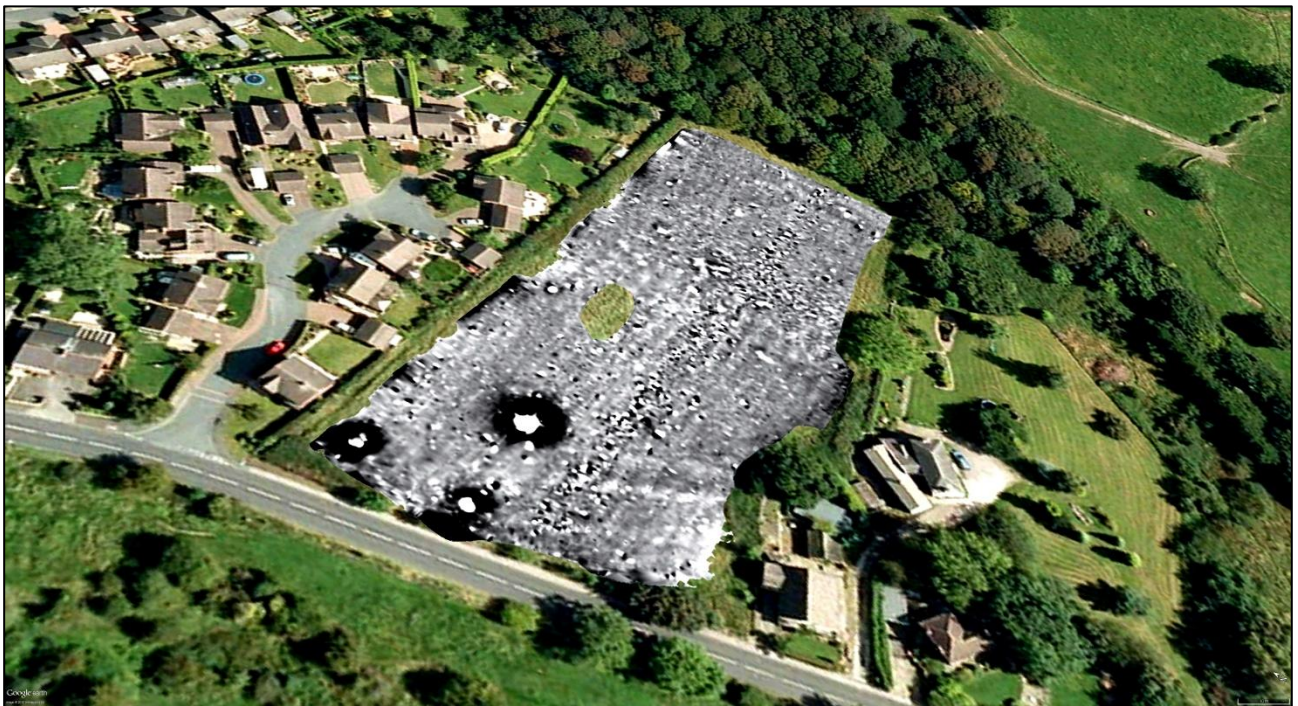


# Geophiz.biz

**Report on a fluxgate gradiometer survey carried out  
over land to the east of Cote Lane, Thurgoland, South  
Yorkshire**



**on behalf of Land Innovations Ltd**

**August 2016**

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### 3 Report information

Client	Land Innovations Ltd
Report type	Fluxgate gradiometer survey
Location	Thurgoland
County	South Yorkshire
Central grid reference	SE 29197 00624
Report number	GB 041
Date of fieldwork	09/08/2016
Date of report	12/08/2016
Fieldwork personnel	James Lyall MA (Hons), MSc
Report by	James Lyall MA (Hons), MSc
Produced by	Geophiz.biz

### 4 Summary

- 4.1.1 James Lyall (of Geophiz.biz) was engaged by Land Innovations Ltd to undertake a fluxgate gradiometer survey over land to the east of Cote Lane, Thurgoland, South Yorkshire (see Figure 1 and Figure 2 for location). The work has been undertaken to support and inform a planning application.
- 4.1.2 The survey detected a total of 16 anomalies, many of which could be attributed to a modern or recent origin. Three faint linear anomalies were detected, possibly indicating the presence of an old trackway, and three large signals in the north-western corner of the field could indicate the presence of kilns.

