
NPA GEOPHYSICAL SURVEYS

Client Report CP684

May 2008

GEOPHYSICAL SURVEYS OF LAND AT MANTHORPE, GRANTHAM, LINCOLNSHIRE

on behalf of

WARDELL ARMSTRONG LLP

NGR SK 916 382

OASIS ID: northpen3-43135

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SUMMARY

In May 2008, North Pennines Archaeology Ltd, commissioned by Wardell Armstrong LLP, undertook geophysical surveys of 23ha of land to the northwest of Manthorpe, Grantham, Lincolnshire (NGR SK 916 382). The work was undertaken as predetermination works to support a planning application for a residential development at the site. The objective of the geophysical surveys was to determine the presence/absence, nature and extent of any archaeological anomalies within the proposed development area.

Two archaeological sites were recorded in the Lincolnshire County Council Historic Environment Record (HER), which fall within the proposed development area. The earthworks of medieval ridge and furrow cultivation had previously been identified on the east side of the site (HER 36396), and a scatter of Romano-British pottery had been recorded on the southwest part of the site (HER 30437). A WWI military railway, known as the Belton War Development Line, was also believed to cross the northwest corner of the proposed development area.

Geomagnetic survey was undertaken over six separate areas (Areas 1-6) within the study area, covering 50% of the area of the proposed new residential development. The surveys detected agricultural features over the majority of the study area. These comprised the well-preserved remains of former ridge and furrow earthworks of probable medieval date, and a possible post-medieval field boundary. It was evident that the plough furrows belonged to at least two open fields, which may have been associated with one of the nearby deserted medieval villages of Towthorpe or Easthorpe. The location of the WWI military railway was detected as a positive magnetic anomaly at the northwest corner of the study area.

No early features were detected in the area of the scatter of Romano-British pottery previously recorded on the southwest part of the site. It is possible that the pottery was spread on to the field as midden material in the Romano-British period.

1 INTRODUCTION (*Figures 1 & 2*)

- 1.1 In May 2008, North Pennines Archaeology Ltd, commissioned by Wardell Armstrong LLP, undertook geophysical surveys of 23ha of land to the northwest of Manthorpe, Grantham, Lincolnshire. This was following an application for a proposed new residential development at the site. The objective of the geophysical surveys was to determine the presence/absence, nature and extent of any archaeological anomalies within the proposed development area. The work was conducted in accordance with a Written Scheme of Investigation (WSI), produced by Wardell Armstrong LLP (Wardell Armstrong 2008), and the relevant English Heritage and IFA guidelines.
- 1.2 The proposed development area is situated on the northwest outskirts of Manthorpe, to the northeast of Manthorpe Grange. The site is bounded by Belton Lane to the north, High Road to the east, and a railway line to the west. The site is centred on Ordnance Survey grid reference SK 916 382 (Figure 1).
- 1.3 Two archaeological sites are recorded in the Lincolnshire County Council Historic Environment Record (HER), which fall within the proposed development area. The earthworks of medieval ridge and furrow cultivation have previously been identified on the east side of the site (HER 36396), and a scatter of Romano-British pottery has been recorded on the southwest part of the site (HER 30437). A WWI military railway, known as the Belton War Development Line, was also believed to cross the northwest corner of the proposed development area.
- 1.4 The solid geology of the area comprises Lower and Middle Lias limestones and shales. These are overlain by glacial deposits of boulder clay.
- 1.5 The proposed development area measured 47ha in total. At the time of the survey this area comprised 3 arable fields, and a small strip of pasture to the southwest of Manthorpe Grange. A line of electricity pylons crossed the study area, aligned northwest to southeast. A stream, known as Running Furrows, ran along the southeast side of the site.
- 1.6 The geophysical survey areas measured 23ha in total, divided into six separate areas (Areas 1-6). These survey areas were determined by Wardell Armstrong LLP, and were selected to target the area of the WWI military railway (Area 1), the area of the Romano-British pottery scatter (Areas 2 & 3), and the area of ridge and furrow (Areas 4, 5 & 6), as well as sampling apparently blank areas (Figure 2).
- 1.7 The objective of the geophysical surveys was to determine the presence/absence, nature and extent of any archaeological anomalies within the proposed development area, and the presence/absence of any known modern anomalies within the study area, which may affect the results. The results of the geophysical survey were to be used to inform the need for any further evaluation work within the proposed development area.
- 1.8 The geophysical surveys were conducted by Kevin Mounsey, Angus Clark, and Christian Sutton between 6th May and 20th May 2008, and managed by Martin Railton, NPA Project Manager. This report was prepared and illustrated by Martin Railton.

2 METHODOLOGY

2.1 Standards

2.1.1 The geophysical survey and reporting were conducted in accordance with English Heritage guidelines (English Heritage 1995), and the recommendations of the Institute of Field Archaeologists (IFA 2002).

2.2 Technique Selection

2.2.1 Geomagnetic survey was selected as the most appropriate technique, given the non-igneous environment, and the expected presence of cut archaeological features at depths of no more than 1.5m.

2.2.2 This technique involved the use of hand-held gradiometers, which measure variations in the vertical component of the earth's magnetic field. These variations can be due to the presence of sub-surface archaeological features. Data was recorded by the instruments and downloaded into a laptop computer for initial data processing in the field using specialist software.

2.3 Field Methods

2.3.1 The study area was located in three separate arable fields. Six separate areas were surveyed (Areas 1-6). A 30m grid was established in each area, and tied-in to known Ordnance Survey points using a Trimble 3605DR Geodimeter total station with datalogger.

2.3.2 Geomagnetic measurements were determined using a Bartington Grad601-2 dual gradiometer system, with twin probes set 1m apart. It was expected that significant archaeological features at a depth of up to 1.5m would be detected using this arrangement. The survey was undertaken using a zig-zag traverse scheme, with data being logged in 30m grid units. A sample interval of 0.25m was used, with a traverse interval of 1m, providing 3600 sample measurements per grid unit. The data was downloaded on site into a laptop computer for processing and storage.

2.4 Data Processing

2.4.1 Geophysical survey data was processed using ArchaeoSurveyor II software, which was used to produce 'grey-scale' images of the raw data. Positive magnetic anomalies are displayed as dark grey, and negative magnetic anomalies are displayed as light grey. A palette bar shows the relationship between the grey shades and geomagnetic values in nT for each area.

2.4.2 Raw data was processed in order to further define and highlight the archaeological features detected. The following basic data processing functions were used:

Despike: to locate and suppress random iron spikes in the gradiometer data

Clip: to clip data to specified maximum and minimum values, in order to limit large noise spikes in the gradiometer data

Destagger: to reduce the effect of staggered gradiometer data, sometimes caused by difficult working conditions, topography, or operator error

2.5 *Interpretation*

2.5.1 Two types of geophysical anomaly were detected in the gradiometer data:

positive magnetic: regions of anomalously high or positive magnetic gradient, which may be associated with the presence of high magnetic susceptibility soil-filled features, such as pits or ditches.

dipolar magnetic: regions of paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials, including fired/ferrous debris in the topsoil, modern services, metallic structures, or fired structures, such as kilns or hearths.

2.5.2 Discrete dipolar magnetic anomalies were detected across the whole of the study area. These are almost certainly caused by fired/ferrous litter in the topsoil, which is typical for modern agricultural land. These anomalies are indicated on the geophysical interpretation drawings, but not referred to again in the subsequent interpretations.

2.6 *Presentation*

2.6.1 The grey-scale images were combined with site survey data and Ordnance Survey data to produce the geophysical survey plans. Colour-coded geophysical interpretation diagrams are provided, showing the locations and extent of positive, negative, dipolar, and diffuse magnetic anomalies.

2.6.2 An archaeological interpretation diagram is provided, which is based on the interpretation of the geophysical survey results, in light of the archaeological and historical background of the site.

2.6.3 Trace plots of the unprocessed geophysical data are available if required.

2.7 *Project Archive*

2.7.1 The data archive for this project has been created in accordance with the recommendations of the Archaeology Data Service (ADS 2001). The archive is currently held at the company offices at Nenthead, Cumbria.

2.7.2 One copy of the survey report will be deposited with the County Historic Environment Record, where viewing will be available on request. The project is also registered with the **Online Access to the Index of archaeological investigationS (OASIS)**. The OASIS reference for this project is **northpen3-43135**.

3 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 Historical Background

- 3.1.1 A desk-based assessment of the proposed development area has been undertaken by Wardell Armstrong, a summary of which is included below.
- 3.1.2 No known prehistoric sites are recorded in the immediate vicinity of the proposed development area. However, the wider area was probably exploited during this period.
- 3.1.3 Roman period activity is represented by a number of scatters of Romano-British pottery, which have been recorded in the area. One of these (HER 30437) is recorded within the southwest part of the site, suggesting that the proposed development area may have been cultivated in this period.
- 3.1.4 Two possible deserted medieval villages were located within 1km of the proposed development area. Towthorpe (HER 30434) was located approximately 150m to the northeast. Easthorpe (HER 30458) may have been situated 800m west of the site boundary. Some of the open fields associated with these villages were almost certainly located within the proposed development area.
- 3.1.5 The study area was probably enclosed in the late 17th century. The earliest available cartographic depiction of the study area is the 1809 Great Gonerby with Manthorpe and Little Gonnerby Inclosure Map, which indicates that the area was owned or leased by Lord Brownlow at this time. His manor house, Belton, was situated to the northeast of the site within a park and gardens. The study area had been further subdivided by the time of the 1st Edition Ordnance Survey map of 1890-91.
- 3.1.6 In the 19th century the Grantham-Newark section of the Great Northern Railway was constructed along the western boundary of the study area (opened 1853). A WWI military railway was constructed in 1915 to serve an army camp, located to the northeast of the study area. This is believed to have crossed the northwest corner of the site.
- 3.1.7 The majority of the proposed development area appears to have remained as agricultural land into the modern period.

