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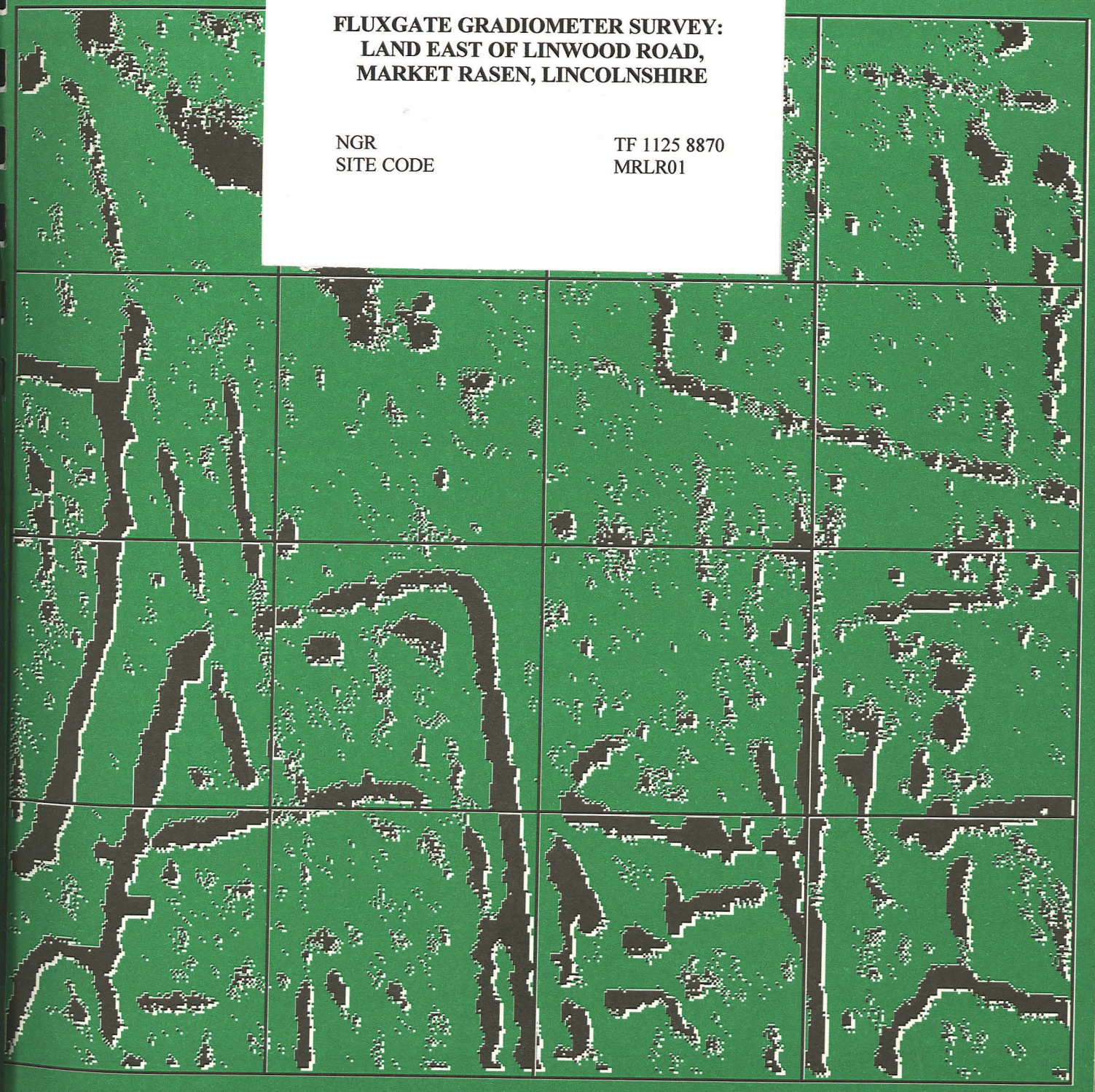
PRE-CONSTRUCT GEOPHYSICS

