ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AECOM

Molesworth
Huntingdon
Cambridgeshire

geophysical survey

report 2611
March 2011

Durham University

Contents

Figures

South Road · Durham · DH1 3LE · tel 0191 334 1121 · fax 0191 334 1126
archaeological.services@durham.ac.uk · www.dur.ac.uk/archaeological.services

1. Summary

The project

1.1 This report presents the results of geophysical survey conducted in advance of proposed development at Molesworth, near Huntingdon, Cambridgeshire. The works comprised geomagnetic survey of nine areas totalling 2.65ha in eight land parcels.

1.2 The works were commissioned by AECOM and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled features, including a possible ditched enclosure system, a possible pit alignment and other discrete features, were identified in Areas 4 and 8.

1.4 Former ridge and furrow cultivation has been identified in Areas 2, 3, 5, 6, 7 and 9.

1.5 Probable former field boundaries have been identified in Areas 8 and 9.

1.6 Land drains have been identified in Areas 1, 2 and 5.

2. Project background

Location (Figures 1 & 2)

2.1 The proposed development area was located close to the village of Bythorn in Cambridgeshire (NGR centre: TL 06059 76943). The western site boundary corresponds to the county boundary between Cambridgeshire and Northamptonshire. Nine surveys totalling 2.65ha were a conducted in eight land parcels (see table below).

Area	Location	Development proposal	Size
1	TL 05417 77407	Turbine 1	50m x 50m
2	TL 06323 77072	Turbine 2	50m x 50m
3	TL 04783 77066	Turbine 3	50m x 50m
4	TL 05814 76974	Turbine 4	50m x 50m
5	TL 05279 76919	Turbine 5	50m x 50m
6	TL 06505 76701	Turbine 6	50m x 50m
7	TL 04368 76522	132kV Control Building Compound	50m x 70m
8	TL 06421 75683	Temporary Construction Compound	50m x 80m
9	TL 06164 75701	Temporary Storage Area	50m x 80m

Development proposal

2.2 The proposal is for a six turbine wind farm with associated access tracks and structures.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

Methods statement

2.4 The surveys have been undertaken in accordance with a Written Scheme of Investigation (WSI) provided by the client (Appendix) and with national standards and guidance (see para 5.1). Areas for survey were specified by the client following discussion with the Cambridgeshire County Council Archaeologist.

Dates

2.5 Fieldwork was undertaken between 16th and 17th February 2011. This report was prepared for 4th March 2011.

Personnel

2.6 Fieldwork was conducted by Edward Davies and Richie Villis (Supervisor). The geophysical data were processed by Richie Villis. This report was prepared by Richie Villis, with illustrations by Janine Watson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **HMW11**, for **H**untingdon **M**olesworth **W**ind Farm 20**11**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline

Acces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-94730**.

3. Historical and archaeological background

3.1 An archaeological and cultural heritage chapter for an Environmental Impact Assessment is currently being undertaken for the proposed development. The geophysical survey has been commissioned to complement and enhance this assessment. The following information is taken from the supplied WSI.

3.2 There are a large number of known archaeological and cultural heritage assets recorded within the 2km study area. These assets range from the Neolithic through to the post-medieval and modern periods. A number of later prehistoric sites are known in the proximity of the site and the area was extensively utilised during the Roman period. There are four villages within this study area. These are at least medieval in origin, possibly earlier. The post-medieval period is generally characterised by agriculturally related sites and residential dwellings.

3.3 There are a number of recorded cropmark features within the boundary of the proposed development. Whilst the dates of these have not been confirmed by intrusive investigations, it is likely that they are of later prehistoric or Romano-British origins based upon comparative analysis with similar sites. One additional cropmark site may date to the Second World War and be related to defensive activities. There are also many examples of ridge and furrow cultivation spread through the study area. Further subsurface deposits may be present within the site but have not left discernable evidence either in the form of artefactual material or cropmarks. Turbines have been located to avoid the known cropmark sites.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised eight arable fields. A deep drainage channel across Area 4 prevented some data collection there.

4.2 The proposed development area lay on undulating land, with elevations of between *c*. 40m OD in the south-east to *c*. 70m OD in the south-west, and *c*. 76m OD in the north-east to *c*. 60m in the north-west.

