99/20

FLUXGATE GRADIOMETER SURVEY
LAND AT THE HAWTHORNS
CHERRY WILLINGHAM
LINCOLNSHIRE

FLUXGATE GRADIOMETER SURVEY
LAND AT THE HAWTHORNS
CHERRY WILLINGHAM
LINCOLNSHIRE

Report prepared for City of Lincoln Archaeology Unit
by James Snee BSc & David Bunn BSc.
November1999

Pre-Construct Geophysics
61 High Street
Newton on Trent
Lincoln
LN1 2JP
Tel. & Fax. 01777228129

Contents

Illustrations

Summary

- *A detailed fluxgate gradiometer survey took place to evaluate the archaeological potential of land off Ladymeers Road, Cherry Willingham, Lincolnshire.*

- *An area of strong magnetic variation was detected in the vicinity of a trial excavation trench which was known to contain archaeological features, comprising linear anomalies and possible metal working areas.*

- *The survey detected a pattern of natural reticulation in the bedrock possibly caused by glacial fractures.*

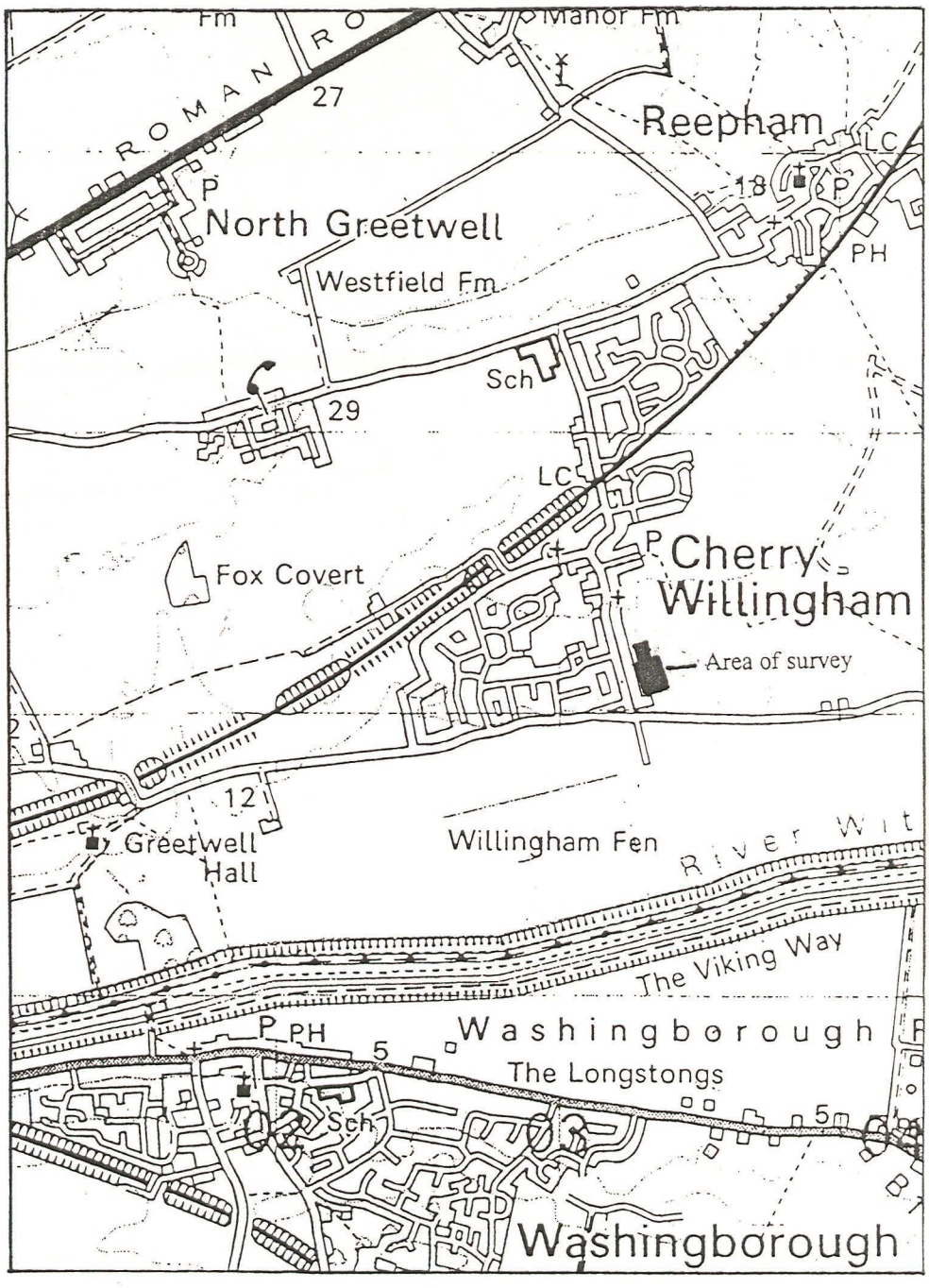


Fig.1 Location of survey area.
Scale 1:25,000.

Scale 1:1250

Fig.2 Location of survey grids.

1.0 Introduction

A detailed fluxgate gradiometer survey was commissioned by the City of Lincoln Archaeology Unit, on behalf of Lindsey Homes, to evaluate the archaeological potential of land off Ladymeers Road, Cherry Willingham, Lincolnshire. This work was undertaken prior to additional phases of construction work for 'The Hawthornes' residential development.

The survey was undertaken in accordance with the guidelines set out in the Lincolnshire County Council Archaeology Section publication *'Lincolnshire Archaeological Handbook; A Manual of Archaeological Practice'*, 1998, and in accordance with the guidelines set out in the English Heritage document *'Geophysical Survey in Archaeological Field Evaluation'*, 1995.

2.0 Location and description

Cherry Willingham is approximately 6km east of Lincoln. The site is located on the east side of the village, on land south of St Peter's Church, centred on NGR TF ~~03507225~~ 0333 7211. It comprises an irregular unit of approximately 1 hectare.

