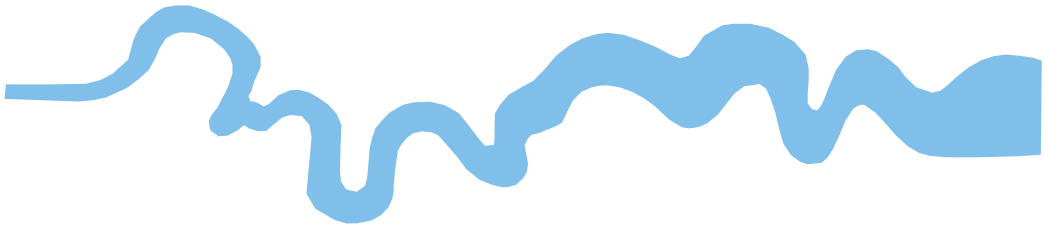
T V A S



NORTH MIDLANDS

Land off Thornsfield Road, Urbar Nosterfield, North Yorkshire

Geophysical Survey

by Kyle Beaverstock

Site Code: NNY 19/138

(SE 2765 8051)

Land at Thornsfield Road, Urbar Nosterfield, North Yorkshire

Geophysical Survey (Magnetic) Report

For Mr E Sherwin

by Kyle Beaverstock

TVAS North Midlands

Site Code NNY 19/138

September 2019

Summary

Site name: Land at Thornsfield Road, Urbar Nostefield, North Yorkshire

Grid reference: SE 2765 8051

Site activity: Magnetometer survey

Date and duration of project: 9th September 2019

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: NNY19/138

Area of site: 0.41ha

Summary of results: The geophysical survey revealed an extensive series of perpendicular positive and negative linear anomalies representing at least one phase of ridge and furrow across the whole survey area. No other features could be discerned.

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

Report edited/checked by:	Steve Ford✓ 20.09.19
	Tim Dawson✓ 25.09.19

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Land at Thornsfield Road, Urbar Nosterfield, North Yorkshire
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 19/138

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Thornsfield Road, Urbar Nosterfield, North Yorkshire (SE 2765 8051) (Fig. 1). The work was commissioned by Helen Martin-Bacon of Avalon Heritage on behalf of Mr Ernie Sherwin, Grange Farm, Nosterfield, North Yorkshire DL8 2QU.

Planning permission (app 19/00024/OUT) has been sought from Hambleton District Council for the construction of new housing on a c. 0.5ha hectare plot of land. Geophysical survey and evaluation trenching have been requested to inform the application as set out in NPPF (2019) and the District's policies on archaeology. The field investigation was carried out to a specification approved by Melanie Dalton, Heratige Officer for North Yorkshire County Council. The fieldwork was undertaken by Kyle Beaverstock and Thomas Stewart on the 9th of September 2019 and the site code is NNY 19/138.

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 on the northern side of Thornsfield Road at the north-western edge of Nosterfield village, some 9.5km north of Ripon (Fig. 1). The site is bounded by Thornsfield Road to the south, farm buildings to the east and pastoral fields to the north and west. The site is a sub-rectangular parcel of land, 0.41ha in area, that is currently being utilised for both arable and pastoral farming and lies at a height of *c*.45m above Ordnance Datum. The underlying geology is stated as Till above Lower Magnesian Limestone (BGS 1992).

Site history and archaeological background

The archaeological potential of the site has been highlighted in a briefing document prepared by Ms Melanie Dalton of North Yorkshire County Council and Mr Keith Emerick of Historic England. In summary the site lies within the environs of a major prehistoric monument complex, that of the Thornborough henges (Harding, 2013). The complex includes very large henge monuments, non-defended ceremonial sites of Late Neolithic/Early Bronze Age comparable in size to large monuments in Wessex as at Avebury, Wiltshire and

more recently in Oxford (Wallis 2013). The monuments at Thornborough, as elsewhere, are associated with other monuments and burials and can be considered to lie within a 'ritual' landscape. The site lies adjacent to Nosterfield Quarry where fieldwork has revealed pit alignments, linear boundaries, ring ditches (levelled round barrows) and cremation cemeteries.