### 5 Methodology

#### 5.1 Technique

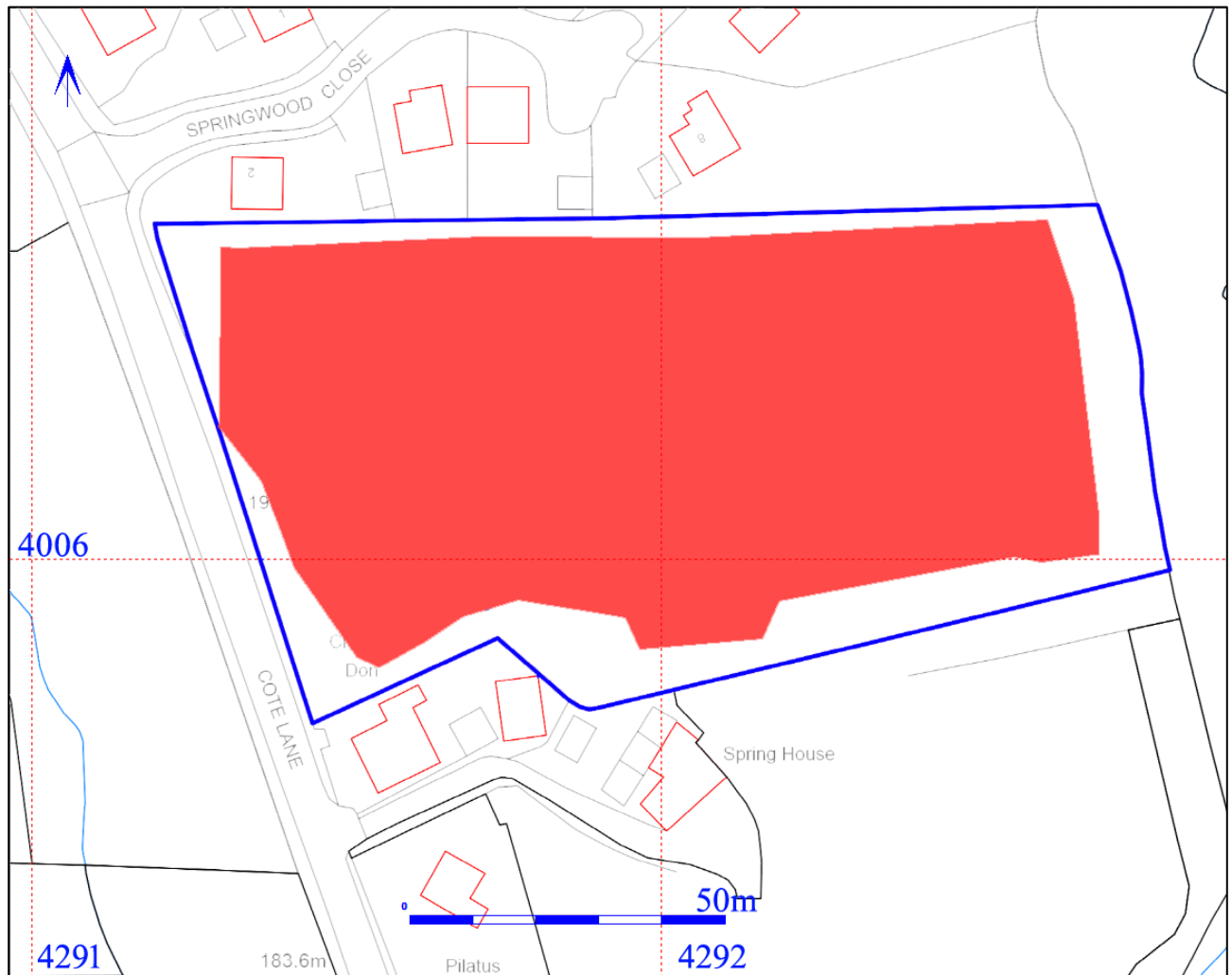
- 5.1.1 The survey was conducted using a *Foerster Ferex 4.032 DLG* fluxgate gradiometer 4-probe array. This machine is capable of high resolution data collection, and takes readings every 10cm along the traverse axis and every 50cm along the grid axis (thus achieving 18000 readings per 30m square). The machine collects data within a 0.2 nT (nanoTesla) sensitivity range. Because the cart uses a real time kinematic GPS to position itself, each data point of the survey has an inbuilt sub 2cm accuracy.
- 5.1.2 Survey in the field, report production and archiving were conducted and prepared using the most up to date guidelines, as laid out in David et al (2008), Schmidt (2013) and Schmidt et al (2015).
- 5.1.3 The data from the magnetometer has been processed and presented using G-Sys (a proprietary Geographic Database Management program which can also display, process and present digitised plans and images). This report was produced using Microsoft Word 2010 and Adobe Photoshop 7 for further image manipulation. All maps have north pointing to the top of the page, and Google Earth images are used for background map location for some of the figures.