FLUXGATE GRADIOMETER SURVEY: LAND EAST OF LINWOOD ROAD, MARKET RASEN, LINCOLNSHIRE

NGR	TF 1125 8870
SITE CODE	MRLR01



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FLUXGATE GRADIOMETER SURVEY: LAND EAST OF LINWOOD ROAD, MARKET RASEN, LINCOLNSHIRE

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Report prepared for Hugh Bourn Developments (Wragby) Ltd
By David Bunn & Colin Palmer-Brown

PRE-CONSTRUCT GEOPHYSICS

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Contents

Illustrations

Summary

- *A fluxgate gradiometer survey was undertaken on c.2.0ha of land at Market Rasen, Lincolnshire*
- *The survey identified significant magnetic variation across the site, and some of this variability can be resolved into a series of magnetic anomalies*
- *Some of the stronger anomalies are probably associated with modern activities, such pond backfilling: others reflect more subtle sub-surface features of potential archaeological origin*
- *Several linear anomalies possibly represent previous land divisions and/or enclosures, and certain areas of moderate activity may reflect burnt or fired material*
- *Small discrete anomalies distributed across the site suggest the presence of ferrous and ceramic debris in the topsoil*
- *It is concluded that areas of the site may be of some archaeological significance, although this cannot be clarified based on this survey alone. Significant areas of the site are magnetically quiet, and it is likely that these areas do not incorporate important archaeological remains.*

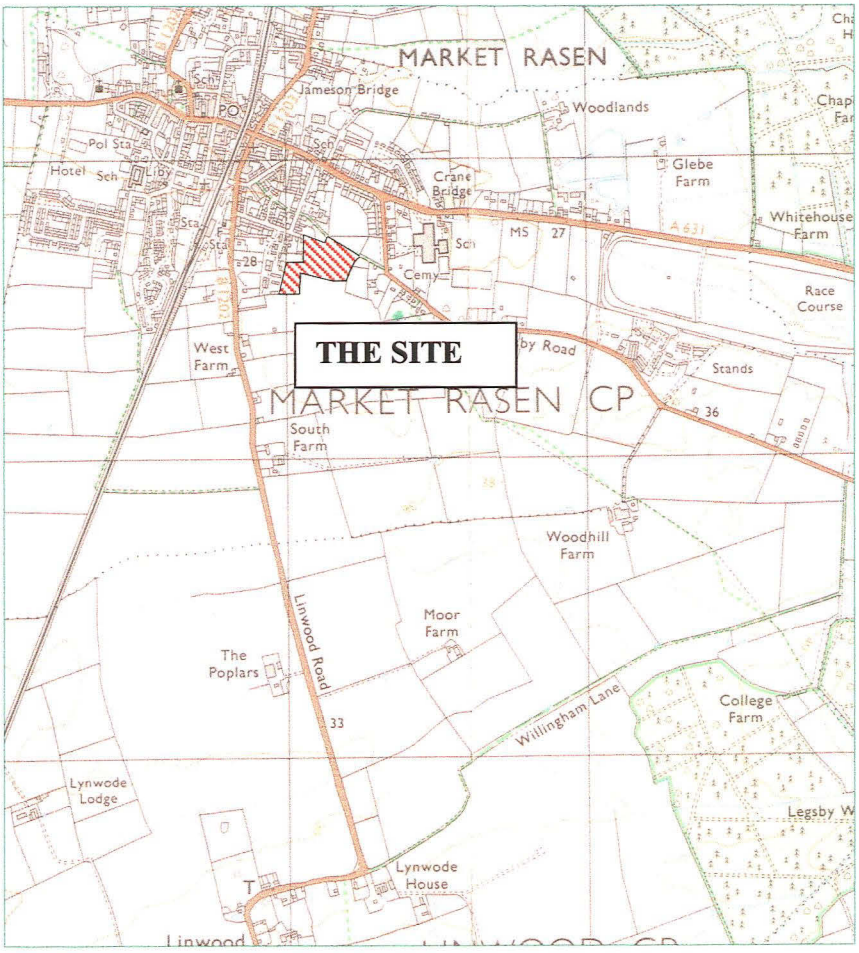

Fig.1: Location of site Scale 1:25000

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Fig.2: Location of survey 1:1250

1.0 Introduction

Hugh Bourn Developments (Wragby) Ltd commissioned Pre-Construct Geophysics to undertake a gradiometer survey on land to the east of Linwood Road, Market Rasen, Lincolnshire. The survey forms part of an archaeological assessment of the site in advance of a planning application for residential development.

