CAMBRIAN ARCHAEOLOGICAL PROJECTS LTD.

Laughton Wind Farm

Geophysical Survey

By

Chris Smith and Phil Evans

CAP Report No. **342**

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ARCHAEOLOGICAL DESK-BASED ASSESSMENT

Laughton Wind Farm, Lincolnshire

BY ***Chris E Smith Ba (Hons) PIFA***

Prepared for:
Your Energy

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Cambrian Archaeological Projects Ltd
Old Chapel Farm
Llanidloes
Montgomeryshire
SY18 6JR

Telephone: 01686 413857 / Fax: 01686 411280
e-mail: info@cambrian-archaeology.co.uk

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Non Technical Summary

This report results from a geophysical survey undertaken by Cambrian Archaeological Projects Ltd (CAP) for E4 Your Energy on behalf of their client, Laughton Wind Farm Ltd. The report draws upon the results obtained by the geophysical survey.
Ten areas of detailed survey were undertaken within the area of proposed wind farm development. The survey has highlighted six distinct features

1 Introduction

1.1 Location and scope of work

1.1.1 In October 2004 Cambrian Archaeological Projects (CAP) carried out a detailed geophysical survey of ten areas within a proposed wind farm development site at Laughton, near Gainsborough, North Lincolnshire (Fig 1). The work was carried out for E4 Environment and PMSS Ltd on behalf of their client Laughton Wind Farm Ltd. The site is centred around NGR SK487000397000. The survey was undertaken in order to locate any potential archaeological features prior to turbine construction.

1.1.2 The development concerns the construction of ten wind turbines and ten adjoining areas of hardstanding.

1.2 Geology and topography

1.2.1 The area of proposed development is located to the east of the village of Laughton in North Lincolnshire (Fig 1) and covers the two kilometres of land between Park House Farm (SK 397400 486900) and Grange Farm (SK 397500 488400). The site is composed mainly of gently undulating agricultural land.

1.2.2 The underlying solid geology of the castle is comprised of Triassic mudstones (including 'Keuper Marl', Dolomitic conglomerate and Rhaetic). (*Soils of England and Wales, 1993, Sheet 2: Geological Survey Ten mile map: South Sheet, 1979, 3rd ed*). The Lincolnshire Edge forms a distinctive limestone backbone to Lincolnshire running like a thread through the county from Whitton on the Humber Estuary in the north, down to Grantham in the south. It is a diverse landscape with a number of local variations. To the west of the Edge is the gently undulating Trent Vale which eventually flows into the moors and levels of Humberhead, draining to the Humber Estuary. To the east there is a gentle transition into the Central Lincolnshire Vale between the Humber and Lincoln, while south of Lincoln the Edge is bounded by a narrow finger of Fenland, which follows the River Witham into Lincoln. To the south, the Edge merges into the more undulating Kesteven Uplands.

1.3 Archaeological and historical background

1.3.1 The area surrounding the proposed wind farm development contains several archaeological features such as a Roman Villa (SK 4850 3978), a medieval settlement (SK 4855 3971), a Prehistoric enclosure (SK 4855 3971) and various other crop marks and undated boundaries. Royal Commission archive notes by Paul Everson tell of much pre-medieval evidence in the form of small finds. Bronze Age flints and metal work are known from several locations and a complex of rectangular enclosures has revealed much Romano-British pottery. Within the proposed turbine construction areas finds visible on the ploughed surface consisted mainly of 18^{th}-19^{th} century tile and pottery, clay pipe fragments and land drain shards (Phillips, 2004).

2 Methodology

2.1 Fluxgate Magnetic Gradiometer Survey

Two Fluxgate Gradiometers were used to undertake the survey. Previous research has shown that fired, or cut and back filled archaeological features such as kilns or hearths, ditches and pits often have an anomalously higher magnetic susceptibility than the surrounding subsoil due to burning and biological processes. Differences in magnetic susceptibility within the subsoil and archaeological features can be detected as changing magnetic flux by an instrument such as a fluxgate gradiometer. Data from this may be mapped at closely spaced regular intervals, to produce an image that may be interpreted to locate buried archaeological features (Clarke, 1990)

The machines used for both of the surveys were Geoscan Research FM256 Fluxgate Gradiometers using the double speed dual gradiometer survey mode. Detailed surveys were carried out in grids of 20m x 20m along parallel traverses spaced at 2m intervals, recording data points spaced at 0.25m intervals (a total of 1600 points within each grid) to a maximum instrument sensitivity of 0.1nT in accordance with English Heritage guidelines (EH, 1995). The grids were surveyed in the 'zigzag' style (traverses walked alternately south-north/north-south). At regular intervals the data was downloaded to a laptop computer for storage and assessment.

