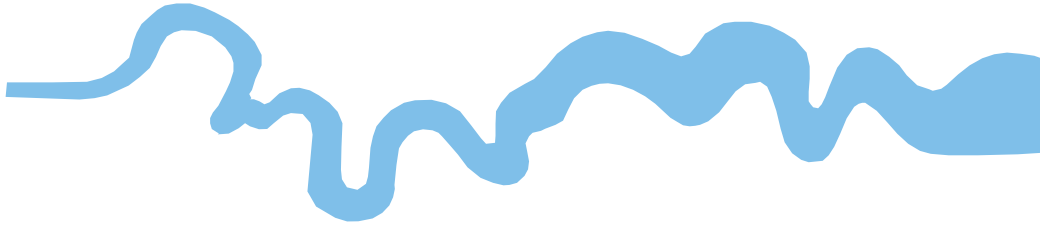


**T V A S**



**EAST MIDLANDS**

**Three Oaks Hydroponics Farm,  
Courteenhall, Northamptonshire**

**Geophysical Survey (Magnetic)**

**by Kyle Beaverstock**

**Site Code: TOC20/207**

**(SP 7707 5240)**

# **Three Oaks Hydroponics Farm, Courteenhall, Northamptonshire**

## **Geophysical Survey (Magnetic) Report**

**For Shockingly Fresh Ltd.**

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code TOC 20/207

**February 2021**

## Summary

**Site name:** Three Oaks Hydroponics Farm, Courteenhall, Northamptonshire

**Grid reference:** SP 7707 5240

**Site activity:** Magnetometer survey

**Date and duration of project:** 15<sup>th</sup> - 17<sup>th</sup> of February 2021

**Project coordinator:** Tim Dawson

**Site supervisor:** Kyle Beaverstock

**Site code:** TOC20/207

**Area of site:** 15.7ha

**Summary of results:** A number of magnetic anomalies were discovered by the geophysical survey but these are all most likely caused by modern disturbances such as services. No features of archaeological interest were identified.

**Location of archive:** The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

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[www.tvas.co.uk/reports/reports.asp](http://www.tvas.co.uk/reports/reports.asp).*

Report edited/checked by: Steve Ford✓ 02.03.21 Tim Dawson✓ 02.03.21
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# Three Oaks Hydroponics Farm, Courteenhall, Northamptonshire A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 20/207b

## Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Three Oaks Hydroponics Farm, Courteenhall, Northamptonshire (SP 7707 5240) (Fig. 1). The work was commissioned by Helen Ansell on behalf of Shockingly Fresh Limited, Gyleview House Suite 01, 3 Redheughs Rigg, Edinburgh, EH12 9DQ.

Planning permission is to be sought from the South Northamptonshire Council for the development for a farm diversification proposal to erect polytunnels and associated equipment. This is in accordance with the *National Planning Policy Framework* (NPPF 2019), and the Council's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock and Luciano Cicu between the 15<sup>th</sup> to the 17<sup>th</sup> of February 2021 and the site code is TOC20/207.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

## Location, topography and geology

The site is located within the Courteenhall Estate, some 8km to the south of the centre of Northampton, to the west of the M1 Motorway and 1km to the south-east of Courteenhall House itself. It consists of three fields with a total area of c.15.7ha. The site is undulating, sitting at a height of 126m above Ordinance Datum and is currently being utilised for arable farming. The underlying geology is stated as Boulder Clay (BGS 1969).

## Site history and archaeological background

A full assessment of the sites history and background can be found in the desk-based assessment (St. John-Brooks 2021). To summarise, although few historic assets have been found within the vicinity of the site aerial photography has shown the potential for some prehistoric activity.

## Methodology

### Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating zig-zag pattern, on a north-west to south-east orientation across the survey area. There were no significant obstructions across the site, conditions were dry and bright.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to  $10^{-9}$  Tesla, the SI unit of magnetic flux density.

### Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10 mounted at the rear of the cart. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response

as will buried ferrous objects. More subtle anomalies such as pits and ditches can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

<b>Process</b>	<b>Effect</b>
Clip from -5.50 to 5.53 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.18.15 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised, they are exported in .PDF format for inclusion within the finished report.

## Results

The most significant anomaly across the site is a bipolar linear pattern running from the north-east of the eastern field to the south-west before turning to the south-east at the boundary between the eastern and central fields. This is most likely caused by a buried modern service such as a water pipe. In the west of the eastern field is an area of scattered magnetic debris. This is represented by positive and negative responses of high amplitude spread over an area which is likely caused by disturbance surrounding the field entrance. Across the site are a number of magnetic spikes, these are points with a strong positive and negative responses that indicate the presence of ferrous objects. There appear to be no magnetic anomalies which might suggest the presence of buried archaeological features.

## Conclusion

A number of magnetic anomalies were mapped by the geophysical survey but these are all most likely caused by modern disturbances such as services. No anomalies suggesting features of archaeological interest were recorded.

## References

- BGS, 1969, *British Geological Survey*, 1:63,360, Sheet 202, Solid and Drift Edition, Keyworth
- CI/A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading
- EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur
- IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading
- NPPF, 2019, *National Planning Policy Framework (revised)*, Ministry for Housing, Communities and Local Government, London
- St. John-Brooks, E, 2021, 'Three Oaks Hydroponics Farm, Courteenhall, Northamptonshire, archaeological desk-based assessment', Thames Valley Archaeological Services unpublished report 20/207, Reading

## Appendix 1. Survey and data information

### Programme:

Name: TerraSurveyor  
Version: 3.0.25.0

### Raw data

Filename: Courteenhall RAW.xcp  
Instrument Type: MLgrad Import  
Units:  
UTM Zone: 30  
Survey corner coordinates (X/Y):  
Northwest corner: 476745.881567342, 252542.69176893 m  
Southeast corner: 477001.071567342, 252233.03176893 m  
Direction of 1st Traverse: 90 deg  
Collection Method: Parallel  
Sensors: 2 @ 1 m spacing.  
Dummy Value: 32702

### Dimensions

Survey Size (meters): 255 m x 310 m  
X&Y Interval: 0.13 m  
Source GPS Points: Active: 138399, Recorded: 138399

### Stats

Max: 106.60  
Min: -109.71  
Std Dev: 4.04  
Mean: 0.77  
Median: 0.66  
Composite Area: 7.9022 ha  
Surveyed Area: 4.182 ha

Filename: Courteenhall B RAW.xcp  
Instrument Type: MLgrad Import  
Units:  
UTM Zone: 30  
Survey corner coordinates (X/Y):  
Northwest corner: 476936.521146536, 252555.552733971 m  
Southeast corner: 477181.051146536, 252241.862733971 m  
Direction of 1st Traverse: 90 deg  
Collection Method: Parallel  
Sensors: 2 @ 1 m spacing.  
Dummy Value: 32702

### Dimensions

Survey Size (meters): 245 m x 314 m  
X&Y Interval: 0.13 m  
Source GPS Points: Active: 148567, Recorded: 148567

### Stats

Max: 107.13  
Min: -109.74  
Std Dev: 2.99  
Mean: -0.17  
Median: -0.02  
Composite Area: 7.6707 ha  
Surveyed Area: 4.4924 ha

Filename: Courteenhall C RAW.xcp  
Instrument Type: MLgrad Import  
Units:  
UTM Zone: 30  
Survey corner coordinates (X/Y):  
Northwest corner: 477110.775260538, 252698.292675875 m  
Southeast corner: 477253.385260538, 252497.702675875 m  
Direction of 1st Traverse: 90 deg  
Collection Method: Parallel  
Sensors: 2 @ 1 m spacing.  
Dummy Value: 32702

### Dimensions

Survey Size (meters): 143 m x 201 m  
X&Y Interval: 0.13 m  
Source GPS Points: Active: 45479, Recorded: 45479