A significant amount of archaeological remains and artefacts have been discovered in this area of the village, mainly dating from Saxon to medieval times. To the north, a trial excavation recorded drainage gullies, a sunken building and evidence of metal working, all dating from the Saxon and early medieval periods (Field, 1981). Further evidence of metal working has been recorded during a watching brief to the east of the site (M. Jarvis pers. com.).

In September 1999, a geophysical survey was undertaken to evaluate land north-east of the current survey. The survey detected a linear anomaly that was later identified as a rubble filled ditch (J. Snee 1999 & M. Jarvis pers. com.). Further trial excavations in the area south-west of the linear feature exposed a concentration of archaeological features, including ditches and gullies.

The land is currently pasture of varying length, with recent residential development to the east, and property boundaries to the west and south. Land south-east of the survey comprises additional pasture, falling away towards Fiskerton Road.

The geology of the area consists of limestone brash, over which lies varying depths of clay and topsoil.

3.0 Methodology

Detailed area survey using a fluxgate gradiometer is a non-intrusive means of evaluating the archaeological potential of a site. The fluxgate gradiometer detects (often discrete) magnetic anomalies caused by areas of high or low magnetic susceptibility. These areas are caused by changes in the composition of the subsoil or the underlying geology. Archaeological features are the result of man-made changes to the composition of the soil and the introduction of intrusive materials such as brick, charcoal and pottery. These features will create detectable magnetic variability.

Activities which involve heating and burning will create magnetic anomalies, as will the presence of ferrous metal objects.

By examining the anomalies detected by a fluxgate gradiometer survey, geophysicists can often translate the data into archaeological interpretation.

