

**LOCKINGTON QUARRY, LEICESTERSHIRE
SOUTHERN EXTENSION**

**Report on Archaeological Geophysical Survey
2013**

Surveyed by:

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for:

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on behalf of:

Lafarge Tarmac

Lockington Quarry Southern Extension

Report on Archaeological Geophysical Survey of Phases 5 and 9 2013

Introduction

This geophysical survey was undertaken as part of an ongoing programme of archaeological investigations at the site of the proposed southern extension to the existing Lockington Quarry. The survey was commissioned from Bartlett-Clark Consultancy, Specialists in Archaeogeophysics of Oxford, by Archaeologica Ltd on behalf of Lafarge Tarmac. Fieldwork for the survey was done on 18-20th December 2013.

This survey follows a series of similar previous investigations (including an adjacent area surveyed in 2007), as commented on below. Comparison with earlier results helps us assess the validity and significance of the current findings.

The Site

Location and topography

The present survey covered the areas designated as Phases 5 and 9 of the extension area (as labelled on the phasing plan inset in figure 1). The total coverage (as indicated by red cross hatching in figure 1) amounts to 19.8ha. [The eastern corner of Phase 9 was planted for cover at the time of the fieldwork, and could not be surveyed.]

The southern extension area at Lockington Quarry is located around grid reference SK 480290, and includes arable fields to the east of junction 24a of the M1 to the north of Kegworth, Leicestershire.

The land is on an underlying geology of sand and gravel river terrace deposits above a bedrock of Triassic Mudstone. We are told the subsoil at the site includes areas both of Pierrepoint gravel, and of Hemington formation which includes silt as well as gravel. The survey response from features which are cut into silt is likely to be weaker than for features cut into gravel, but the response will also vary according to the depth, origin and composition of the fill. The two deposits are interspersed across the various survey areas, and do not appear to correspond to clearly distinguishable variations in the quality of the survey response.

The site may also contain areas of deeper alluvial deposits, although the survey evidence suggests they are localised rather than extensive. The land is generally level, with minor variations in elevation between c. 29.5m and 30m AOD. The only extended area within the combined survey coverage which lies beneath the 29.5m contour is a strip along the southern boundary of the 2007 survey. This is identified as an area of deeper topsoil in the 2005 aerial photographic interpretation (as shown in figure 4), and produced strong magnetic anomalies

of a kind which are commonly seen in areas of alluvial deposition. Only a few other similar magnetic anomalies were seen in the 2013 survey, suggesting there are few other deep or extensive alluvial deposits within the survey area.

Archaeological background

Previous nearby geophysical surveys include the 2007 survey as mentioned above [3], which covered Phase 10 (then called Phase 1B). Earlier surveys were done by University of Leicester Archaeological Services (ULAS) in 1998 and 2000 [1] and [2]. The locations of the 2007 and 2013 surveys, and the approximate locations of the ULAS surveys, are shown by outlines and cross hatching in figure 1.

Previously identified archaeological sites in the area (as noted in [4]) include a large Iron Age and Romano-British settlement and enclosures to the north (Scheduled Monument SM 126), which includes a villa (SM 140) to the east. The site also forms part of a late Iron Age and Roman landscape, and Lockington Bronze Age barrow cemetery lies to the west and south.

The 1998 ULAS survey [1] covered land at Warren Farm, and is indicated by blue cross hatching at the north of figure 1. The grey scale plot (reproduced in figure 2) and interpretation of this survey (inset in figure 4) show a dense and strongly responsive group of enclosures and associated features which together clearly represent a settlement site.

The 2000 survey by ULAS [2] produced only limited findings. This survey covered a series of sample areas, together with background magnetic susceptibility testing. Some of the survey areas (as indicated by blue outlines and hatching in the southern half of figure 1) lie within the 2007 and 2013 coverage. Features from the ULAS interpretation are reproduced (as grey lines) in figures 4, 11 and 12 for comparison with later findings. It can be seen from the ULAS grey scale plots reproduced in figures 2 and 3 that these features represent generally weak and inconclusive variations in the survey data, and are much less distinct than those seen in the 1998 survey plot (shown in figure 2). The most clearly defined of the 2000 findings located within the 2013 survey area was interpreted as a possible pit alignment (marked at C in figure 12). This was detected also in 2013 (but we interpret it as a probable land drain for reasons as noted below).

Findings from the 2007 survey [3] were intermediate in number and quality between those seen in the 1998 survey to the north, and the 2000/2013 surveys to the south. The area investigated lies immediately south of a settlement site as indicated by cropmark features (shown in figure 4), and some of the cropmarks extend south into the 2007 survey area.

A subsequent excavation here in 2010-11 [4] confirmed the presence of a north-south linear pit alignment and trackway ditch, as indicated both by the cropmarks and survey findings. [The location of the initial stripped area is indicated by a green outline in figure 1, and an excavation plan is shown together with the 2007 survey findings in figure 11. An extended open area excavation was also undertaken in the vicinity of the pit alignment.] Other findings noted in [4] include a number of pit-like features, including some which may relate to the mixed (gravel/silt) geology, and others which could be natural tree-boles, etc. It is likely that some of the smaller pit-like features noted in the 2007 interpretation (shown in figure 11) fall into these categories.

The topsoil and subsoil at the excavated site are described in [4] as sandy silt to a combined depth of 50cm +. Some of the excavated features are no deeper than this, and so (as noted above) would produce a weaker magnetic contrast than feature cut into the underlying gravel. [This is confirmed by magnetic susceptibility tests done at the site of the 1998 survey (then under excavation) which are mentioned in the 2007 report [3]: gravel subsoil samples gave low readings ($5-10 \times 10^{-8}$ SI/kg), compared with readings of 21-38 for topsoil (and higher readings for feature fill). Features with a topsoil fill cut into gravel should therefore be readily detectable, as was seen in the 1998 survey.]