### Stats

Max: 107.02  
Min: -109.73  
Std Dev: 13.07  
Mean: -0.07  
Median: 0.04  
Composite Area: 2.8606 ha  
Surveyed Area: 1.3506 ha

Filename: Courteenhall D RAW.xcp  
Instrument Type: MLgrad Import  
Units:  
UTM Zone: 30  
Survey corner coordinates (X/Y):  
Northwest corner: 477116.721515867, 252524.31499183 m  
Southeast corner: 477356.441515867, 252292.26499183 m  
Direction of 1st Traverse: 90 deg  
Collection Method: Parallel  
Sensors: 2 @ 1 m spacing.  
Dummy Value: 32702

### Dimensions

Survey Size (meters): 240 m x 232 m  
X&Y Interval: 0.13 m  
Source GPS Points: Active: 101255, Recorded: 101255

### Stats

Max: 106.92  
Min: -109.72  
Std Dev: 9.73  
Mean: 2.00  
Median: 2.30  
Composite Area: 5.5627 ha  
Surveyed Area: 3.1262 ha



**Processed data**

Filename: Courteenhall.xcp

Stats

Max: 5.53

Min: -5.50

Std Dev: 0.94

Mean: 0.04

Median: 0.01

Composite Area: 7.9022 ha

Surveyed Area: 4.182 ha

GPS based Proce5

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 DeStagger by: 100.00cm, Shift Values

