HDGP19



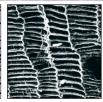














LAND WEST OF HIGH DIKE, GREAT PONTON, LINCOLNSHIRE

GEOPHYSICAL SURVEY

commissioned by RSK ADAS Ltd

November 2019





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PROJECT INFO:

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PROJECT TEAM

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PROJECT SUMMARY

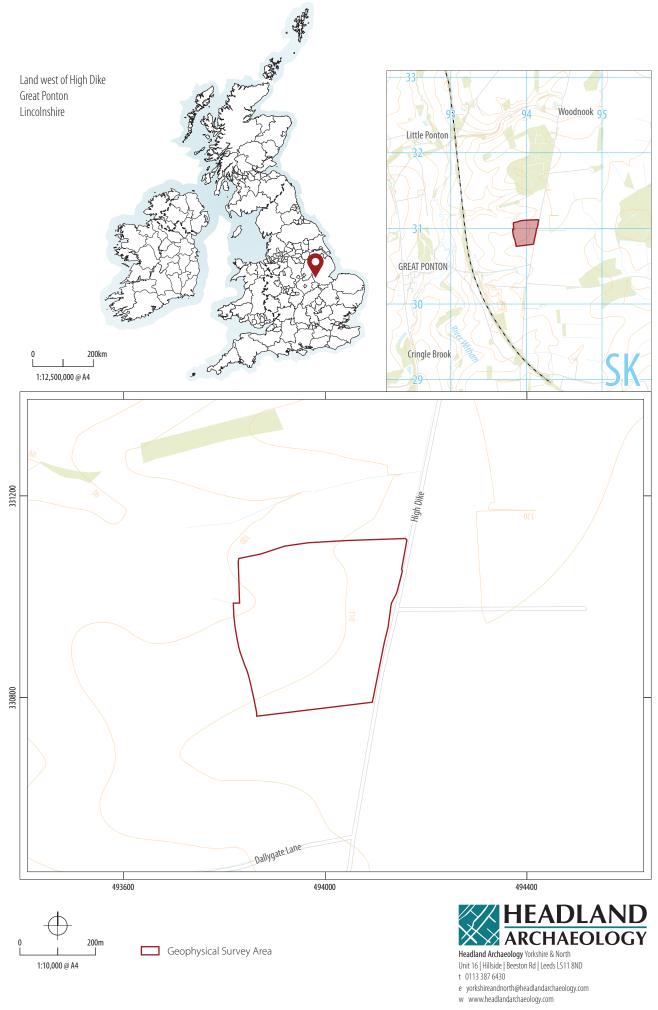
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 9 hectare site at Great Ponton, Lincolnshire, to inform a planning application for the development of the site. No anomalies of clear archaeological potential have been identified and none to suggest the presence of any archaeological activity along Ermine Street Roman Road which forms the eastern site boundary. Isolated areas of magnetic enhancement in the north of the site have been ascribed some archaeological potential, perhaps being due to pits, although a geological or pedological origin is equally plausible. At least two regimes of ridge and furrow cultivation have been detected as series of slightly sinuous parallel trends. These are of likely post-medieval, or earlier medieval, origin and may be of local historic interest but are not thought to be of any archaeological significance. Therefore, on the basis of the geophysical survey, the site is assessed as of low archaeological potential, and low to moderate in the vicinity of the possible pits.

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LAND WEST OF HIGH DIKE, GREAT PONTON, LINCOLNSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by RSK ADAS Ltd (the Client), to undertake a geophysical (magnetometer) survey on land at Great Ponton, Lincolnshire, to inform a planning application for the development of the site. The results of the survey will inform future archaeological strategy at the site.

The survey was undertaken in order to assess the impact of the proposed development on the historic environment and was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI) (Dyulgerski 2019), with guidance within the National Planning Policy Framework (MHCLG 2019) and in line with current best practice (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Geophysical Survey Area (GSA) is located 1.5km north-east of the village of Great Ponton, centred on SK 9400 3103 (Illus 1). It comprises a single arable field, measuring 9 hectares, which is bound to the east by the B6403 High Dlke and by arable farmland on all other sides.

Generally, the topography slopes down from 115m Above Ordnance Datum (AOD) in the south-east to 101m AOD in the north-west. At the time of survey, the field contained the remnants of a recently harvested wheat crop (Illus 2 and Illus 3).

The survey was carried out on the 4th November 2019.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Rutland Formation (argillaceous rocks with subordinate sandstone and limestone) and is overlain by glacial till superficial deposits (NERC 2019).

The soils are classified in the Soilscape 18 Association, characterised as slowly permeable, seasonally wet loams and clays (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

High Dike, which bounds the GSA to the east, follows the route of Ermine Street Roman Road (HER No. 60638). A single sherd of Roman pottery (HER No. 39390) was recovered 441m south of the proposed development. The Royal Commission on the Historical Monuments of England National Mapping Programme 1992 to 1996 recorded the cropmark of a linear feature (HER No. 36276), 385m to the southwest of the GSA. The linear feature is recorded as Medieval in date, although it is not explained why (Heritage Gateway 2019). Medieval ridge and furrow earthworks (HER No. 36275) are also recorded immediately east and adjacent to the GSA. The earthworks appear to have been ploughed out by 2012, as they were no longer visible on Google Maps at this time (Heritage Gateway 2019).