## 5.2 Location



**Figure 1 Location of surveyed area (in red) on Google Earth background**

5.2.1 The area surveyed was a grass field, located to the east of Cote Lane and north of Spring House in Thurgoland. Although the grass had not been cut by the time of the survey, this did not prevent the survey from taking place. All four boundaries had either thicker vegetation or trees and bushes which prevented survey along the edges of the requested area (see Figure 2). Two obstacles within the main area also prevented survey, the first being a pile of silage in the centre of the area (see Figure 3), and the second some deep wheel ruts, particularly along the southern part of the site (see Figure 4).



**Figure 2** Surveyed area (in red) with site boundary marked in blue on Ordnance Survey grid



**Figure 3** Silage preventing survey in centre of area



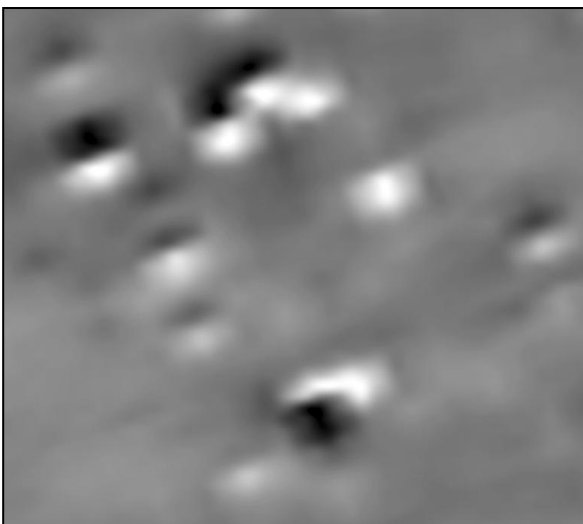
**Figure 4** Wheel ruts along the southern edge of the site

### **5.3 Geology**

5.3.1 The underlying solid geology is part of the Pennine Lower Coal Measures Formation, comprising sedimentary bedrock (mudstone, siltstone and sandstone) formed approximately 312 to 313 million years ago in the Carboniferous Period. (source <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>).

## **6 Gradiometer results and interpretation**

### **6.1 Magnetic anomalies**



6.1.1 Features discovered by magnetic survey techniques are referred to as "anomalies", defined as such because they are different from the background magnetic norm. All magnetic survey plots relating to the current survey are plotted with a scale of  $\pm 20$  nanoTesla (nT).

6.1.2 The large and small black and white areas in the greyscale images (see Figure 5) are dipoles (iron spikes), which indicate the presence of iron or steel objects. These are generally found in the topsoil, and although they could signify the presence of archaeological objects, it is much more likely that they relate to more modern detritus, such as broken ploughshares, iron horseshoes, shotgun cartridges etc.