The area survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36) with an electronic sample trigger set to take 4 readings per metre (a sample interval of 0.25m). The zigzag traverse method of survey was used, with 1m wide traverses across 30m x 30m grids. The base line was established approximately parallel to the property boundaries 2m to the west. The survey grid was established on this base line with the southern edge 2m north of the southern property boundary. A peg was placed in the south-west corner to show the starting position of the survey.

The sensitivity of the machine was set to detect magnetic variation in the order of 0.1 nanoTesla.

The data from the survey was processed using *Geoplot* version 3.0. It was desloped (a means of compensating for sensor drift during the survey by subjecting the data to a mathematical bias sloping in the opposite direction of the bias created by sensor drift). The data was clipped to reduce the distorting effect of extremely high or low readings caused by ferrous metals on the site, and the results were plotted as a number of greyscale images.

The survey was carried out by David Bunn and the writer on the 1st November 1999. The weather was cold, windy with frequent showers. The area surveyed measured approximately 1.1 hectares.

4.0 Results

The survey revealed a wide range of magnetic variation, caused by a number of factors. The limestone bedrock produced a faint pattern of fine reticulation resulting from ice fractures. Along the north and west edges and in the south corner were areas of positive, negative and dipolar anomalies (Fig. 6:1). These were probably the result of construction debris from nearby modern houses.

Across the centre of the site was a broad strip of high magnetic variation, composed of a number of anomalies concentrated together. The strip was oriented approximately north-west to south-east, and at the north was cut by an evaluation trench (Fig, 6:2).

In the north west of the concentration of anomalies; was a group of six small linear positive anomalies (Fig. 6:3). These do not form a recognisable pattern but may be of archaeological significance, possibly ditches or gullies.

To the south is a pair of linear positive anomalies (Fig. 6:4) that may represent ditches.

In the south-east area of the busy zone is a group of three linear positive anomalies (Fig. 6:5). These may be ditches or gullies.

Fig. 3 Smoothed greyscale image.

