BLACK CAT ISLAND, ROXTON, BEDFORDSHIRE

Report on Archaeogeophysical Survey 2006

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Introduction

This report describes the findings from a magnetometer survey carried out as part of an archaeological evaluation of a proposed sand and gravel extraction site at Roxton, Bedfordshire. The site is centred at OS grid reference TL 164552, and is located between the River Great Ouse and the A1. adjacent to the Black Cat service area.

Fieldwork for the survey was done in two stages following the removal of crops in August 2006. The large arable field to the north of the site was surveyed on 15-18 August, and the set-aside areas to the south were surveyed after mowing on 30 August – 1 September. A further low-lying area of overgrown set-aside land next to the river to the north east of the site was excluded from the survey at this stage. The survey coverage was therefore 26.5 ha, from a total application area of some 31 ha.

The survey was commissioned on behalf of Lafarge Aggregates by Archaeologica Ltd, in consultation with the Heritage and Environment Section of Bedfordshire County Council.

The Site

The application area covers an area of flood plain on the west bank of the Great Ouse, together with adjacent river terrace deposits which rise slightly (by some 2m) towards the western boundary of the site.

Previously identified archaeological findings from the site and its surroundings include cropmarks, which have been recorded in adjoining fields to both the north and south of the application area. A cropmark complex (HER 2664) has also been identified in the northern field within the application area. This cropmark is indicated (by blue broken lines traced from a plan supplied to us by Archaeologica Ltd) on figure 8 of this report. The same cropmark plan also shows a number of broad soil marks. These may represent palaeochannels, or areas of alluvial deposition, and have in some cases been detected in the magnetometer survey. At least one north –south earth bank is visible in the southern part of the northern field. This perhaps represents a former field boundary, but was not detected in the survey. A burnt flint scatter was also noted on the ground near the eastern boundary of the northern field during the course of the survey.

Survey Procedure

The survey was carried out by means of a full recorded magnetometer survey covering the area as indicated by cross hatching on the location plan (figure 1).

The magnetometer survey followed standard procedures for work of this kind with readings collected along transects 1m apart using Bartington 1m fluxgate magnetometers. The results of the survey are shown as a grey scale plot at 1:2500 in figure 2, and as graphical (x-y trace) plots at 1:1250 scale in figures 3-6. An interpretation of the findings is shown superimposed on figures 3-6, and is reproduced separately to provide a summary of the findings on the final plan (figure 8).

The survey plots show the magnetometer readings after standard treatments which include adjustment for irregularities in line spacing caused by variations in the instrument zero setting, and slight linear smoothing. Additional 2D low pass filtering has been applied to the grey scale plot to reduce background noise levels.

The survey grid was set out and located at the required national grid co-ordinates by means of a sub-1m accuracy GPS system. OS co-ordinates of map locations can be read from the AutoCAD (.dwg) version of the plans which can be supplied with this report. The survey plans which are included in this report are based on a digital site plan supplied to us by the client.

The magnetometer survey was supplemented by a background magnetic susceptibility survey with readings taken at 20m intervals using a Bartington MS2 meter and field sensor loop. Two versions of the results are presented as plots of shaded squares of density proportional to the readings in figure 7. The second of the two plots shows the readings after treatment with a median filter. This emphasises broad trends in the data, and is used as the basis for the contoured outlines indicating areas of high readings, which are shown in blue on the interpretative plan (figure 8).

Susceptibility surveying provides a useful complement to a magnetometer survey, and indicates the strength of response which is likely to be obtained. It can also be used to provide a broad indication of previously occupied or disturbed areas in which burning associated with past human occupation has enhanced the magnetic susceptibility of the topsoil, although the readings may be affected by a number of non-archaeological factors, including geology and land use.

The magnetometer responds to cut features such as ditches and pits when they are silted with topsoil, which usually has a higher magnetic susceptibility than the underlying natural subsoil. It also detects the thermoremanent magnetism of fired materials, notably baked clay structures such as kilns or hearths, and so responds preferentially to the presence of ancient settlement or industrial remains.

Results

Conditions at the site appear, in general, to be favourable for the magnetic detection of archaeological features. The topsoil magnetic susceptibility values are sufficiently high (mean = 26 x 10^{-5} SI) for there to be a reasonable likelihood that silted or earth-filled features cut into the gravel subsoil will produce detectable magnetic anomalies. A potential difficulty, which has been encountered in other surveys on gravel soils, is that the gravel often contain small naturally magnetic stones (presumably of igneous origin, and transported by glacial action). These give rise to magnetic anomalies, some of which exhibit similar characteristics of size, strength and profile to those produced by archaeological features such as small silted pits.

Magnetic responses of this kind appear to be a feature of the gravels of the Ouse valley, and were seen also in the 2004 survey at Dairy Farm, Willington, Bedfordshire, which is some 6km upstream from the present survey [1]. This site contains significant and readily detectable archaeological features, including ring ditches and enclosures, the locations of which were subsequently confirmed by excavation. Some pits and other individual archaeological features were also excavated, but the smaller magnetic anomalies were in general found not to be archaeologically significant [2].

