Archaeological Services
University of Durham

Land at Langwith Farm, Nosterfield, North Yorkshire

geophysical survey

on behalf of
On-Site Archaeology

Report 1327
September 2005

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Contents

1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of a possible extension to Nosterfield Quarry near Thornborough, North Yorkshire.

1.2 The works were commissioned by On-Site Archaeology, on behalf of Mike Griffiths Associates, and conducted by Archaeological Services in accordance with instructions provided by On-Site Archaeology.

Results

1.3 A geophysical investigation comprising gradiometer survey on land at Langwith Farm, Nosterfield, North Yorkshire has been carried out.

1.4 Features relating to modern land-use were detected, including features possibly related to post-war agricultural land improvements.

1.5 A linear alignment of large anomalies, which may represent areas of burning or pits infilled with fired or ferrous debris, possibly in association with a series of ditch features, was detected.

1.6 A number of other ditch and pit features were discovered throughout the survey area. Some of these pit features may be of natural origin; sink-holes are a common occurrence across areas underlain by limestone bedrock in this region.

1.7 Features resembling palaeochannels and areas of ancient inundation were detected. These are likely to be related to a lake known to have existed in the early Holocene directly to the south of the survey area.

2. Project background

Location (Figure 1)

2.1 The study area is located on land to the north-east of Nosterfield in North Yorkshire, (NGR centre: SE 2875 8113), in a field known as Howlands Hill, which measures approximately 14ha and is bounded to the north by Ings Goit, and to the south-east and south-west by drainage ditches, treelines and fences.

Development proposal

2.2 The surveys have been carried out in advance of a possible proposal to extend Nosterfield Quarry to the north of its present site.

Objective

2.3 The principal aim of the surveys was to determine the extent and nature of any sub-surface features of likely archaeological interest, including cut, built and fired features, which would assist the client and the planning authority in determining appropriate mitigation strategies should archaeological deposits be found to survive within the study area.

Brief

2.4 The surveys have been undertaken in accordance with instructions provided by On-Site Archaeology and adhering to English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists (2002) Paper No.6, *The use of geophysical techniques in archaeological evaluations*; and the Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*.

Dates

2.5 Fieldwork was undertaken between 30th August and 3rd September 2005. This report was prepared between 5th and 9th September 2005.

Personnel

2.6 Fieldwork was conducted by Jill Inglis, Richard Villis and Lorne Elliott, and supervised by Sam Roberts. This report was prepared by Sam Roberts, with contributions by Duncan Hale and illustrations by Martin Railton. The Project Manager was Duncan Hale.

Archive/OASIS

2.7 The site code is **LFT05**, for **L**angwith **F**arm, **T**hornborough 20**05**. The paper and data archive is currently held by Archaeological Services. Archaeological Services is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is **archaeol3-10119**.

3. Archaeological and historical background

3.1 The area under investigation lies to the north-east of the early Neolithic complex of monuments known as the Thornborough Rings, consisting of three main circular henges, associated with an earlier cursus monument and later pit alignments. Although some distance away from our investigation area, the scale of this monumental complex requires the landscape to be interpreted with these in mind. These monuments were a centre of ritual activity throughout the Neolithic, and acted as a focal point for later activity demarcating and dividing the prehistoric landscape, with domestic settlement only being found some distance away from the henges.

3.2 Their importance in the landscape continued into the Bronze Age, seemingly acting as a hub for burial activity, with both inhumations and cremations having been discovered in the vicinity. Although an integral part of the ritual landscape of the Bronze Age, there is little evidence for domestic settlement, implying that landscape divisions formed in the Neolithic continued to be a factor in the Bronze Age.

3.3 There is little evidence so far for Iron Age activity in the area, however, burials and pit alignments discovered to the north of the henges (south-west of the current investigation area) have shown that this area was in use through this period, and seemingly with a similar focus on ritual activity. Evidence for a number of pit alignments dug during this period suggests that there may have been a re-structuring of landscape divisions during the Iron Age.

3.4 There is more evidence for settlement in the surrounding area during the Roman period. One of the main arterial Roman roads, Dere Street, lies to the east of the investigation area, with forts situated at regular intervals along its course. Villa complexes discovered in the area attest to a Romanisation of the surrounding landscape. A Roman bath-house discovered at Well, just 0.5km to the north-west, together with a portion of tesselated pavement suggest that a villa complex of fairly high status would have been situated here. A corn-drying oven found just to the south in Nosterfield Quarry further illustrates that this landscape was utilised for agricultural purposes during the Roman period.