2.2 Data Processing and Presentation

Following the completion of the detailed surveys, processing and analysis took place using Geoscan Research's Geoplot v.3.00k software. The most typical method of visualising the data is as a simple greyscale image. In a greyscale, each data point is represented as a shade of grey, from black to white at either extreme of the data range. A number of standard operations were carried out to process the data. The gradiometer data was mathematically adjusted to account for instrument drift over time. The mean level of each traverse of data was reduced to zero and all grids matched so that there were no differences between the background levels. The data was then analysed using a variety of parameters and styles and the most useful of these were saved as a *JPEG image and manipulated using Adobe Illustrator software. The results of each survey were then overlaid onto a digital map of the study area. This was then used to produce the interpretation figures.

All works were undertaken in accordance with both the IFA's *Standards and Guidance: for an archaeological desk-based assessment and archaeological evaluation* and current Health and Safety legislation.

3 Results of the Geophysical Survey

3.1 Location of the Detailed Surveys

The detailed scan survey was undertaken in areas 1 to 10 as highlighted on fig 2.

Turbine 1 (SK 486720 397040). The area for turbine 1 is bounded to the south and west by field boundaries and tracks with open field to the north and east. The site lies just to the north of Willowbank fisheries. The top layer of subsoil in the field had been freshly turned over thus rendering the field surface uneven and limiting the effectiveness of the survey. The survey was undertaken in light rain and drizzle.

Turbine 2 (SK 486260 397200). The area for turbine 2 is at the confluence of two field boundaries (fig 2) with open field spreading away to the south and west. The survey was undertaken in high winds and rain over stubbled crop. Standing water in the survey area may again have limited the surveys effectiveness.

Turbine 3 (SK 486470 397500). The area for turbine 3 is located east of a track running approximately north south (fig 2) with open field to the north, south and east of the site. The survey was undertaken in good conditions over a freshly planted winter crop.

Turbine 4 (SK 487210 397050). The area for turbine 4 is at the confluence of three drainage ditches acting as field boundaries (fig 2) immediately to the north of the survey area. Open field spreads away from the survey area to the south and east. The survey was done in high winds and rain over freshly stubbled crop. Standing water in the field was again a feature of this survey and as such may have limited the surveys effectiveness.

Turbine 5 (SK 487590 397170). The area for turbine 5 is located just north of a track and field boundary running east west (fig 2). The survey was performed over an area of stubbled crop with up to .15m of standing water also in the survey area.

Turbine 6 (SK 486840 397320). The area for turbine 6 is bounded on both the east and west sides by two parallel field boundary ditches (fig 2) and is located immediately north of the track. The survey was undertaken over rough and uneven freshly ploughed soil.

Turbine 7 (SK 487000 397640). The area for turbine 7 is located in the middle of an open expanse of field and is the northernmost survey area (fig 2). The survey was performed over heavily waterlogged and freshly ploughed soil, thus rendering the survey area extremely difficult to move through.

Turbine 8 (SK 487700 397500). The area for turbine 8 is located immediately east of a field boundary running north south across the site (fig 2). The survey was undertaken in good weather conditions over a relatively short stubbled crop.

Turbine 9 (SK 487760 396860). The area for turbine 9 is bounded to the north and west by field boundaries with open field towards the south and east (fig 2). The survey was undertaken in good weather conditions over relatively short grass.

Turbine 10 (SK 486260 396890). The area for turbine 10 is located just to the south of a temporary haul road with open field spreading away to the west, east and south (fig 2). Visible on the ground as a distinctive band at this point is a change in the colour of the plough soil from dark brown to light brown. The survey was performed over heavily ploughed and uneven soil in drizzly conditions.

The site of the anemometry mast (SK 487380 397610) was unsuitable for survey due to the high metal content of objects in the surrounding area such as wrecked cars, the mast itself and its supporting cables

3.2 Results of the Survey

Turbine 1. The area surveyed for turbine 1 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. Only 1 feature was highlighted (A), an anomalousy high but extremely localised readings 'spike' in the north eastern corner of the grid.