4.3 The underlying solid geology of the area comprises Jurassic Mudstone of the Oxford Clay Formation, which is overlain by Oadby Member in the south and Middle Pleistocene Till in the north. The soils are slowly permeable calcareous clayey soils with some seasonally waterlogged.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Draft Standard and Guidance for archaeological geophysical survey* (2010); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden

2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (draft 2nd edition, Schmidt & Ernenwein 2010).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on cropmark evidence, it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system with real-time correction.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m grid unit.

5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.8 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2 - 5; the trace plots are provided in Figure 6. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to each dataset:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
despike	locates and suppresses iron spikes in gradiometer data
interpolate	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 Colour-coded geophysical interpretations are provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

5.11 Colour-coded archaeological interpretations are provided.

5.12 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Series of parallel, weak, positive magnetic anomalies which almost certainly reflect former ridge and furrow cultivation have been detected across each of Areas 2, 3, 5, 6, 7 and 9.

5.14 Chains of dipolar magnetic anomalies have been detected in Areas 2 and 5; these may reflect fired clay land drains. Similar, much weaker, anomalies have been detected in Area 1.

5.15 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretations, however, they have been omitted from the archaeological interpretations and the following discussion.

5.16 Further anomalies of possible archaeological interest have been detected in Areas 4 and 8, below.

5.17 Several rectilinear and curvilinear positive magnetic anomalies have been detected in Area 4. These almost certainly reflect soil-filled ditch features and may be associated with those features evident as cropmarks in the vicinity of Area 4. These ditches may reflect an enclosure system, however, due to the small size of the survey area their full nature and extent cannot be determined.

5.18 Occasional discrete positive magnetic anomalies have also been detected in Area 4. These could reflect soil-filled pits, possibly related to the enclosure system.

5.19 A number of similar, discrete positive magnetic anomalies have also been detected in Area 8, which could also reflect soil-filled pit features. Six of these features are in alignment in the north-east corner of Area 8.

5.20 Three weak linear positive magnetic anomalies have also been detected in Area 8. These may reflect soil-filled ditch features. The broadly east-west aligned linear feature in the south of the area may be a former field boundary as recorded by the Ordnance Survey County Series 3rd revision of Northamptonshire in 1952 and Huntingdonshire in 1953.

5.21 The series of strong dipolar magnetic anomalies detected at the south edge of Area 8 reflects the location of a wire fence and the proximity of several parked trucks in the scrap yard to the south.

5.22 A chain of dipolar magnetic anomalies has been detected in the south of Area 9. This corresponds to a change in land use at the time of survey, from planted oilseed rape in the north, to recently ploughed earth in the south. The anomaly may reflect the position of a former field boundary.

6. Conclusions

6.1 Nine geomagnetic surveys totalling 2.65ha were undertaken at Molesworth, near Huntingdon, Cambridgeshire, prior to the proposed development of a wind farm.

6.2 Probable soil-filled features, including a possible ditched enclosure system, a possible pit alignment and other discrete features, were identified in Areas 4 and 8.

6.3 Former ridge and furrow cultivation has been identified in Areas 2, 3, 5, 6, 7 and 9.

6.4 Probable former field boundaries have been identified in Areas 8 and 9.

6.5 Land drains have been identified in Areas 1, 2 and 5.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2010 *Draft Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2010 (draft) *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

Appendix: Written Scheme of Investigation

8.2 The geophysicist appointed will need to provide a copy of their Health and Safety policy. In addition, a site specific risk assessment should be undertaken.

9.0 Programme

9.1 An indication of programme should be provided with the tender.

9.2 Submission of the final report to AECOM should take place within four weeks of the completion of fieldwork. Interim results will be required within one week of works being completed on site.

10.0 Tendering

10.1 In response to this Written Scheme of Investigation (WSI) the archaeological contractor shall, if they wish to tender for the contract, submit a quotation for the work as specified above.

10.2 The contractor should also submit appropriate documentation to support their quotation as necessary to demonstrate their experience and capability to undertake the surveys as detailed in section 3.4 above.