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 east to west zig-zag orientation across the survey area. No obstructions were encountered within the surveyed area and the conditions were rainy and damp (Pl. 1-2).

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.

Process	**Effect**
Clip from -7.70 to 7.74 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 geophysical survey (Fig. 2) revealed two sets of parallel linear anomalies, the first aligned north-east to south-west and characterised by a mostly negative linear shapes and the second set aligned north-west to south-east and characterised by mostly positive linear shapes, both sets are accompanied by corresponding but faint positive and negative linear anomalies respectively (Fig. 3). These anomalies, which repeat across the whole survey area, are approximately 7 to 8m apart and run for nearly the whole length of the surveyed area (Fig. 4).

Conclusion

The geophysical survey revealed an extensive series of perpendicular positive and negative linear anomalies representing two probable phases of ridge and furrow cultivation across the survey area. The first and most extensive phase ran in a north-east to south-west pattern whilst the second phase runs in a near opposite direction and aligns with the current direction of cultivation. No other features could be discerned.

References

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CI*f*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

Harding, J, 2013, *Cult, Religion and Pilgrimage: Archaeological investigations at the Neolithic and Bronze Age monument complex of Thornborough, North Yorkshire*, CBA Res Rep **174**, York

IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

NPPF, 2019, *National Planning Policy Framework*, Department of Communities and Local Government, London (TSO)

Wallis, S, 2014, *The Oxford Henge and Late Saxon massacre, with Medieval and later occupation at St John's College, Oxford*, Thames Valley Archaeological Services Monograph **17**

Appendix 1. **Survey and data information**

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

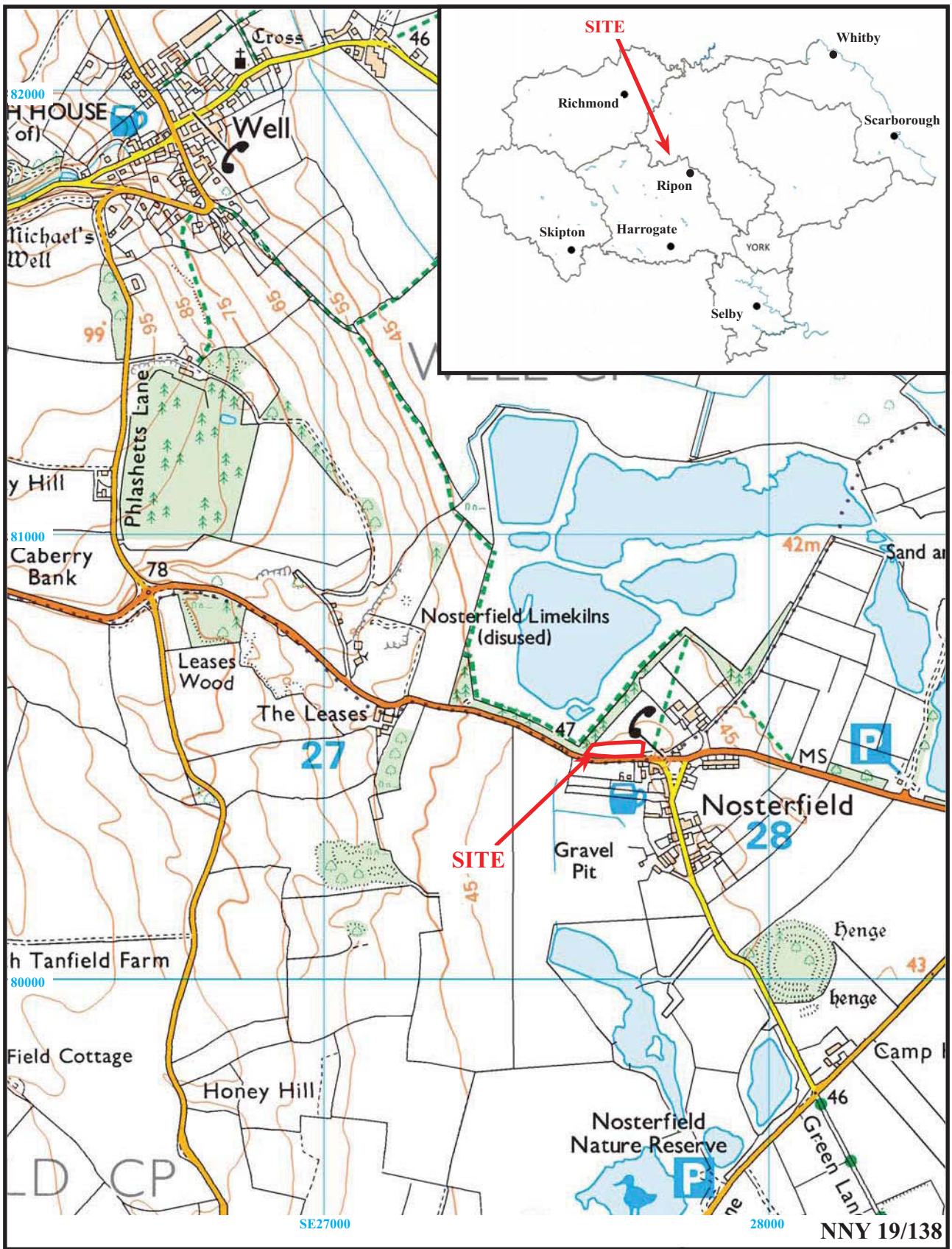
Raw data
Filename: *Nosterfield.xcp*
Instrument Type: *MLgrad Import*
Units:
UTM Zone: *30*
Survey corner coordinates (X/Y):
Northwest corner: *427595.069276456, 480548.080841734 m*
Southeast corner: *427740.929276456, 480498.030841734 m*
Direction of 1st Traverse: *90 deg*
Collection Method: *Parallel*
Sensors: *2 @ 1 m spacing.*
Dummy Value: *32702*

