Archaeology South-East

ASE

Geophysical Survey
Proposed Solar Farm at
London Southend Airport

NGR: TQ 86714 89622

ASE Project no: 8299

OASIS ID REF: 206068

March 2014

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ARCHAEOLOGICAL GEOPHYSICAL SURVEY

PROPOSED SOLAR FARM

LONDON SOUTHEND AIRPORT

NGR: TQ 86714 89622

REPORT PREPARED

FOR ARCHAEOLOGY SOUTH-EAST

ON BEHALF OF STOBART DEVELOPMENTS

BY DAVID BUNN

MARCH 2015

Contents

Illustrations

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Non technical summary

A fluxgate gradiometer survey was undertaken on land at Southend Airport, Southend on Sea, Essex.

The survey has not identified magnetic anomalies that clearly define traces of archaeological remains.

For the most part, distinct magnetic variation is likely to be of modern or recent origin, including indicators of a former field boundary, current boundaries and miscellaneous ferrous-rich materials associated with the use of the site for airfield/airport activity. Weak variation is conceivably of natural origin.

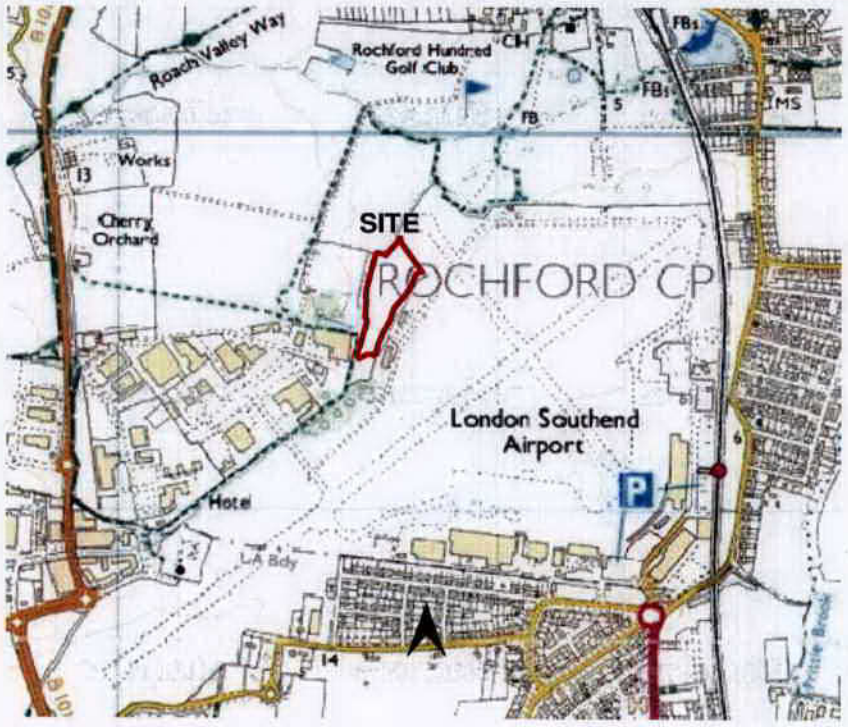

Fig.1: Location of site

1.0 Introduction

Acting for Stobart Developments, Archaeology South-East (ASE) commissioned Pre-Construct Geophysics Ltd to undertake a fluxgate gradiometer survey on land at London Southend Airport, Southend on Sea, Essex (centred at c.NGR TQ 86714 89622).

The survey forms part of an archaeological evaluation prior to the submission of a planning application for the redevelopment of the site as a solar farm.

This report incorporates information that has been selectively extracted from a Written Scheme of Investigation for a Geophysical Survey (WSI) prepared by ASE (ASE, 2014).

2.0 Location and description (Figs. 1 – 2)

The c. 3.7ha proposed development is situated at the north-western edge of London Southend Airport, within the current airside perimeter. It largely encompasses open grassland, with (smaller) overgrown areas along/adjacent to the perimeter that were unsuitable/unsafe for effective survey. It is bounded to the west by an airport security fence, to the south by open land and to the north and west by airport facilities/buildings.

3.0 Geology and topography

The solid geology comprises Thames Group (clay, silt sand and gravel)[1] This is overlain by undifferentiated river terrace deposits.

The site occupies level ground at a height of c.10m AOD. Observations made during previous investigations at the airport suggest that the site may have been levelled during the construction of the airfield/airport.

4.0 Archaeological Context

Extract of the WSI* (ASE, 2014):

The development lies within a general area of established archaeological interest and potential. A number of investigations have been undertaken and findspots recorded in both the immediate and wider proximity. The vicinity has also been the subject of various desk-based assessments and environmental impact assessments in recent years (e.g. Heppell 2003; 2004), which have served to collate and evaluate the evidence produced by previous works. Most pertinent to this scheme is the DBA produced by Jacobs consultancy (Preston 2009).