The larger pits seen in the 2010-11 excavation relate mainly to the north-south cropmark feature, and others were generally smaller and shallower. Dating evidence included Neolithic flints and pottery, although there were also some later finds. These were limited in number, and it is therefore concluded that the excavated site was not a focus of settlement activity. It is mentioned in the report [4] that the (2007) magnetometer survey was relatively accurate in predicting the larger linear boundary features, but less successful with smaller discrete deposits. This is as would be expected at a site lacking occupation remains, and where the features therefore do not contain the magnetically enhanced fill which is usually associated with settlement activity.

Survey Procedure

The 2013 survey followed procedures essentially the same as those used in 2007.

The method used for this geophysical investigation was a recorded magnetometer survey, with readings collected along transects 1m apart using Bartington 1m fluxgate gradiometers, and plotted at 25cm intervals along each transect. Figures 1-4 show the survey location (figure 1), and previous results (figures 2-4). The results of the 2013 survey are presented as a grey scale plot at 1:2000 scale (figures 5-7), and as a graphical (x-y trace) plot at 1:1500 in three overlapping sections in figures 8-10. Comparison of these alternative presentations allows the detected magnetic anomalies to be examined in plan and profile respectively. An interpretation of the findings is shown superimposed on figures 8-10 (which permits the interpreted magnetic anomalies to be compared with the underlying data), and is reproduced separately to provide a summary of the findings (figures 11-12).

The graphical plot shows the magnetometer readings after minimal processing to adjust for irregularities in line spacing caused by variations in the instrument zero setting. Additional 2D low pass filtering has been applied to the grey scale plot to adjust background noise levels.

Colour coding has been used in the interpretation to distinguish different effects. Magnetic anomalies of possibly archaeological origin are outlined in red. Strong magnetic disturbances which are likely to be of recent origin are shown in brown. Individual strong magnetic anomalies which appear to represent iron objects are in blue, and potential cultivation effects in green. Irregular magnetic anomalies which are likely to indicate variations in the depth or composition of alluvial deposits are in light green. Possible land drains are shown in blue/purple.

Survey location

The survey grid was set out and tied to the OS grid using a Trimble differential GPS system (with VRS correction to give c. 10cm accuracy). The plans are therefore geo-referenced, and OS co-ordinates of map locations can be read from the AutoCAD version of the plans which can be supplied with this report.

Results

The 2013 survey has produced only limited findings, as was the case also in the 2000 ULAS surveys of adjacent or overlapping areas [2].

One of the more distinctive findings is a ditch-like linear feature towards the north of the Phase 9 survey area (as labelled A in figure 11). This appears to be isolated, with no other nearby interpretable features other than possible recent disturbances, and weak linear markings (visible in the grey scale plot, and shown in green) which could result from modern ploughing. Items of ferrous debris (as indicated by narrow spikes in the graphical plots 8-10) are outlined in blue (not shown in 2007 interpretation). They appear to be uniformly distributed across the site, with no apparent concentrations.

A few broad irregular magnetic anomalies of the kind which appear to be associated with alluvial deposits in the 2007 survey are visible in the north-west corner of the survey in figure 11 (as outlined in light green), but only a few similar features are visible elsewhere. The strongest of these are close to the cropmark ring ditch at B. The ring ditch, and the two smaller ones to the east, were not detected. The reason for this could be that shallow or eroded earthwork features remote from settlement features or other sources of enhanced fill may not respond reliably to a survey (as noted above). The proximity of the ring ditch to the magnetic anomalies at B may also raise the possibility that the cropmark features could perhaps be of natural origin.

Findings in the Phase 5 survey area (figure 12) include a pair of intermittent parallel linear features at C. We interpret these as land drains because sections of clay pipe often give rise to a broken linear response, and because they terminate at a distinct linear feature D. The features at D correspond to a ward boundary shown on the OS map, and the magnetic anomalies must therefore represent debris in the fill of a former ditch marking an old field boundary. The linear features C could therefore drain into the ditch at D.

One of the features at C clearly corresponds to the ULAS pit alignment. The position is offset slightly, but we do not have detailed location plans for the ULAS survey. Other features from the ULAS survey (grey lines in figure 12) do not correspond to identifiable features in the 2013 survey (and relate only to minimal or uncertain markings in the 2000 grey scale plot inset in figure 3).

One other finding is a short ditch-like feature (in red) at E. This is rather irregular in plan, and not very clearly distinguishable from other features outlined in green as possible alluvial effects. Other individual pit-like features (as outlined in red) are very dispersed and difficult to identify. There are no groups or clusters of such features to suggest the presence of an archaeological site.

Conclusions

It is always more difficult to confirm the validity of negative geophysical results than of positive findings, but comparison in this case with the previous surveys suggest there are unlikely to be any substantial concentrations of archaeological features within the 2013 survey areas.

A distinct ditch-like feature was detected at A in Phase 9, but the survey did not confirm the presence of the cropmark ring ditches (perhaps for reasons as noted above). Drains and a ditch were found at C and D in Phase 5, and one of the drains appears to relate to a linear feature seen also in the 2000 survey.

The 2007 survey detected a number of archaeological findings, even in the absence of associated settlement activity. It is likely therefore that any dense concentrations of archaeological features of the kind seen in the 1998 survey would be detectable, if they were present. Features comparable to those seen in 2007 appear to be absent from the 2013 survey, other than the possible ditch at A.

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17 February 2014

The fieldwork for this project was done by C. Oatley, P. Heykoop, N. Paveley and R. Organ.

References:

- [1] Butler, A. *A Geophysical Survey at Warren Farm Leicestershire*; University of Leicester Archaeological Services. Report No. 98/79 for Redlands Aggregates Ltd, 1998

- [2] Butler, A. *A Geophysical Survey at the Fulcrum Site, Kegworth, Leicestershire*; University of Leicester Archaeological Services. Report No. 2000/57 for Redlands Aggregates Ltd, 2000.

- [3] *Lockington Quarry, Leicestershire; Southern Extension. Report on Archaeological Geophysical Survey 2007*. Report by Bartlett-Clark Consultancy for Archaeologica Ltd; 30 November 2007.

- [4] Coward, J. *An open area excavation and attendant watching brief at Lockington Quarry, Lockington, Leicestershire*. University of Leicester Archaeological Services. ULAS Report No. 2011-058. 2011.