The present survey again detected numerous such anomalies, a selection of which have been outlined in red on the survey plots (figures 3-6), and the interpretation (figure 8). The anomalies as outlined are those which, in terms of their amplitude and profile could, in a suitable context, represent archaeological features. Their relatively widespread distribution across the site, however, suggests that many are again likely to be geological in origin. The possibility cannot immediately be excluded, even so, that some of the more concentrated clusters of anomalies may be archaeologically significant. This is particularly the case for groups of magnetic anomalies which contain features of varied dimensions, and which are comparable with magnetic disturbances which may be associated with ancient settlement sites. A number of clusters of this kind are marked on figure 8 by red cross-hatching superimposed on the anomaly outlines (and are labelled A-G). The demarcation of these groups of features is rather arbitrary, and in general they lack any coherence of plan which would confirm their archaeological significance, but it may be unsafe to exclude them from consideration without further investigation.

The group of features at H lies close to, and may be associated with, an area of strong magnetic disturbances in the north west corner of the survey, which must be of recent origin. (Magnetic activity of this kind is marked by orange cross-hatching on the interpretation.)

Other features detected by the survey include a number of linear magnetic anomalies, some of which may indicate the presence of former ditches or enclosures. The examples labelled at J and K on figure 8 are particularly distinct. The extended east-west linear features L and M are defined in part by relatively strong magnetic anomalies, as can be seen in the graphical plot (figure 6). They do, however, align with the present field

boundary, and with other more widely distributed linear markings which are probably cultivation effects. Such linear patterns are sometimes a result of modern cultivation, but can also indicate traces of ridge and furrow. Some of the stronger examples of linear markings, which are visible particularly in the grey scale plot (figure 2), are indicated in the interpretation by green broken lines. It remains possible, therefore, that the linear features L and M are simply unusually distinct examples of cultivation effects.

Two further linear features are labelled in the centre of the survey at N. These, together with the nearby linear anomaly at P, are the features which most closely relate to the cropmark (HER 2664; traced in blue). The cropmark does not otherwise appear to have been detected. Much of the cropmark complex is located in a relatively unresponsive area of the survey. This could suggest that the cropmark indicates a ditched enclosure with a magnetically unresponsive fill, or that it represents only superficial markings on the ground.

The remaining category of features which are outlined on the interpretation are extended curving linear sequences of magnetic anomalies, which are marked in orange. These (particularly at Q, R, S) align with soil marks (as indicated on the cropmark plan supplied to us), and so may represent topographical features, or discontinuities in soil composition at the edges of palaeochannels.

A blue contour has been added to figure 8 to indicate those parts of the site in which magnetic susceptibility readings (as shown in the median filtered plot, figure 7ii) exceed the (arbitrary) threshold of 30 (x 10^{-5} SI). These areas occur mostly in the lower lying eastern half of the site (although there are high readings also in the recently disturbed area in the north west corner). This distribution suggests that the susceptibility variation could, at least in part, be a topographical effect. Some of the magnetometer findings which were noted earlier lie within the region of raised susceptibility values (e.g. K, E, F), although the clusters of magnetic anomalies towards the north of the site at A, B C, D do not. This lack of any susceptibility enhancement associated with the features A-D leaves open the possibility that they are of largely natural rather than archaeological origin.

Magnetic disturbances visible along the eastern edge of the grey scale plot relate to an oil pipeline which is located immediately to the east of the adjacent field boundary.

Conclusions

Magnetic activity is most concentrated in the southern part of the site, where groups of linear features at J, K and perhaps L, M suggest the presence of enclosures. The clusters of magnetic anomalies E and F could perhaps be tested to determine whether they are of archaeological or natural origin. The significance of these and other clusters of magnetic anomalies (e.g., A-D) remains uncertain on the basis of the survey evidence alone.

The presence of a cropmark complex was not confirmed by the survey, although features

which may be associated with it were detected at N and P. Other features detected by the survey appear to relate to soil marks, cultivation, and recent disturbances.

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12 October 2006

P. Cottrell, S. Brown, C. Oatley and R. Ainslie carried out the fieldwork for this project.

References

[1] Dairy Farm, Willington, Bedfordshire. Report on Archaeogeophysical Survey 2004 by A.D.H. Bartlett. Survey report by Bartlett-Clark Consultancy for Archaeologica Ltd; (revised) 21 January 2005.

[2] An Archaeological Evaluation. Land at Dairy Farm South, Willington, Bedfordshire. Emma Beardsmore; Cambridge Archaeological Unit, University of Cambridge. Report No. 702, November 2005.