This wider content includes extensive Iron Age, Roman and Saxon remains at the Temple Farm Industrial Estate to the north-east (EHER 13751-5, 9733-5, etc.), Neolithic burials and Iron Age pottery to the north within the airport area (EHER 9605-6), and a range of Roman to post-medieval remains beneath the housing immediately east of Southend Road (EHER 9685). Particularly indicative of the general incidence of remains in the landscape, are the prehistoric and Roman sites at Westbarrow Hall Farm (Dale 2001) which lies to the west of the airport.

Within the eastern part of the airport, where construction of a new rail station, car parking and terminal is ongoing as part of the completion of an overall multi-modal transport interchange scheme, evaluation and subsequent monitoring by FAU has identified the presence of remains of various dates. Prehistoric (probably Bronze Age) and medieval features (EHER 18227-8), and a number of buildings associated with the WW2 airfield have been recorded (Atkinson 2009, 2010; Ennis 2007; Germany 2005; Wardill 1998). Outside the airport, immediately to its south-east, investigations at Warners Bridge (EHER 16956) revealed further prehistoric ditches of probable Bronze Age date (Foreman and Germany 1997).

The 1998 trial trenching work immediately to the west of the railway identified a low density of ditches and pits of prehistoric date, but also areas of disturbance to a depth of 1.5m and the

presence of relatively substantial thicknesses of overburden deposits (Wardill 1998). This vicinity was revisited in 2006 and 2010, when car park construction works were monitored. The presence of as much as 0.8m of overburden was substantiated and the remains of a probably prehistoric pit identified (Ennis 2007; Atkinson 2010). To the east of the railway, trial trenching and subsequent monitoring of enabling works associated with the construction of the new rail station established the presence of a quantity of small prehistoric pits and two 15th- 16th century ditches, the latter speculated to possibly be associated with a near-by settlement (Atkinson 2009; Germany 2005).

Specific to the new terminal building and apron site, Trenches 5 and 6 of the 1998 evaluation were located within the current site area. These contained a quantity of prehistoric remains, primarily parallel ditches that clearly extend further across this vicinity and may have other remains in association. Further ditches found in evaluation trenches in what is now the new car park can also be projected to head in the direction of this site. The crouched burial and Iron Age pottery found a short distance to the north-east of the new terminal site (EHER 9505-6) could be associated.

The site was first used as an airfield by the Royal Flying Corps during the First World War. It developed as a civil airport between the wars before being equisitioned by the RAF in 1939 as a fighter base. It returned again to its current civil use in 1946 at which time it was equipped with a concrete runway. Various structures associated with the use and defence of the WW2 airfield have been recorded to the east, alongside the railway line (Wardill 1998). Some still stand, but others have been demolished. The 2009 desk-based assessment additionally identified the approximate location of a Pickett-Hamilton fort (a rare type of retracting pillbox) to the north-east of the new terminal sit (Preston 2009). Other significant WW2 remains and possibly WW1, as yet unidentified, may exist elsewhere in this vicinity of the airport.

* WSI bibliography.

5.0 Objectives

The objectives of the geophysical survey were to establish, by using non intrusive techniques;

- The nature, extent and location of any archaeological features, should any lie within the proposed development;
- The presence/absence of any modern features, such as services, that may impact on the survey results and any archaeological features in close proximity.

6.0 Methodology

The survey methodology is based upon English Heritage guidelines: *'Geophysical Survey in Archaeological Field Evaluation'* (English Heritage, 2008).

Fluxgate Gradiometry is a non-intrusive scientific prospecting tool that is used to determine the presence/absence of some classes of sub-surface archaeological features (e.g. pits, ditches, kilns, and occasionally stone walls).

The use of gradiometry should help to establish the presence/absence of buried magnetic anomalies, which may reflect sub-surface archaeological features, and may therefore form a basis for a subsequent scheme of archaeological trenching.

The use of magnetic surveys to locate sub-surface ceramic materials and areas of burning, as well as magnetically weaker features, is well established, particularly on large green field sites. The detection of anomalies requires the use of highly sensitive instruments; in this instance the Bartington 601 Dual Fluxgate Gradiometer. This is accurately calibrated to the mean magnetic value of each survey area. Two sensors, mounted vertically and separated by 1m, measure slight, localised distortions of the earth's magnetic field, which are recorded by a data logger.