5 Clip from -5.00 to 5.00

Filename: Courteenhall B.xcp

Stats

Max: 5.53

Min: -5.50

Std Dev: 0.74

Mean: -0.02

Median: 0.01

Composite Area: 7.6707 ha

Surveyed Area: 4.4924 ha

GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -5.00 to 5.00

Filename: Courteenhall C.xcp

Stats

Max: 5.53

Min: -5.50

Std Dev: 1.83

Mean: -0.10

Median: 0.01

Composite Area: 2.8606 ha

Surveyed Area: 1.3506 ha

GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -5.00 to 5.00

Filename: Courteenhall D.xcp

Stats

Max: 5.53

Min: -5.50

Std Dev: 1.50

Mean: -0.07

Median: 0.01

Composite Area: 5.5627 ha

Surveyed Area: 3.1262 ha

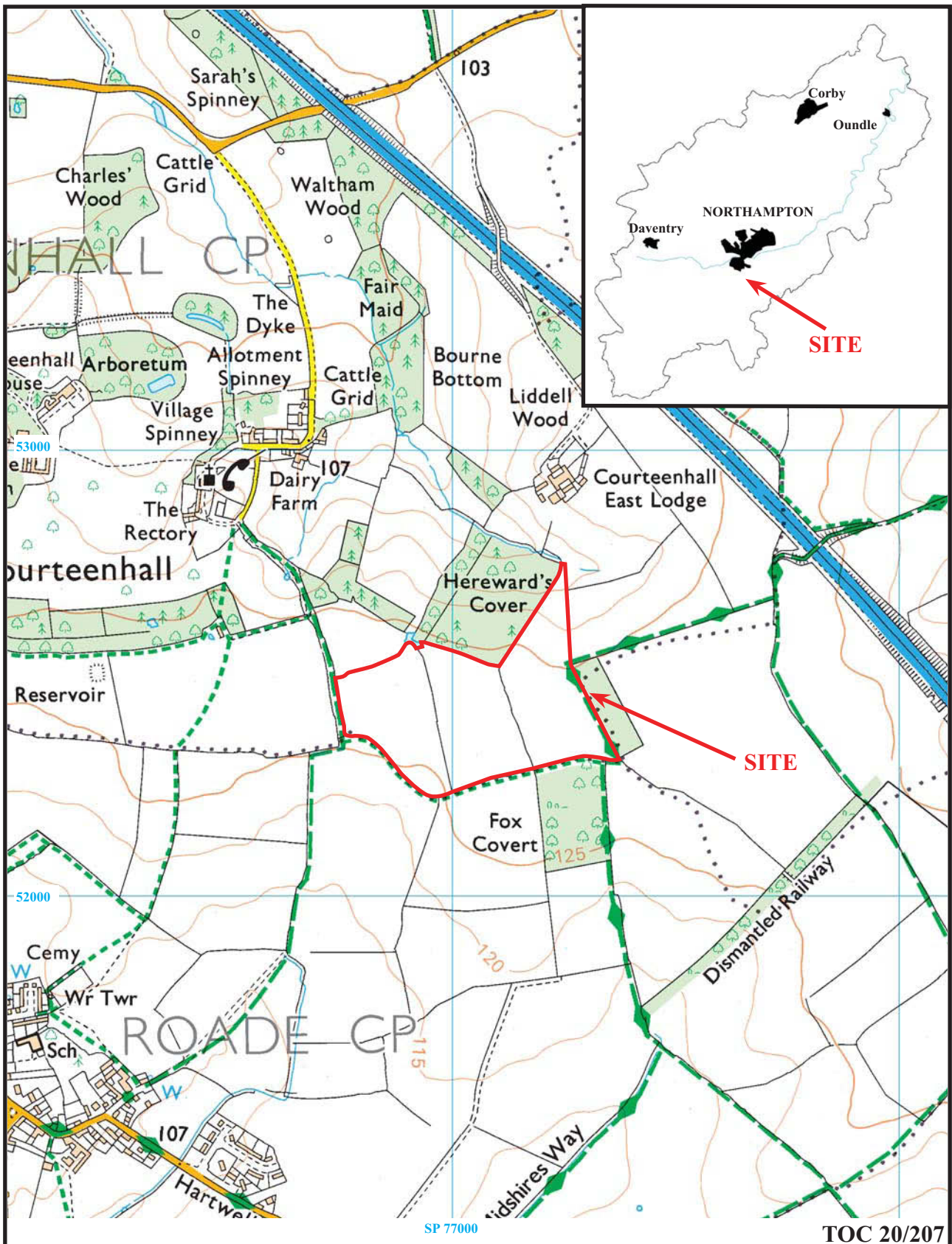
GPS based Proce4

1 Base Layer.

2 Unit Conversion Layer (Lat/Long to UTM).

3 DeStripe Median Traverse:

4 Clip from -5.00 to 5.00



**Three Oaks Hydroponics Farm, Courteenhall,  
Northamptonshire, 2021**

**Geophysical Survey (Magnetic)**

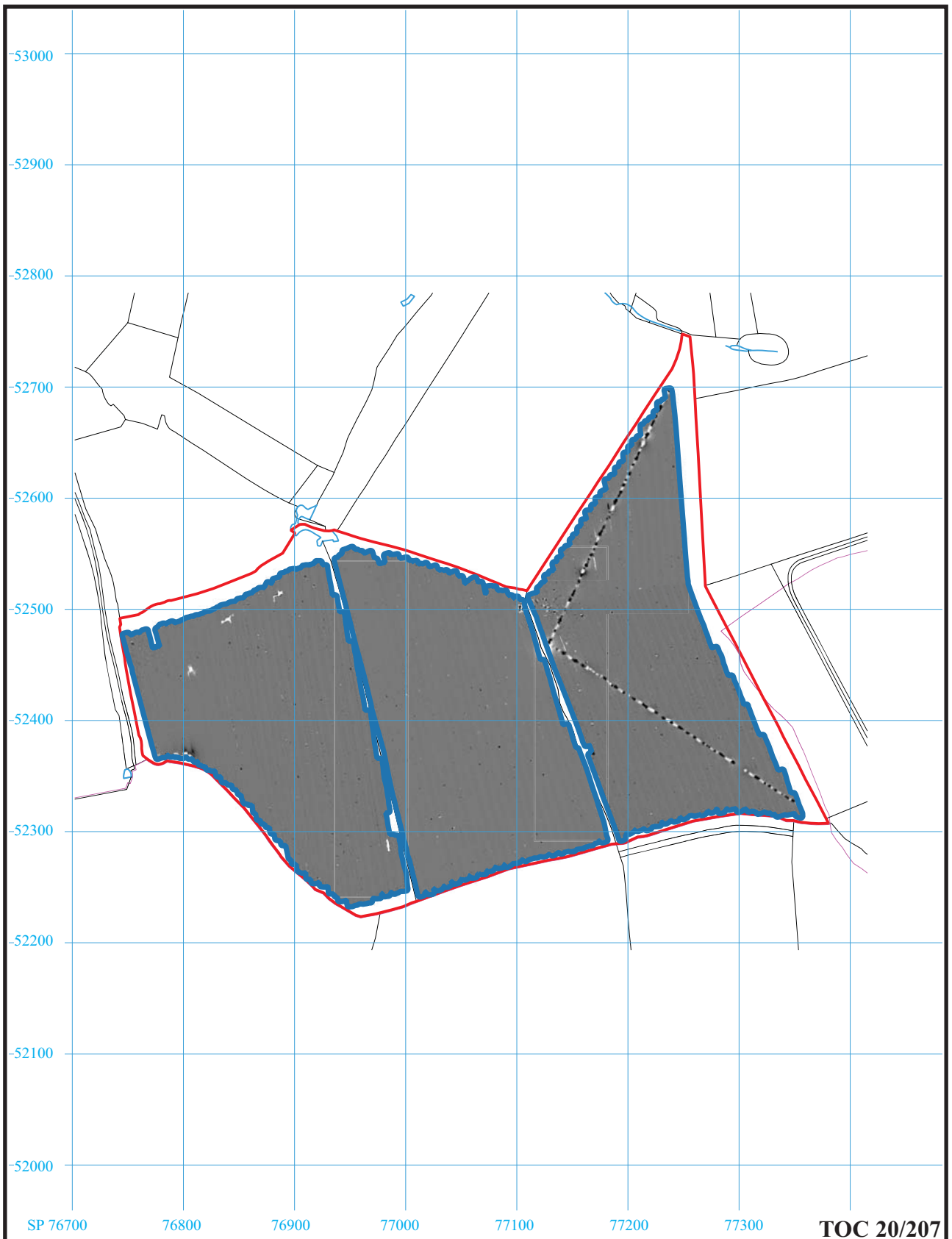
Figure 1. Location of site within Courteenhall and Northamptonshire.

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Crown Copyright reserved



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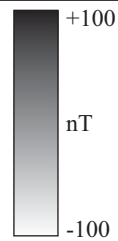
SP 77000