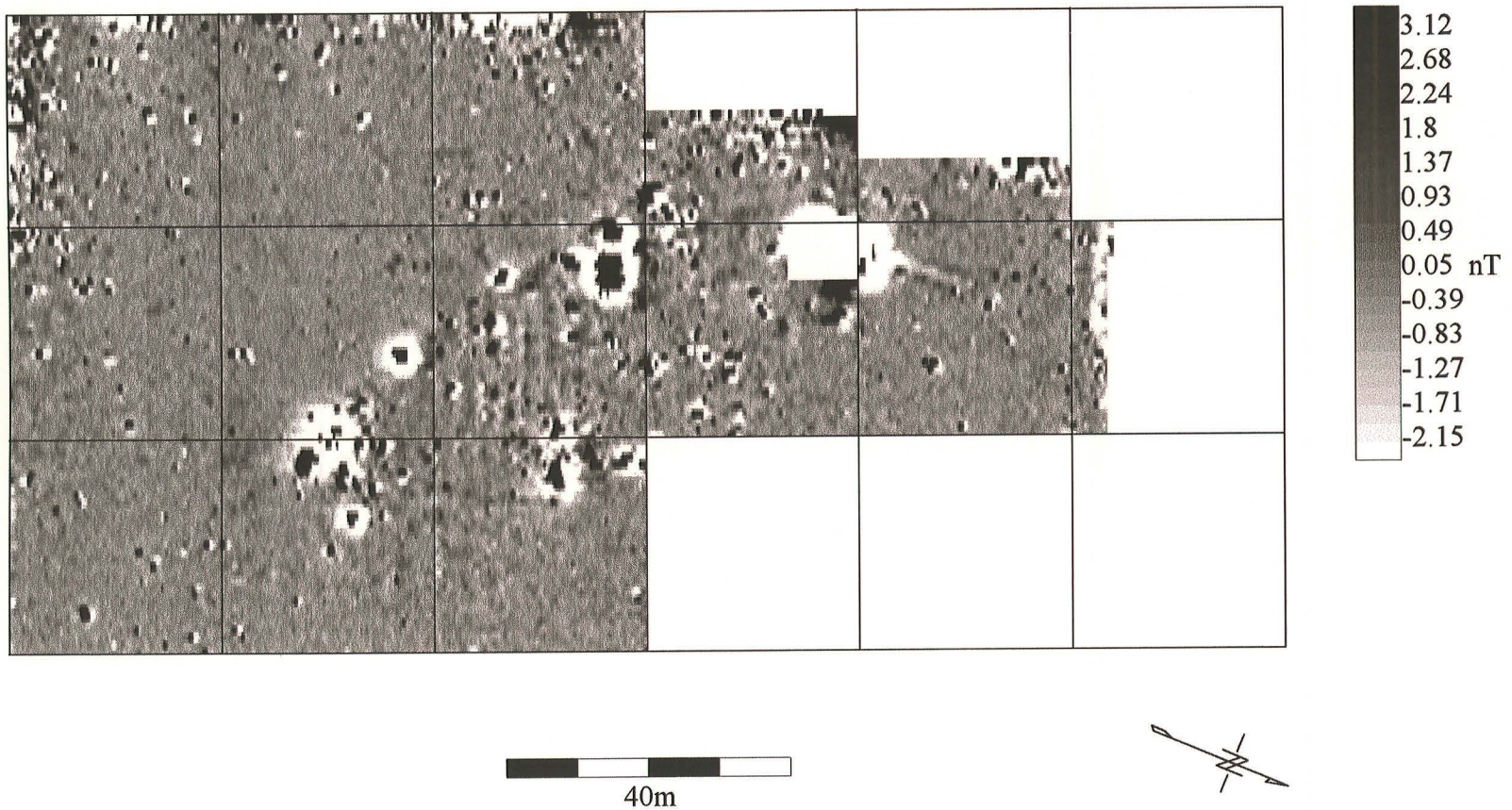


Fig. 4 Clipped greyscale image.