It should be noted that this technique only records magnetic variation (relative to natural background levels). As such, the magnetic response of archaeological remains will vary according to geology/pedology. Additionally, remains may be buried beyond the effective of 1 - 2m range of the instrumentation (e.g. sealed beneath alluvium).

The survey was undertaken on 16th – 17th February 2015. The zigzag traverse method of survey was used, with readings taken at 0.25m intervals along 1.0m wide traverses.

The survey grid was established by Global Positioning Satellite using a Topcon GRS-1, with an accuracy of +/- 0.1m and subsequently geo-referenced on an Auto drawing of the site.

The data sets were processed using *Terrasurveyor 3.*

The raw data sets are presented as a greyscale image on Fig. 4 (clipped to +/-10nT to enhance resolution).

The 'Despike' function was applied to reduce the effect of extreme readings induced by metal objects, and 'Destripe' to eliminate striping introduced by zigzag traversing. The data set was clipped to +/- 20nT on the trace plot (Fig. 5) and +/-5nT on the greyscale image (Fig. 2).

6.2 Character, interpretation and presentation of magnetic anomalies

The interpretation of geophysical survey results should only be regarded as an aid to establishing the true nature and origin of buried features. These can only be fully achieved by intrusive investigation

Anomalies considered to reflect modern ferrous-rich features and objects are highlighted as blue and/or pink on the interpretive images. These are characterised magnetically as dipolar 'iron spikes', often displaying strong positive (pink) and/or negative responses (blue). Examples include those deposited along existing or former boundaries (e.g. wire fencing), services and scatters of horseshoes, ploughshares etc across open areas. Ferro-enhanced (fired) materials such brick and tile (sometimes introduced during manuring or land drain construction) usually induce a similar, though predominately weaker response. Concentrations of such anomalies will often indicate rubble spreads, such as would be used to backfill ponds or redundant ditches, or indicate the blurred footprints of demolished structures.

On a cautionary note, fired clay associated with early activity (e.g. kilns, furnaces, tile spreads) has the same magnetic characteristics as modern brick/tile rubble. Therefore, the interpretation of such variation must consider the context in which it occurs.

Likely natural responses are highlighted as green.

7.0 Results and discussion (Figs. 2 - 5)

The survey recorded stronger magnetic variation that clearly/almost certainly relates to modern occupation of the area (Fig. 3: highlighted pink and/or blue). This includes strong responses registered along and adjacent to boundaries, with examples within the field conceivably associated with former airfield features. Such responses typically signify miscellaneous modern ferrous-rich materials/objects (iron or ceramic objects, metal fencing etc), some potentially associated with *in-situ* remains of former RAF structures/installations. It is also possible that elements of stronger variation relate to a former field boundary, as depicted on historic O.S. Maps[2] (dotted yellow line).

It is likely that the majority of weak responses recorded against a 'neutral' background reflect natural inconsistencies within the upper geological and pedological horizons (subtle variations within greenscale image).

8.0 Conclusions

The survey has not identified magnetic anomalies that clearly define traces of archaeological remains.

For the most part, distinct magnetic variation is likely to be of modern or recent origin, including indicators of a former field boundary, current boundaries and miscellaneous ferrous-rich materials associated with the use of the site for airfield/airport activity. Weak variation is conceivably of natural origin.

9.0 Acknowledgements

Pre-Construct Geophysics would like to thank Archaeology South-East for this commission.

10.0 References

Archaeology South-East 2014 *Written Scheme of Investigation for Geophysical Survey for a proposed Solar Farm at Southend Airport.* ASE Project No: 8299. Unpublished.

English Heritage. 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, London

[1] http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html, 1:50,000. British Geological Survey, Keyworth