The survey methodology was based upon guidelines set out in the English Heritage document *'Geophysical Survey in Archaeological Field Evaluation'* (David, 1995).

2.0 Location and description

The site is located to the south-east of the town centre, on land to the east of Linwood Road, and to the north of The Ridings Housing development. It comprises two sub-rectangular units extending to c. 2.0ha (Area A) and 0.6ha (Area B) (fig.2).

Area A is bounded to the north-west, east and south by mature hedging and wire fencing, and a redundant ditch extends c. 60m along the western end of the southern boundary. The north-east edge of the site is defined by a metal fence and path. Mature hawthorn trees separate Areas A and B.

Area B is bounded to the west, south and south-east by mature hedging and wire fencing. The northern edge of the survey area is unbounded.

Both A and B currently support grazed permanent pasture. The remains of ridge and furrow are visible in Area A, particularly in the eastern two thirds of the field, where drainage ditches cut across the ridges. Water had collected in many of the ditches and furrows following heavy rainfall. Area B is predominately level, with a slight gradient that falls to wetter ground to the north.

The drift geology comprises blown sands, beneath which lie solid deposits of the Upper Jurassic period; the uppermost of these are beds of Kimmeridge Clay, which consist of grey mudstones interbedded with oil shales (B.G.S. 1999).

Central National Grid Reference TF 1125 8870.

3.0 Archaeological and historical background

The sand and clay soils found in and around Market Rasen provide the basic raw materials that are required for the production of pottery. Evidence for a local industry dates from the Romano-British period, with potters probably being part-reliant on a road, which is thought to be located to the south of the town (Whitwell, 1992). A number of Roman kilns have been discovered to the south and west of the site, and the Market Rasen industry is currently the focus of an on-going research agenda (N. Field, *pers comm.*). Previous magnetic surveys have demonstrated the value of this technique for detecting kilns and related archaeological remains (Johnson, 1998).

4.0 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 magnetic anomalies created 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 result from man-made changes to the soil and the introduction of intrusive materials such as brick and stone. These features can create detectable magnetic anomalies. In addition, activities that involve heating and burning will create magnetic anomalies, as will the presence of ferrous metal objects.

The anomalies detected by a fluxgate gradiometer survey can often be resolved into entities sharing morphological characteristics with features of known archaeological provenance. This enables the formulation of an informed, but subjective interpretation.

Magnetic variation between archaeological or naturally produced features and the natural background level can result from:

- different depth or density of fill, with respect to the depth or density of surrounding soils magnetically similar to the fill
- the magnetic properties of materials introduced as a result of human activity (e.g. rubble, stone, brick/tile, ferrous metal etc.) in contrast to those within surrounding natural deposits
- the magnetic susceptibility of areas of burning, as opposed to unburnt areas
- the magnetic properties of localised, naturally deposited minerals, such as occur in the fill of palaeo-channels, in contrast to those of the surrounding soils.

The area survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36) with an electronic sample trigger set to take four 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 sensitivity of the machine was set to detect magnetic variation in the order of 0.1 nanoTesla. Base lines were established along the southern and eastern edges of Areas A and B, respectively (Fig.2).

The data from the survey was processed using *Geoplot* (*v. 3.0*). It was desloped (a means of compensating for sensor drift during the survey) and clipped to reduce the distorting effect of extremely high or low readings caused by discrete pieces of ferrous metal. The results are plotted as greyscale, colour and trace images.

The survey was carried out by David Bunn on the 21st and 24th of May 2001.