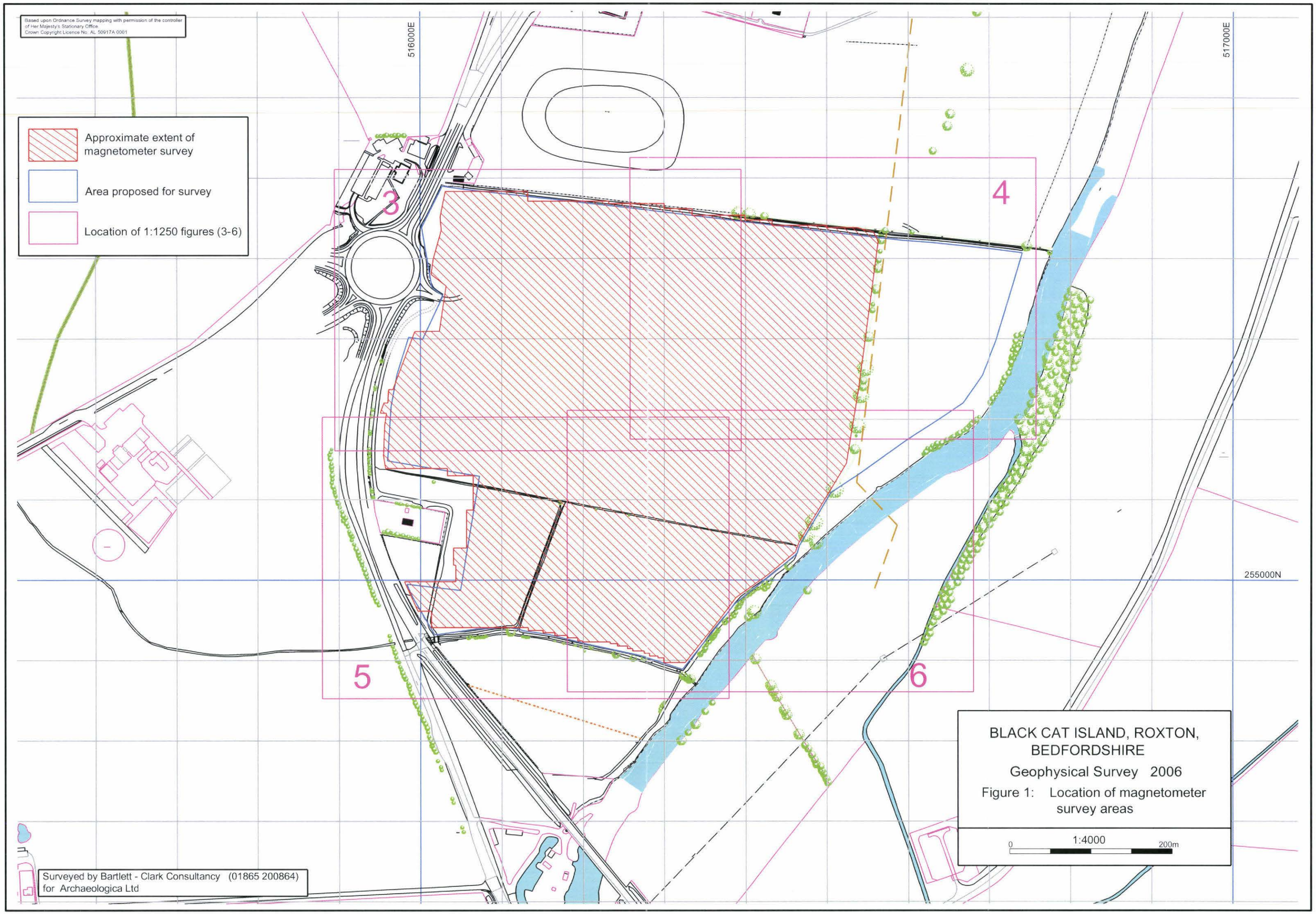
Based upon Ordnance Survey mapping with permission of the controller of Her Majesty's Stationary Office.
Crown Copyright Licence No. AL 50917A 0001
Approximate extent of magnetometer survey
Area proposed for survey
Location of 1:1250 figures (3-6)
516000E
517000E
255000N
3
4
5
6
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Figure 1: Location of magnetometer survey areas
0
1:4000
200m
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1.6 nT/m
-1.8 nT/m
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Figure 2: Grey Scale Plot
0
1:2500
100m