3.2 Previous Archaeological Works

- 3.2.1 No known previous archaeological investigations have taken place within the proposed development area.

4 SURVEY RESULTS (*Figures 3-15*)

4.1 *Area 1 (Figures 3-4)*

- 4.1.1 Area 1 measured 100m by 150m, and was situated on the northwest corner of the study area, to target the area of the WWI military railway.
- 4.1.2 Small discrete dipolar magnetic anomalies were detected across the whole of Area 1. These are almost certainly caused by fired/ferrous litter in the topsoil, which is typical for modern agricultural land.
- 4.1.3 A concentrated band of small discrete dipolar magnetic anomalies was detected in Area 1, aligned northeast to southwest, and was interpreted as dispersed track material associated with the former military railway. A positive linear magnetic anomaly, with values between *c.2.5nT* and *c.3.9nT*, was also detected in the same area, and was interpreted as the remains of the former railway.
- 4.1.4 A series of weak parallel positive anomalies, with values between *c.0.9nT* and *c.3.6nT*, were detected at the southeast corner of Area 1, aligned northeast to southwest and northwest to southeast. These anomalies were interpreted as possible plough furrows.

4.2 *Area 2 (Figures 5-6)*

- 4.2.1 Area 2 measured 140m square, and was situated immediately to the south of Area 1, in the area of a scatter of Romano-British pottery. A large number of small discrete dipolar magnetic anomalies were detected across the whole of Area 2, caused by fired/ferrous litter in the topsoil.
- 4.2.2 A series of weak linear positive magnetic anomalies, with values between *c.0.9nT* and *c.2.1nT*, were detected over the majority of Area 2, aligned approximately northeast to southwest. These anomalies were also interpreted as the remains of former ridge and furrow cultivation.
- 4.2.3 Two weak linear positive magnetic anomalies were detected on the north side of Area 2, which had a different alignment to the ridge and furrow. These were interpreted as possible soil-filled features.

4.3 *Area 3 (Figures 7-8)*

- 4.3.1 Area 3 was situated in an arable field on the east side of Area 1 and Area 2, and measured 200m by 400m. An electricity pylon was situated on the north side of this area. This produced a very strong positive magnetic anomaly, measuring almost 50m in diameter, which masked other features in this area. A strongly dipolar magnetic anomaly was detected at the centre of Area 3, and is likely to be due to ferrous material in the topsoil. This anomaly is similar to an anomaly in Area 4, which was produced by an existing telegraph pole.
- 4.3.2 A parallel series of weak linear positive magnetic anomalies, with values between *c.0.5nT* and *c.1.6nT*, were detected over the whole of Area 3, aligned approximately northeast to southwest, curving northwards at the northern end. These anomalies were spaced between 6m and 7m apart, and were almost certainly the furrows of former ridge and furrow cultivation of probable medieval date.

4.4 *Area 4 (Figures 9-10)*

- 4.4.1 Area 4 measured 130m by 380m, and was situated on the northeast side of the study area. A strongly dipolar magnetic anomaly was detected in the vicinity of a telegraph pole on the east side of Area 4.
- 4.4.2 A chain of discrete dipolar magnetic anomalies were detected on the west side of Area 4, aligned north-south. These were probably caused by fired/ferrous material in the topsoil, and mark the location of a former field boundary.
- 4.4.3 A parallel series of weak linear positive magnetic anomalies, with values between *c.*0.5nT and *c.*1.2nT, were detected on the north side of Area 4, aligned approximately north to south. These were interpreted as possible plough furrows.
- 4.4.4 A second series of parallel weak linear positive magnetic anomalies, with values between *c.*0.5nT and *c.*1.8nT, were detected on the east side of Area 4, aligned approximately southeast to northwest, curving westwards at their western ends. These were between 6m and 14m apart, and were typical of the furrows of former ridge and furrow cultivation.
- 4.4.5 Three weak linear positive magnetic anomalies, with values between *c.*0.3nT and *c.*0.9nT, were detected at the centre of Area 4, and were interpreted as possible soil-filled features.

4.5 *Area 5 (Figures 11-12)*

- 4.5.1 Area 5 measured 125m by 250m, and was situated immediately to the south of Area 4. Another electricity pylon was situated in Area 5, and this produced a very strong positive magnetic anomaly, which masked other features in this area.
- 4.5.2 A chain of discrete dipolar magnetic anomalies were detected crossing Area 5, aligned north-south. These were probably caused by fired/ferrous material in the topsoil, and mark the location of a former field boundary, similar to that detected in Area 4.
- 4.5.3 A parallel series of weak linear positive magnetic anomalies, with values between *c.*0.5nT and *c.*1.6nT, were detected over the whole of Area 5, aligned approximately northeast to southwest, curving northwards at the northern end. These anomalies were spaced between 6m and 7m apart, and were almost certainly the furrows of former ridge and furrow cultivation, similar to those in Area 3.

4.6 *Area 6 (Figures 13-14)*

- 4.6.1 Area 6 measured 165m by 210m, and was situated immediately to the south of Area 5, on the south side of the study area.
- 4.6.2 A chain of discrete dipolar magnetic anomalies was detected crossing Area 6, aligned north-south, similar to that in Area 5. These also mark the location of a former field boundary.
- 4.6.3 A parallel series of weak linear positive magnetic anomalies, with values between *c.*0.5nT and *c.*1.6nT, were detected over the whole of Area 6, aligned approximately northeast to southwest, curving northwards at the northern end. These were interpreted as further furrows, marking an area of former ridge and furrow cultivation.

4.7 *Discussion (Figure 15)*

- 4.7.1 Plough furrows, typical of medieval ridge and furrow cultivation, have been detected over the majority of the study area. It is extremely likely that the furrows detected in Area 3, Area 5 and Area 6 are all part of a single open field. These display the characteristic curve of medieval ploughing, which is fossilised in the field boundary on the west side of Area 3. A second field, with furrows aligned northwest to southeast, has been detected at the east end of Area 4. Although these features are no longer visible at the surface, it was noted that the adjacent stream is named Running Furrows, and that these must have been a prominent landscape feature in the past.
- 4.7.2 A former field boundary has been detected in Area 4, Area 5, and Area 6, aligned north-south. This is shown on the 1890-91 Ordnance Survey map.
- 4.7.3 The location of the WWI military railway has been detected as a positive magnetic anomaly in Area 1, and an associated spread of small dipolar anomalies. Highly magnetic slag was often used as bedding on railway tracks, and it is likely that this has been ploughed out, to cause the spread of anomalous material that has been detected by the geophysical survey.
- 4.7.4 No positive early features have been detected in association with the scatter of Romano-British pottery previously recorded in Area 2. It is possible that this pottery was spread on the field as midden material in the Romano-British period.
- 4.7.5 Possible soil-filled features of unknown date have been detected in Area 2 and Area 4, but these are uncertain.

5 CONCLUSIONS

- 5.1 Geomagnetic surveys, covering 23ha of land, have been conducted over six separate areas within the study area, covering 50% of the area of the proposed new residential development.
- 5.2 The surveys have detected agricultural features over the majority of the study area. These comprise the furrows of former ridge and furrow earthworks of probable medieval date, and a post-medieval field boundary. It is evident that the plough furrows belong to at least two former open fields, which may be associated with one of the nearby deserted medieval villages of Towthorpe or Easthorpe.
- 5.3 The remains of a WWI military railway, have been detected at the northwest corner of the study area. This was constructed in 1915 to serve an army camp, situated to the northeast of the study area.
- 5.4 No definite prehistoric or Roman period features have been detected by the geophysical surveys, despite the presence of a spread of Romano-British pottery on the southwest side of the site. It is thought that this may have resulted from manuring fields in the Roman period.
- 5.5 Given the results of the geophysical surveys, no further geophysical survey work is deemed necessary.

6 ACKNOWLEDGEMENTS

North Pennines Archaeology is grateful to Charlotte Dawson of Wardell Armstrong for commissioning the geophysical surveys. The digital mapping used during the survey was provided courtesy of Wardell Armstrong LLP.