**Figure 5** Dipolar anomalies in magnetic data

## 6.2 Interpretation and discussion of anomalies

6.2.1 The survey data is plotted as a greyscale image on Figure 6 (larger scale on Figure 9) and as a digitised interpretation of anomalies on Figure 7.

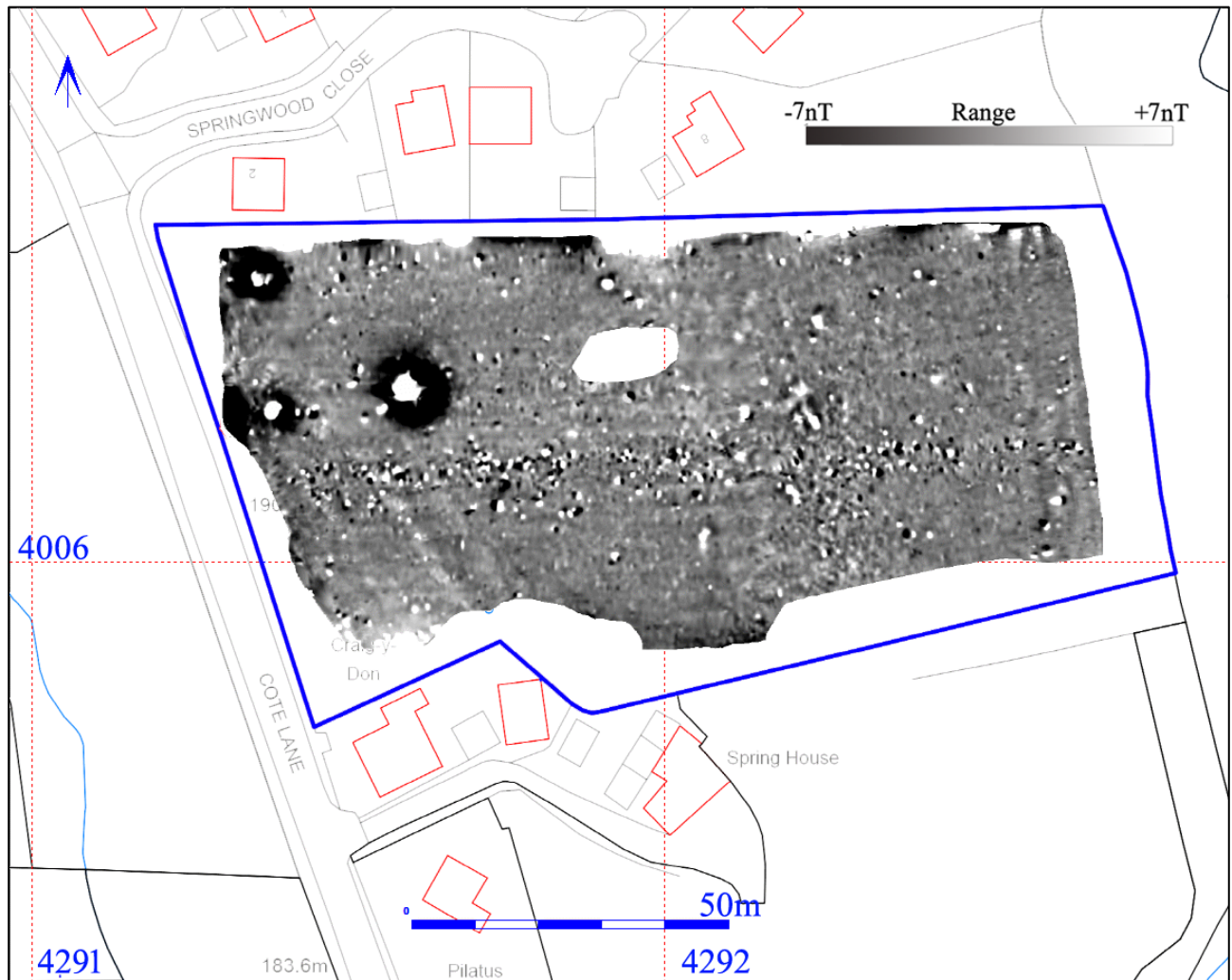
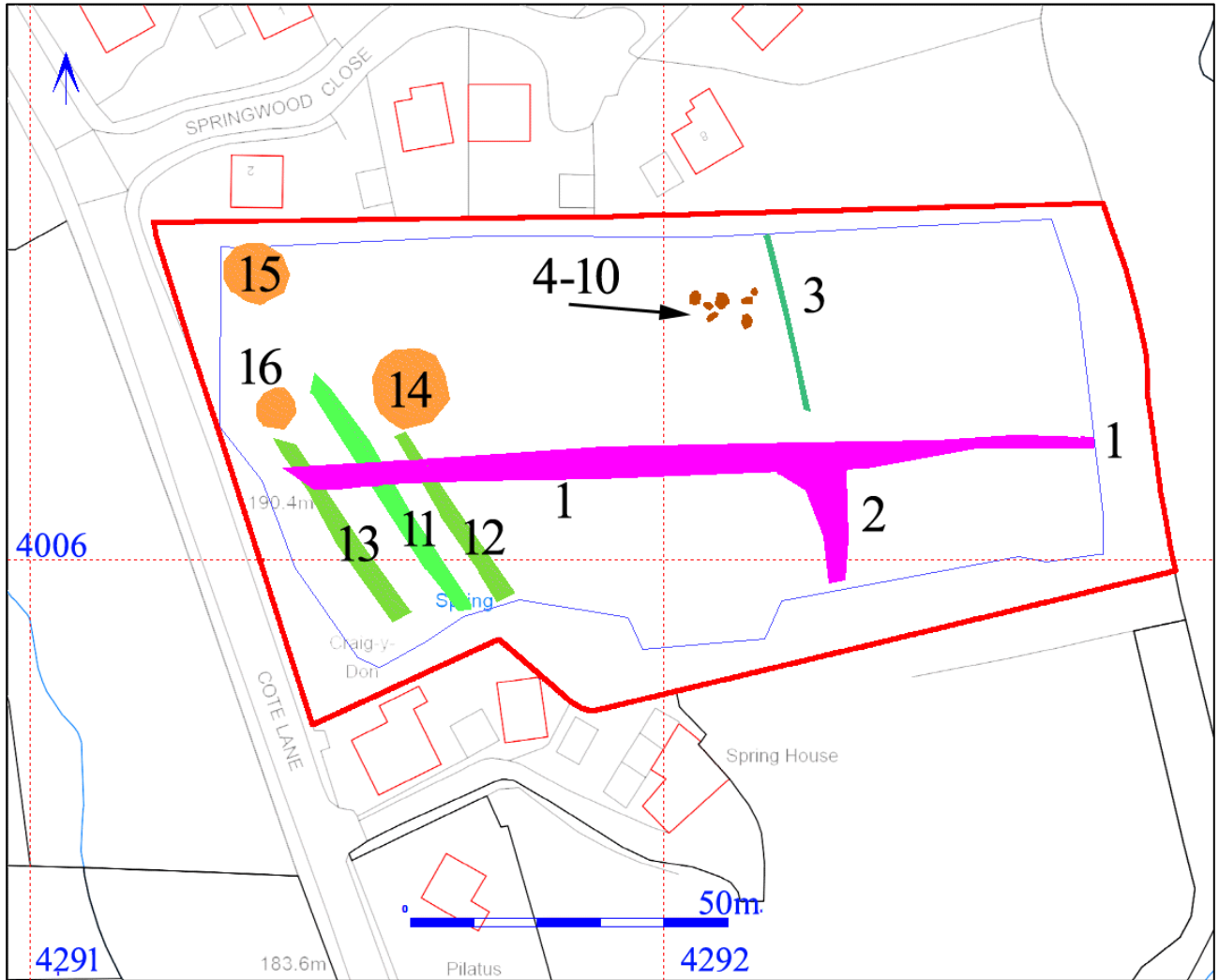