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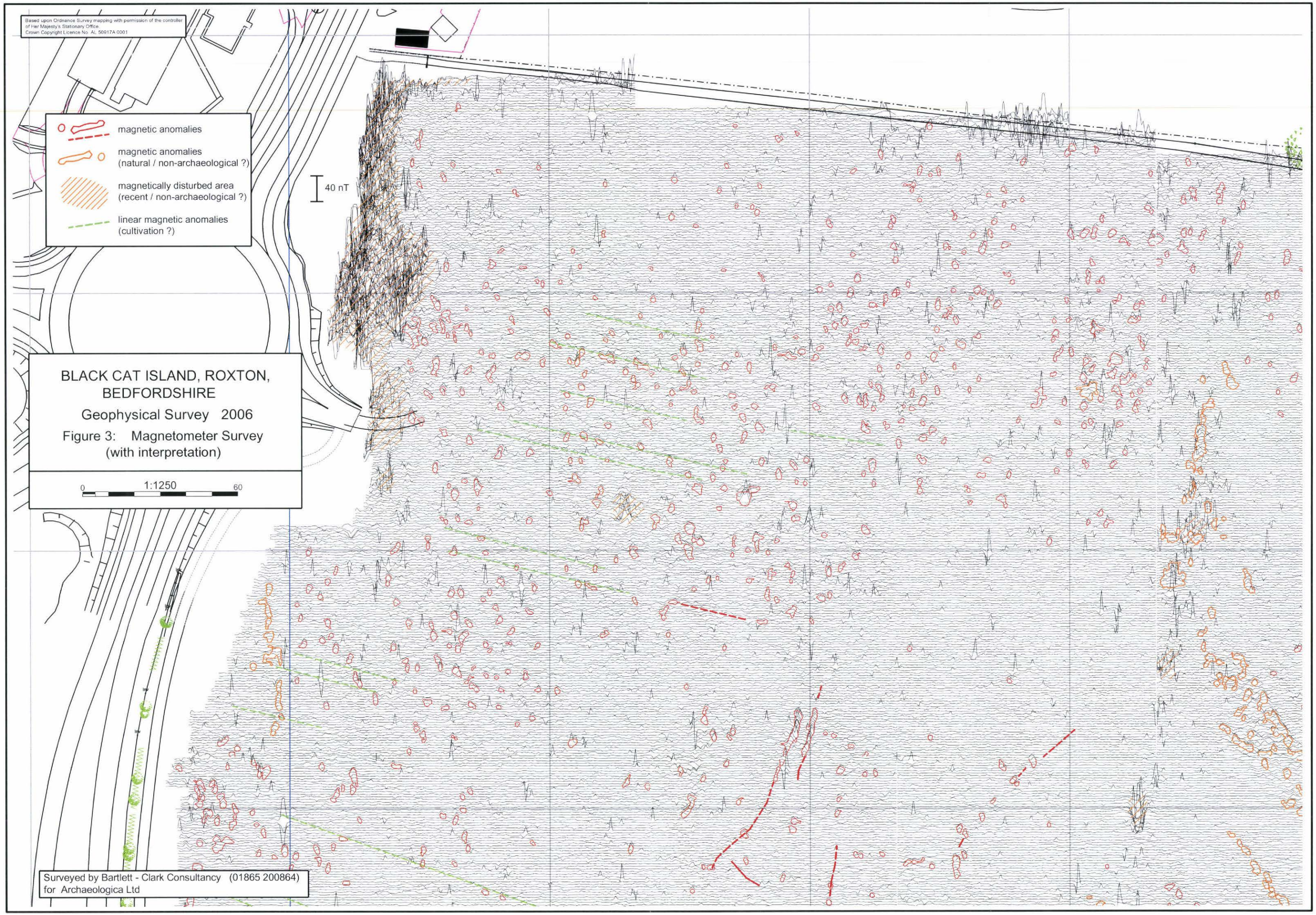
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magnetic anomalies
magnetic anomalies (natural / non-archaeological ?)
magnetically disturbed area (recent / non-archaeological ?)
linear magnetic anomalies (cultivation ?)
40 nT
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Geophysical Survey 2006
Figure 3: Magnetometer Survey (with interpretation)
0
1:1250
60
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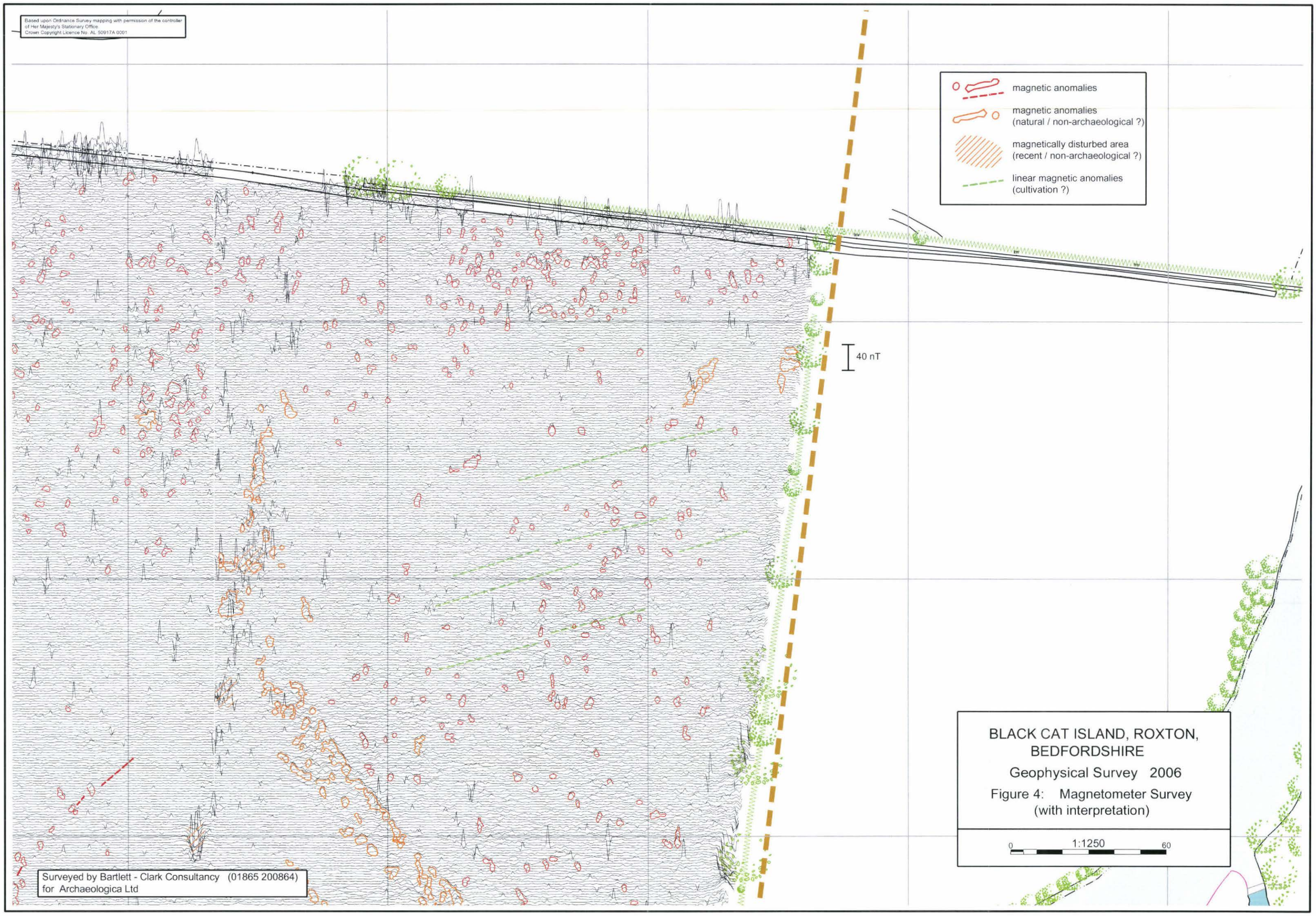
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magnetic anomalies
magnetic anomalies (natural / non-archaeological ?)