10.3 Questions on this WSI and the tender process should be directed to Helen Maclean using the contact details below.

10.4 If the contractor wishes to tender for the project a proposal should be returned no later than 12 noon on Monday 29th November. Tender submissions should be returned to:

Helen Maclean
AECOM
2 City Walk
Leeds
LS11 9AR

Tel: 0113 391 6232
Fax: 0113 391 6899
helen.maclean@aecom.com

File Note

AECOM

Project:	**Proposed Development for Molesworth**	Job No:	**60156409**
Subject:	**Written Scheme of Investigation for an Archaeological Geophysical Survey**	Date:	**22nd November 2010**

Site Location: The site lies in the county of Cambridgeshire on the county boundary of Northamptonshire west of Huntingdon and east of Northampton.
NGR (centre): TL 06059 76943
Proposal: The proposal is for a 6 turbine wind farm.
Planning ref: Pre-application
Site area: 2 hectares.
Land use: Arable farmland.
Client: RWE Npower Renewables Ltd.

1.0 Site location and description

1.1 The site is centred on NGR TL 06059 76943 and is located close to the village of Bythorn in Cambridgeshire. The western site boundary runs along the line of the county boundary of Northamptonshire.

1.2 The site is underlain by Oadby Till overlying bedrock of Oxford Clay Formation (BGS 2005). The soils are often slowly permeable calcareous clayey soils with some seasonally waterlogged (Soil Survey of England and Wales 1983). The land within the site currently comprises arable farmland.

1.3 The area which requires surveying is approximately 1.5 hectares in area. It will be surveyed in 6 blocks of 50m by 50m around each proposed turbine location

1.4 The suitability of the area for geophysical survey should be confirmed by the contractor and agreed with AECOM and the Cambridgeshire County Council Archaeologist.

2.0 Archaeological and historical background

2.1 An archaeological and cultural heritage chapter for an Environmental Impact Assessment is currently being undertaken for the proposed development. The geophysical survey is being commissioned to complement and enhance this assessment.

2.2 There are a large number of known archaeological and cultural heritage assets recorded within the 2 km study area. These assets range from the Neolithic through to the post-medieval and modern periods. A number of later prehistoric sites are known within proximity of the site and the area was extensively utilised during the Roman period. There are four villages within this study area. These are at least of medieval date and may be earlier in date. The post-medieval period is generally characterised by agriculturally related sites and residential dwellings.

2.3 There are a number of recorded cropmark features within the boundary of the proposed development. Whilst the date of these have not been confirmed by intrusive investigations, it is likely that they are of later prehistoric or Romano-British origins based upon comparative analysis with similar sites. One additional cropmark site may date to the Second World War and be related to defensive activities. There are also many examples of ridge and furrow cultivation spread through the study area. Further subsurface deposits may be present within the site but have not left discernable evidence either in the form of artefactual material or cropmarks. Turbines have been located to avoid the known cropmark sites.

Direct Tel: 0113 301 2460
T +44 (0)113 391 6800
F +44 (0)113 391 6899
E matthew.parker@aecom.com
www.aecom.com

2 City Walk
Leeds
LS11 9AR

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3.0 Requirement for work

3.1 The geophysical survey is required to examine the area for potential archaeological features. This information will be used to inform the requirement for further work. The survey will be undertaken as part of pre-determination evaluation works as part of an Environmental Impact Assessment.

3.2 The aim of the geophysical survey is to gather sufficient information to establish the location and extent of any archaeological features within the confines of each turbine location, and, where possible, to characterise the archaeology thus located. The surveys should be undertaken following standard practice to achieve the best results.

3.3 The programme will result in the preparation of a report, which should follow the report outline in the standards and guidance listed in 3.5 below.

3.4 In addition to the required project design (see 4.1 below), a list of key personnel must be supplied along with details of their relevant experience in Curriculum Vitae for each member of staff as appropriate. Details of relevant experience and an insurance statement are also required.

3.5 The surveys should be carried out in accordance with the Institute for Archaeologists (IfA) *Draft Standards & Guidance: Geophysical Survey* (2010), *IFA Paper No. 6: The Use of Geophysical Techniques in Archaeological Evaluations* (2002) and English Heritage *Geophysical Survey in Archaeological Field Evaluation* (2008).