2

Location of 1:4000 figures (2-3)

Location of 1:2000 figures (5-7)

Location of 1:1500 figures (8-10)

Location of 1:2500 figures (11-12)

Previous magnetometer surveys (by ULAS)

Excavation (2011)

Magnetometer survey (2007)

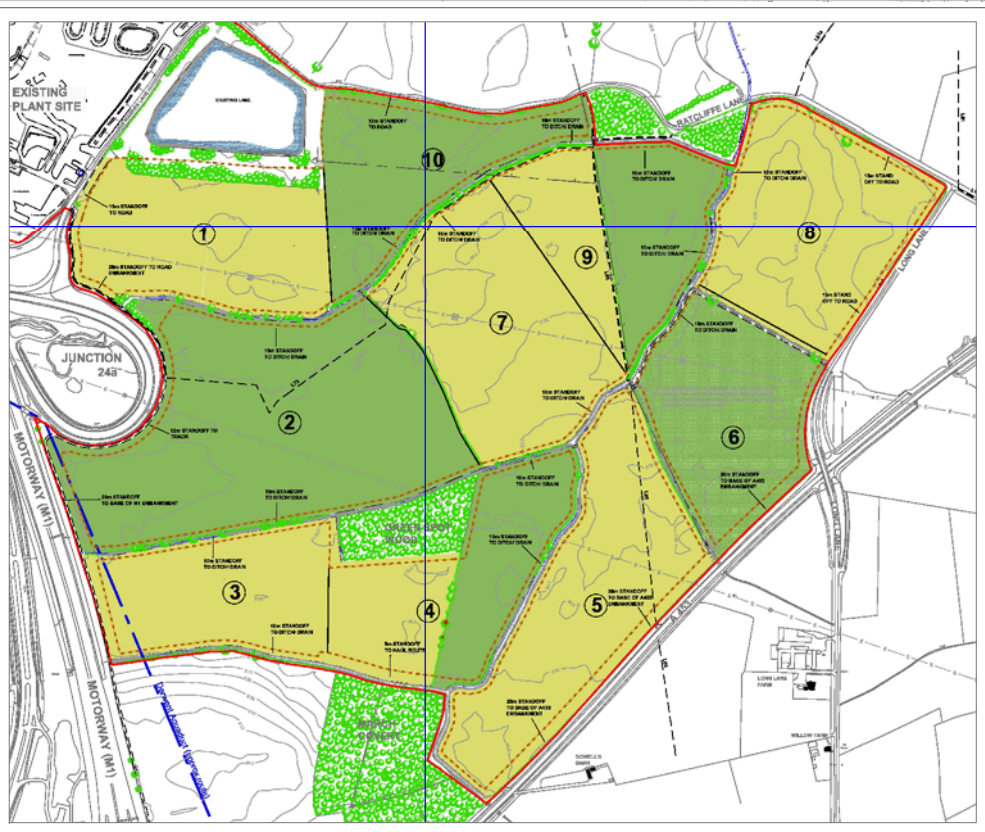
Magnetometer survey (2013)



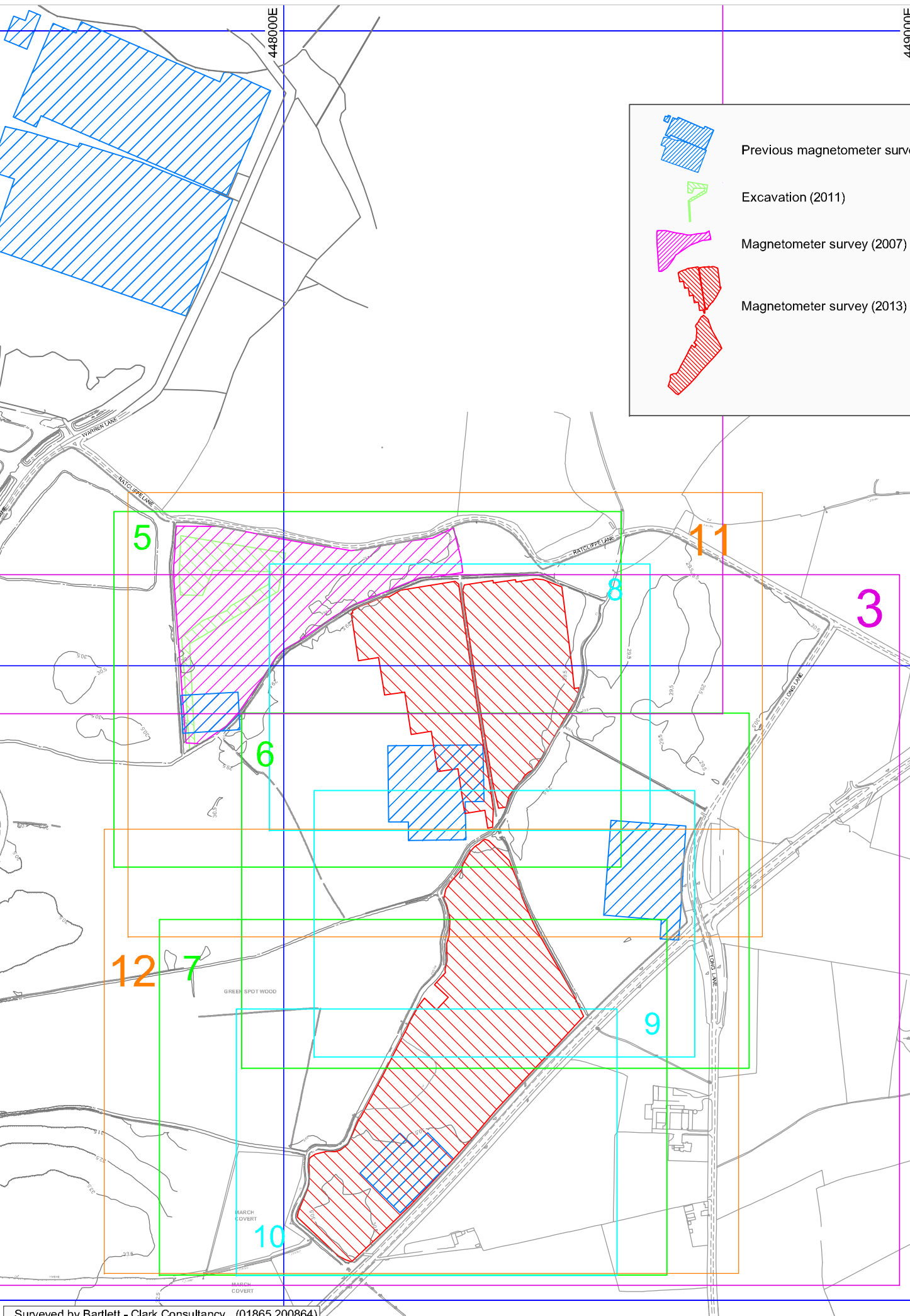
329000N

448000E

449000E



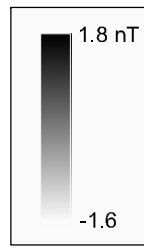
Revised phasing (plan by Lafarge Tarmac) 1:12500