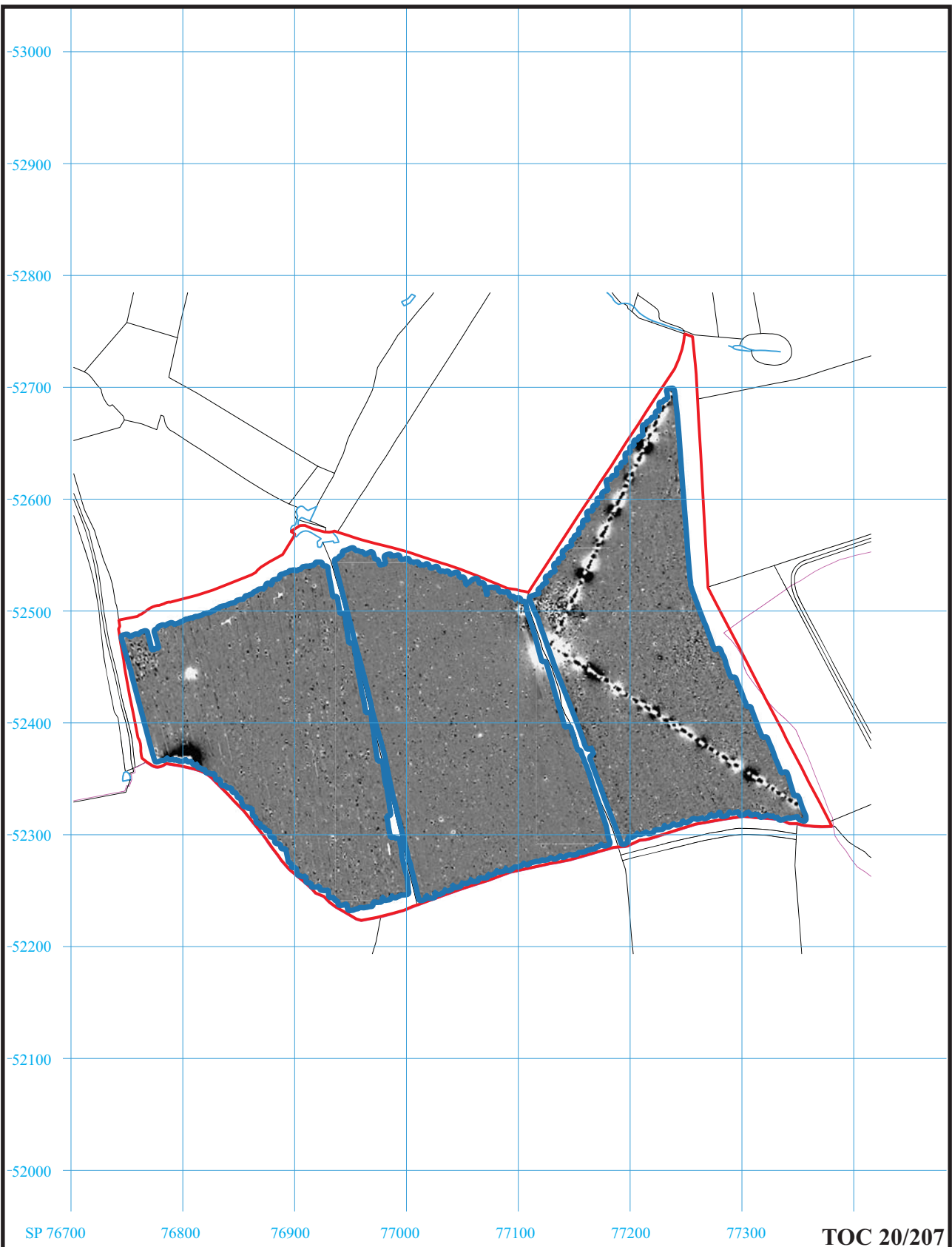


**Three Oaks Hydroponics Farm, Courteenhall,  
Northamptonshire, 2021**

**Geophysical Survey (Magnetic)**

Figure 2. Plot of raw gradiometer data.





