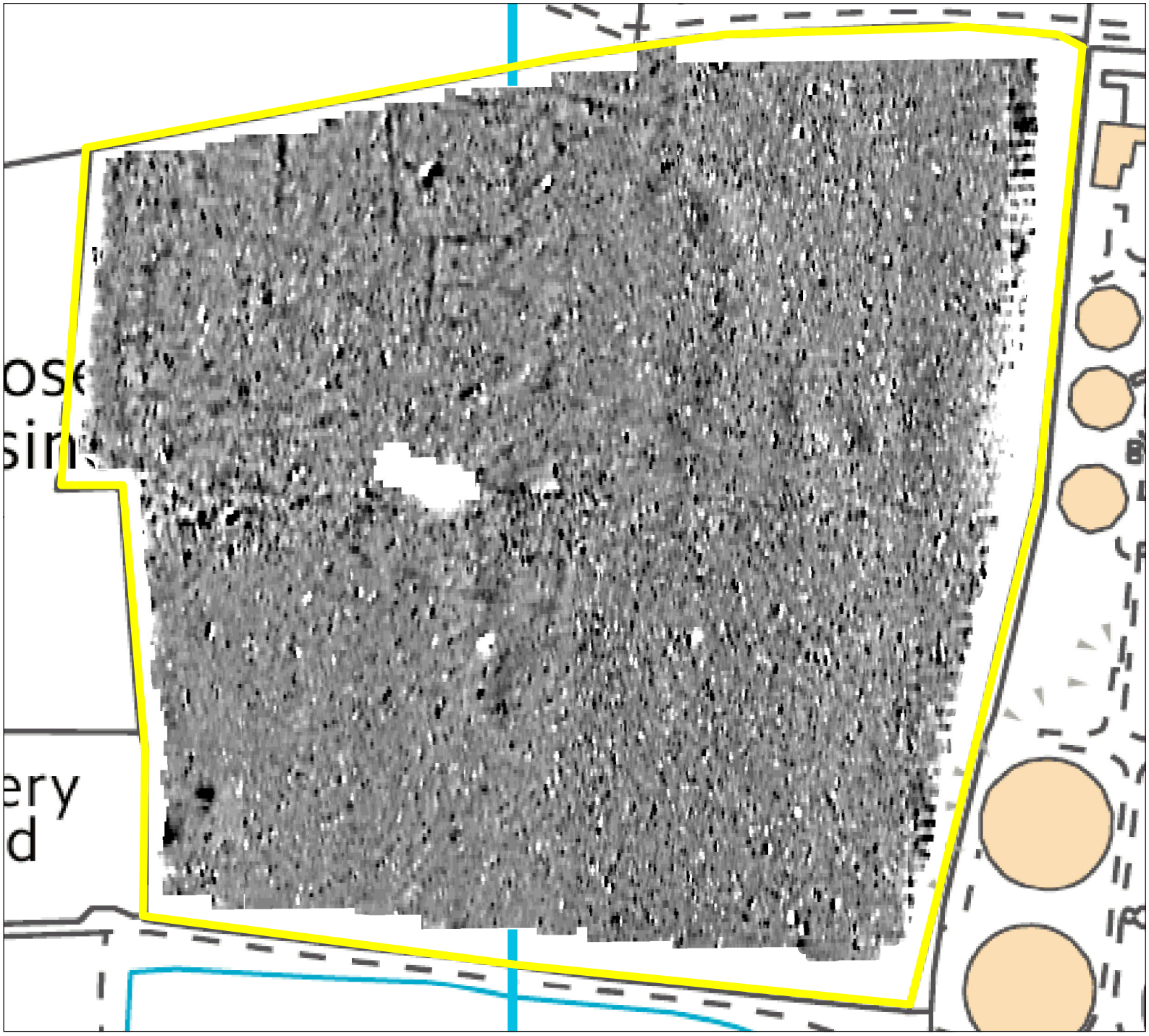




Figure 3: Processed Geophysical

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| Date: 28/10/15 | Job Number: 10695 |
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