Figure 6 Greyscale data plotted using OS coordinate system

## 6.3 Modern or recent anomalies (1-3)

- 6.3.1 The most obvious anomalies are the spread of dipolar signals, which dominate the site. Anomaly 1 is not a single signal, but is rather made up of numerous smaller dipolar signatures, spear out in a linear east-west alignment. This strongly implies that there was a boundary here, along which the iron detritus gathered. However, there is no indication of a boundary in any of the Ordnance Survey maps, going back to 1855.
- 6.3.2 Anomaly 2 is similar in character to 1, in that it is made up of a number of smaller dipolar signals. It extends southwards from anomaly 1, and is likely to be related to the east-west anomaly 1.
- 6.3.3 Anomaly 3 is different to the first two, in that it is a weakly positive linear, possibly indicating a shallow ditch. It is grouped with the recent anomalies because it is on a similar alignment to anomaly 2, and does not appear to extend beyond anomaly 1, although this area is masked by the stronger signals of anomaly 2.



**Figure 7 Interpretation of anomalies**

**6.4 Possible archaeological anomalies (4-13)**

- 6.4.1 Anomalies 4-10, are a small group of discrete anomalies (coloured brown on Figure 7), located to the west of linear anomaly 3. While it is possible that they are a small group of pits, they could also be geological in origin.
- 6.4.2 Anomalies 11-13 are three parallel features, with anomaly 11 being the most obvious, and 12 and 13 being very faint, only just visible in the survey data. On the 2008 Google Earth image of the area, a possible feature with the same alignment can be seen, heading from the south to the north-western corner of the field (see Figure 8, where the feature is indicated by arrows). This could indicate the location of an old road or track, but it is also feasible that they could be the remains of Medieval ridge and furrow ploughing, although the first interpretation is the most likely.



**Figure 8 2008 Google Earth image showing a possible feature**

## **6.5 Anomalies of unknown origin (14-16)**

- 6.5.1 At first glance, the three anomalies in the north-western corner of the field appear as very strong dipolar features, and could thus be of a relatively modern origin. However, closer inspection of these anomalies shows that they are not strictly dipolar (black/white), but rather appear as a central positive magnetic signal surrounded by a negative magnetic response.
- 6.5.2 There are a number of different possibilities for this type of anomaly, but two are the most likely. The first is that they are large iron bars buried in the soil, but upright, in effect acting as large bar magnets. The author has seen this response before, where soil augurs had broken off underground. However, it would be very unlikely to have three of these break in such close proximity.
- 6.5.3 The second possibility is that the anomalies could be caused by the presence of buried kilns, or perhaps small furnaces. The dome shape of these features also give a magnetic response similar to that seen in the survey data. However, it should be clearly stated that the actual reason for the anomalies cannot be ascertained by magnetic survey alone, and should be treated as interpretations only.

## **7 Conclusions**

- 7.1.1 In conclusion, it can be stated that the geophysical survey was dominated by the presence of dipolar anomalies (small iron objects in the topsoil), a linear spread of these anomalies indicating the presence of an old boundary. Three much larger signals could indicate the presence of kilns, although they could also relate to large iron objects buried in the soil.
- 7.1.2 The other anomalies were a group of seven discrete features, possibly pits, although they could be geological in origin, and three parallel linear features, possibly indicating an old trackway.

## **8 Bibliography**

- David, A. et al, 2008. Geophysical Survey in Archaeological Field Evaluation (2<sup>nd</sup> edition). English Heritage Publishing.
- Schmidt, A. 2013. Geophysical Data in Archaeology: A Guide to Good Practice (2<sup>nd</sup> edition).
- Schmidt, A. et al 2015. EAC Guidelines for the use of Geophysics in Archaeology.