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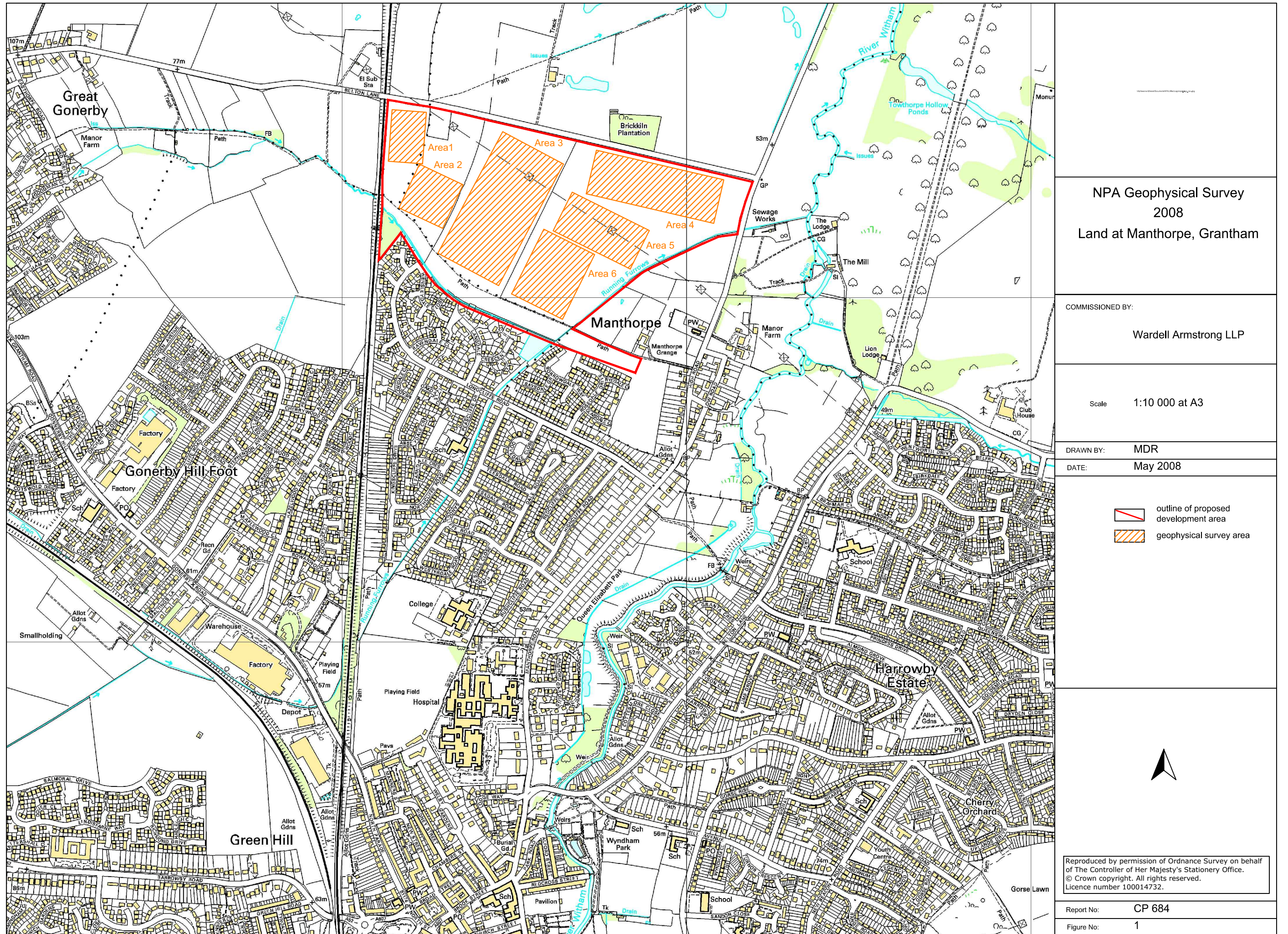
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APPENDIX I – ILLUSTRATIONS





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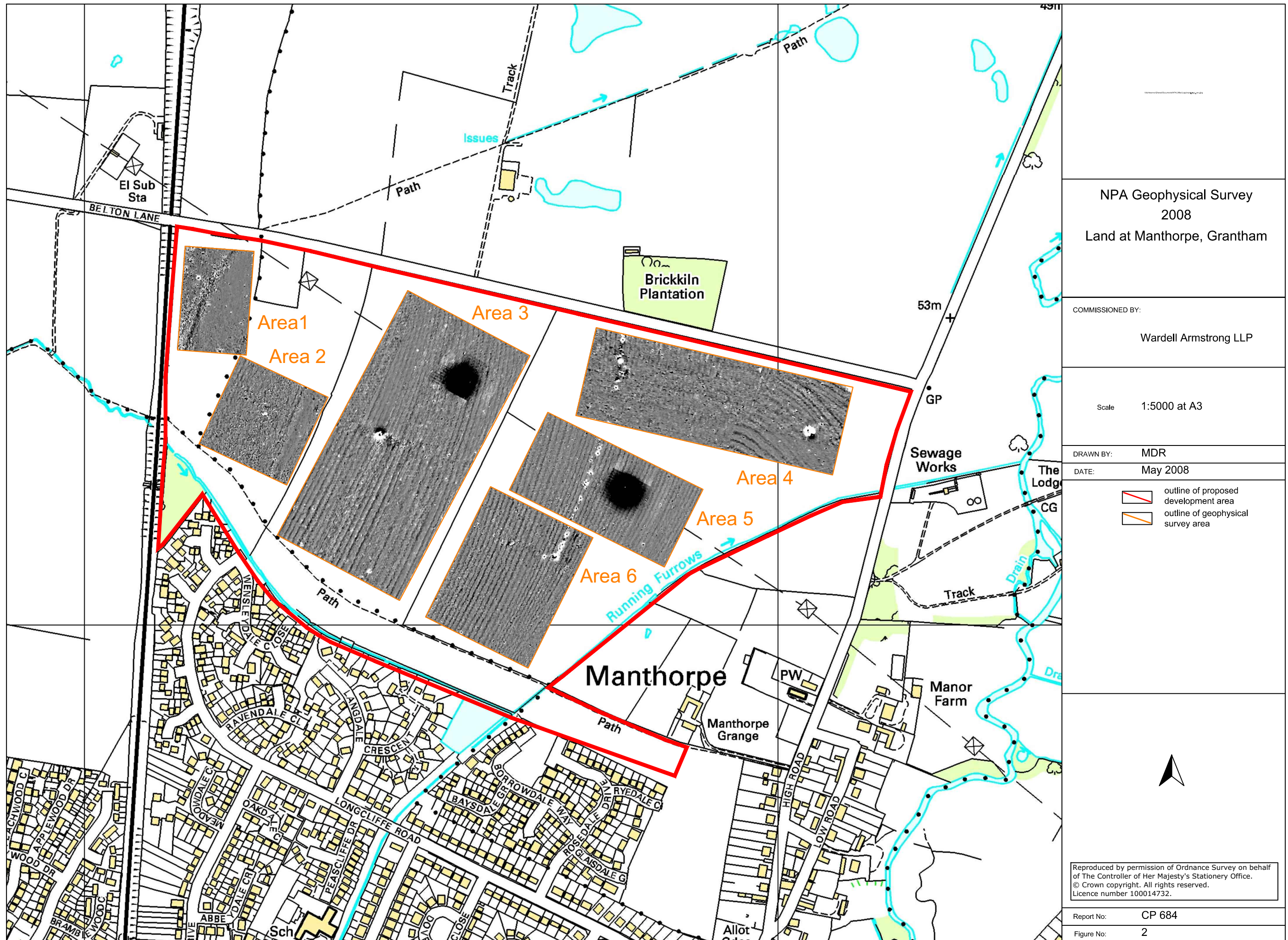
-  outline of proposed development area
-  geophysical survey area



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Figure 1 : Location map



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- outline of proposed development area
- outline of geophysical survey area



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Figure No: 2

Figure 2 : Geophysical survey areas (Areas 1-6)