[2]http://www.old-maps.co.uk/maps.html

Fig. 2: Greyscale image of processed data

Fig. 3: Interpretation

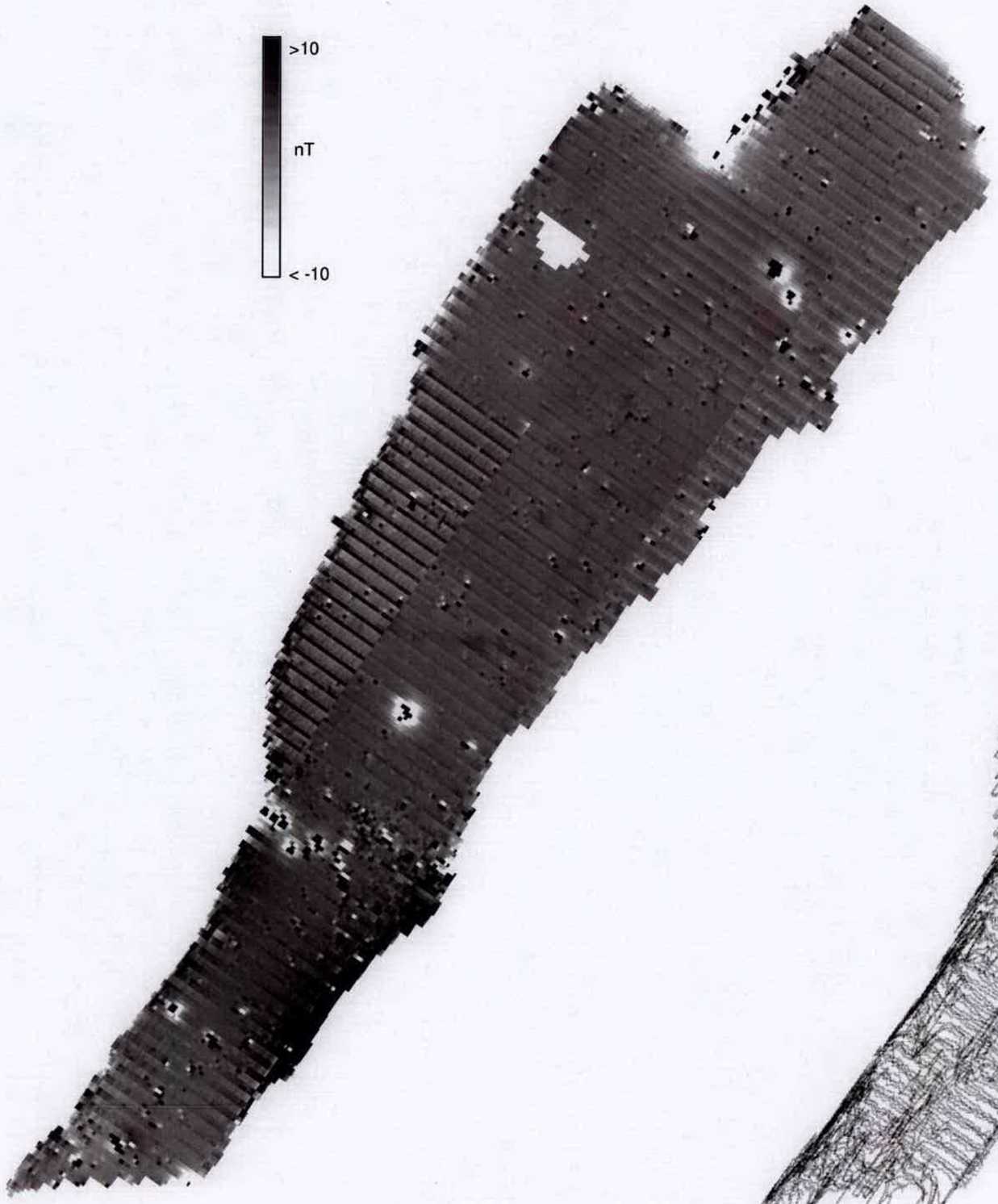

Fig. 4: Greyscale image of unprocessed data

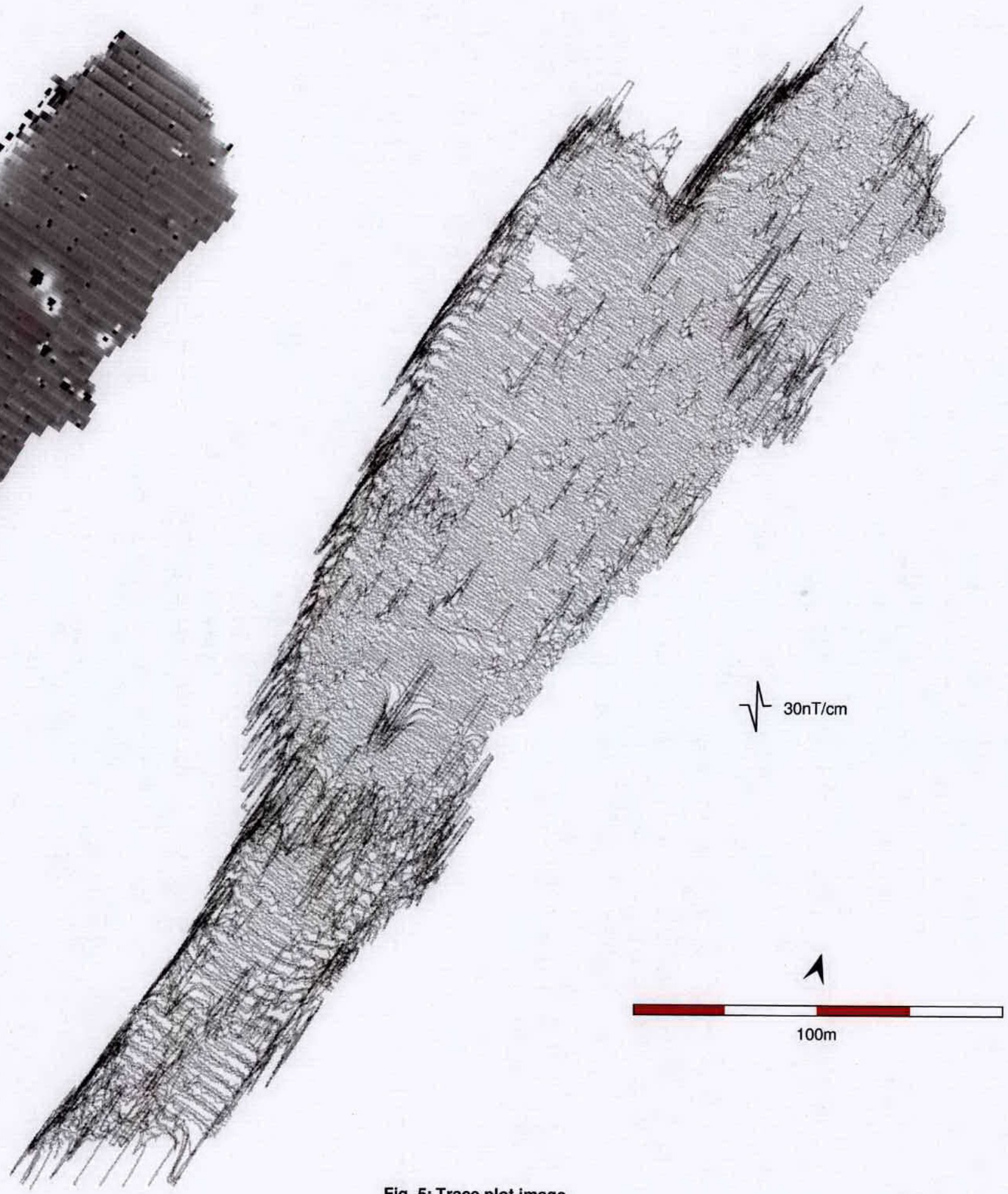

Fig. 5: Trace plot image

Archaeology South-East

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Written Scheme of Investigation

for

Geophysical Survey

For a proposed Solar Farm at

Southend Airport

NGR: TQ 86714 89622

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December 2014

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1 INTRODUCTION

1.1 This Written Scheme of Investigation (WSI) is for a programme of geophysical survey (magnetometer) to be undertaken as a pre-planning prospection exercise on land at Southend Airport, Southend on Sea Essex SS2 6YF (Figure 1). The WSI has been prepared by Archaeology South-East (ASE) on behalf of Stobart Developments following discussions with Essex County Council Place Services, in their capacity as archaeological advisors to the local planning authority, Rochford District Council, regarding the scope of works to be undertaken.

2 BACKGROUND

2.1 Site Description

2.1.1 The development area is located on the north-west side of London Southend Airport, within the current airside perimeter (TQ 86714 89622 - Fig.1). The site itself, show edged in red on Figure 1, is broadly level and comprises closely-mown grassland.

2.1.2 The site lies on a surface geology of undifferentiated river terrace deposits overlying Thames Group clay, silt, sand and gravel. Based on observations during previous investigations at the airport it is possible that the site has been altered (levelled) as part of the airfield/airport creation.

2.2 Reasons for Project

2.2.1 The survey is being undertaken as a pre-planning prospection exercise, the results of which will be used to inform decisions regarding a potential planning application for the site, for a solar farm, and the need for any further archaeological works that may be required in connection with the proposed development.

2.3 Archaeological Background

2.3.1 The development lies within a general area of established archaeological interest and potential. A number of investigations have been undertaken and findspots recorded in both the immediate and wider proximity. The vicinity has also been the subject of various desk-based assessments and

environmental impact assessments in recent years (e.g. Heppell 2003; 2004), which have served to collate and evaluate the evidence produced by previous works. Most pertinent to this scheme is the DBA produced by Jacobs consultancy (Preston 2009).

2.3.2 This wider content includes extensive Iron Age, Roman and Saxon remains at the Temple Farm Industrial Estate to the north-east (EHER 13751-5, 9733-5, etc.), Neolithic burials and Iron Age pottery to the north within the airport area (EHER 9605-6), and a range of Roman to post-medieval remains beneath the housing immediately east of Southend Road (EHER 9685). Particularly indicative of the general incidence of remains in the landscape, are the prehistoric and Roman sites at Westbarrow Hall Farm (Dale 2001) which lies to the west of the airport.