Dimensions
Survey Size (meters): *146 m x 50 m*
X&Y Interval: *0.13 m*
Source GPS Points: *Active: 17399, Recorded: 17399*

Stats
Max: *105.01*
Min: *-104.20*
Std Dev: *14.58*
Mean: *1.64*
Median: *1.82*
Composite Area: *0.73003 ha*
Surveyed Area: *0.56405 ha*

Processed data
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -7.00 to 7.00

Stats
Max: *7.74*
Min: *-7.70*
Std Dev: *2.72*
Mean: *-0.19*
Median: *-0.05*
Composite Area: *0.73003 ha*
Surveyed Area: *0.56405 ha*



Land off Thornsfield Road, Nosterfield, West Tanfield, North Yorkshire, 2019
Geophysical Survey (Magenetic)

Figure 1. Location of site within Nosterfield and North Yorkshire.

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Land off Thornsfield Road, Nosterfield, West Tanfield, North Yorkshire, 2019
Geophysical Survey (Magnetic)
Figure 2. Plot of raw gradiometer data.

0m 50m

+100
nT
-100

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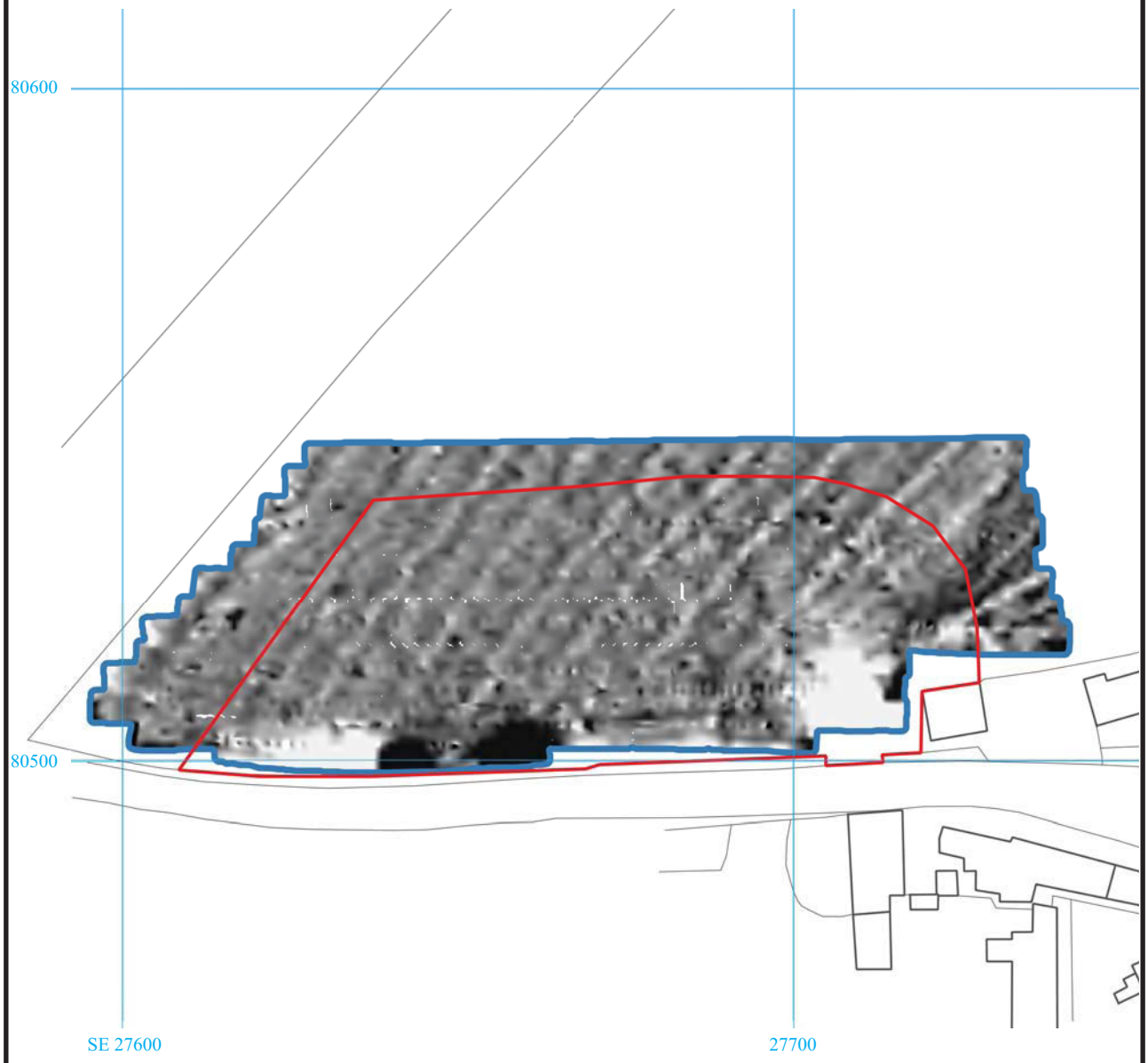

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Land off Thornsfield Road, Nosterfield, West Tanfield, North Yorkshire, 2019
Geophysical Survey (Magnetic)
Figure 4. Plot of processed gradiometer data.