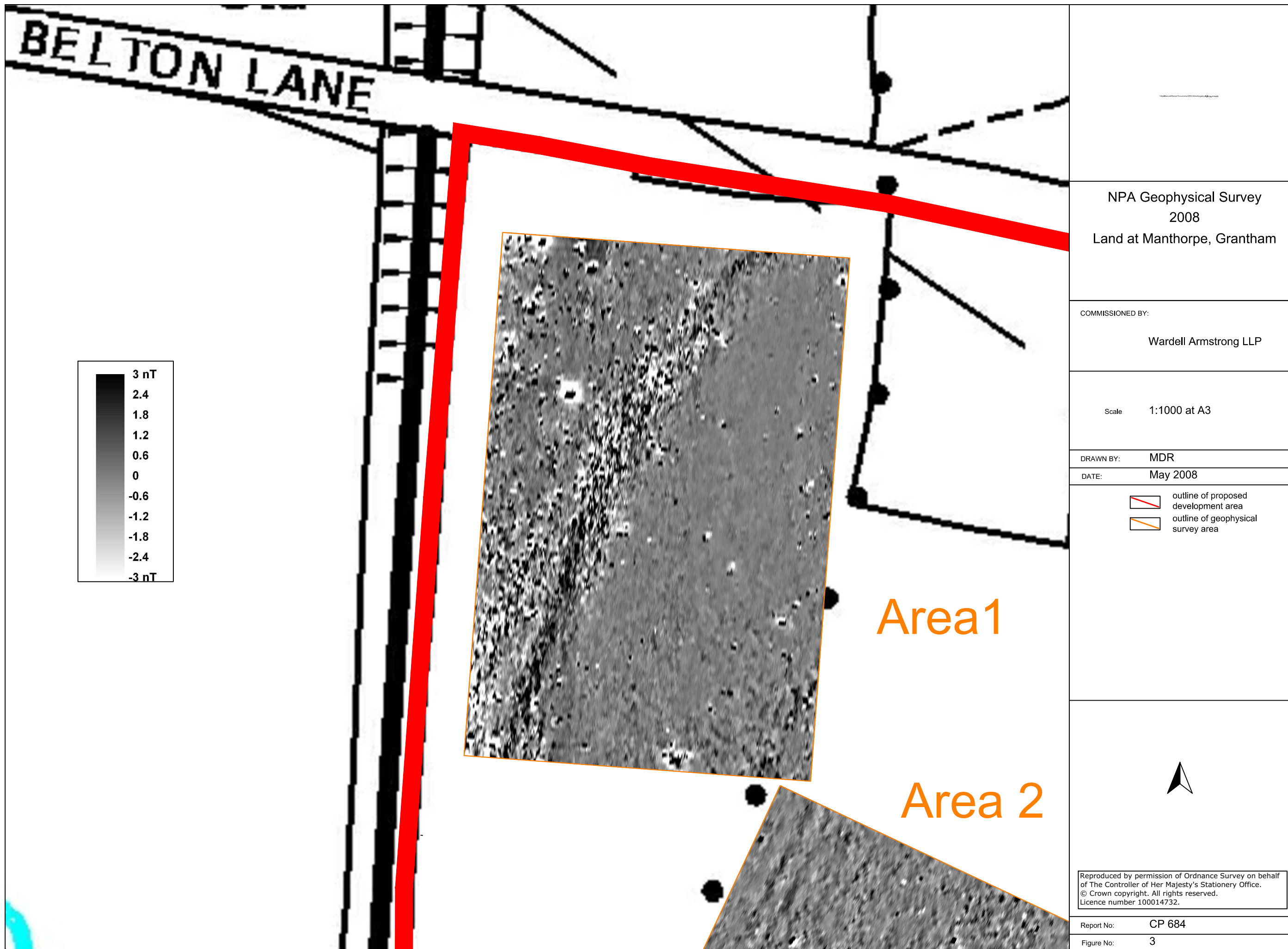
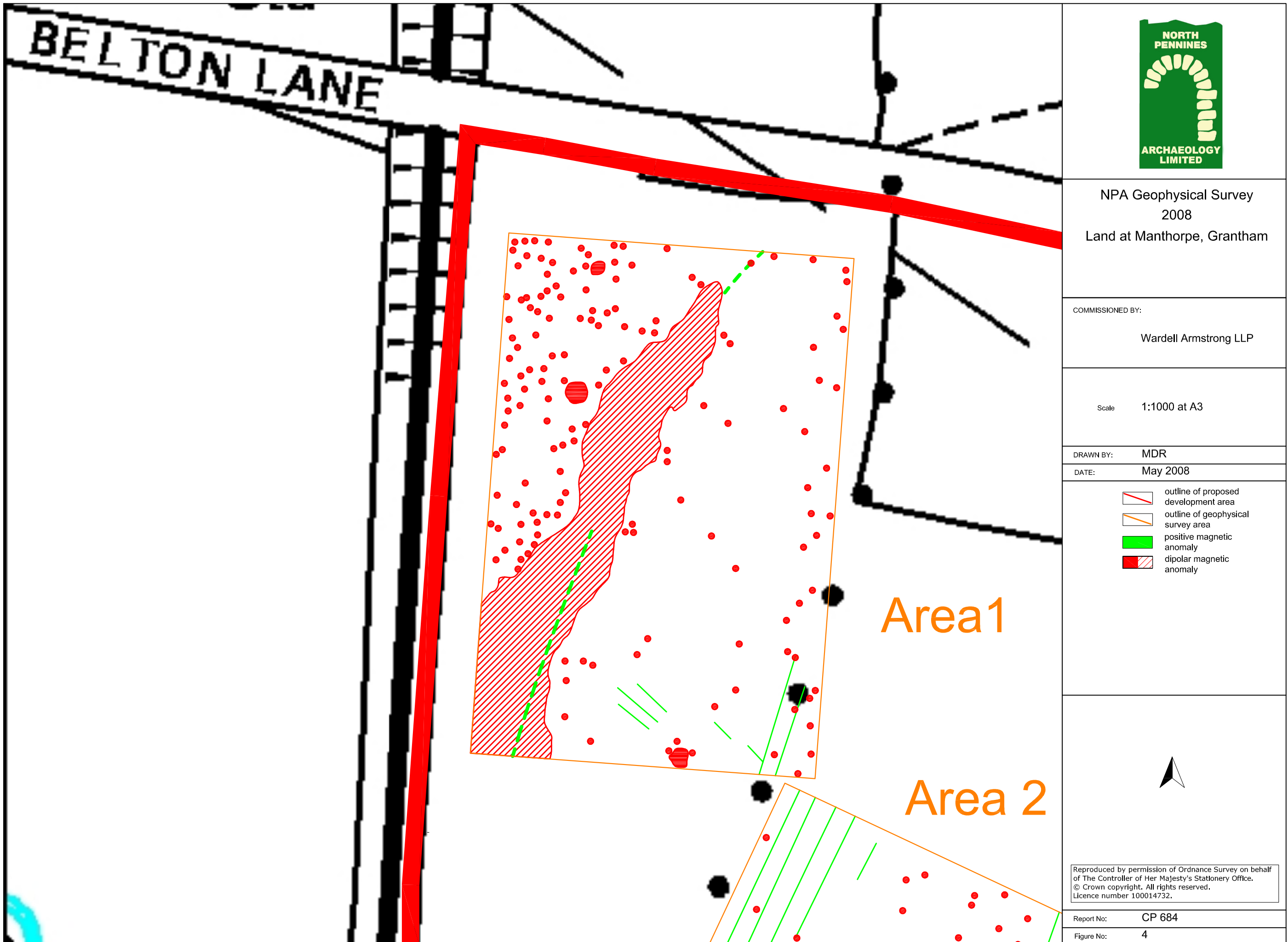


Figure 3 : Geophysical survey of Area 1







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-  outline of proposed development area
-  outline of geophysical survey area
-  positive magnetic anomaly
-  dipolar magnetic anomaly