2.3.3 Within the eastern part of the airport, where construction of a new rail station, car parking and terminal is ongoing as part of the completion of an overall multi-modal transport interchange scheme, evaluation and subsequent monitoring by FAU has identified the presence of remains of various dates. Prehistoric (probably Bronze Age) and medieval features (EHER 18227-8), and a number of buildings associated with the WW2 airfield have been recorded (Atkinson 2009, 2010; Ennis 2007; Germany 2005; Wardill 1998). Outside the airport, immediately to its south-east, investigations at Warners Bridge (EHER 16956) revealed further prehistoric ditches of probable Bronze Age date (Foreman and Germany 1997).

2.3.4 The 1998 trial trenching work immediately to the west of the railway identified a low density of ditches and pits of prehistoric date, but also areas of disturbance to a depth of 1.5m and the presence of relatively substantial thicknesses of overburden deposits (Wardill 1998). This vicinity was revisited in 2006 and 2010, when car park construction works were monitored. The presence of as much as 0.8m of overburden was substantiated and the remains of a probably prehistoric pit identified (Ennis 2007; Atkinson 2010). To the east of the railway, trial trenching and subsequent monitoring of enabling works associated with the construction of the new rail station established the presence of a quantity of small prehistoric pits and two 15th-

16th century ditches, the latter speculated to possibly be associated with a near-by settlement (Atkinson 2009; Germany 2005).

2.3.5 Specific to the new terminal building and apron site, Trenches 5 and 6 of the 1998 evaluation were located within the current site area. These contained a quantity of prehistoric remains, primarily parallel ditches that clearly extend further across this vicinity and may have other remains in association. Further ditches found in evaluation trenches in what is now the new car park can also be projected to head in the direction of this site. The crouched burial and Iron Age pottery found a short distance to the north-east of the new terminal site (EHER 9505-6) could be associated.

2.3.6 The site was first used as an airfield by the Royal Flying Corps during the First World War. It developed as a civil airport between the wars before being requisitioned by the RAF in 1939 as a fighter base. It returned again to its current civil use in 1946 at which time it was equipped with a concrete runway. Various structures associated with the use and defence of the WW2 airfield have been recorded to the east, alongside the railway line (Wardill 1998). Some still stand, but others have been demolished. The 2009 desk-based assessment additionally identified the approximate location of a Pickett-Hamilton fort (a rare type of retracting pillbox) to the north-east of the new terminal site (Preston 2009). Other significant WW2 remains and possibly WW1, as yet unidentified, may exist elsewhere in this vicinity of the airport.

3 AIMS AND OBJECTIVES

3.1 Aims

3.1.1 The aim of the geophysical survey will be to determine the likely presence or absence of any archaeological remains within the survey area. The results of the survey will be used to inform any planning application that may be submitted for the site and, in consultation with ECC Place Services, the need for and extent of any further work that may be required in order to more fully determine the presence or absence of any archaeological remains.

3.2 Research Objectives

3.2.1 In the event of significant discoveries potential research objectives will be identified for any further work in line with those presented in Research and Archaeology: a Framework for the Eastern Counties, 2. research agenda and strategy (Brown and Glazebrook 2000) and the revised framework, Research and Archaeology Revisited: A revised Framework for the East of England (Medlycott 2011).

4 METHODOLOGY

4.1 Requirements

4.1.1 A fluxgate gradiometer survey will be undertaken of all available land within the development, totalling approximately 3.7ha (Fig. 1). A site code will b obtained from ECC Place Services and this will be quoted on all project documentation, including the final report and the site archive. Prior to the commencement of fieldwork an OASIS online record will be initiated and key fields completed on the *Details*, *Location* and *Creators* forms. Once the project is completed, all parts of the OASIS online form will be completed for submission to ECC Place Services. This will include an uploaded .pdf version of the entire report. A copy of the OASIS form will be included in the final report.

4.2 Standards

4.2.1 The geophysical survey works will be undertaken in accordance with *Geophysical Survey in Archaeological Field Evaluation* (English Heritage 2008), *The Use of Geophysical Techniques in Archaeological Evaluation* (Gaffney et al 2002), *Geophysical Data in Archaeology: a Guide to Good Practice* (Schmidt and Ernenwein 2011) and the *Standard and Guidance for Geophysical Survey* (IfA 2011). Archaeology South-East is a registered archaeological organisation with the IfA.