0m 50m

+7
nT
-7

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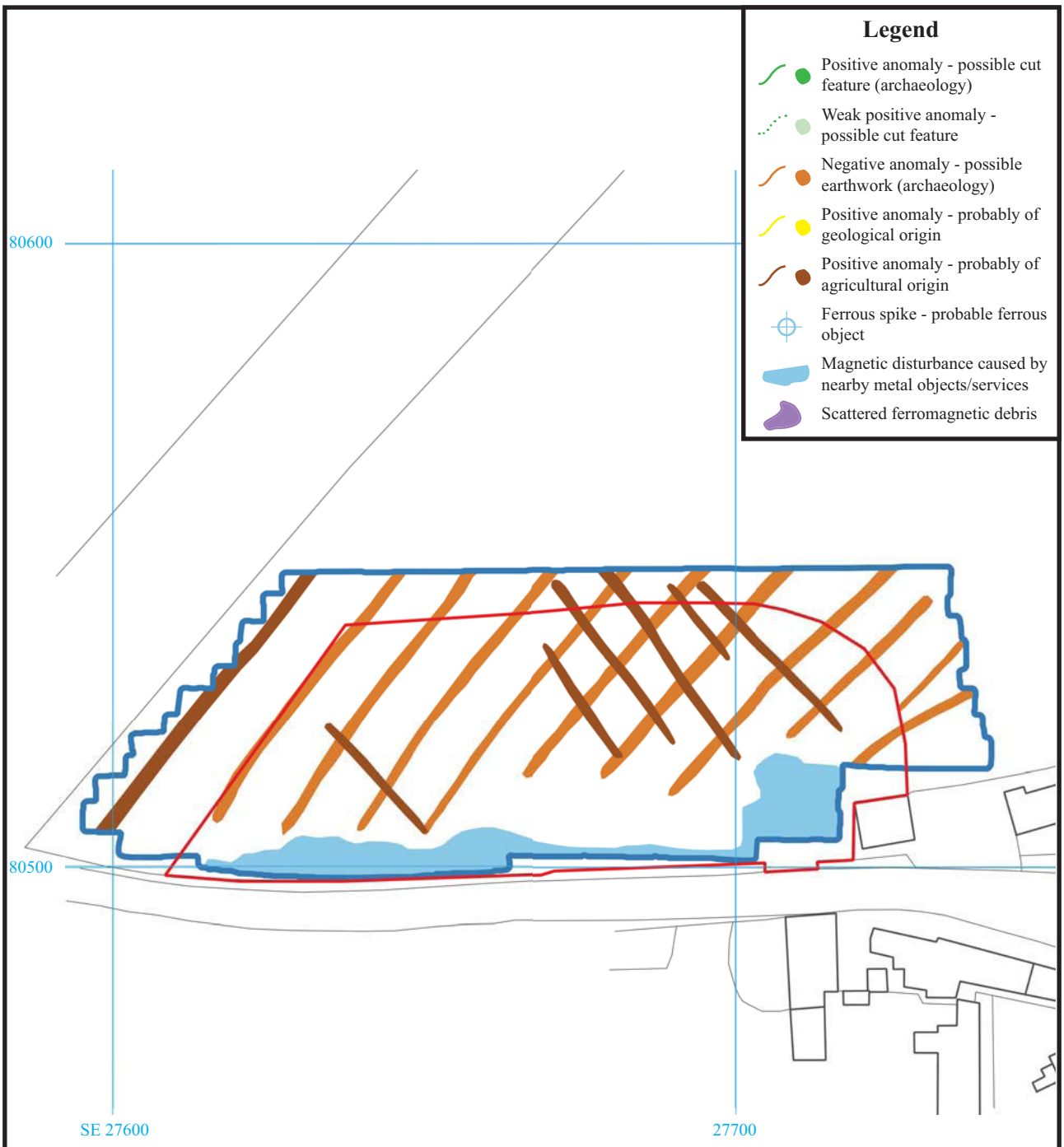

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Land off Thornsfield Road, Nosterfield, West Tanfield, North Yorkshire, 2019
Geophysical Survey (Magnetic)
Figure 4. Interpretation plot.

0m 50m

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Plate 1. The survey area looking west along the site's southern boundary.

Plate 2. The survey area looking north-east.

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Land off Thornsfield Road, Nosterfield, West Tanfield, North Yorkshire, 2019
Geophysical Survey (Magnetic)
Plates 1 and 2.

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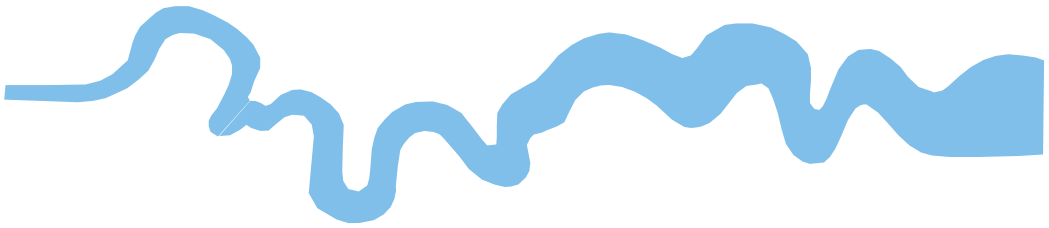
TIME CHART

	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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