Surveyed by Bartlett - Clark Consultancy (01865 200864)
 for Archaeologica Ltd

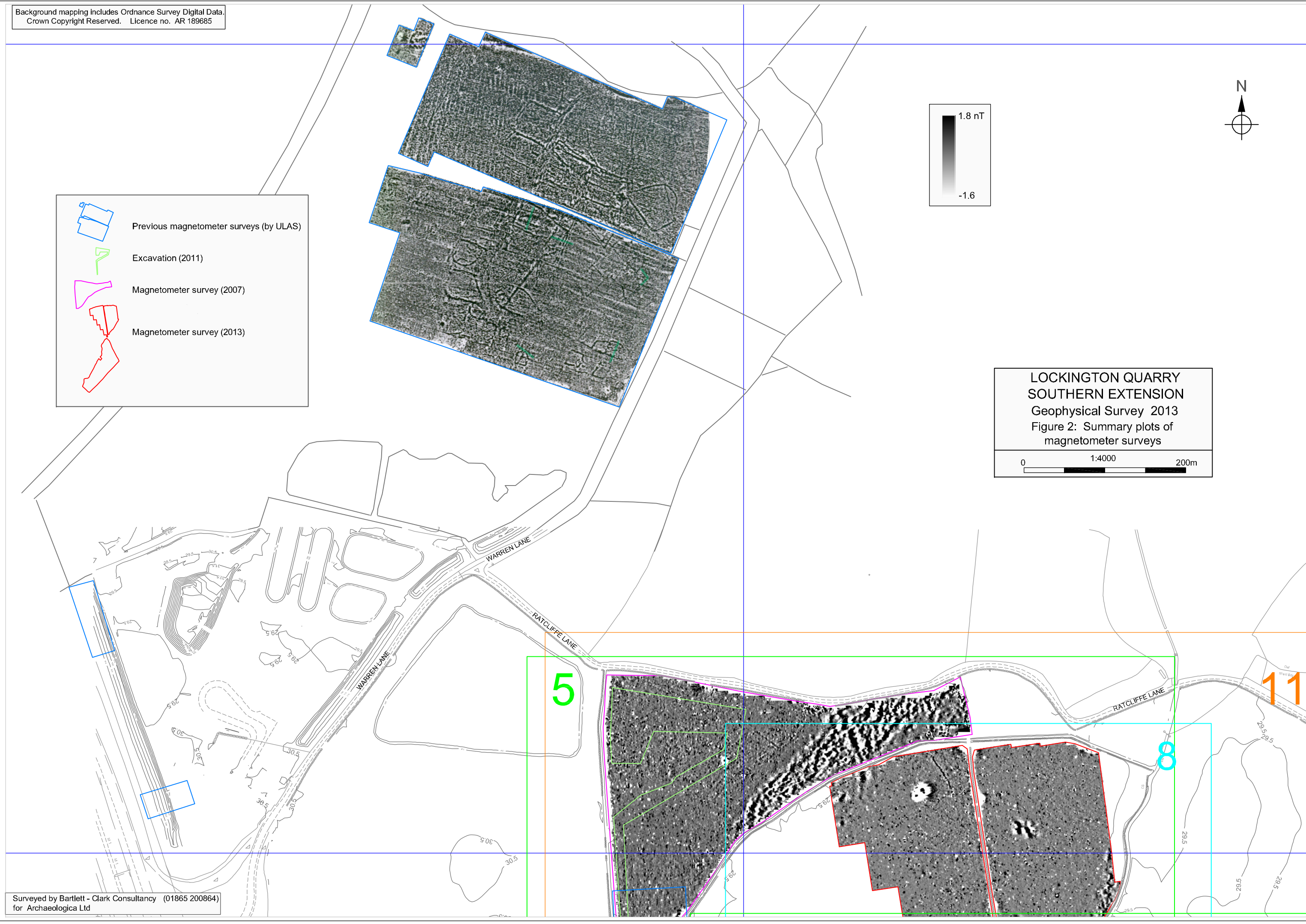

**LOCKINGTON QUARRY
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 Geophysical Survey 2013
 Figure 1: Survey location
 (with previous surveys)

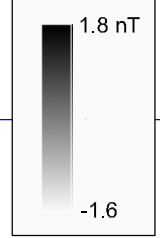
0 1:7500 250m







-  Previous magnetometer surveys (by ULAS)
-  Excavation (2011)
-  Magnetometer survey (2007)
-  Magnetometer survey (2013)