4.3 Methods

4.3.1 Gradiometry is a non-intrusive scientific prospecting technique; used to determine the presence/absence of some classes of sub-surface archaeological remains (e.g. pits, ditches, kilns, and occasionally stone walls).

By scanning the soil surface, geophysicists identify areas of varying magnetic susceptibility and can interpret such variation by presenting data, measured in units of nanoTesla (nT), in various graphical formats and identifying images that share morphological affinities with diagnostic archaeological remains. The technique records anomalous magnetic variation within buried archaeological and other remains; therefore an absence of magnetic variation would predispose detection by gradiometry.

4.3.2 The survey will be undertaken using a Bartington Grad-601 Dual Fluxgate Gradiometer. The zigzag traverse method will be used, where readings are taken at 0.25m intervals along 1.0m wide traverses. The sensitivity of the instrument will be set to record magnetic variation in the order of 0.1 nanoTesla. Data will be downloaded onto a laptop computer, and subsequently analysed and processed using ArcheoSurveyor v 1.3.2.8. The survey grid will be located to an accuracy of +/- 20cm by GPS.

4.3.3 Each day on site the team will re-survey one grid square a second time, to demonstrate the consistency and repeatability of the results. The chosen grid will not be re-surveyed in quick succession, but will be undertaken at a later point in the day. The results of both surveys of the selected grids will be presented as raw data in an appendix to the site report.

5 REPORTING

5.1 The written report will include:

- An executive summary of the survey results
- Introduction, including details of development, and client,
- Description of site
- Description of geology and topography
- Archaeological background
- Methodology, including:
  - Details of field work
  - Date of survey
  - Principles of geophysical techniques
  - Details of data processing

Presentation of written results and graphic images

- Written results, describing nature of recorded magnetic variation referenced to:

  Figures showing general location of survey (1:25,000 or less)

  Greyscale or colourscale images of raw data, presented on a base map

  Greyscale images of processed data

  Trace plot (gradiometer data)

  Interpretive images of recorded anomalies
- Acknowledgements
- References
- Appendices – raw data for the re-surveyed grids (as per 4.3.3 above)

5.2 All images will be presented at appropriate scales and, where appropriate, will be presented on a map base with details of OS coordinates of the survey grid.

5.3 A draft of the report will be submitted to ECC Place Services for approval within 2 weeks of the completion of fieldwork.

5.4 A PDF copy of the final report will be supplied to ECC Place Services within eight weeks of the completion of the fieldwork on the understanding that this will become a public document after an appropriate period of time (generally not exceeding six months). A copy of the report will also be sent to the Regional Advisor for Archaeological Science, English Heritage, Brooklands House, 24 Brooklands Avenue, Cambridge CB2 8BU.

5.5 If required, a digital vector plan will be supplied with the report for integration with the Essex HER.

6 PUBLICATION

6.1 If positive results are obtained from the project, a summary report will be prepared and submitted for inclusion in an appropriate local journal.

6.2 Archive

6.2.1 A full archive will be prepared for all work undertaken.

6.2.2 Guidelines contained in *Archaeological Archives. A guide to best practice, compilation, transfer and curation* (Brown 2007) and IfA guidance will be followed in the preparation of the archive for museum deposition.

6.2.3 If appropriate, a digital archive will be deposited with the Archaeological Data Service. As a minimum, the project report will be uploaded to OASIS and be accessible via the ADS 'grey literature' library. A hard copy of the OASIS record will also be included in the archive.

7 HEALTH AND SAFETY

7.1 General

7.1.1 It is the policy of Archaeology South-East to follow the Archaeology South-East & The Centre for Applied Archaeology Health & Safety Policy. Archaeology South-East will adhere to all current Health and Safety legislation.

7.1.2 Archaeology South-East has employer's liability insurance, and third party liability insurance in respect of any incident on site involving staff.

7.2 Code of Practice and Risk Assessment

7.2.1 The Archaeology South-East & The Centre for Applied Archaeology Health & Safety Policy covers most aspects of archaeological work and ensures that for most sites the risks are adequately controlled. Prior to and during fieldwork work each site is individually assessed. During this assessment, additional risks not covered by the Code of Practice are identified and the appropriate action is taken. A copy of any such Risk Assessment is kept on site.

7.3 Site Risk Assessment and Safety Measures

7.3.1 An initial appraisal of risk suggests that adherence to the Health & Safety Policy should adequately control identified risks. However, assessment of

risk is an ongoing process and should circumstances demand additional risk assessments will be carried out both prior to and during archaeological works.