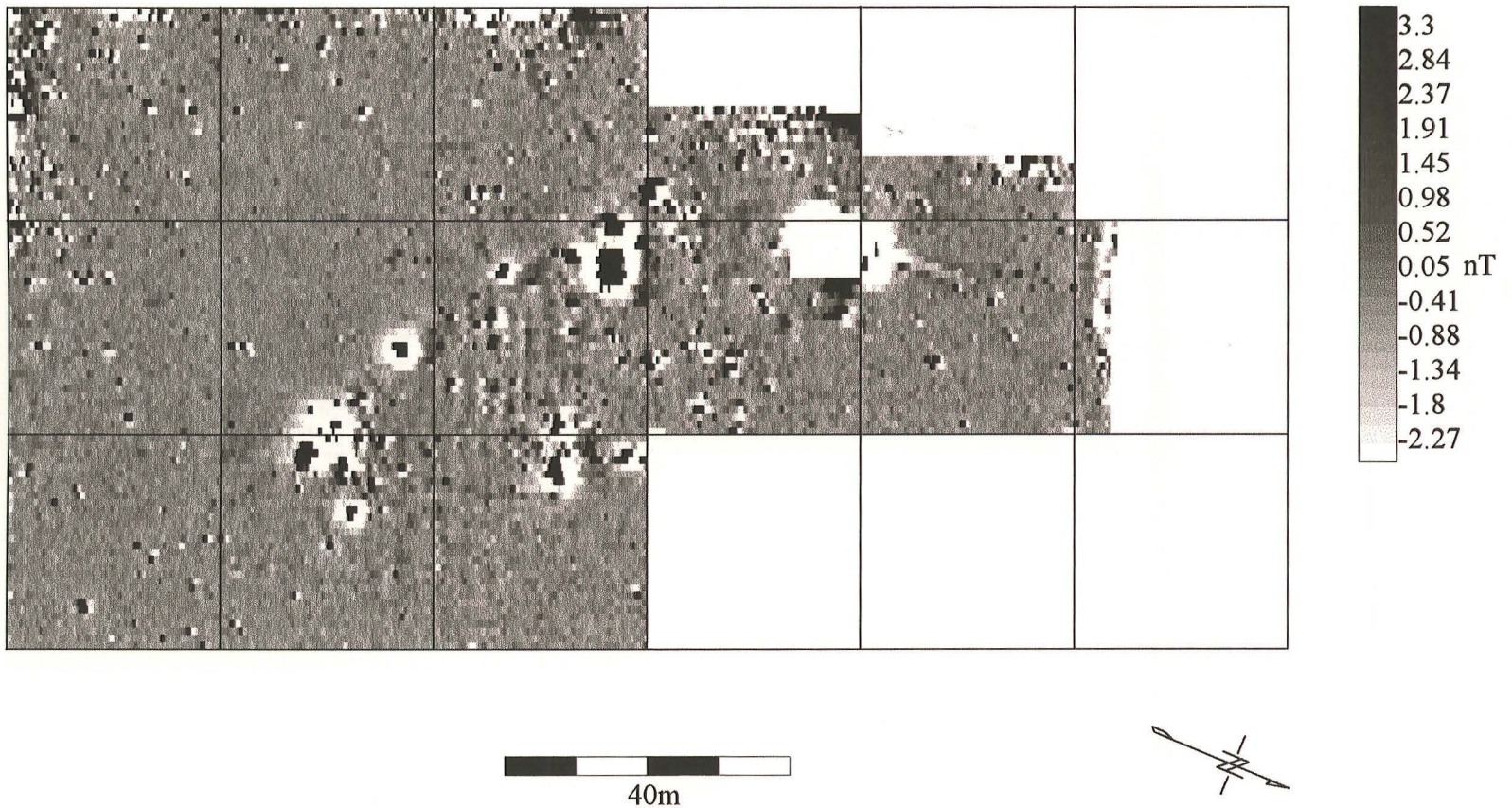


Fig. 5 Clipped and compressed greyscale image.