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Figure No: 4

Figure 4 : Geophysical interpretation of Area 1

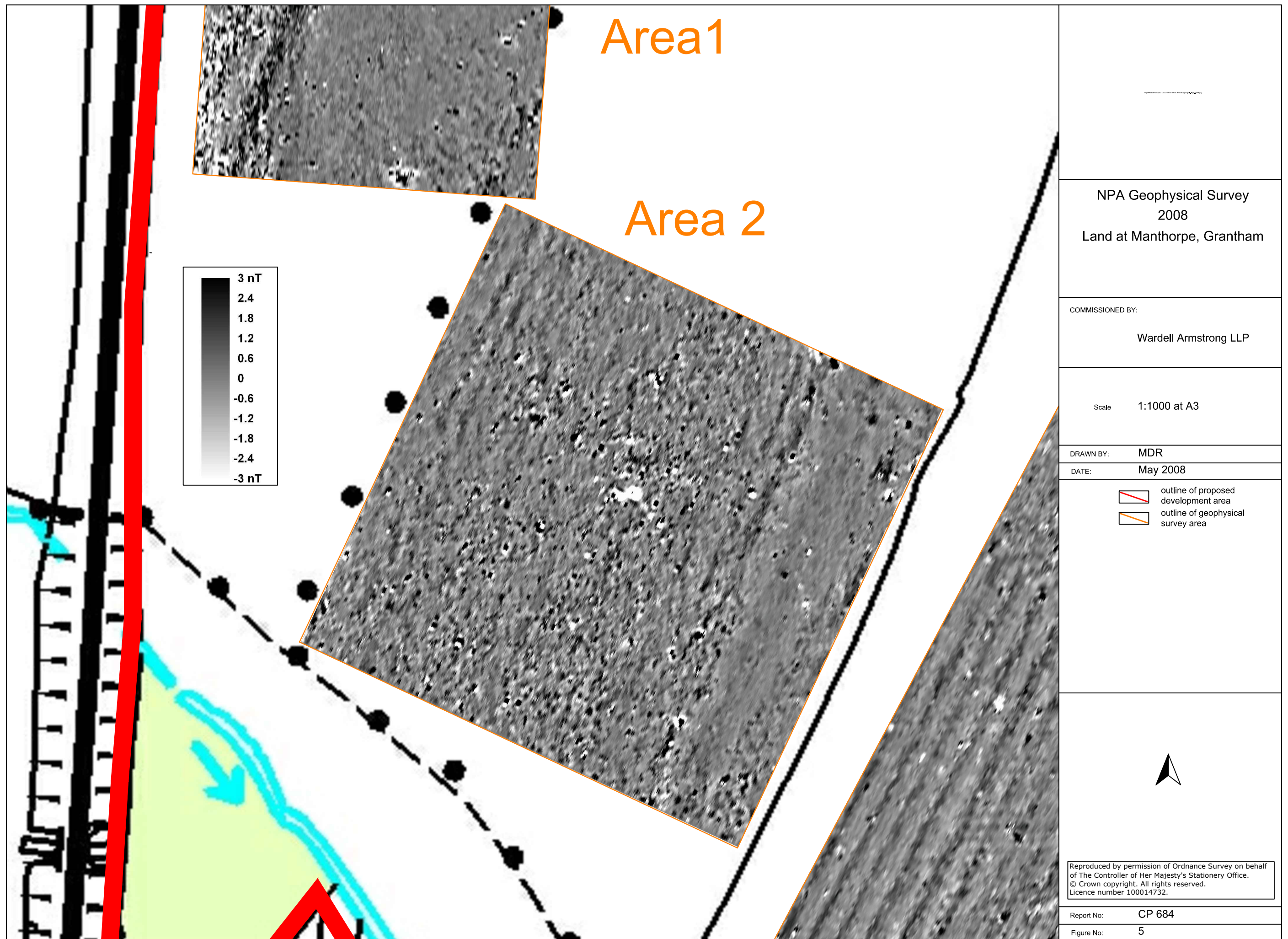


Figure 5 : Geophysical survey of Area 2

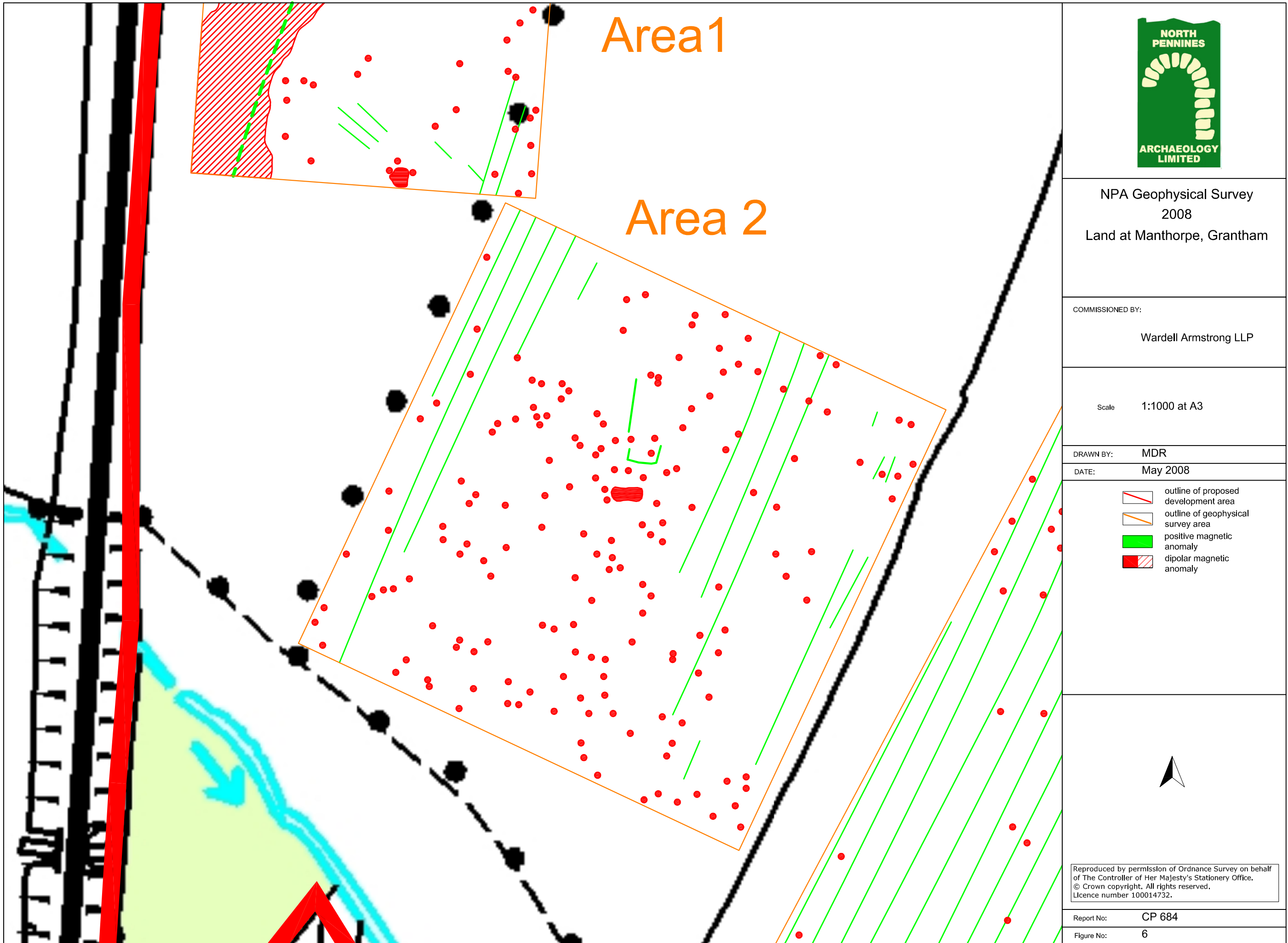


Figure 6 : Geophysical interpretation of Area 2

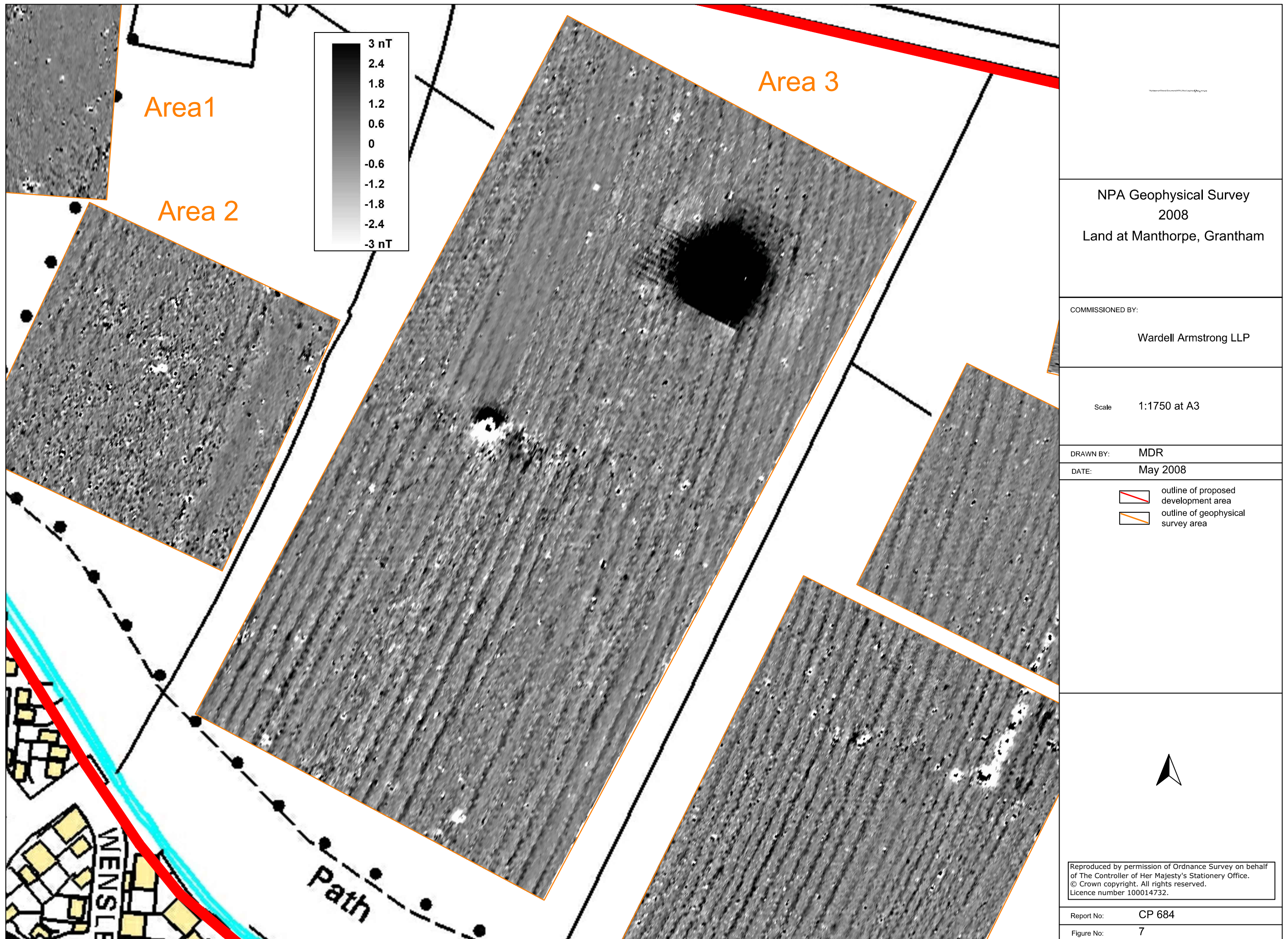
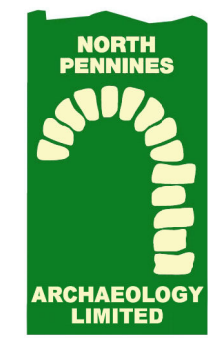
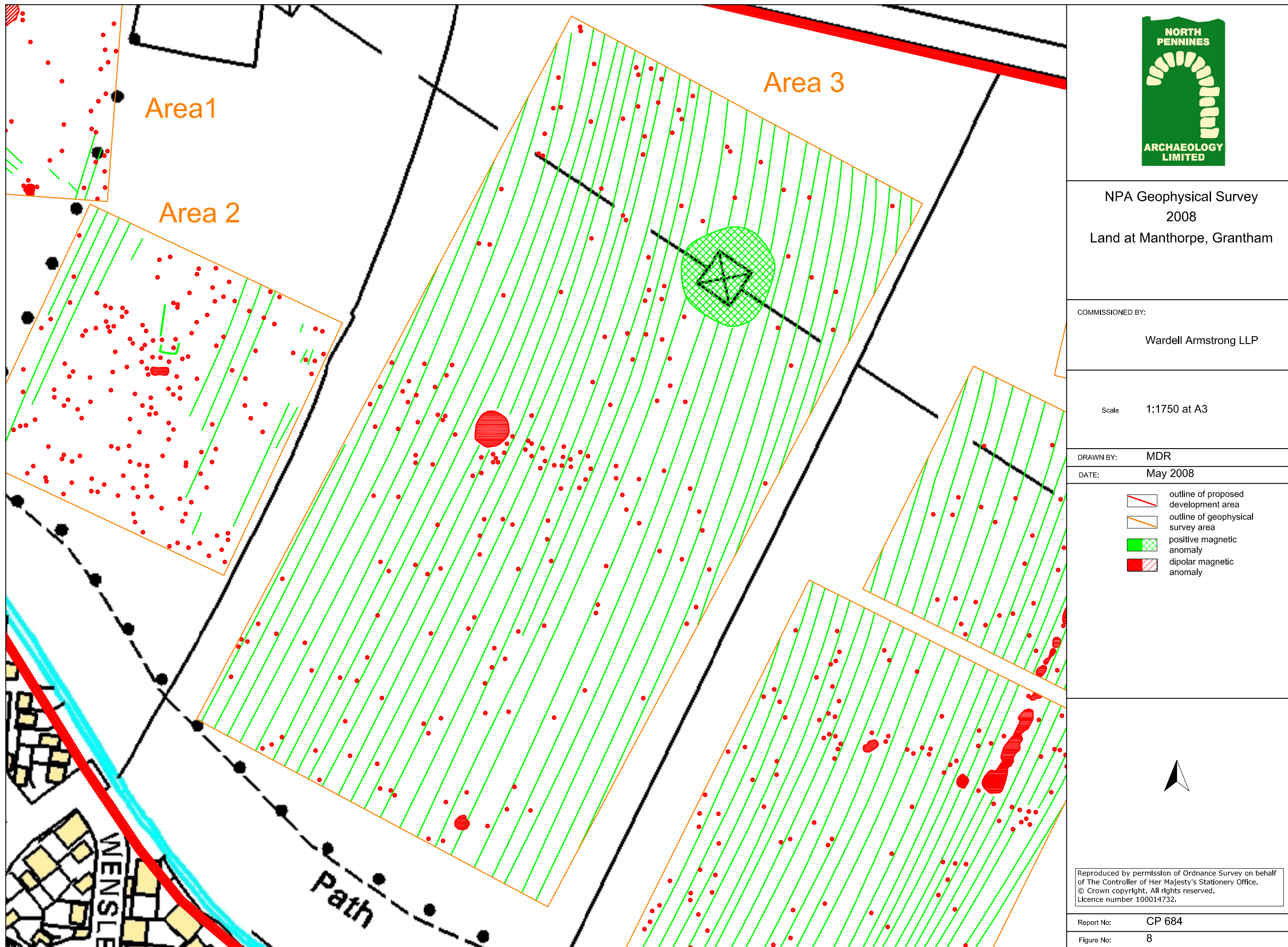