4.0 Methodology

4.1 The successful contractor will be required to prepare a project design to be agreed with the County Archaeologist. The project design should include sufficient information to detail the field methodology. The following should also be covered:

- Summary and introduction
- A written statement on the project's overall objectives, strategy and methods
- Field methodology
- Report preparation and contents
- Copyright and publication
- Publication and dissemination proposals
- Timetable
- Staffing and responsibilities (including and sub-contractors and/or specialists)
- Health and safety policy and implementation
- Insurance

4.4 The surveys should be undertaken within a grid independently re-locatable on the ground by a third party, by measuring to a permanent feature.

4.5 A detailed geophysical survey should be undertaken using a fluxgate gradiometer, utilising traverses of 1m with readings taken at intervals of 0.25m within a 20mx20m survey grid. If it becomes evident that discrete features such as postholes exist in some areas, it may be necessary to reduce the traverse width to 0.5m.

4.6 The actual areas of survey, and any features of possible archaeological interest, should be accurately located on a site plan and recorded in a written description sufficient to permit the preparation of a report on the site.

4.7 During fieldwork a record should be made of surface and weather conditions that may have a bearing on subsequent interpretation on field data.

4.8 Should the survey indicate the presence of likely archaeological features, appropriate fieldwork and/or mitigation will be explored to further investigate the anomalies and /or avoid disturbance of significant features by development proposals.

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F +44 (0)113 391 6899
E matthew.parker@aecom.com
www.aecom.com

2 City Walk
Leeds
LS11 9AR

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5.0 Monitoring arrangements

5.1 To ensure that archaeological work is conducted in accordance with the agreed project design, monitoring of fieldwork and post-fieldwork analysis may be required. This may be by AECOM staff or the County Archaeologist for Cambridgeshire.

5.2 The monitors are not liable in any way for the failings of the archaeological contractor and such monitoring is not intended to take the place of proper self-regulation.

6.0 Post-Fieldwork Methodology

6.1 On completion of the fieldwork, a report should be produced as soon as possible but no later than 4 weeks upon completion of the fieldwork element. Interim results (draft plan and accompanying brief notes) are required as soon as possible but no later than one week after completion of the fieldwork.

7.0 Report requirements

7.1 Essentially the report must define the location, extent and significance of archaeological features recorded as part of the survey. The final report should follow the guidance in the standards and guidance listed in paragraph 3.5 above, specifically the 2008 English Heritage guidance on page 9, but is likely to consist of the following sections:

1) Title page
2) List of contents, figures, tables, etc
3) Non-technical summary
4) Introduction
5) 10 Figure National Grid Reference
6) Archaeological and historical background
7) Aims and Objectives
8) Methodology
9) Results – Supported by a survey location plan (minimum scale 1:2500), a plot of the raw data (minimum scale 1:1000, grey-scale format, and/or X-Y trace format as appropriate), a plot of enhanced data and one or more interpretative plots (minimum scale of 1:1000).
10) Discussion
11) Recommendations
12) Conclusion
13) References to all primary and secondary sources consulted.
14) OASIS reference number
15) Statement of Indemnity

7.2 The final report on the site should be presented in Word format and any digital images in tiff format and should be produced within four weeks of completion of fieldwork.

7.3 Copies of the final report should be provided to the following:

- AECOM (hard copy and pdf), including copies for distribution to the client
- Cambridgeshire County Council Historic Environment Record (hard copy and pdf)
- OASIS (pdf)

8.0 Health and Safety, Staffing and Insurance

8.1 Health and safety will take priority over archaeological matters. All archaeologists undertaking fieldwork must comply with all Health and Safety Legislation. All archaeologists or archaeological organisations undertaking the fieldwork should ensure that they, or any proposed sub-contractors, are appropriately qualified and adequately insured to undertake such projects.