Turbine 2. The area surveyed for turbine 2 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. 3 distinct archaeological features were located (B, C & D). The features seem to respect the field boundary by running on an angle parallel with it.

Turbine 3. The area surveyed for turbine 3 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. 3 distinct archaeological features were located (E, F & G). These faint linear features run roughly east west and are equally spaced, similar to features B, C & D.

Turbine 4. The area surveyed for turbine 4 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. Only 1 feature was highlighted (H), an anomalousy high but extremely localised readings 'spike' in the south western corner of the grid.

Turbine 5. The area surveyed for turbine 5 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. No archaeological features were identified. Survey partly spoiled by standing water.

Turbine 6. The area surveyed for turbine 6 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. No archaeological features were identified.

Turbine 7. The area surveyed for turbine 7 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. No archaeological features were identified.

Turbine 8. The area surveyed for turbine 8 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. No archaeological features were identified.

Turbine 9. The area surveyed for turbine 9 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. Only 1 feature was highlighted (I).

This strong linear signal is unlikely to represent a grubbed up field boundary or ditch as, owing to the anomalously high signal, it is more likely to represent a drain or other service feature

Turbine 10. The area surveyed for turbine 10 comprised 2 survey grids covering a total area of 40m x 20m and was aligned on a north-south axis. 2 potential features were located by the survey in this area. Feature J is a curvilinear feature measuring approximately 20m across while feature K appears as a linear with a 90° bend in the middle, possibly representative of a corner of a building or platform.

4 Conclusions

The geophysical survey undertaken at Laughton, Lincolnshire, identified a number of linear, curvilinear and more localised features. The linear features B, C & D are likely to represent cultivation furrows (possibly medieval ridge and furrow) owing to their regular spacing and respect of the field boundary. It seems likely that features E, F & G also represent cultivation furrows as they exhibit the same regular spacing as B, C & D and also share the same east – west alignment. Linear feature I, whilst definitely being the most positive feature surveyed, is likely to be a service of some sort. Curvilinear feature J seems likely to relate to the D-shaped or oval enclosure highlighted by Phillips (2004, CAP report no. 269) with surface finds from that area dating to the 18th-19th centuries. Feature K may be contemporary with feature J as both features appear to respect each other. Owing to the presence of features J and K within the proposed area of turbine 10 a shift of approximately 10m to the northwest is recommended so as to lessen the impact of construction upon the archaeology. Further investigation of these features would be useful in order to gain more information. More localised features such as H and A are also more difficult to interpret without further information. It is likely, however, that they both represent large metallic objects (such as agricultural equipment) which have become buried.

5 Bibliography

CLARK, A, J. 1990. *Seeing Beneath the Soil.* BT Batsford Ltd, London

EH 1995, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage Research and Services Guidelines No.1