magnetically disturbed area (recent / non-archaeological ?)
linear magnetic anomalies (cultivation ?)
40 nT
BLACK CAT ISLAND, ROXTON, BEDFORDSHIRE
Geophysical Survey 2006
Figure 4: Magnetometer Survey (with interpretation)
0
1:1250
60
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40 nT
magnetic anomalies
magnetic anomalies (natural / non-archaeological ?)
magnetically disturbed area (recent / non-archaeological ?)
linear magnetic anomalies (cultivation ?)
BLACK CAT ISLAND, ROXTON, BEDFORDSHIRE
Geophysical Survey 2006
Figure 5: Magnetometer Survey (with interpretation)
0
1:1250
60
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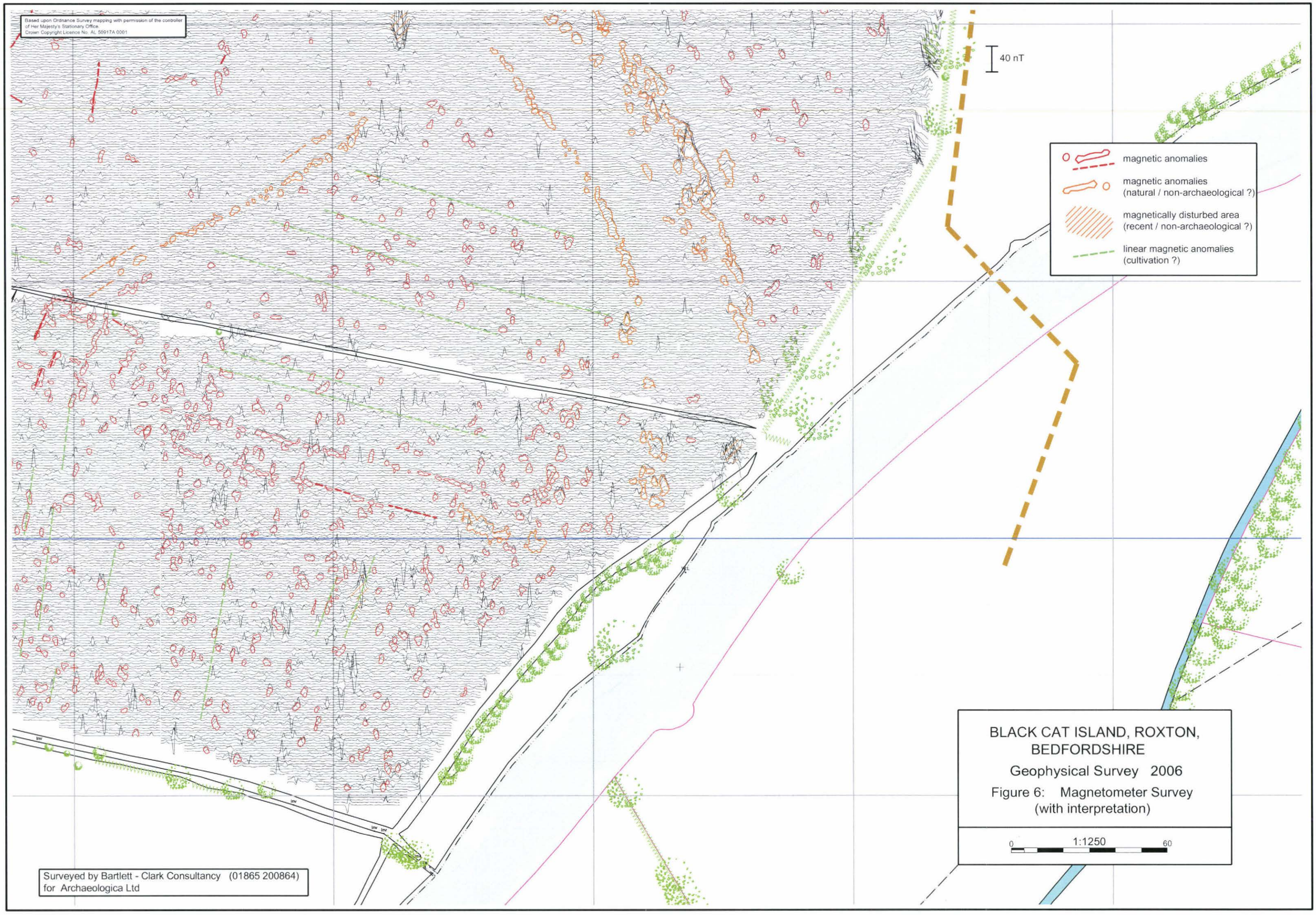