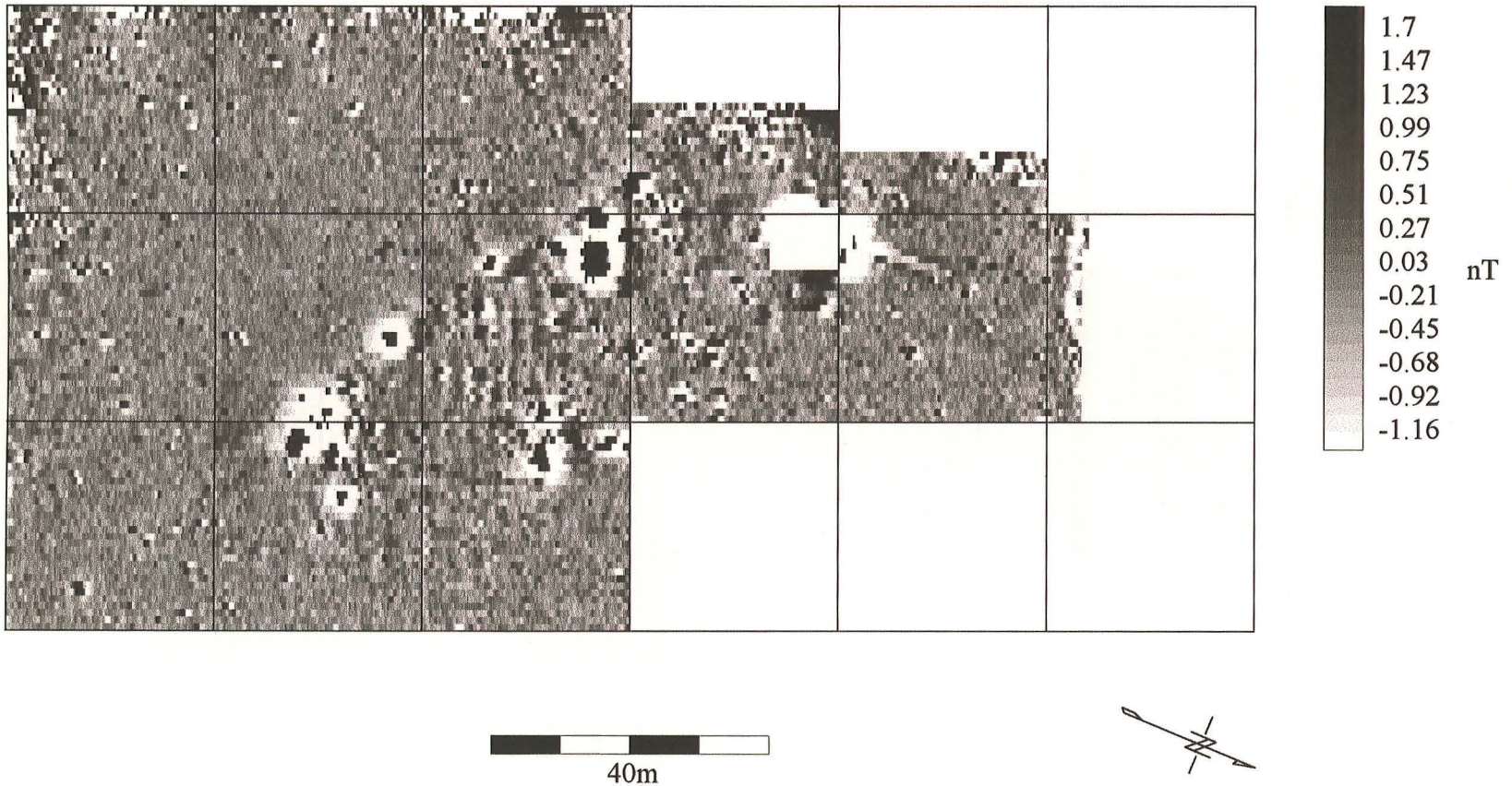
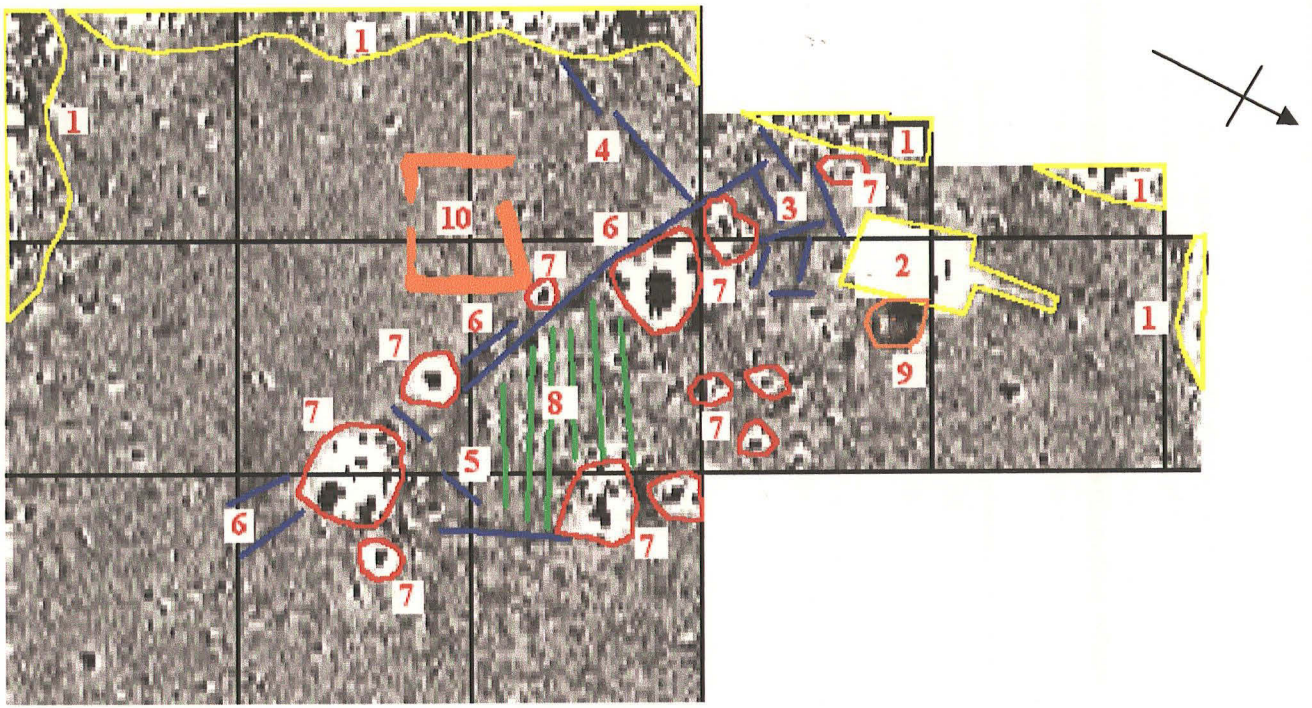