Instrument	Geoscan Research fluxgate gradiometer FM36 Sample trigger ST1
Grid size	30m x 30m
Sample interval	0.25m
Traverse interval	1.0m
Traverse method	Zigzag
Sensitivity	0.1nT
Processing software	Geoplot (*v. 3.0*)
Weather conditions	Fine, warm and sunny
Area surveyed	c. 2.0ha

Table 1: Summary of survey parameters

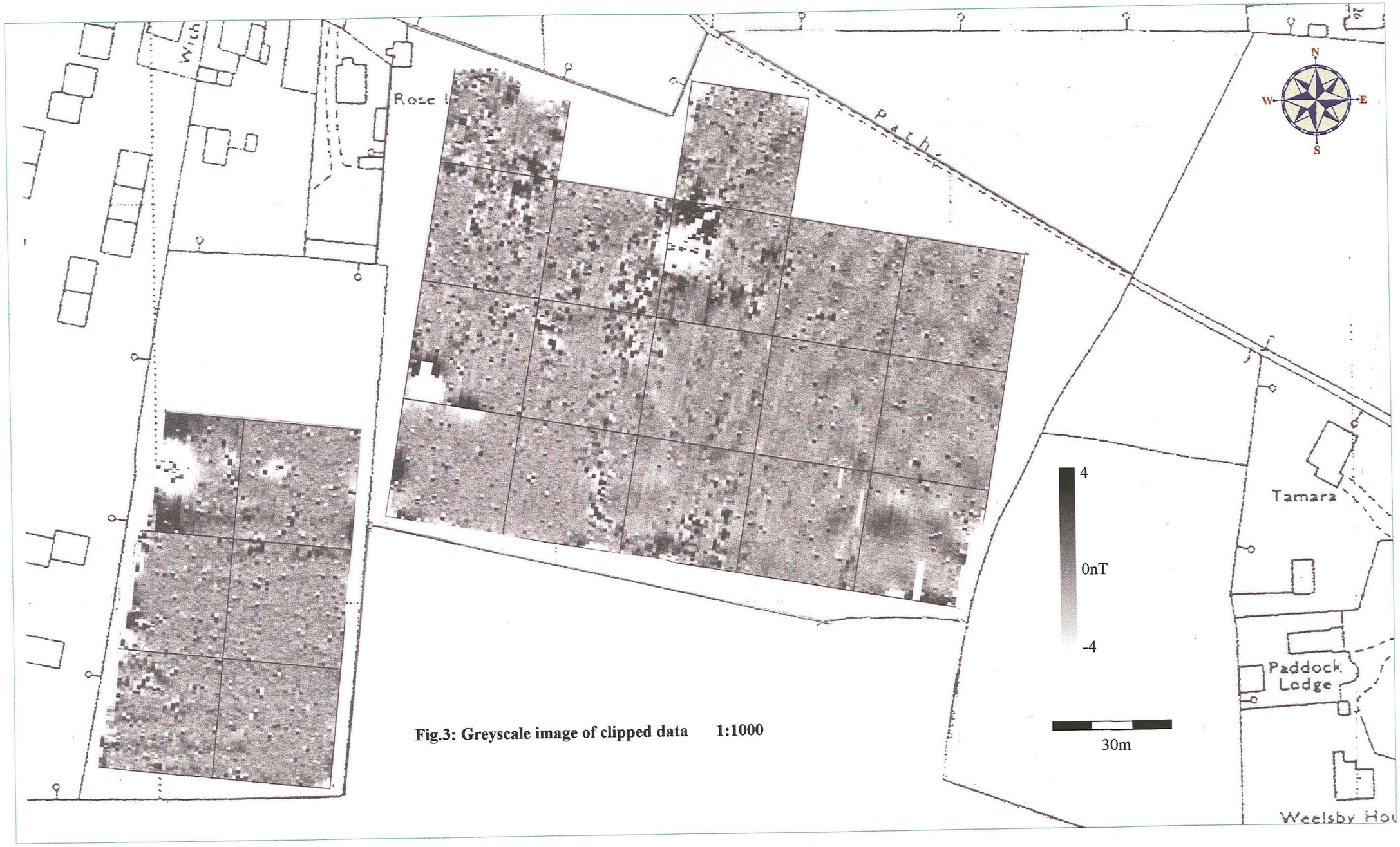

Fig.3: Greyscale image of clipped data 1:1000

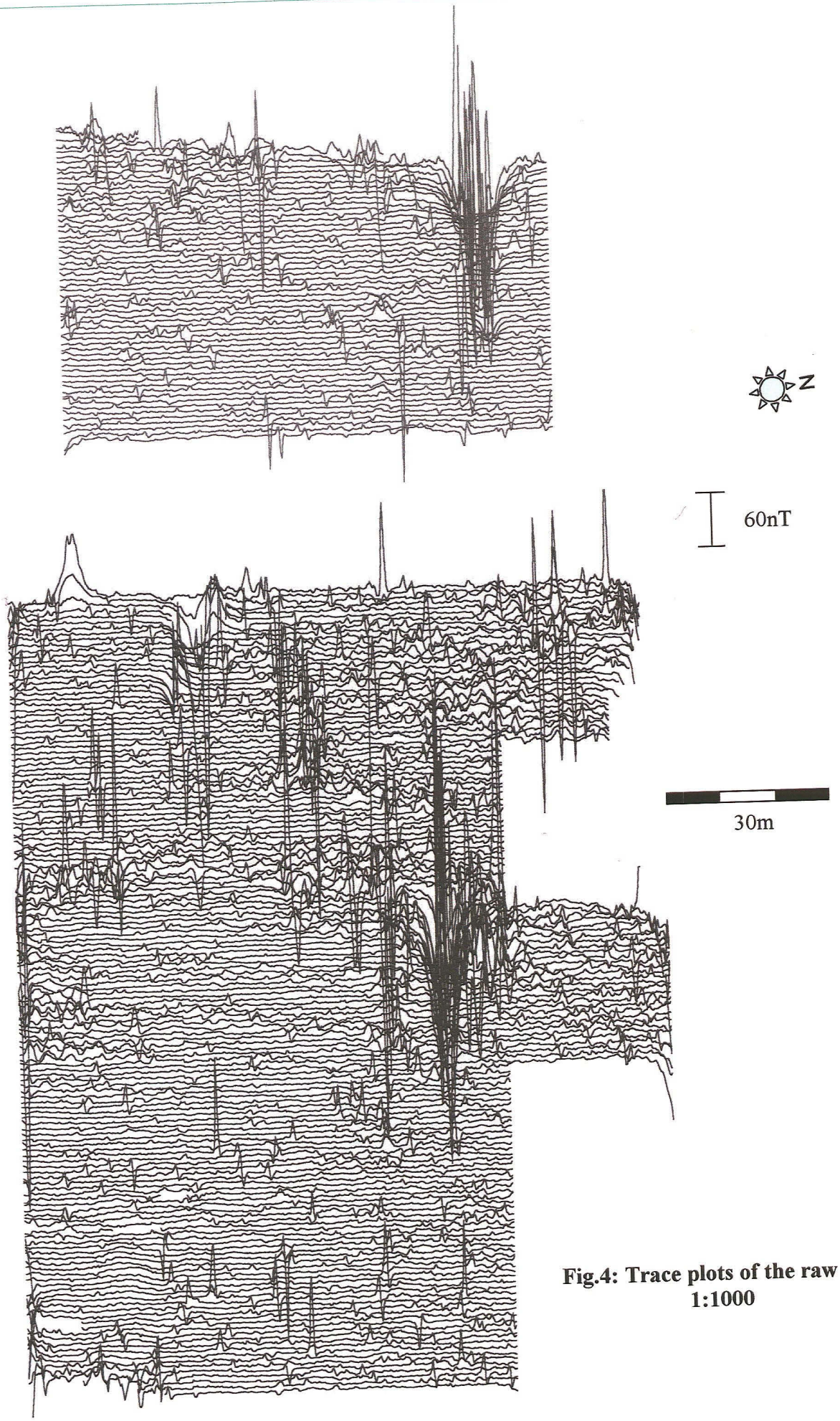

Fig.4: Trace plots of the raw data 1:1000

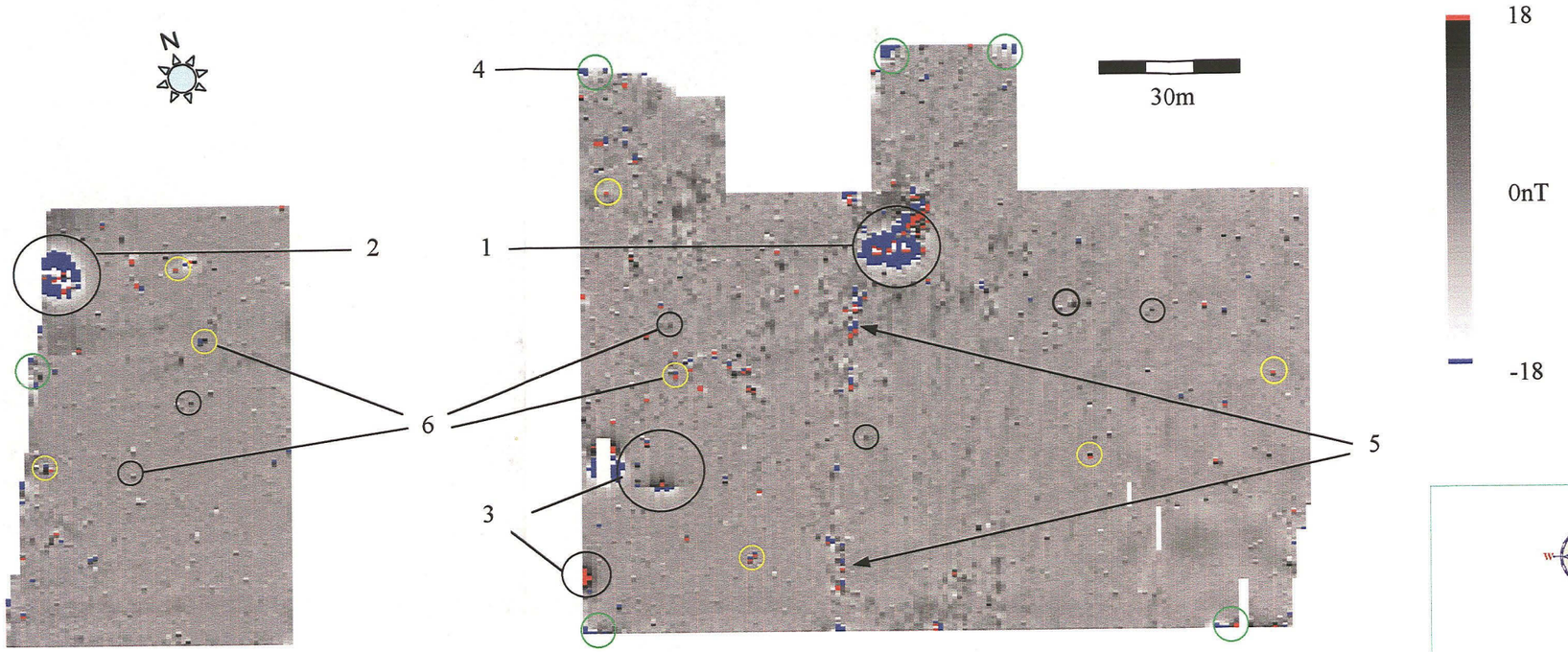

Fig.5: Image of raw data showing strongest anomalies in colour 1:1250

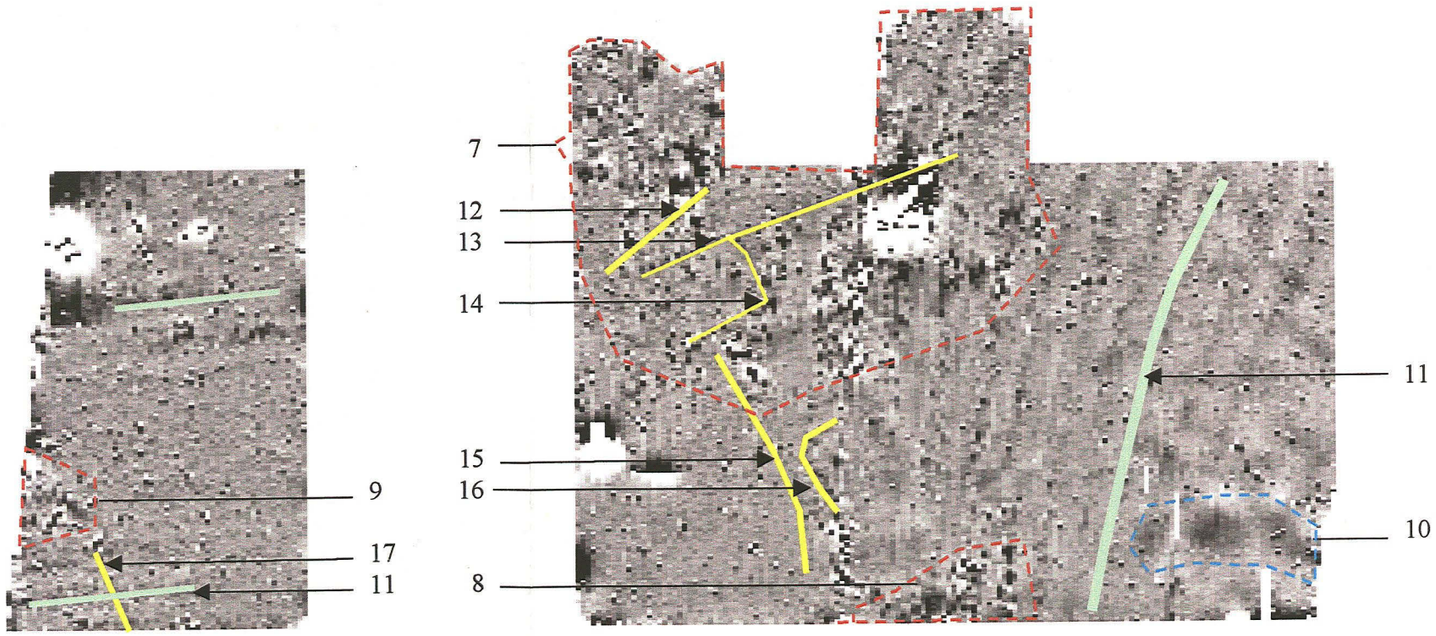

Fig.6: Interpretive plan 1:1250

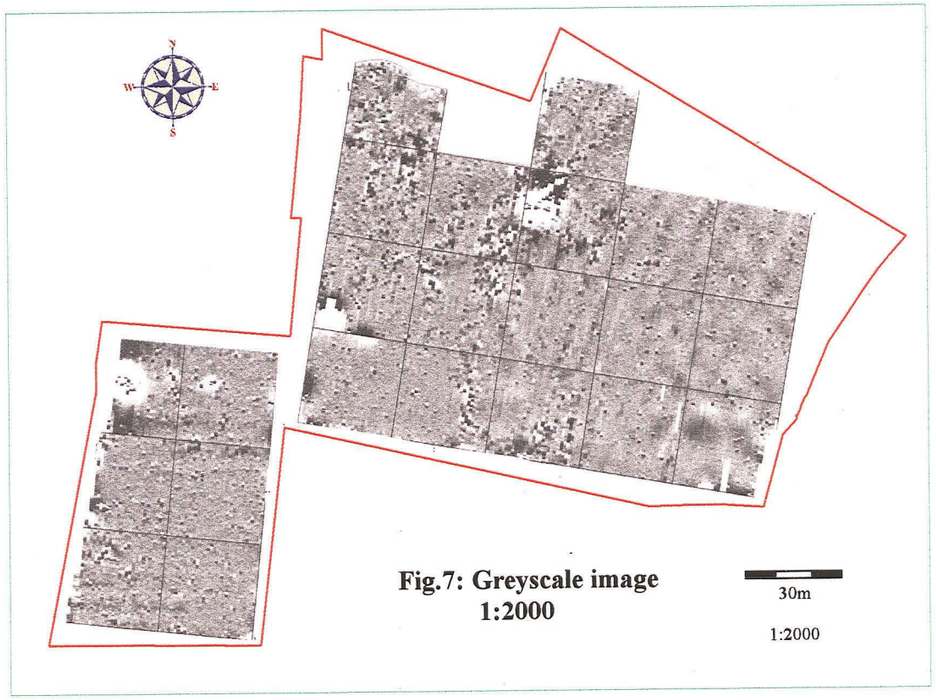

Fig.7: Greyscale image 1:2000

5.0 Results

The results are represented graphically as greyscale, trace and interpretive images (Figs. 2-7).

The raw data is presented as a trace plot (Fig.4), and as an image showing the strongest anomalies highlighted in colour (Fig.5).