Direct Tel: 0113 301 2460
T +44 (0)113 391 6800
F +44 (0)113 391 6899
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www.aecom.com

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Leeds
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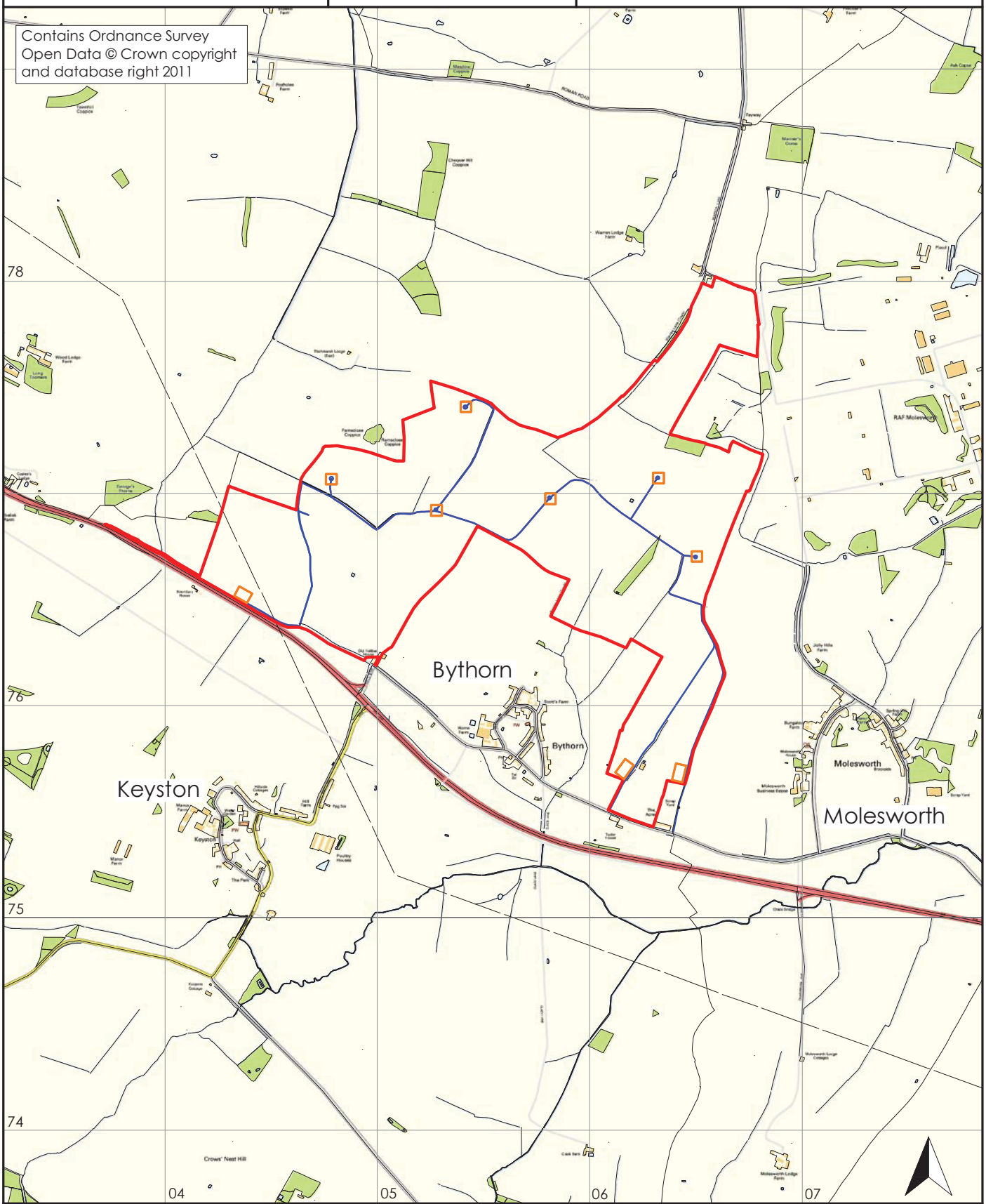
Figure 1: Site location



Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
Area 7
Area 8
Area 9

Titchmarsh Lodge (East)
Ramsclose Coppice
Ramsclose Coppice
Warren Lane (Track)
Boundary House
Old Tollbar House
TOLL BAR A
A14
B663
TOLL BAR LANE
Scott's Farm
Home Farm
WARREN LANE
PW
PH
Tel Ex
Bythorn
Hillside Cottages
Manor Farm
Water Garden
Hill Farm
Ppg Sta
LOOP ROAD
PW
Keyston
Hall
PH
The Park
Poultry Houses
CLACK LANE
Tudor House
The Acres
Scrap Yard
Molesworth Business Estate
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04
05
06

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Figure 2: Survey locations

0 500m
scale 1:10 000 for A3 plot

site boundary

proposed development

magnetic survey