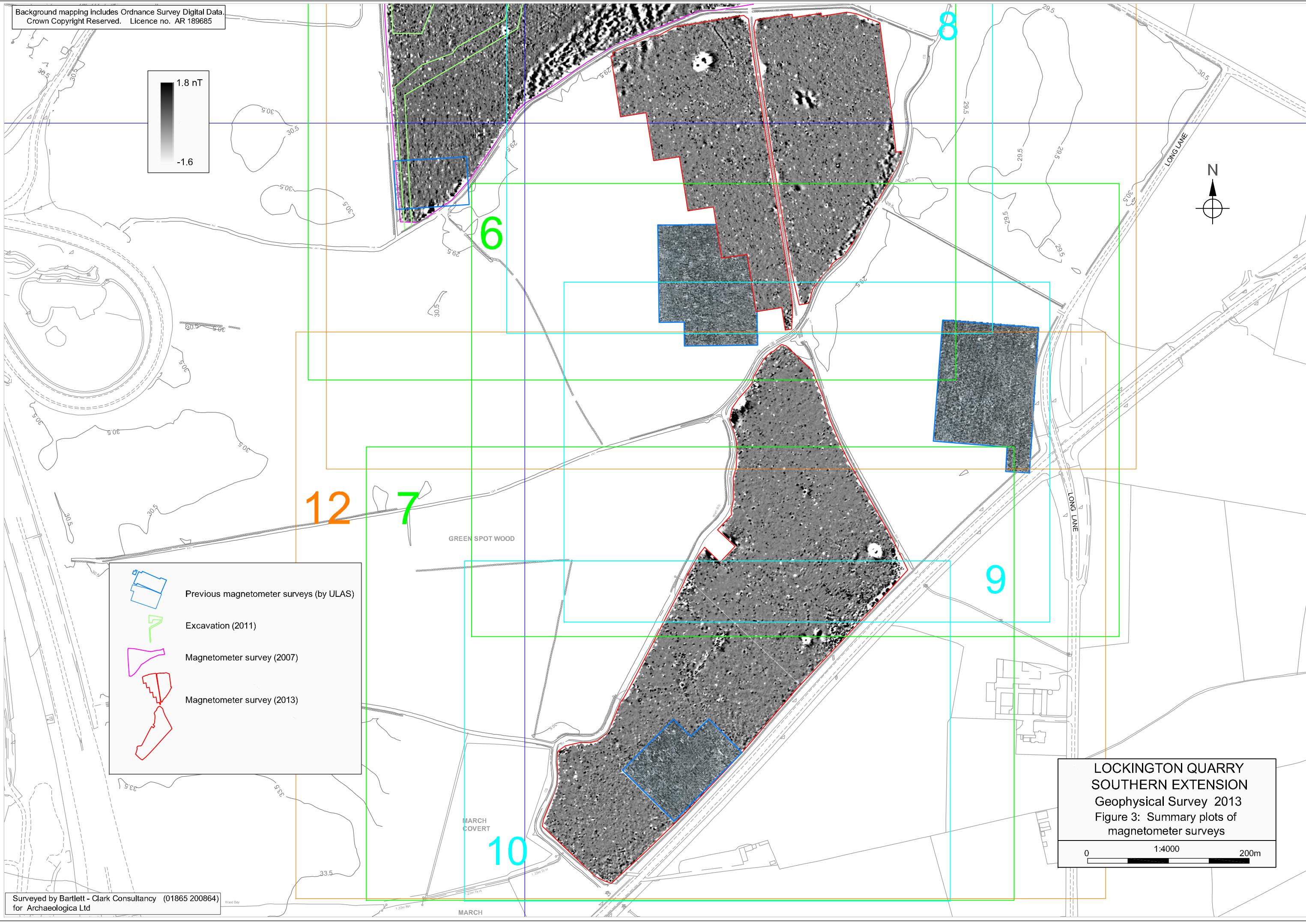
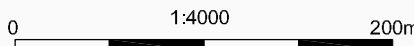
**LOCKINGTON QUARRY
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Geophysical Survey 2013
Figure 2: Summary plots of
magnetometer surveys

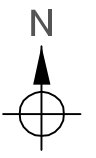




-  Previous magnetometer surveys (by ULAS)
-  Excavation (2011)
-  Magnetometer survey (2007)
-  Magnetometer survey (2013)

**LOCKINGTON QUARRY
SOUTHERN EXTENSION**
Geophysical Survey 2013
Figure 3: Summary plots of
magnetometer surveys





Previous magnetometer surveys (by ULAS)

Excavation (2011)

Magnetometer survey (2007)

Magnetometer survey (2013)

Magnetic anomalies (traced from ULAS interpretative plans)

329000N

448000E

449000E

Area examined

Archaeological features

Ditch

Possible ditch

Headland

Ridge and furrow (schematic)