Fig.6 Interpretive greyscale image. Scale 1:1000



The south-west edge of the area of activity is defined by the presence of two long linear positive anomalies (Fig. 6:6). These converge and may represent two phases of a ditch boundary.

Throughout the area of activity there are areas of very strong positive, negative and dipolar variation (Fig. 6:7). These may represent areas of burning and rubble and/or ferrous litter, and could be modern. However, areas of metal working activity have been identified in the vicinity of the site and it is possible that these anomalies represent such areas.

In the centre of the area of activity were a series of six positive linear anomalies, oriented east-north-east to west-south-west (Fig. 6:8). These were roughly parallel and close together. They resemble ridge and furrow, but they are close together (2 to 3 metres) and are very localised. It is difficult to suggest an explanation of why ridge and furrow should be detectable in this area and nowhere else in the survey.

On the east edge of the evaluation trench, a large amorphous positive anomaly was detected (Fig.6:9). This corresponds closely to the position of a large cut feature identified in the evaluation and is probably the continuation of it.

To the south-west of the area of activity is a pair of positive anomalies that appear to form a sub-rectangular feature with two gaps (Fig.6:10). This could be an enclosure or possibly a structure.

Across the whole of the survey were a number of small discrete positive or dipolar (positive and negative) anomalies. It is likely that the majority of these are caused by pieces of ferrous debris in the topsoil (particularly the dipolar anomalies) but it is possible that some may represent small pits.

5.0 Conclusions

The survey detected an area of strong magnetic variation close to the trial excavation. This area seems to be defined by a linear feature on the south-west, and contains areas of linear features and areas that may be related to metal working. To the south-west of this is a possible enclosure or structure that may be of a different date. Outside these two areas only natural reticulation and occasional small discrete positive anomalies were detected.

Detailed survey by fluxgate magnetometer is only capable of detecting features that alter the magnetic susceptibility of soils or are magnetically different to the soils around them. It remains a possibility that there are archaeological features that have not been detected as a result of this survey.

6.0 Acknowledgements

Pre-Construct Geophysics would like to thank the City of Lincoln Archaeological Unit for this commission; in particular, Mike Jarvis.