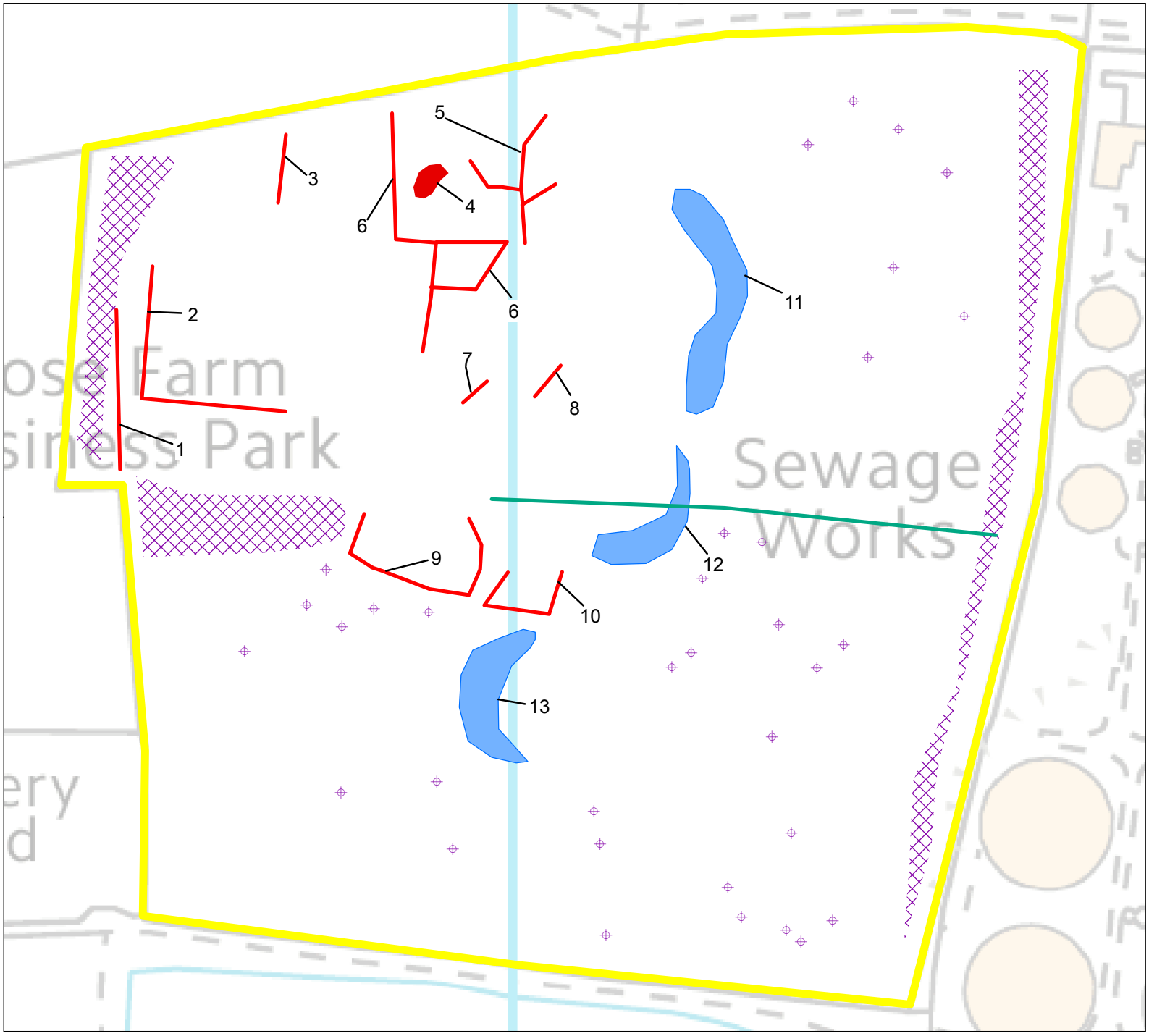


Legend

- Possible Archaeology [GP1 1-10]
- Geological Features [GP2 11-13]
- Magnetic Disturbance [GP3]
- Di-Polar Anomalies [GP4]
- Known Former Field Boundary
- Site Boundary