Recent features

Removed field boundary

Possible hand-dug quarry

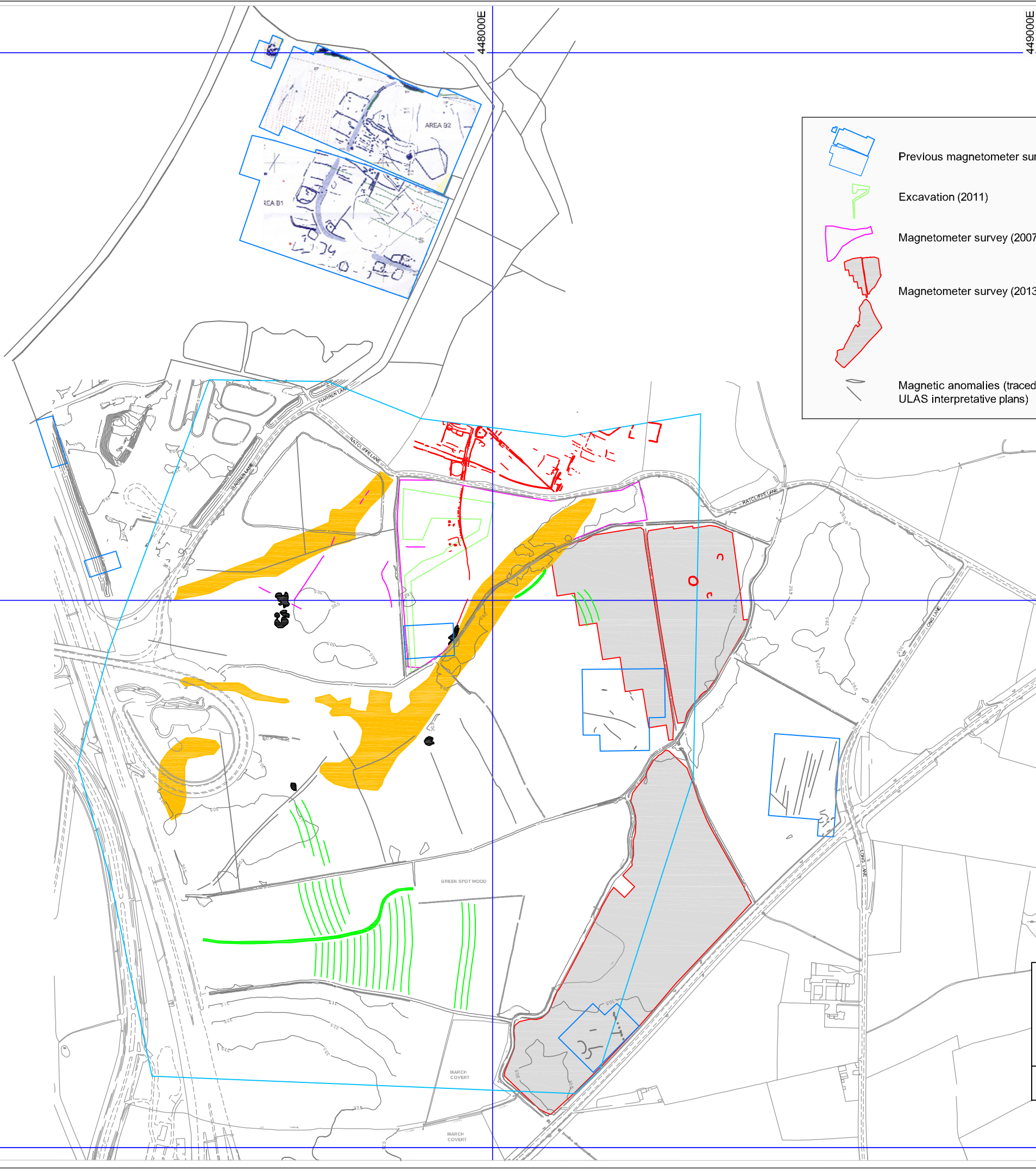
Natural feature

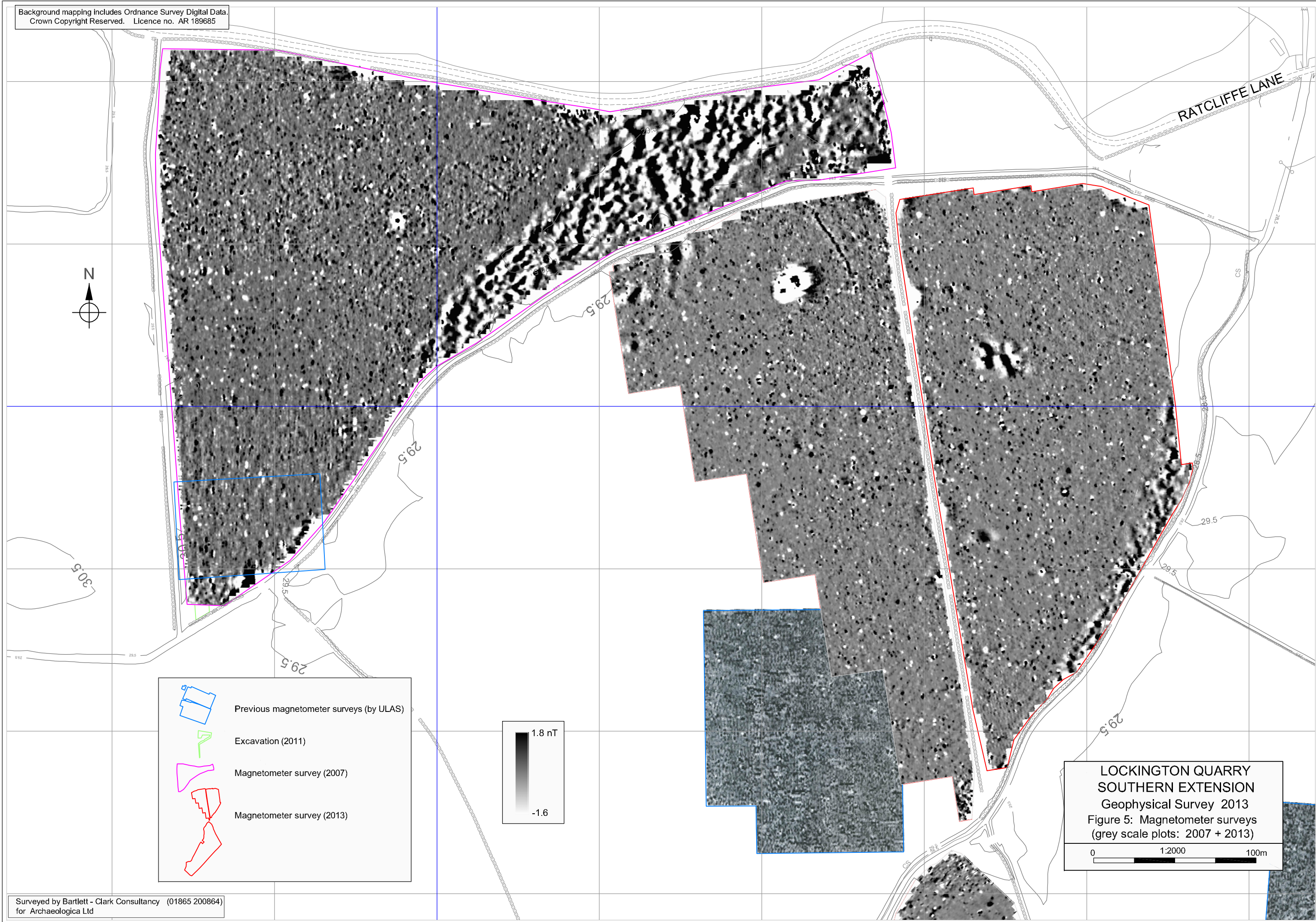
Deeper soil





Aerial photo interpretation
(from plan by Air Photo Services Cambridge
September 2005)

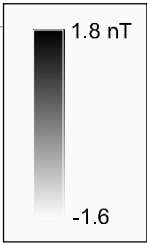
LOCKINGTON QUARRY
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Geophysical Survey 2013
Figure 4: Interpretation of
ULAS surveys (+ cropmarks)