Based upon Ordnance Survey mapping with permission of the controller of Her Majesty's Stationary Office.
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40 nT
magnetic anomalies
magnetic anomalies (natural / non-archaeological ?)
magnetically disturbed area (recent / non-archaeological ?)
linear magnetic anomalies (cultivation ?)
BLACK CAT ISLAND, ROXTON, BEDFORDSHIRE
Geophysical Survey 2006
Figure 6: Magnetometer Survey (with interpretation)
0
1:1250
60
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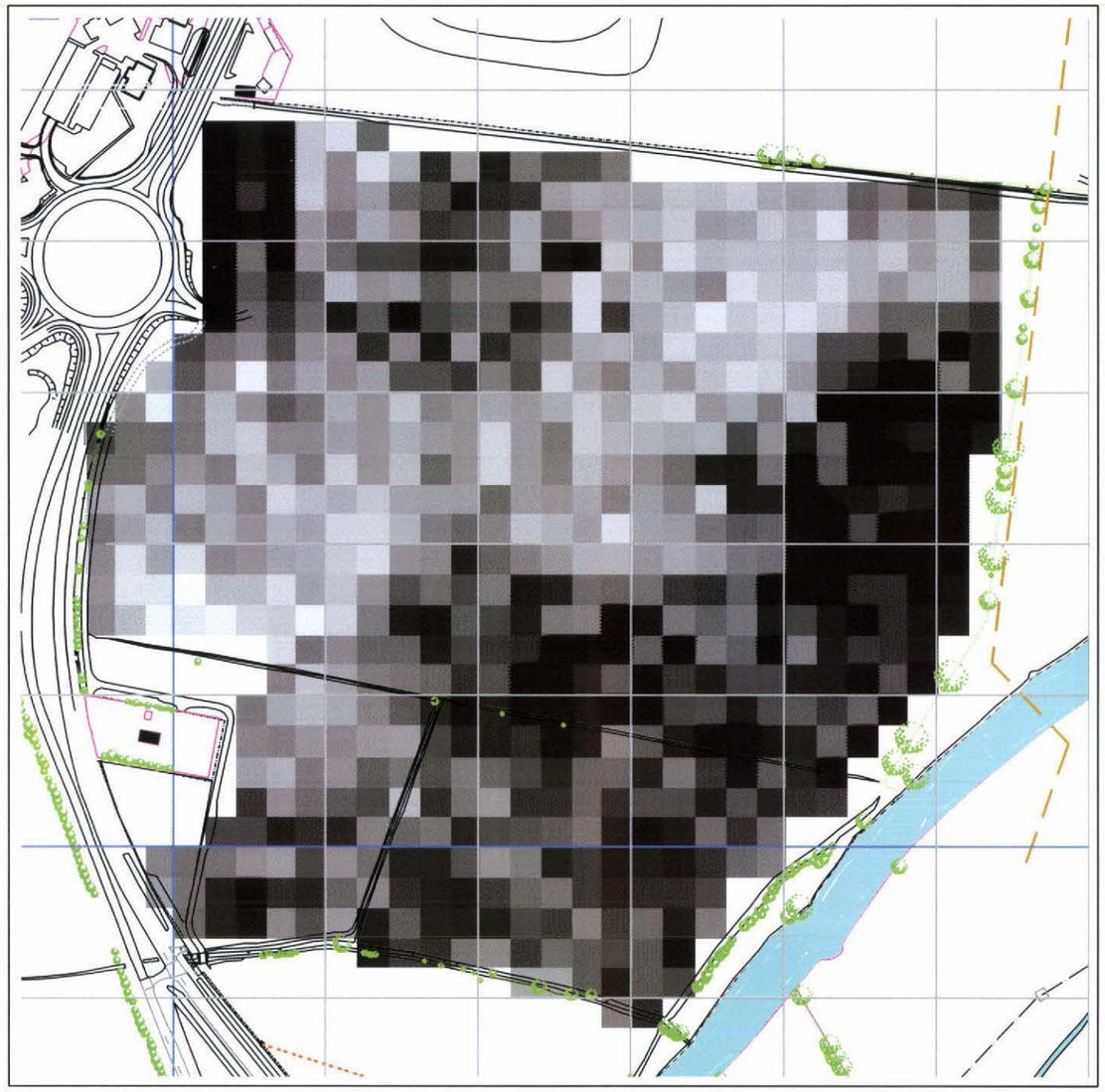
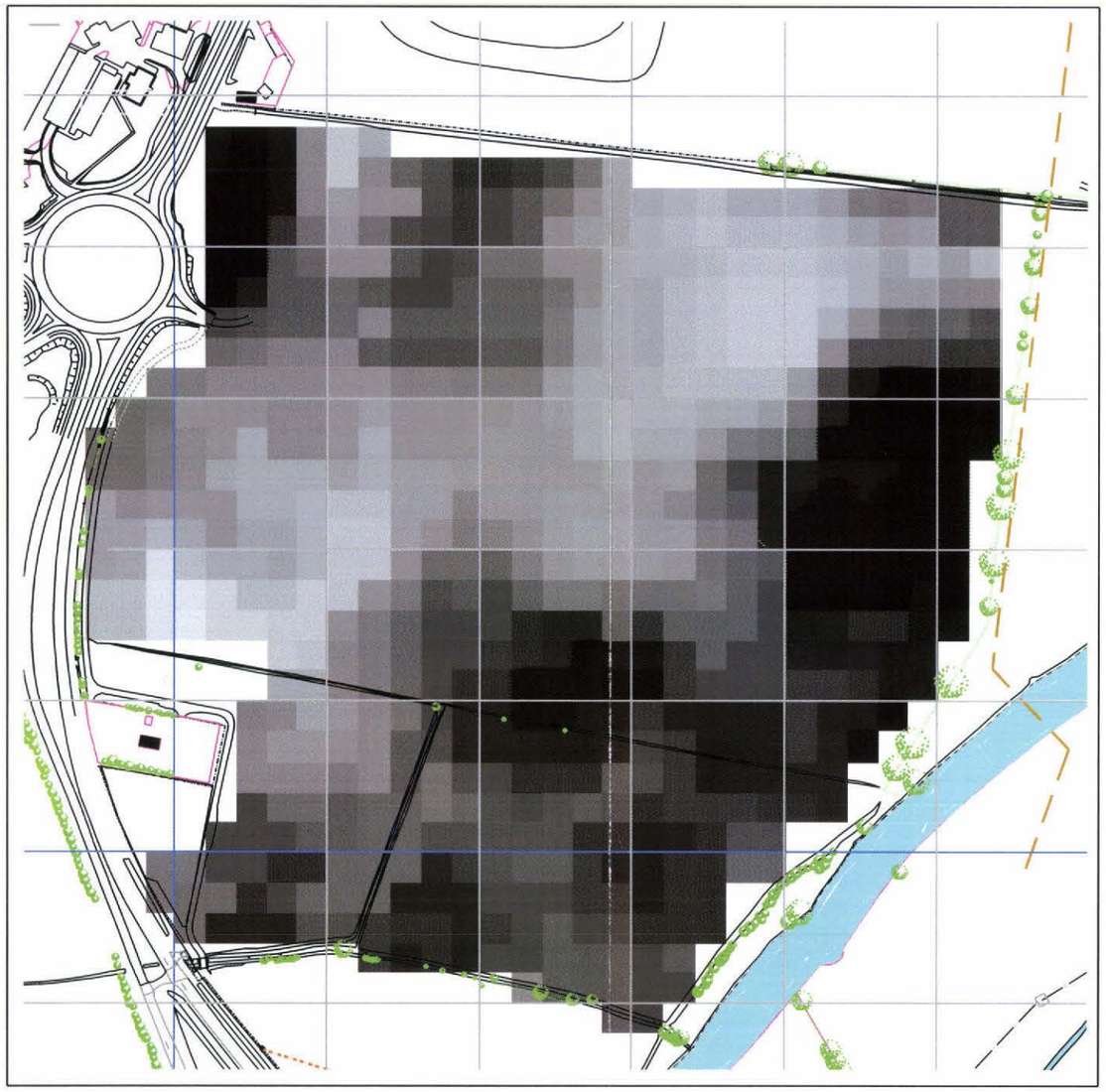