Figure 4: Interpretation of Geophysical Data

Project: Blaby Solar Farm

| Date: 28/10/15 | Job Number: 10695 |
|---|---|
| Drawn by: ZE | Approved by: GR |

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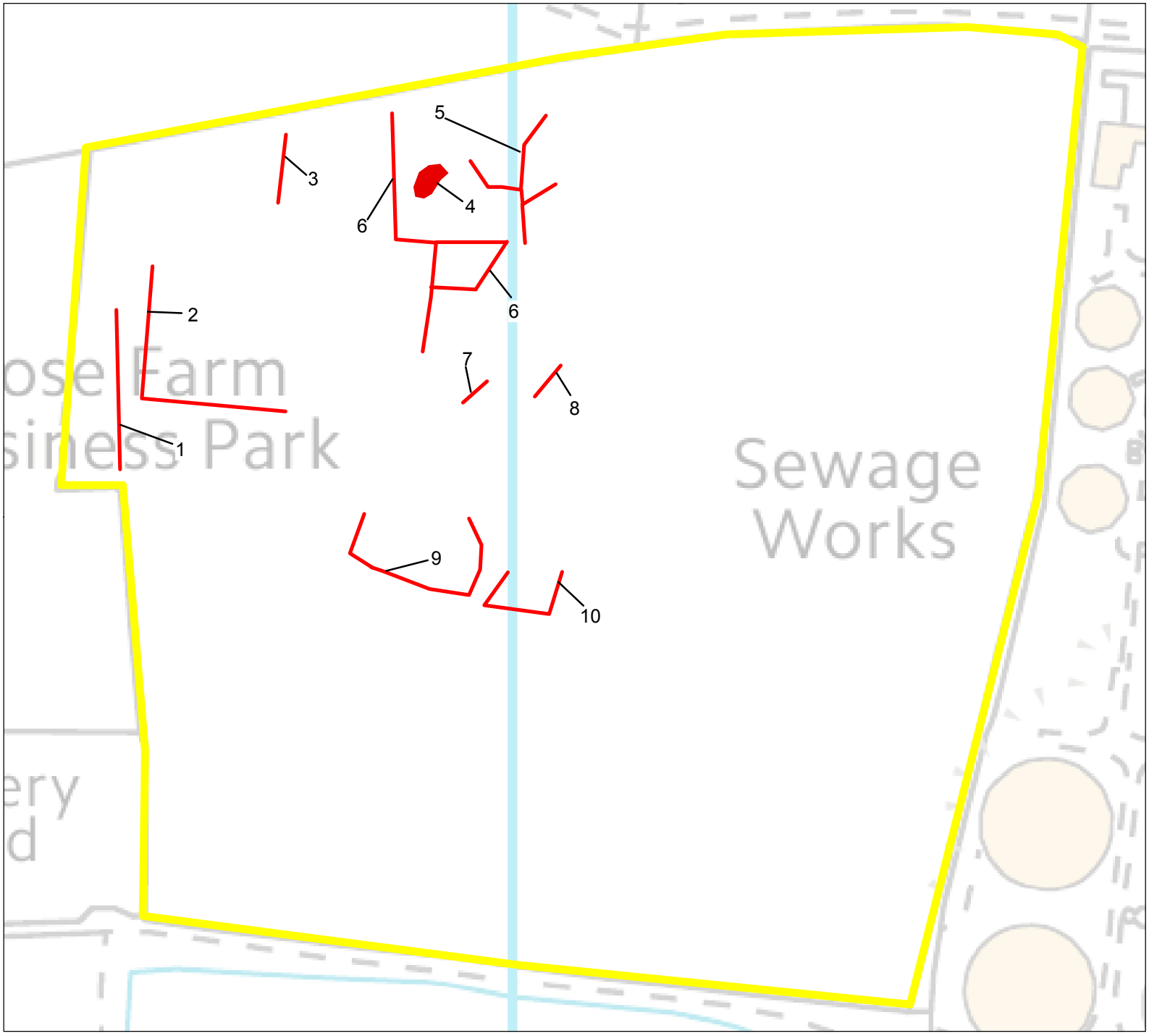




Figure 5: Interpretaton of Archaeology

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