0 1:7500 250m



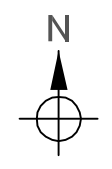
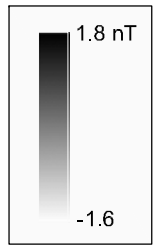






-  Previous magnetometer surveys (by ULAS)
-  Excavation (2011)
-  Magnetometer survey (2007)
-  Magnetometer survey (2013)



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Geophysical Survey 2013**
Figure 5: Magnetometer surveys
(grey scale plots: 2007 + 2013)

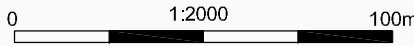
0 1:2000 100m



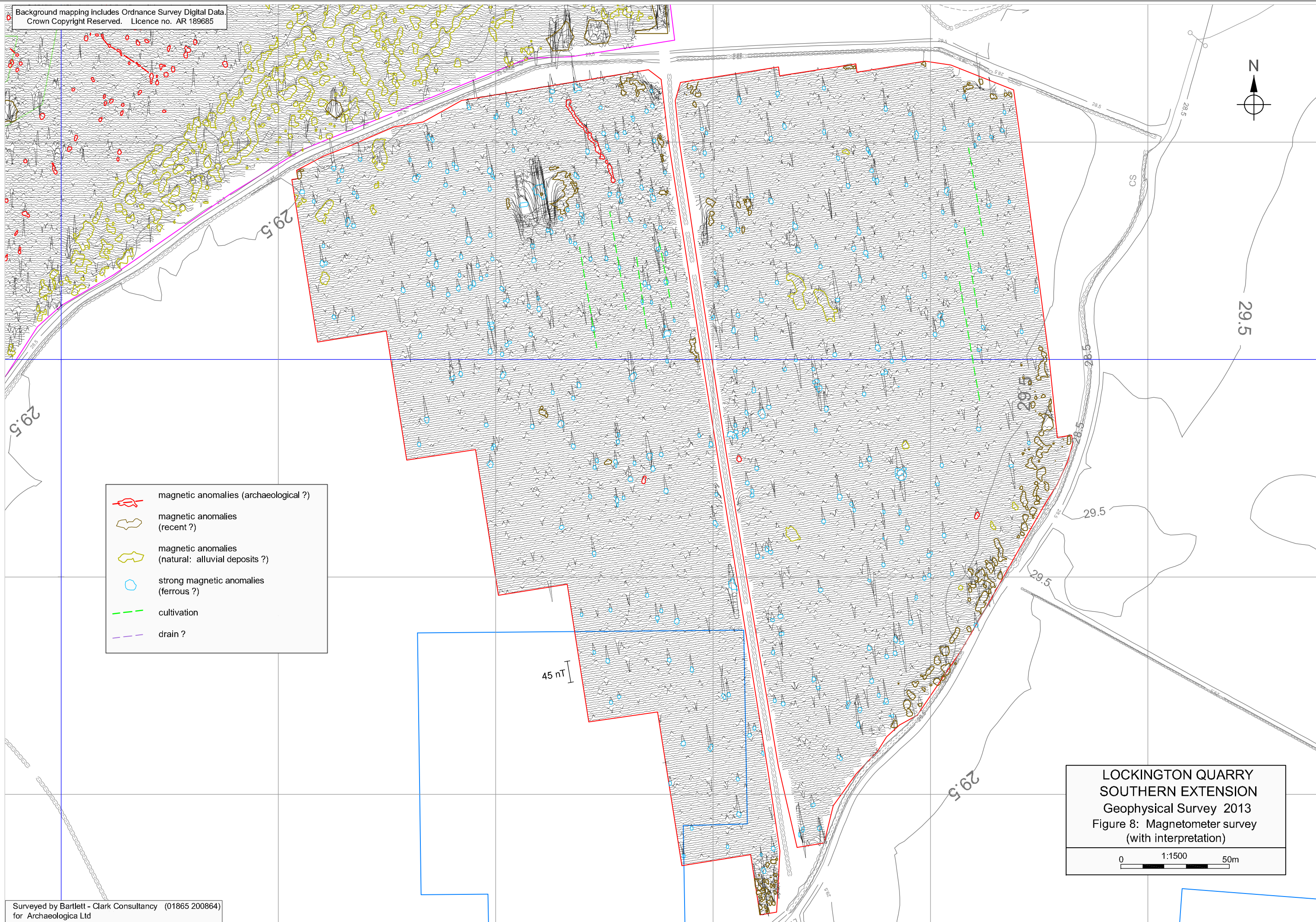
-  Previous magnetometer surveys (by ULAS)
-  Excavation (2011)
-  Magnetometer survey (2007)
-  Magnetometer survey (2013)







N SPOT WOOD

**LOCKINGTON QUARRY
SOUTHERN EXTENSION**
Geophysical Survey 2013
Figure 6: Magnetometer surveys
(grey scale plots: 2007 + 2013)



Background mapping includes Ordnance Survey Digital Data.
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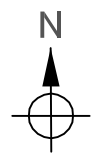


-  magnetic anomalies (archaeological ?)
-  magnetic anomalies (recent ?)
-  magnetic anomalies (natural: alluvial deposits ?)
-  strong magnetic anomalies (ferrous ?)
-  cultivation
-  drain ?

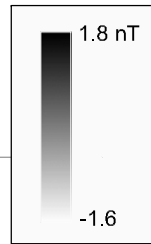
45 nT





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Geophysical Survey 2013
Figure 8: Magnetometer survey
(with interpretation)

0 1:1500 50m



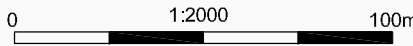
GREEN SPOT WOOD

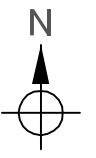








-  Previous magnetometer surveys (by ULAS)
-  Excavation (2011)
-  Magnetometer survey (2007)
-  Magnetometer survey (2013)