Anomaly **1** was detected in the mid-northern part of the site. This is a typical magnetic signature of ferrous and ceramic debris, possibly of relatively recent origin. It appears to coincide with low lying and, at the time of survey, waterlogged ground. It is possible that **1** represents material contained within the fill of a large pit or pond. The north-western part of Area B probably contains a similar anomaly (**2**).

Anomaly group **3** relates to livestock equipment that was noted during the survey.

Anomaly **4** is associated with the close proximity of metallic fences and other ferrous materials that remain hidden within, and adjacent to the site boundaries. Other examples are circled in green.

A linear arrangement of dipolar anomalies (**5**) was detected in the central and south-central survey. The northern components of this occur to the immediate south of **1**, whilst the most southerly appear to relate to the eastern end of a redundant ditch. It is possible that these anomalies reflect the remains of a ditch that may have extended along this line.

A random distribution of discrete anomalies was detected (**6**). Such anomalies often mark the location of *in-situ* burning, or burnt materials, the magnetically enhanced fills of pits, or pieces of ferrous or ceramic debris in the topsoil. The latter are often introduced as a result of agricultural activities, such as midden spreading. Stronger examples are circled in yellow. The enhancement of the magnetically weaker examples, and other subtle anomalies, is achieved by further data processing (Fig.6).

The archaeological significance of anomalies **7-9** is difficult to quantify, given the close proximity of established residential properties, which may be at least partly responsible. It is possible that these anomalies represent traces of burning or of fired materials, such as brick and tile, although the results of the survey, taken in isolation, cannot determine this exactly.