(i) Initial data



(ii) Data x median filter

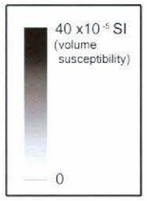


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Figure 7: Magnetic Susceptibility Survey

1:4000

0 200m

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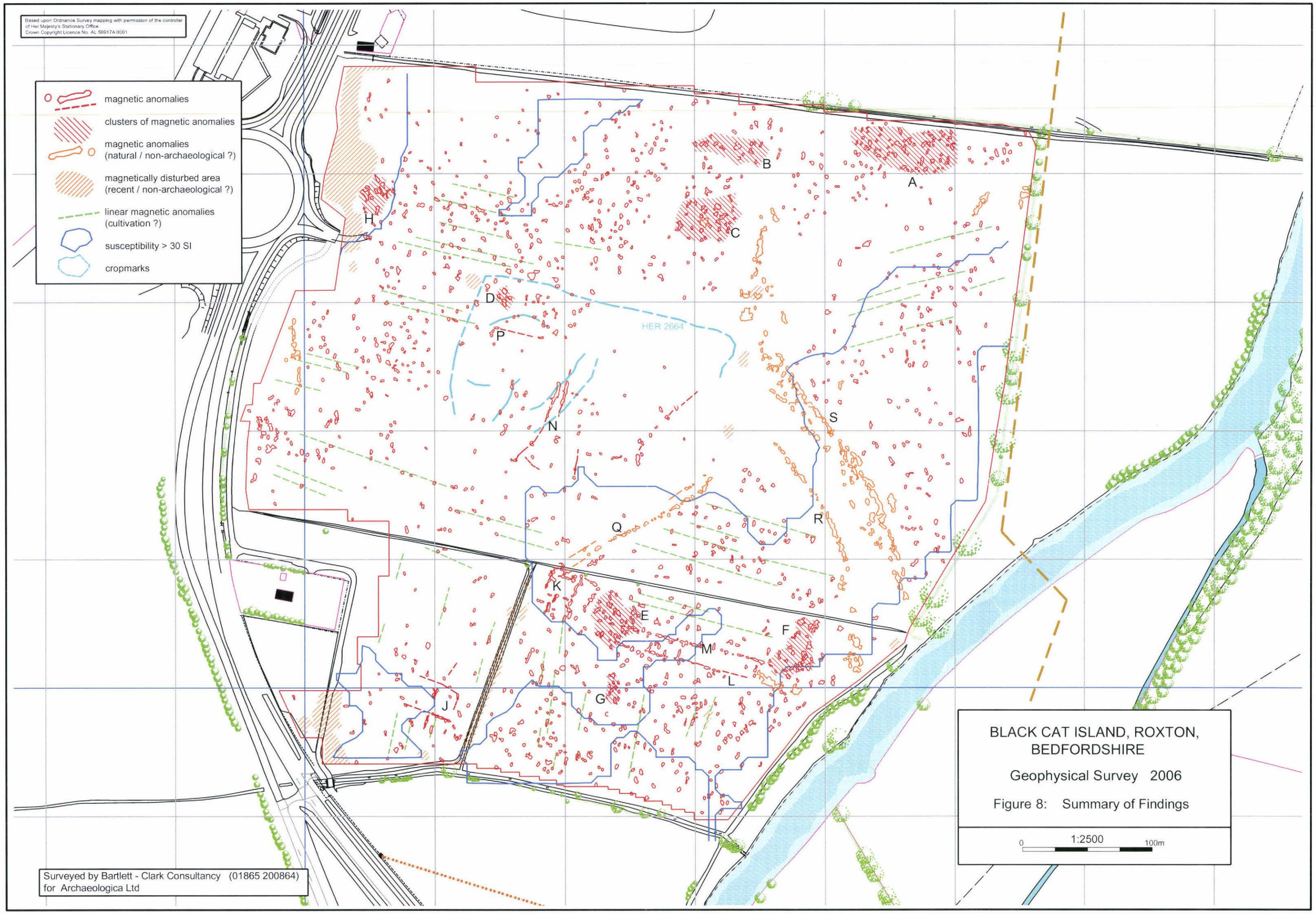
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magnetic anomalies
clusters of magnetic anomalies
magnetic anomalies (natural / non-archaeological ?)
magnetically disturbed area (recent / non-archaeological ?)
linear magnetic anomalies (cultivation ?)
susceptibility > 30 SI
cropmarks
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
HER 2664
BLACK CAT ISLAND, ROXTON, BEDFORDSHIRE
Geophysical Survey 2006
Figure 8: Summary of Findings
0
1:2500
100m
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Fig 3 Geophysical Survey: detailed magnetometry grey scale plot