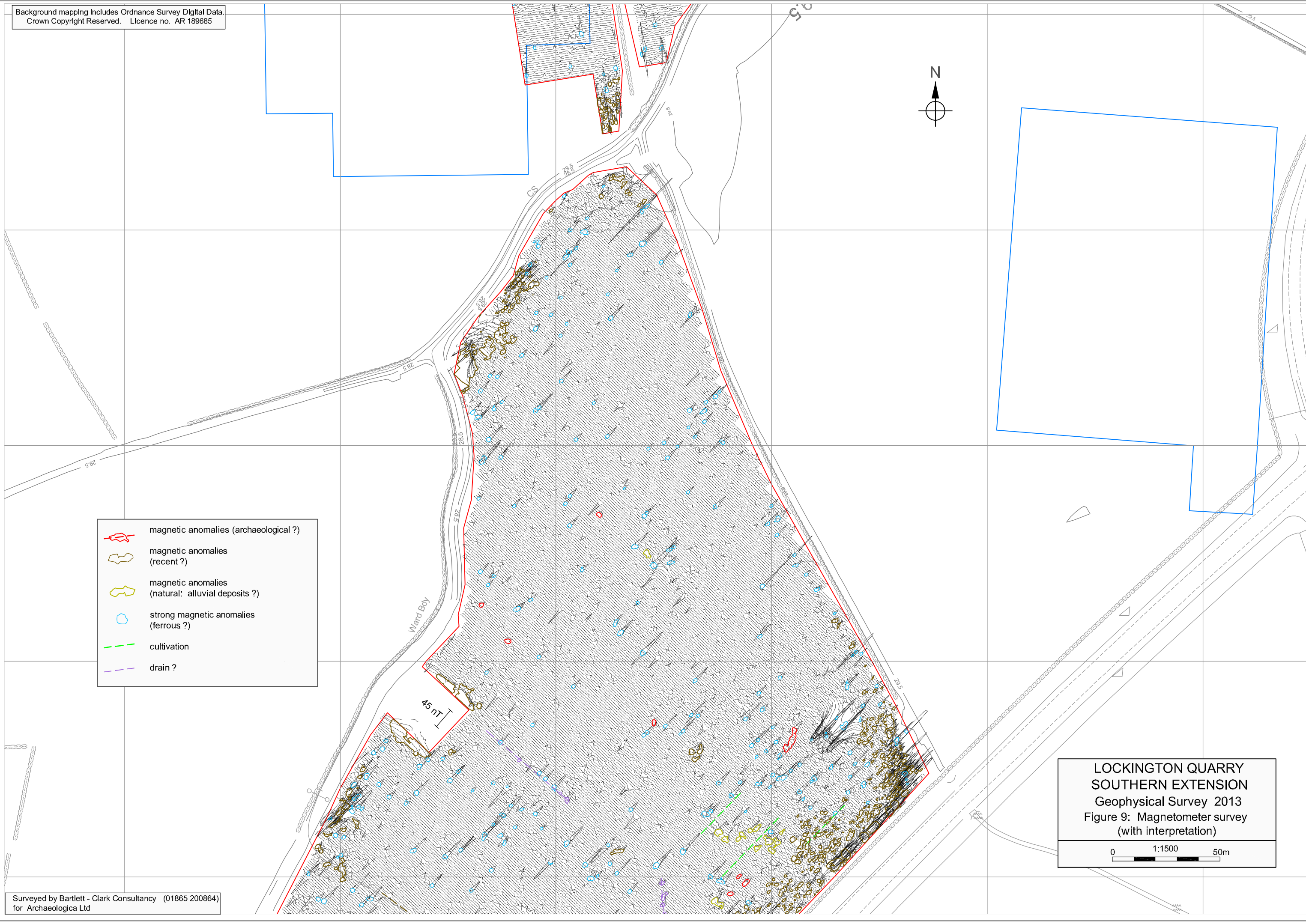
MARCH
COVERT

LOCKINGTON QUARRY
SOUTHERN EXTENSION
Geophysical Survey 2013
Figure 7: Magnetometer surveys
(grey scale plots: 2007 + 2013)



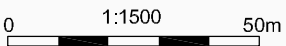








-  magnetic anomalies (archaeological ?)
-  magnetic anomalies (recent ?)
-  magnetic anomalies (natural: alluvial deposits ?)
-  strong magnetic anomalies (ferrous ?)
-  cultivation
-  drain ?

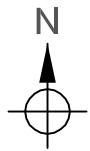


45 nT

LOCKINGTON QUARRY
SOUTHERN EXTENSION
Geophysical Survey 2013
Figure 9: Magnetometer survey
(with interpretation)



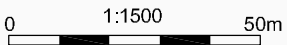
-  magnetic anomalies (archaeological ?)
-  magnetic anomalies (recent ?)
-  magnetic anomalies (natural: alluvial deposits ?)
-  strong magnetic anomalies (ferrous ?)
-  cultivation
-  drain ?



MARCH
COVERT

1.22m Tk H

LOCKINGTON QUARRY
SOUTHERN EXTENSION
Geophysical Survey 2013
Figure 10: Magnetometer survey
(with interpretation)



448000E








329000N



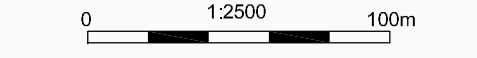
RATCLIFFE LANE

Features west of the topsoil bund Fig 7

Pit/linear complex north Fig 11

-  magnetic anomalies (archaeological ?)
-  magnetic anomalies (recent ?)
-  magnetic anomalies (natural: alluvial deposits ?)
-  strong magnetic anomalies (ferrous ?)
-  cultivation
-  drain ?
-  cropmark ring ditches, and magnetic anomalies traced from ULAS plans

**LOCKINGTON QUARRY
SOUTHERN EXTENSION**
Geophysical Survey 2013
Figure 11: Summary of findings
(2007 + 2013)










448000E



GREEN SPOT WOOD

LONG LANE

-  magnetic anomalies (archaeological ?)
-  magnetic anomalies (recent ?)
-  magnetic anomalies (natural: alluvial deposits ?)
-  strong magnetic anomalies (ferrous ?)
-  cultivation
-  drain ?
-  cropmark ring ditches, and magnetic anomalies traced from ULAS plans

MARCH COVERT

328000N

33.5

LOCKINGTON QUARRY
SOUTHERN EXTENSION
Geophysical Survey 2013
Figure 12: Summary of findings
(2007 + 2013)