Figure 7 : Geophysical survey of Area 3







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-  outline of geophysical survey area
-  positive magnetic anomaly
-  dipolar magnetic anomaly



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Figure No: 8

Figure 8 : Geophysical interpretation of Area 3

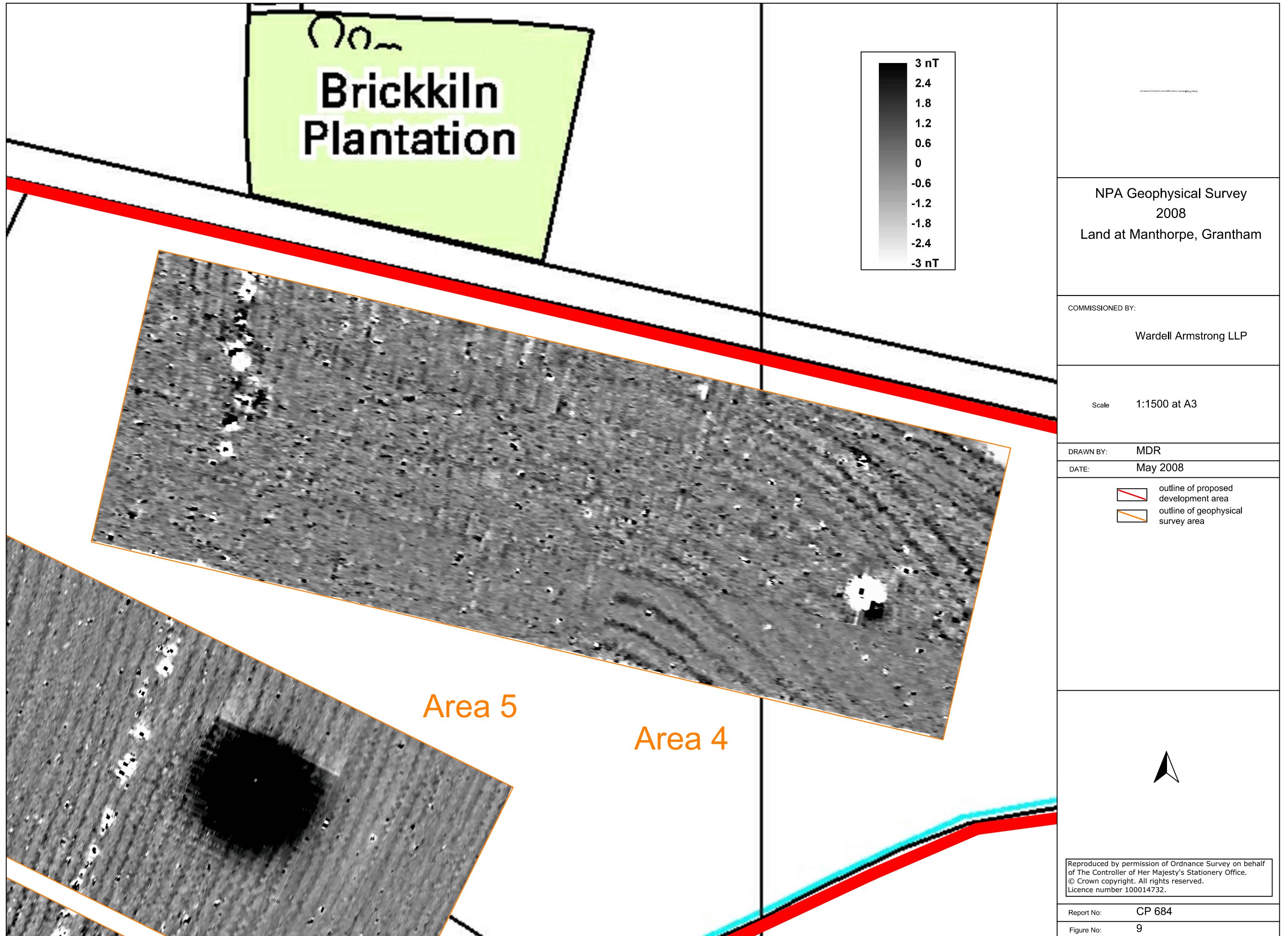
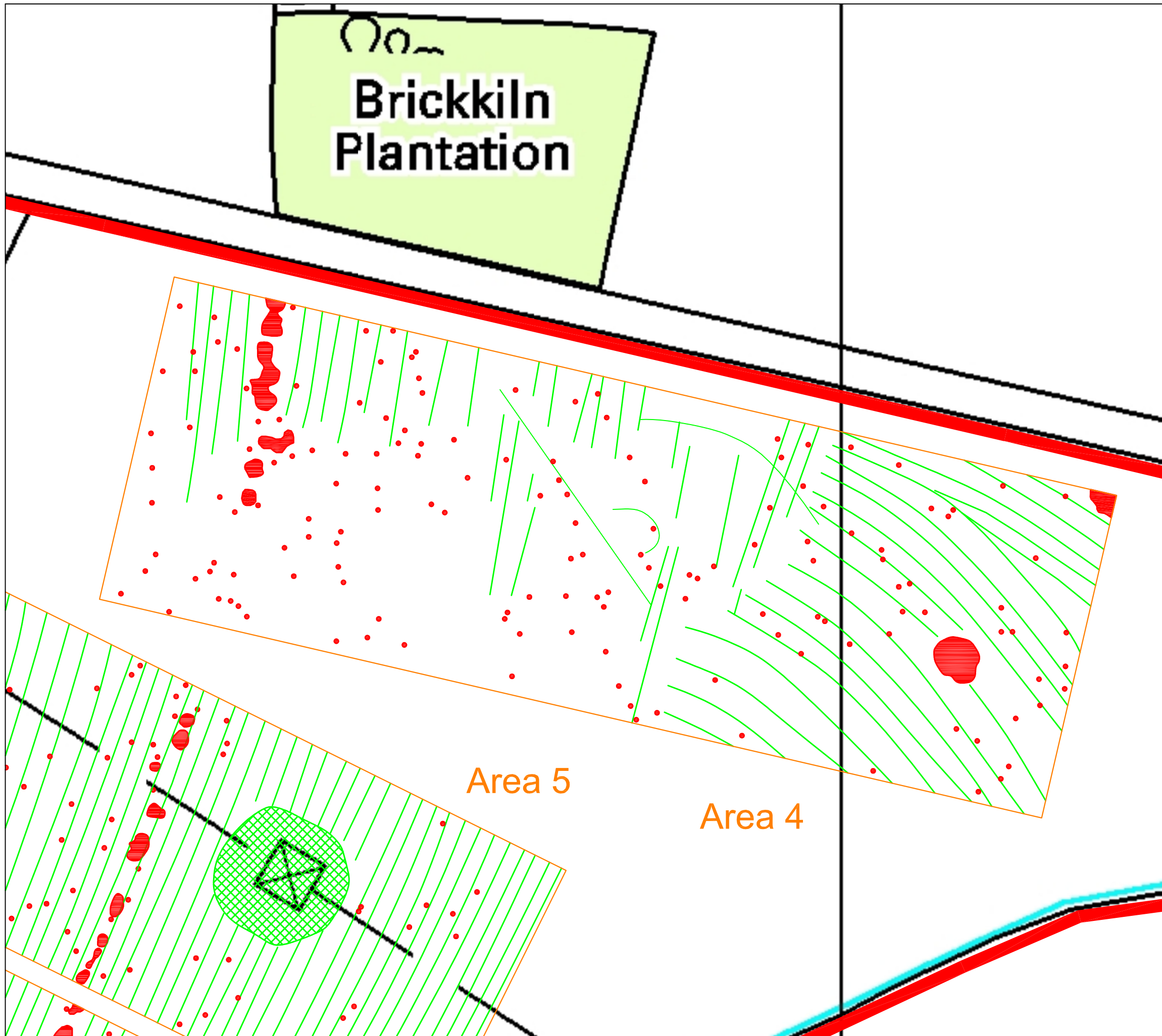