SP 76700

76800

76900

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77100

77200

77300

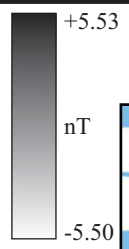
TOC 20/207

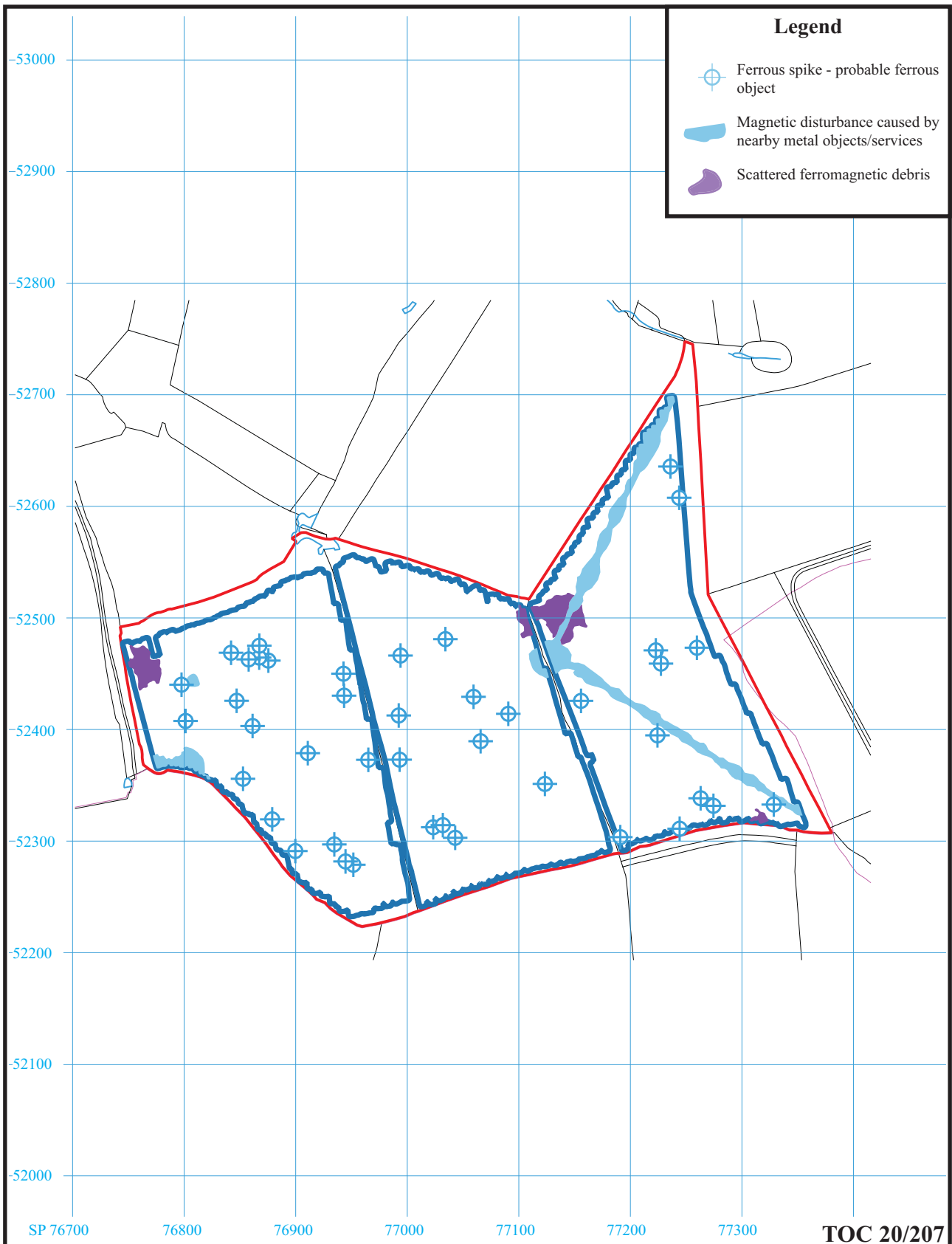


**Three Oaks Hydroponics Farm, Courteenhall,  
Northamptonshire, 2021**

**Geophysical Survey (Magnetic)**

Figure 3. Plot of processed gradiometer data.





**Three Oaks Hydroponics Farm, Courteenhall,  
Northamptonshire, 2021  
Geophysical Survey (Magnetic)  
Figure 4. Interpretation plot.**





Plate 1. Western field looking south.



Plate 2. Central field looking south.



Plate 3. Western field looking south.



Plate 4. Western field looking north.