9 Appendix One - A3 geophysical survey plot

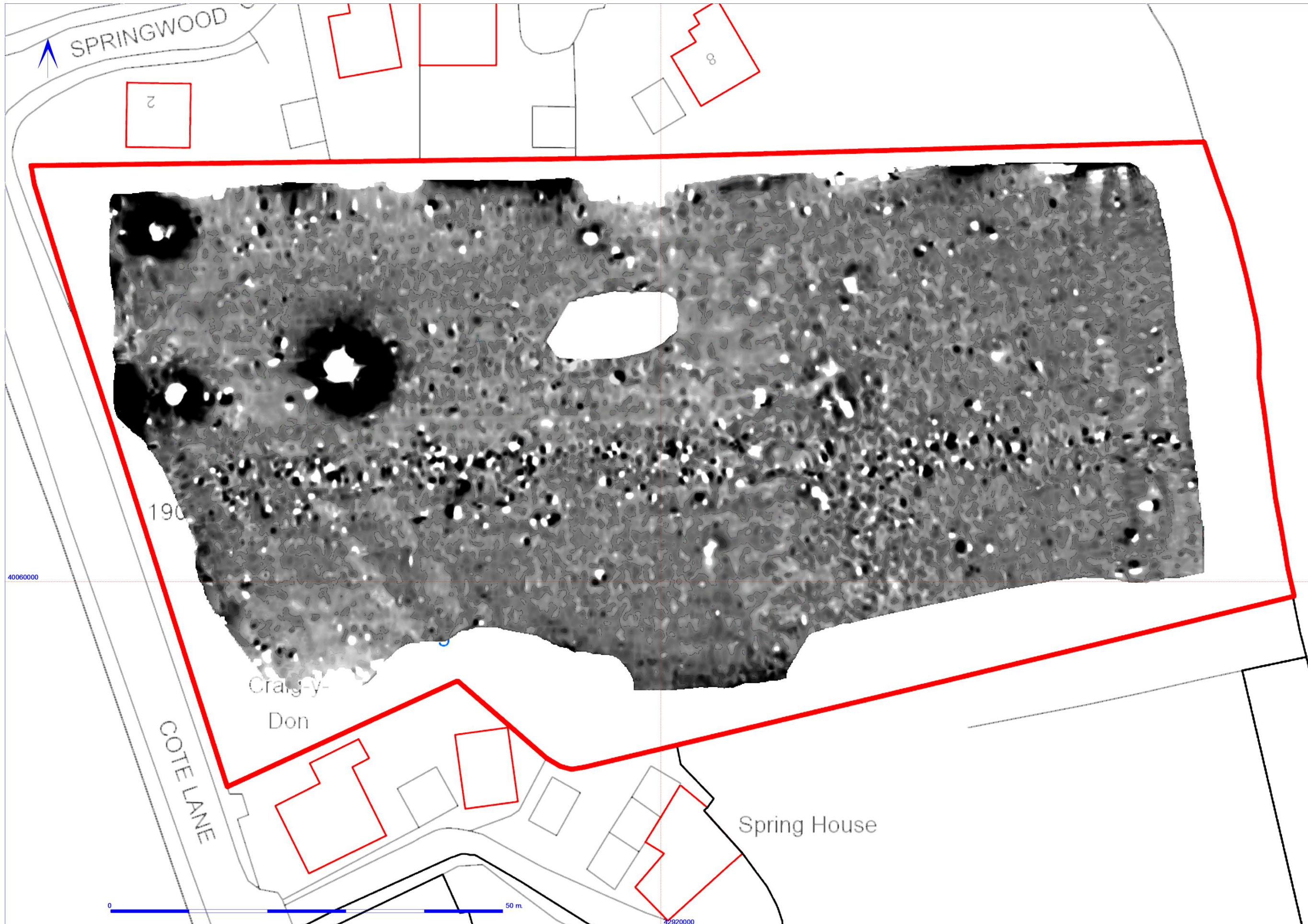


Figure 9 Geophysical survey data processed  $\pm 7nT$