Figure 9 : Geophysical survey of Area 4







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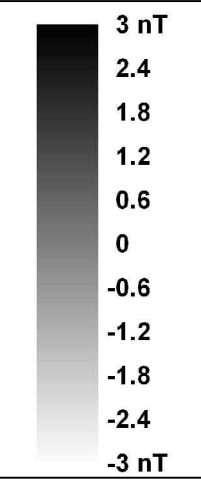
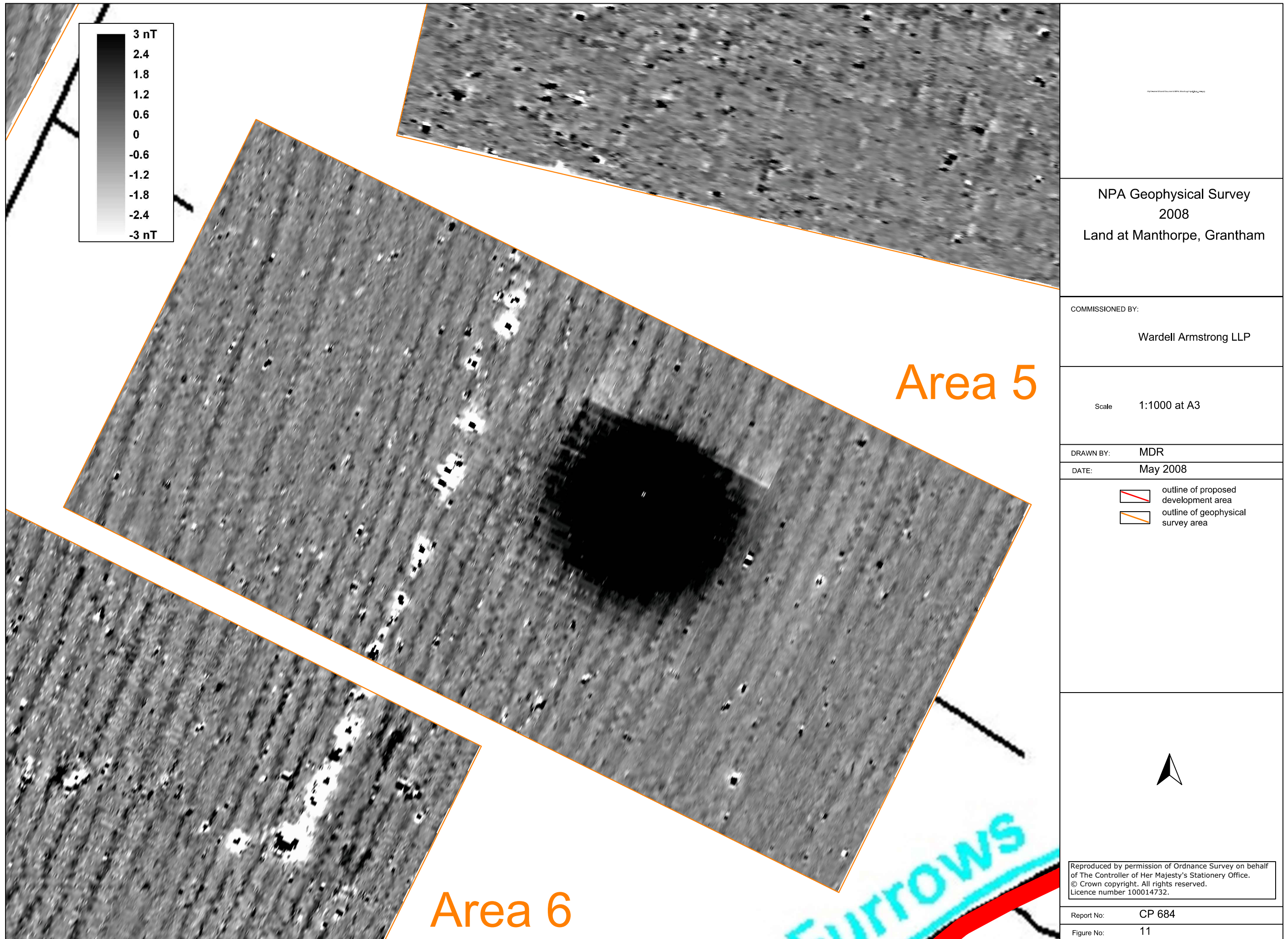
-  outline of proposed development area
-  outline of geophysical survey area
-  positive magnetic anomaly
-  dipolar magnetic anomaly



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Figure 10 : Geophysical interpretation of Area 4





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-  outline of proposed development area
-  outline of geophysical survey area



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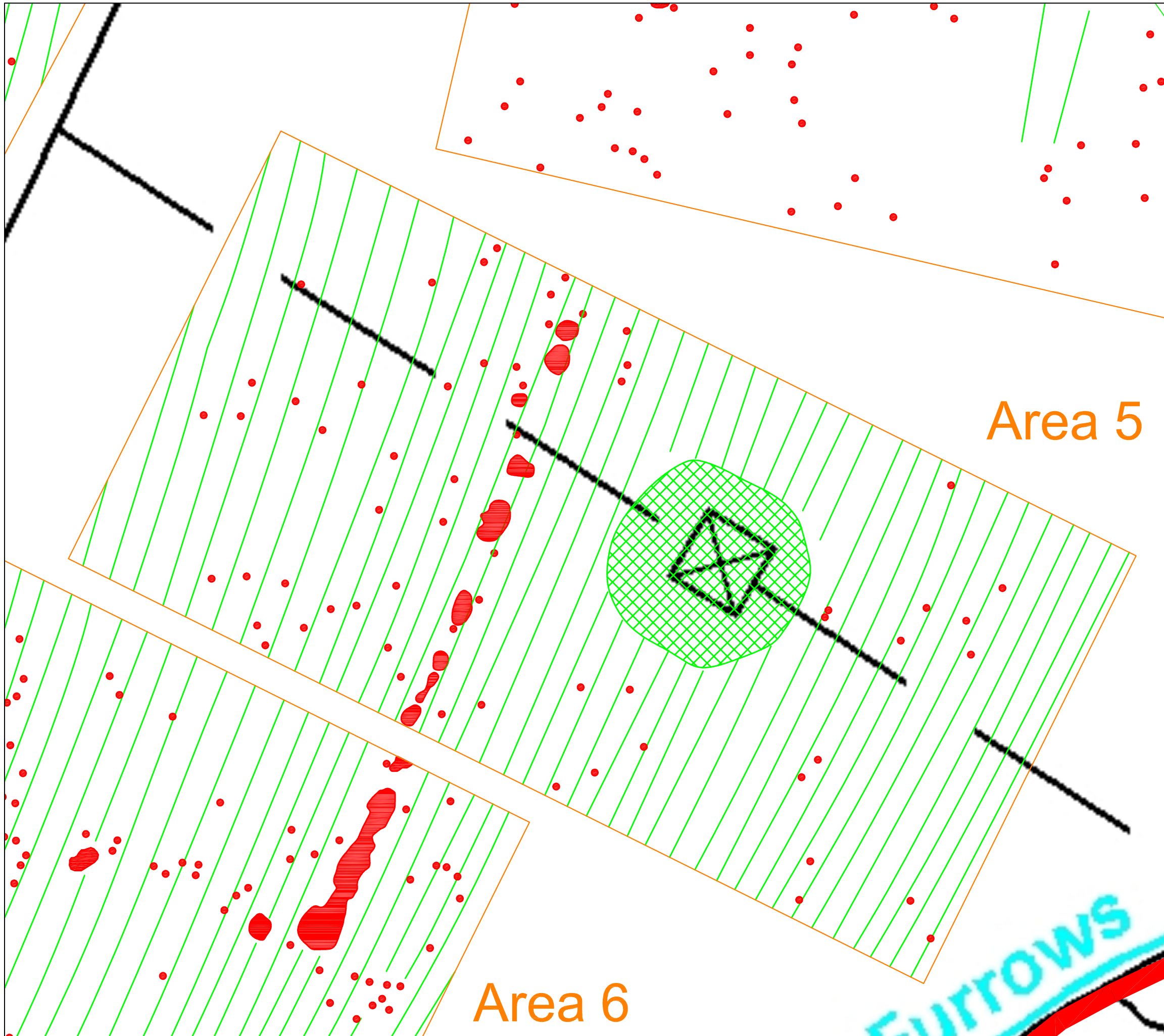
Report No: CP 684

Figure No: 11

Area 6

Area 5

Figure 11 : Geophysical survey of Area 5







NPA Geophysical Survey
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DATE: May 2008

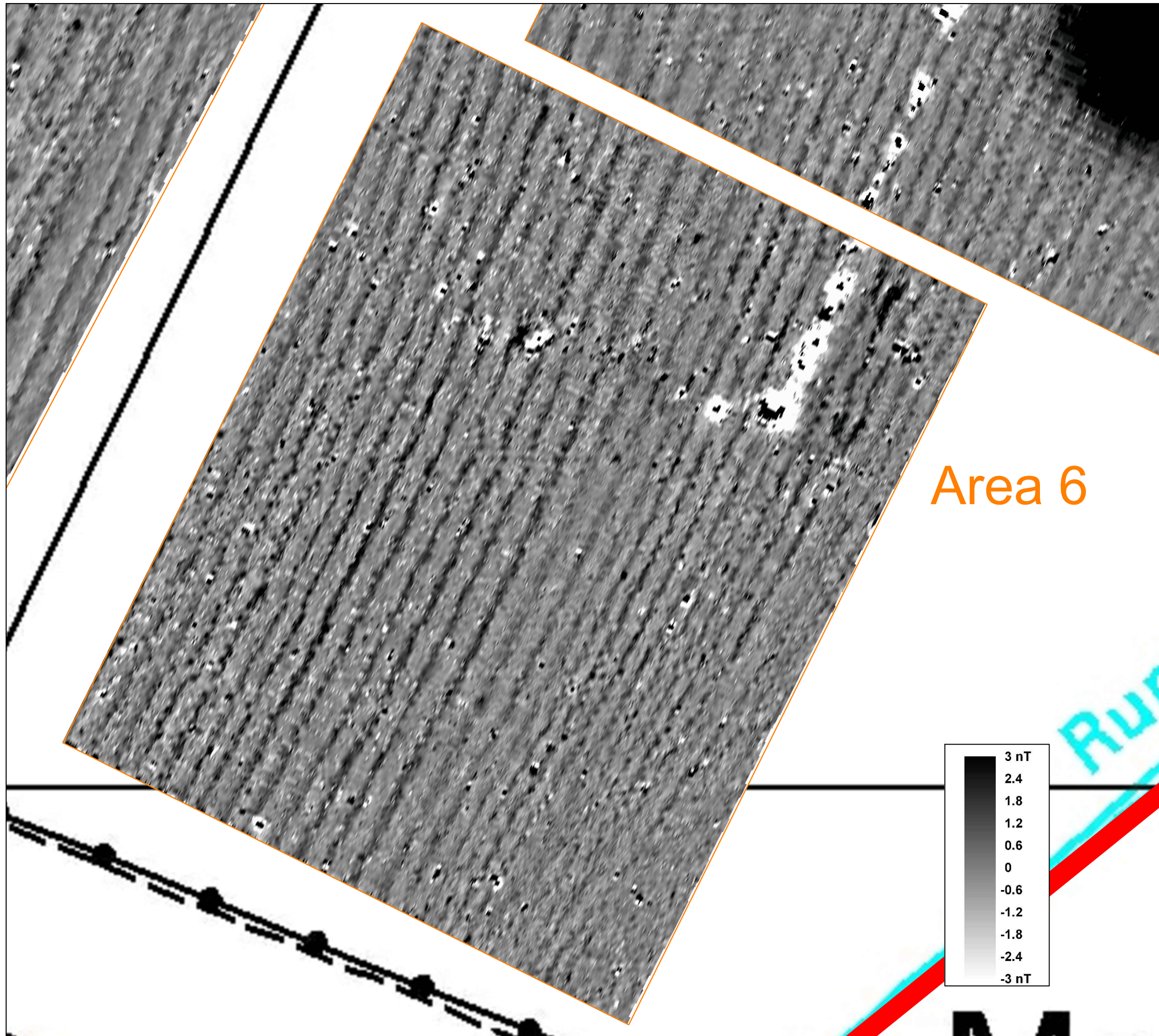
-  outline of proposed development area
-  outline of geophysical survey area
-  positive magnetic anomaly
-  dipolar magnetic anomaly