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide enough information to establish the presence/absence, character and extent



ILLUS 2 GSA, looking north

of any archaeological remains within the GSA. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

- > to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the likely presence/absence and extent of any buried archaeological features; and
- to produce a comprehensive site archive and report.

MAGNETOMETER SURVEY 3.1

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10-15cm sample interval) on roaming

traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.35.1 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2 and Illus 3 are site condition photographs. Illus 4 is a 1:4,000 survey location plan showing the direction of survey as GPS swaths. The data is presented in greyscale and XY trace formats, at a scale of 1:1,500, in Illus 4 and Illus 5. Illus 6 is an interpretation plot of the data also at a scale of 1:1,500.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Dyulgerski 2019), guidelines outlined by Europae Archaeologia Consilium (EAC 2016)



ILLUS 3 GSA, looking west

and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey (OS) mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Ground conditions were good throughout the GSA contributing to a high standard of data collection. The magnetic background is relatively homogenous throughout and is characterised by numerous discrete anomalies. Against this background several anomalies have been identified and cross-referenced to specific examples on the interpretation figure (Illus 7).

4.1 FERROUS AND MODERN ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a result of manuring or tipping/

infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

Magnetic disturbance in the north of the GSA is caused by the close proximity of an electricity pylon. Disturbance in the south-east is due to the presence of ferrous material at the field entrance and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historic Ordnance Survey maps indicates that two boundaries have been removed from within the GSA since the publication of the first edition OS map in 1888. One of these former boundaries manifests in the data as a clear, high magnitude east/west linear anomaly (FB1; Illus 7). The anomaly is caused by the magnetic contrast between the soil-fill of a ditch and the surrounding soil. A second north/south boundary has not been detected with clarity by the survey, but its presence is indicated by the clear contrast between the ridge and furrow cultivation in the south-east of the GSA and the relative absence of ridge and furrow in the south-west. A sinuous linear anomaly (FB2) aligned north-west/south-east does not correspond to any features on historic mapping but follows the natural gradient and is interpreted as a possible former boundary or land drain.

At least two regimes of ridge and furrow cultivation have been detected by the survey aligned east/west and north/south. The characteristic striped appearance to the data is caused by the contrast between the infilled furrows and former ridges. Any linear

anomalies identified oblique to the surrounding field boundaries are likely to locate land drains with those parallel with, or at right angles to, the extant field boundaries likely due to modern ploughing.

POSSIBLE ARCHAFOLOGICAL 4.3 **ANOMALIES**

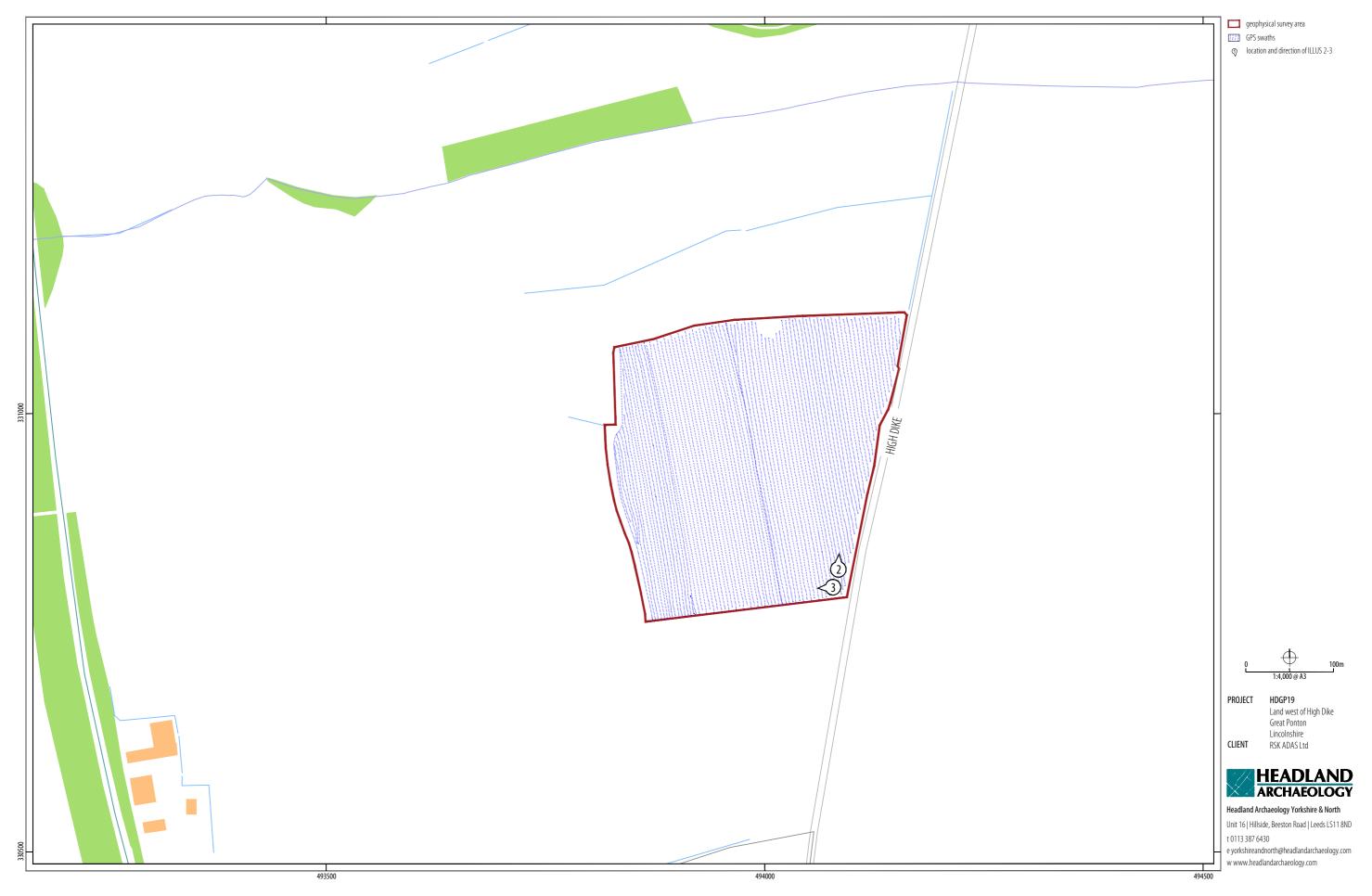
Isolated areas of magnetic enhancement (P1 and AAP1; Illus 7) in the north of the GSA may be archaeological in origin, perhaps being due to plough-damaged archaeological remains such as pits and ditches. However, no clear archaeological pattern is discernible in the data and the anomalies could equally be caused by localised variation in the soils or the glacial superficial deposits from which they derive.