PHILLIPS, N. 2004. Laughton Wind Farm, Desk Based Assessment. CAP report No.269

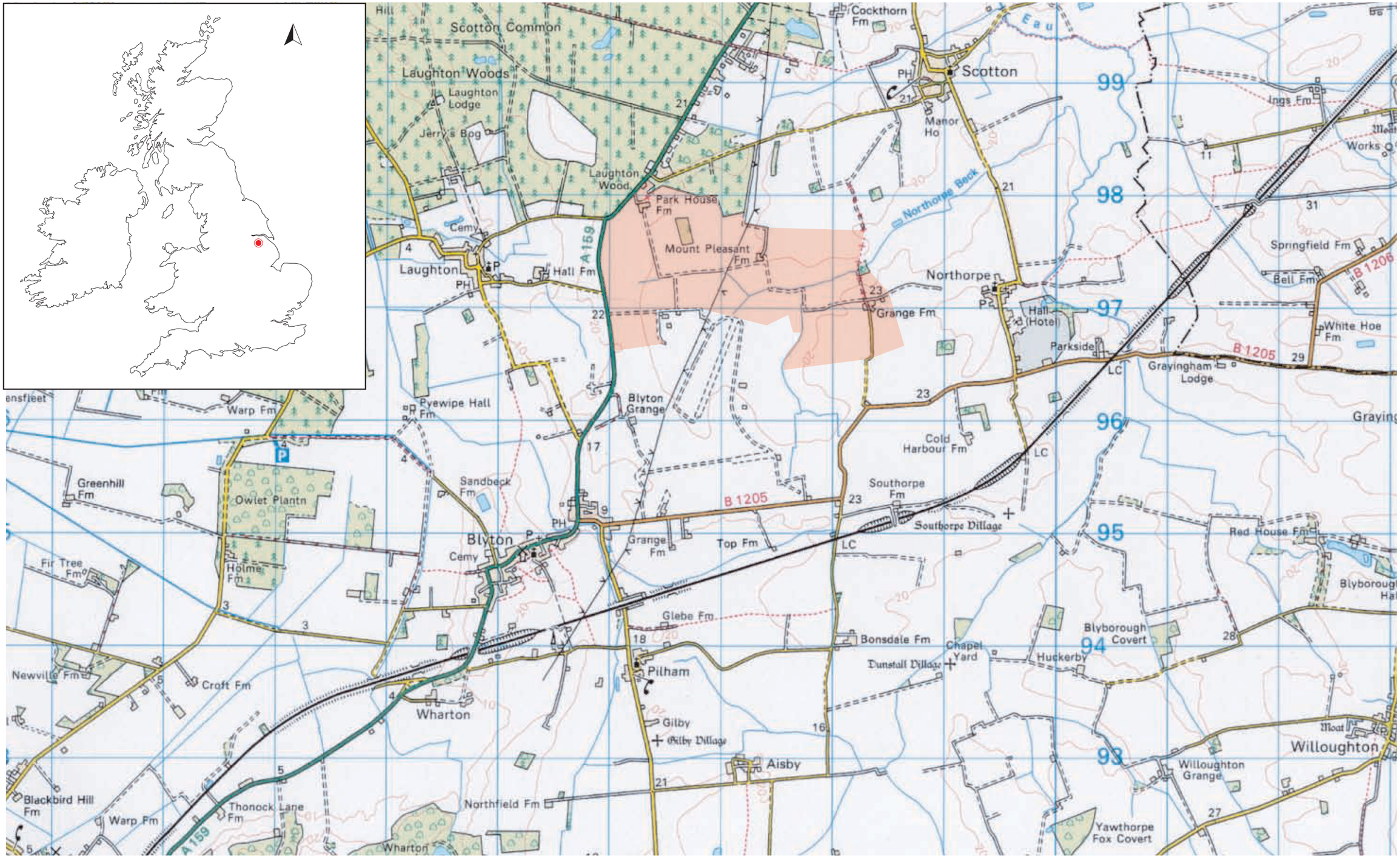


Fig 1: Site Location Plan

WTG

Survey area

Application Boundary

Boundary Ditch

Temporary Haul Road

Overhead Cables

Job Title: Laughton Wind Farm

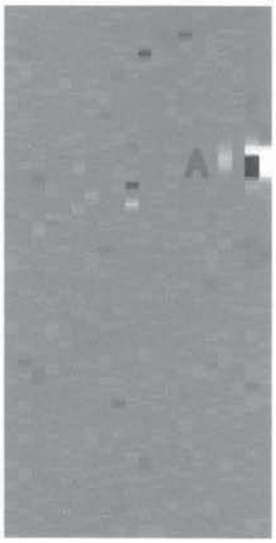
Drawing Title: Turbine Locations

Date: 6 - 2 - 06

Drawn By: Chris E Smith

Scale: 1:17,900

Cambrian Archaeological Projects Limited



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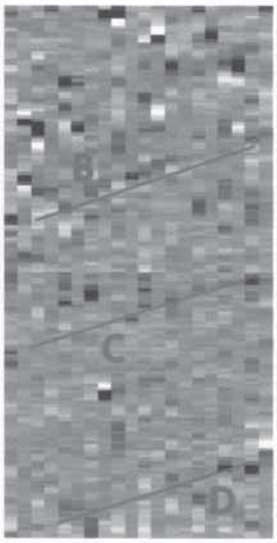