8 RESOURCES AND PROGRAMMING

8.1 Timetable and Programme

8.1.1 The geophysical survey work will be undertaken in the week commencing Monday 5th January 2015 and is expected to take two to three days to complete, followed by the production of a report. The fieldwork and reporting will be undertaken by an experienced team of geophysicists under the supervision of an ASE project manager (Neil Griffin).

9 MONITORING

9.1 The ECC Place Services monitoring officer will be responsible for monitoring progress and standards throughout the project on behalf of the LPA.

9.2 Any variations to the specification will be agreed with the ECC Place Services monitoring officer prior to being carried out. The monitoring officer will be kept informed of progress throughout the project.

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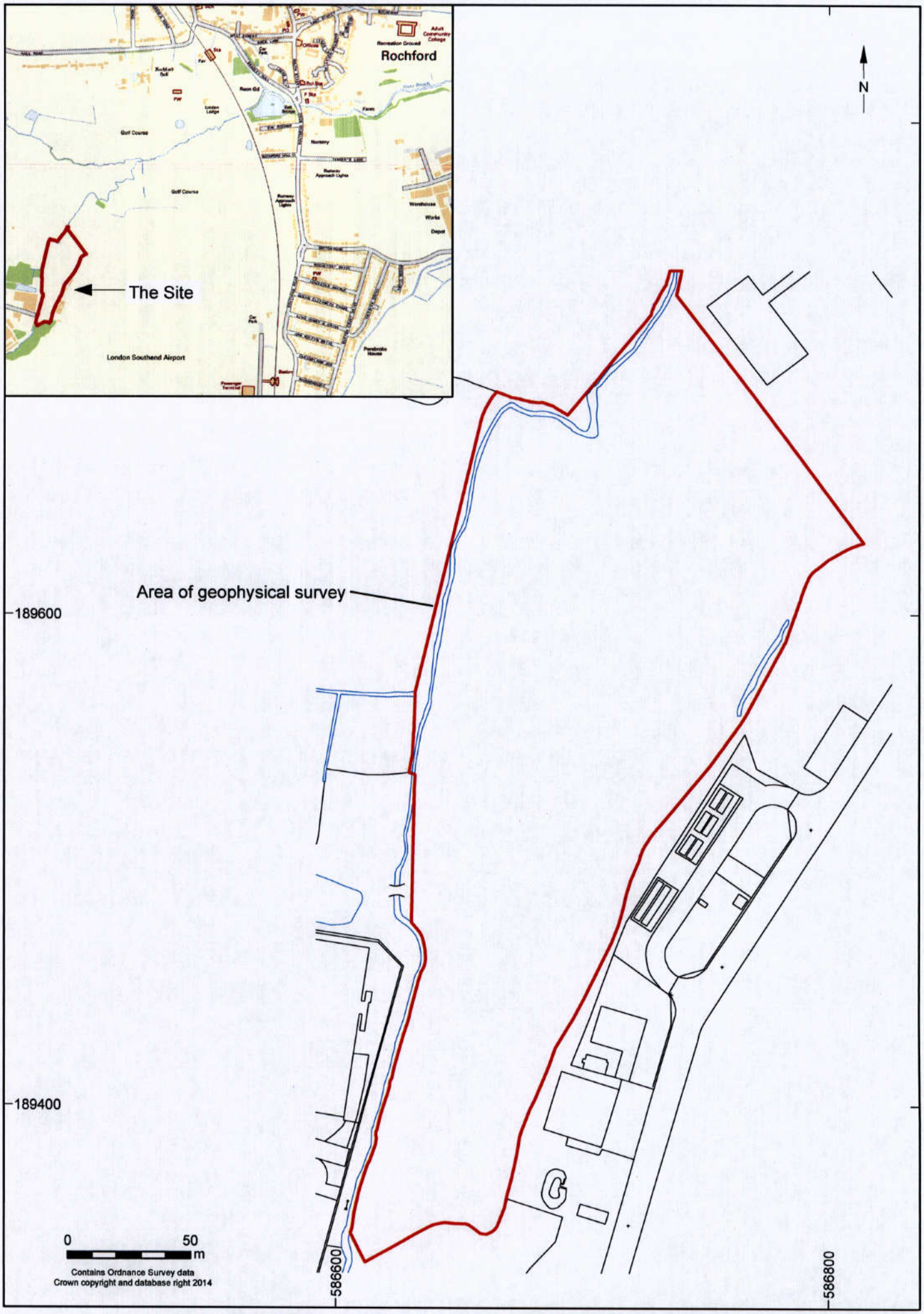

© Archaeology South-East		Southend Airport solar farm	Fig. 1
Project Ref: 8299	Dec 2014	Location of geophsical investigation	
Report No: WSI	Drawn by: APL		

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