7.0 Appendices

7.1 Bibliography

Clark, A J — 1990 *'Seeing beneath the soil.'*

David, A — 1995 *Research & Professional Services Guidelines No 1; 'Geophysical Survey in Archaeological Field Evaluation.'*

Everson, P. — 1979 *'Pagan Saxon pottery from Cherry Willingham and Middle Carlton villages'* in *Lincolnshire History and Archaeology.*

Field, F N — 1981 *'Cherry Willingham'* in *Lincolnshire History and Archaeology.*

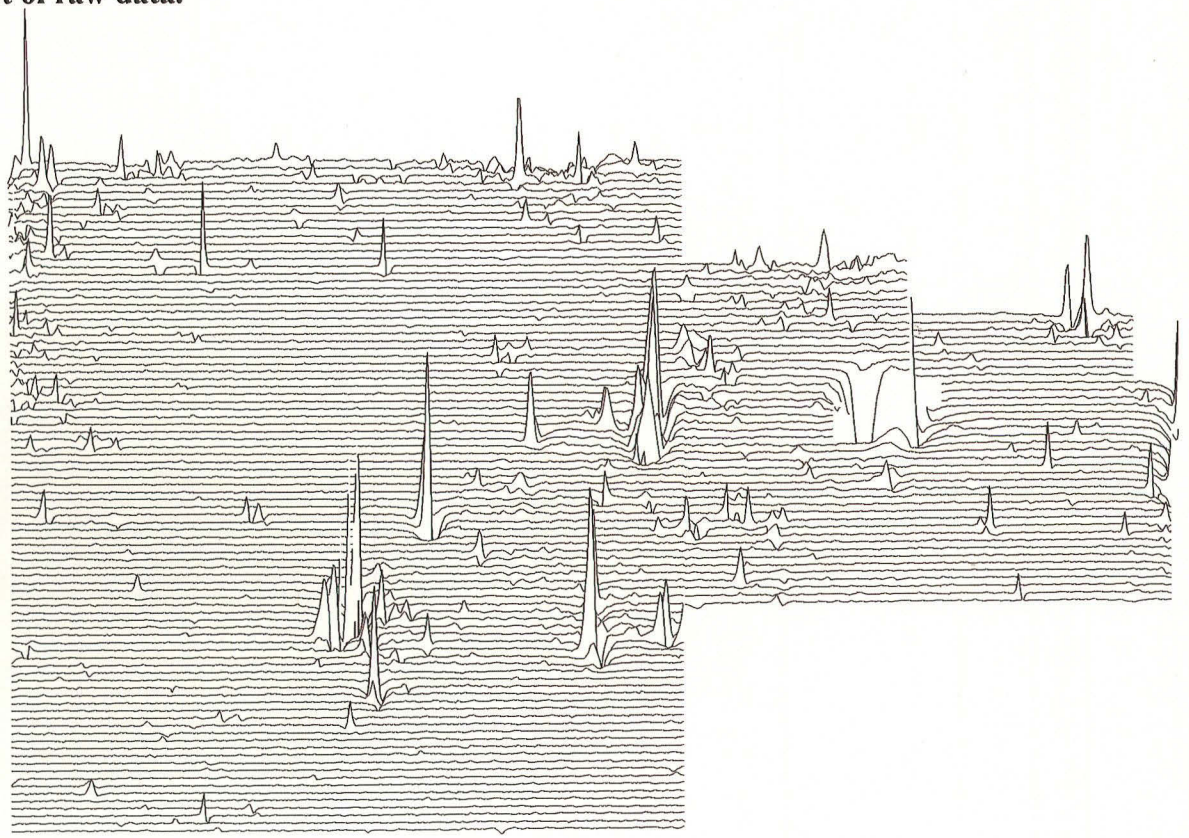
Gaffney, C, Gater, J & Ovenden, S — 1991 *IFA Technical Paper No 9; 'The use of Geophysical techniques in archaeological evaluations.'*

Snee, J. — 1999 *Fluxgate Gradiometer Survey; Land off Ladymeers Road, Cherry Willingham, Lincolnshire.*

7.2 Summary of survey parameters

Instrument:	Geoscan Research Fluxgate Gradiometer FM 36 with Sample Trigger ST1.
Resolution:	0.1 nT
Grid size:	30m x 30m
Sample interval:	0.25m
Traverse interval:	1m
Traverse method:	Zigzag

7.3 Trace plot of raw data.



88.96nT/cm

40m