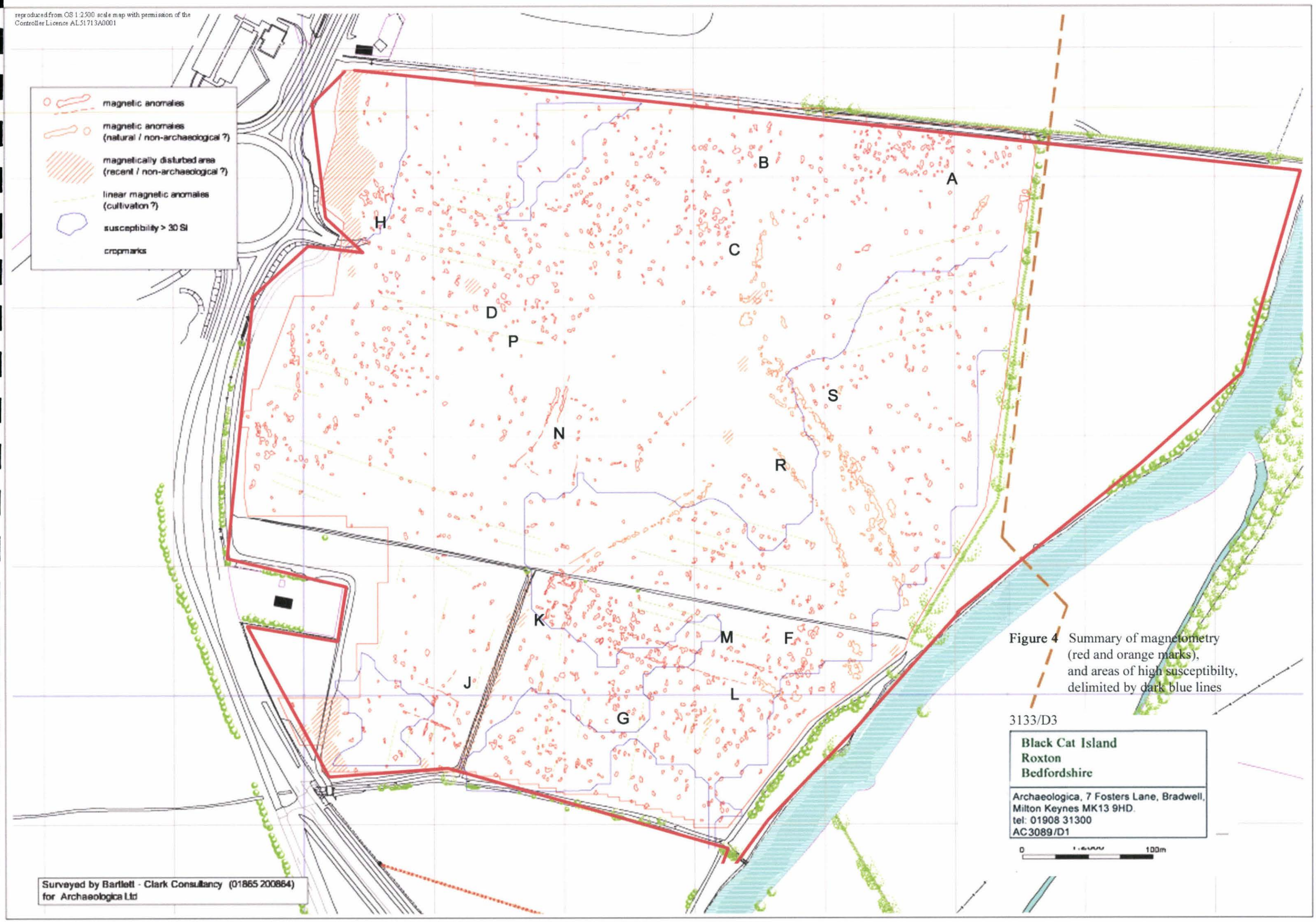

Figure 4 Summary of magnetometry (red and orange marks), and areas of high susceptibilty, delimited by dark blue lines

Figure 5
a) cropmarks of palaeochannels and the detailed magnetometry survey results
b) combined results of the detailed magnetometry and magnetic susceptibility survey

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