CONCLUSION 5

The survey has successfully evaluated the geophysical survey area and has not identified any anomalies of clear archaeological potential and none to suggest the presence of any archaeological activity along Ermine Street Roman Road which forms the eastern site boundary. Isolated areas of magnetic enhancement in the north of the site have been ascribed some archaeological potential, perhaps being due to pits, although a geological or pedological origin is equally plausible. At least two regimes of ridge and furrow cultivation have been detected as series of slightly sinuous parallel trends. These are of likely post-medieval, or earlier medieval, origin and may be of local historic interest but are not thought to be of any archaeological significance. Therefore, on the basis of the geophysical survey, the site is assessed as of low archaeological potential, and low to moderate in the vicinity of the possible pits.

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7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However, some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Lightning-induced remnant magnetisation (LIRM) LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical currents associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION **INFORMATION**

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY **ARCHIVE**

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice. ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast

2019 by Headland Archaeology (UK) Ltd File Name: HDGP19-Report.pdf

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-374345

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Project name

Land West of High Dike, Great Ponton, Lincolnshire

Short description of the project

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 9 hectare site at Great Ponton, Lincolnshire, to inform a planning application for the development of the site. No anomalies of clear archaeological potential have been identified and none to suggest the presence of any archaeological activity along Ermine Street Roman Road which forms the eastern site boundary. Isolated areas of magnetic enhancement in the north of the site have been ascribed some archaeological potential, perhaps being due to pits, although a geological or pedological origin is equally plausible. At least two regimes of ridge and furrow cultivation have been detected as series of slightly sinuous parallel trends. These are of likely post-medieval, or earlier medieval, origin and may be of local historic interest but are not thought to be of any archaeological significance. Therefore, on the basis of the geophysical survey, the site is assessed as of low archaeological potential, and low to moderate in the vicinity of the possible pits.

Project dates Start: 04–11–2019 End: 04–11–2019

Previous/future work No / Not known

Any associated project reference

codes

HDGP19 — Contracting Unit No

Type of project Field evaluation

Site status None

Current Land use Cultivated Land 4 - Character Undetermined

Monument type None

Monument type None

Significant Finds None

Significant Finds None

Methods & techniques "Geophysical Survey"

Development type Not recorded

Prompt National Planning Policy Framework - NPPF

 Position in the planning process
 Not recorded

 Solid geology (other)
 Rutland Formation

 Drift geology
 Glacial sand and gravel

Techniques Magnetometry

PROJECT LOCATION

Country England

Site location Lincolnshire South Kesteven Great Ponton Land west of High Dike, Great Ponton, Lincolnshire

Study area 9 Hectares

Site coordinates SK 9400 3101 52.868019545275 -0.603404610043 52 52 04 N 000 36 12 W Point

PROJECT CREATORS

Name of Organisation Headland Archaeology

Project brief originator RSK ADAS

Project design originator Headland Archaeology

Project director/manager Harrison S
Project supervisor Bishop R

Type of sponsor/funding body Dev

Developer

LAND WEST OF HIGH DIKE, GREAT PONTON, LINCOLNSHIRE HDGP19

PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"none"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
PROJECT BIBLIOGRAPHY 1	
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