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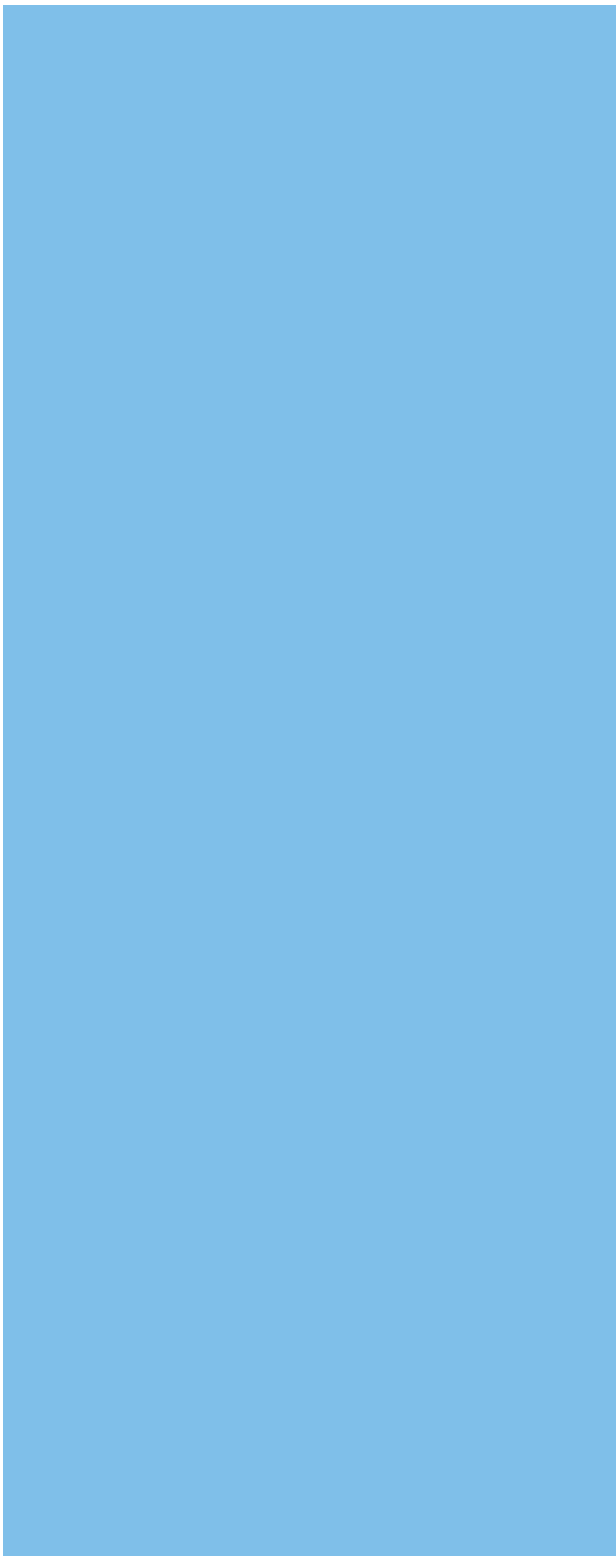
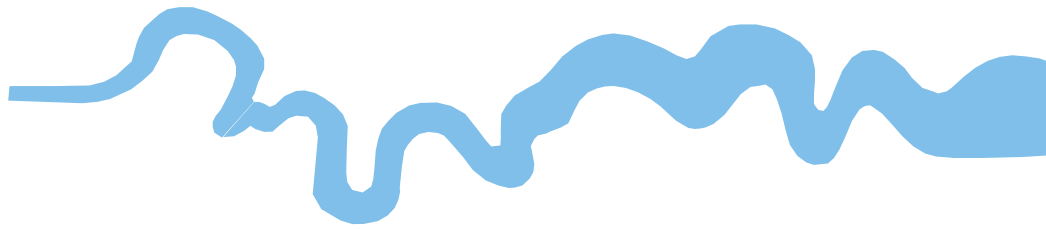
**Three Oaks Hydroponics Farm, Courteenhall,  
Northamptonshire, 2021  
Geophysical Survey (magnetic)  
Plates 1 to 4.**



## TIME CHART

	Calendar Years
Modern _____	AD 1901
Victorian _____	AD 1837
Post Medieval _____	AD 1500
Medieval _____	AD 1066
Saxon _____	AD 410
Roman _____	AD 43 AD 0 BC
Iron Age _____	750 BC
Bronze Age: Late _____	1300 BC
Bronze Age: Middle _____	1700 BC
Bronze Age: Early _____	2100 BC
Neolithic: Late .....	3300 BC
Neolithic: Early .....	4300 BC
Mesolithic: Late .....	6000 BC
Mesolithic: Early .....	10000 BC
Palaeolithic: Upper .....	30000 BC
Palaeolithic: Middle .....	70000 BC
Palaeolithic: Lower .....	2,000,000 BC





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