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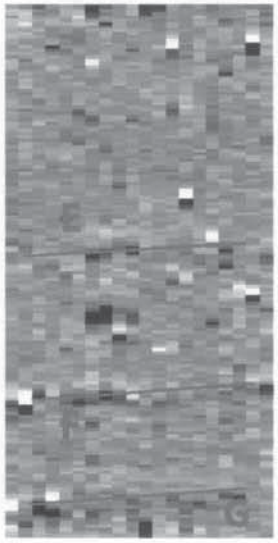

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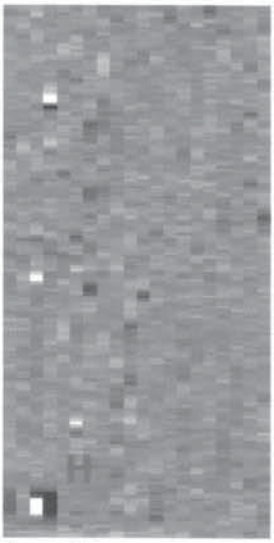

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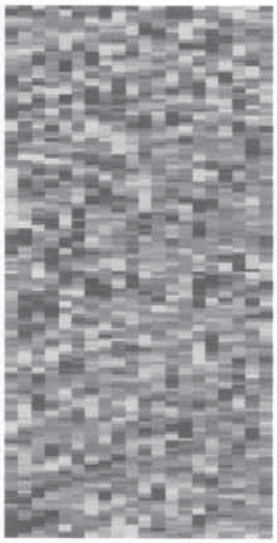

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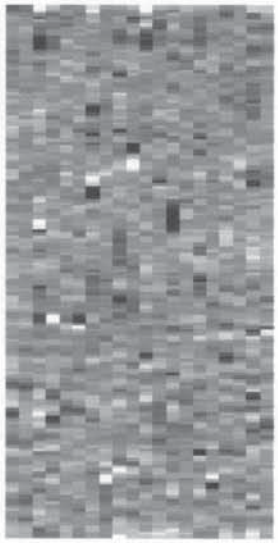
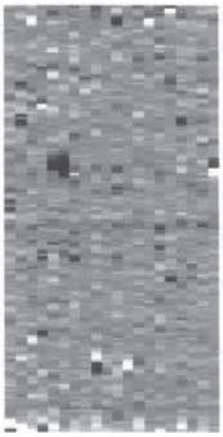


Area 6

0 15 30m

Fig 03: Detailed surveys, Turbines 1 - 6



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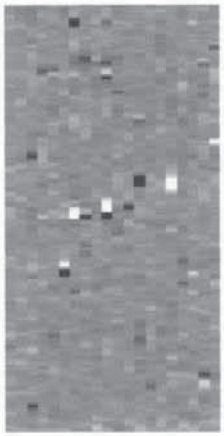

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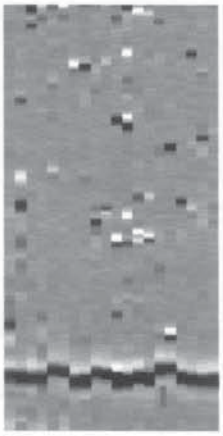

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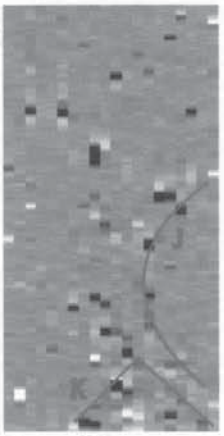

Area 10

0 15 30m

Fig 04: Detailed Surveys, Turbines 7 - 10

APPENDIX I:
Archive cover sheet

ARCHIVE COVER SHEET

Site Name:	**Laughton Wind Farm, Lincolnshire**
Site Code:	**LWF/04/GEO**
Other Ref No:	**Project no. 611**
NGR:	**NGR SK 487000397000**
Project Type:	**Archaeological Geophysical Survey**
Project Officer:	**Chris E Smith**
Project Dates:	**June 2004**
Categories Present:	**N/A**
Location of Original Archive:	**Lincolnshire SMR**
Location of duplicate Archives:	**N/A**
Number of Finds Boxes:	**N/A**
Location of Finds:	**N/A**
Museum Reference:	**N/A**
Copyright:	**CAP Ltd**
Restrictions to access:	**None**

Cambrian Archaeological Projects Ltd
Old Chapel
Llanidloes
Montgomeryshire
SY18 6JR

Telephone: 01686 413857 / Fax: 01686 411280
e-mail:info@cambrian-archaeology.co.uk