The mottled appearance and extremely weak magnetic variation of **10**, which occurs in the south-east corner of the site, suggests that these anomalies may be the result of natural processes or agricultural activities, such as the pronounced ridge and furrows (**11**: example highlighted in green). These are less clearly defined in Area B, where they are orientated perpendicular to those in Area A. It is possible that the southern boundary of the latter marks the northern extent of a headland. The slightly higher ground along and to the south of this boundary substantiates this interpretation.

The site appears to contain linear and sub-rectangular anomalies (**12-17**) that cannot be reconciled in terms of any extant earthworks, but which may represent earlier land divisions. The magnetic response of the anomalies discussed above has reduced the

clarity and definition of several of these (potential) features. It is possible that anomalies **14** and **16** represent the remains of enclosures, but this interpretation is tentative.

6.0 Conclusions

The survey has identified significant levels of magnetic variation across the site. While some of this variation may be associated with relatively modern activities, such as rubble fill, others may be of archaeological significance.

The survey has detected widespread ridge and furrow, which, for the most part, is still visible as earthwork remains. Other linear and curvilinear anomalies are possibly backfilled ditches, and some of these may define enclosed areas.

It is possible that some of the extensive anomaly groups (**7-9**) relate to brick and tile spreads and/or areas of in-situ burning.

7.0 Acknowledgements

Pre-Construct Geophysics would like to thank Hugh Bourn Developments for this commission.

8.0 References

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