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Figure 12 : Geophysical interpretation of Area 5





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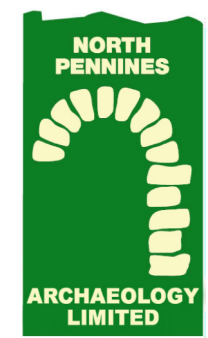
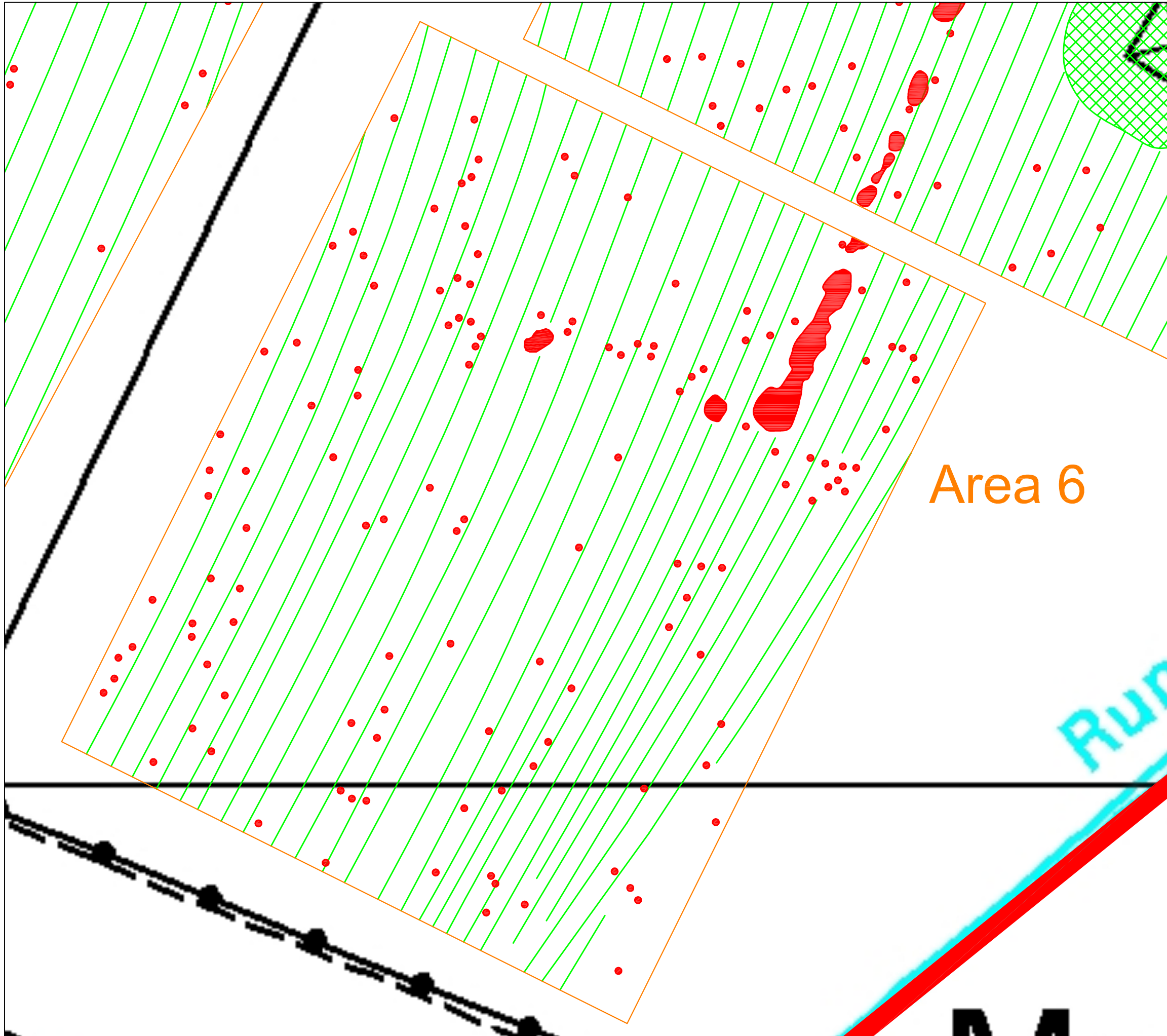
-  outline of proposed development area
-  outline of geophysical survey area



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Figure 13 : Geophysical survey of Area 5







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-  outline of proposed development area
-  outline of geophysical survey area
-  positive magnetic anomaly
-  dipolar magnetic anomaly

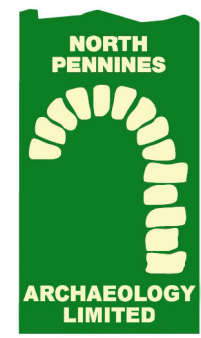
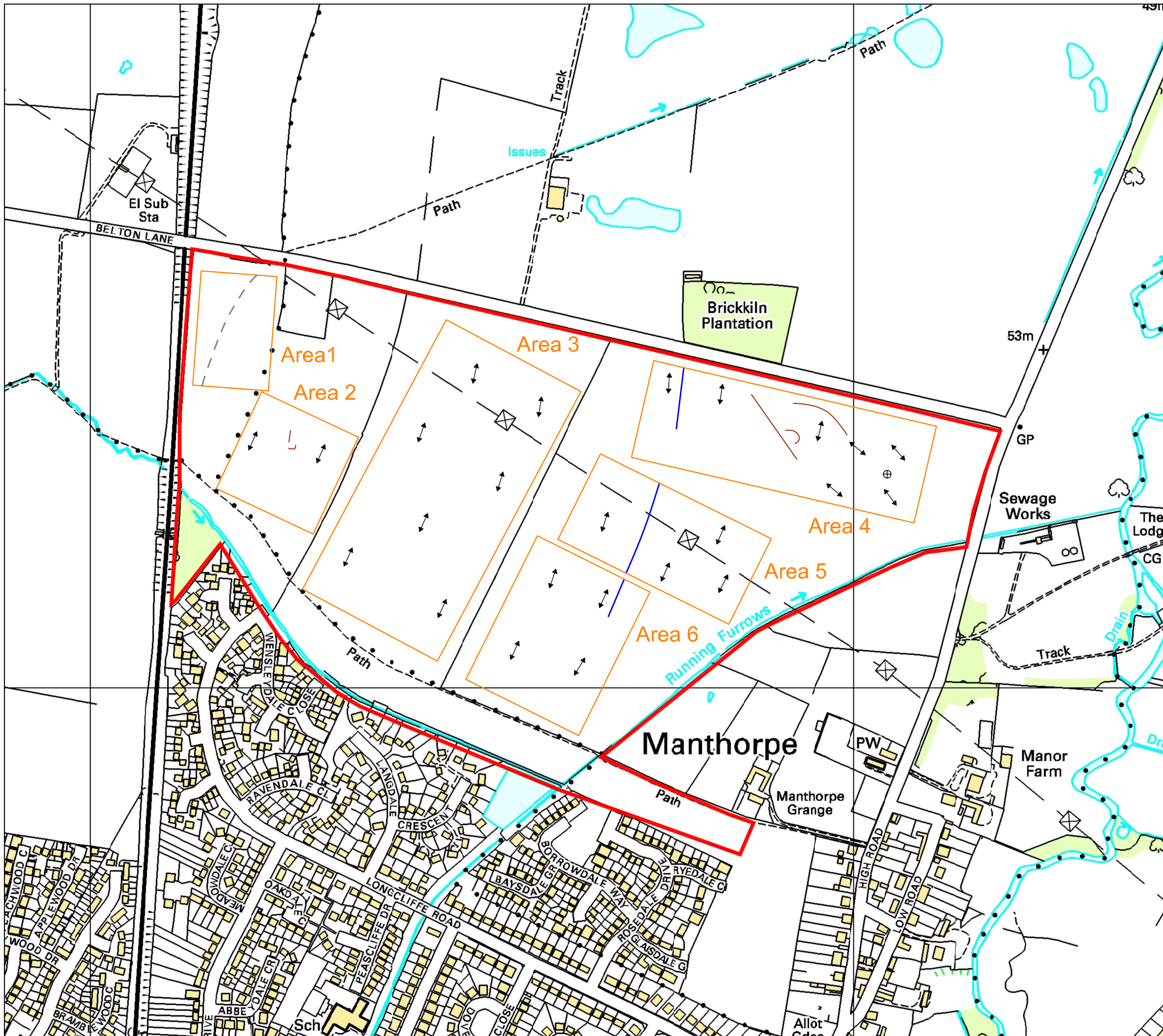
Area 6



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Figure No: 14

Figure 14 : Geophysical interpretation of Area 6



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- outline of proposed development area
- outline of geophysical survey area
- direction of ridge and furrow
- former field boundary
- possible soil-filled features
- former railway
- telegraph pole



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Figure 15 : Archaeological interpretation of the geophysical surveys