3.5 Little evidence is available regarding the post-Roman and early medieval period. The nearby settlement of Well has a church with features dating from the 12th century, and the surrounding land, including the investigation area, is likely to have been agricultural land, either as strip fields or common land. Most of this strip-field farming system would have been lost during the post-medieval period, as more and more land was taken by the Enclosure acts. These enclosed areas have in turn been replaced by more open fields as hedgerows have been removed during the 20th century to facilitate arable farming and larger grazing herds.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised one field of corn stubble, with a 20m wide strip of land set-aside on the north-west and south-west boundaries. An area of land in the south-east corner of the field was also not under cultivation.

4.2 The survey area was gently undulating at a mean elevation of *c*.40m AOD. The land is at its lowest in the eastern end of the field with a raised plateau towards the centre. Information provided by the landowners suggested that parts of the field may have been subject to levelling in the past during episodes of agricultural improvements.

4.3 The underlying solid geology of the area comprises Magnesian Limestone, which is overlain by sands and gravels.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists (2002) Paper No.6, *The use of geophysical techniques in archaeological evaluations*; and the Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*.

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistivity, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of 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 existing aerial photographic cropmark evidence and previous work in the close vicinity, it was considered likely that cut features, such as ditches and pits, may 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 potential targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting each of the types of feature mentioned above. Recent work in the near vicinity involving geophysical survey and archaeological evaluation trenching has shown that this method is effective in detecting sub-surface archaeological features (ASUD 2005a, ASUD 2005b, Garner-Lahire *et al.* 2005). This technique

involves the use of hand-held magnetometers to detect and record minute perturbations 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 by On-Site Archaeology to known, mapped Ordnance Survey points using a total station survey instrument.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 fluxgate gradiometers with automatic datalogging facilities. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

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

Data processing

5.8 ArcheoSurveyor v.1.3 software was used to process the geophysical data and to produce a continuous tone greyscale image of the raw data. Geoplot v.3 software was used to produce the trace plot of the raw data. The greyscale image and interpretations are presented in Figures 2-4; the trace plot is provided in Appendix I. In the greyscale image, 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 the dataset:

Clip – clips, or limits 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 anomalies caused by alternate zig-zag traverses.

Despike – locates and suppresses random iron spikes in gradiometer data.

Interpolate – increases the number of data points in a survey. In this instance the gradiometer data have been interpolated to 0.5 x 0.25m intervals.

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided in Figure 3. 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 A colour-coded archaeological interpretation plan is provided in Figure 4. The anomalies detected are referred to as individual features [F numbers] or as feature groups [FG numbers] in the following discussion.

5.12 The majority of the survey area is characterized by a magnetic 'texture', recorded as closely spaced weak linear positive and negative magnetic anomalies aligned north-west/south-east. A weaker underlying textural effect aligned north/south has also been detected. (These have been excluded from the interpretative drawings for reasons of clarity.) Both of these textures are more marked in the western half of the survey area. These anomalies almost certainly reflect modern ploughing regimes; the north-west/south-east alignment matches that of the current plough direction. The difference in intensity of these textures to the east and west is most likely explained by differences in the soil substrates. The land to the east is at a lower elevation than that to the west and is often subject to inundation during periods of prolonged rainfall (information supplied by landowners).

5.13 A scatter of discrete dipolar magnetic anomalies across the extent of the survey area almost certainly reflects fired and ferrous materials within the topsoil.

5.14 A large dipolar magnetic anomaly [F27] in the north-eastern corner of the survey area corresponds to the location of an electricity pylon.

5.15 An area of broad, diffuse positive and negative magnetic anomalies of differing magnitudes [FG1] crossing the eastern half of the survey area are likely to reflect former courses of a palaeochannel. This may explain the contrasting smoothness of the data in the eastern part of the survey area relative to the more elevated western part; the area to the east may have been subject to flooding from the relict palaeochannel in the past, with drier terraces

existing to the west. An existing drain follows the course of the probable palaeochannel to the immediate north. A lake is known to have existed during the Holocene directly to the south of the current survey area, later becoming infilled with peat deposits (Garner-Lahire *et al.* 2005); [FG1] may be directly related to this landform.

5.16 A series of strong curvilinear positive magnetic anomalies together with some larger concentrations of dipolar magnetic anomalies [FG2] trace the outline of a relatively level plateau. The positive magnetic anomalies are likely to reflect soil-filled features, but there is a possibility that these features are of modern origin, and relate to agricultural improvements carried out to level areas of the field to provide more cultivatable land (information provided by landowners); such activities can leave greater depths of more magnetically susceptible topsoil along the edges of truncated areas, as evidenced elsewhere (eg ASUD 2001 & 2005c). Concentrations of dipolar magnetic anomalies such as those detected at [FG2] are often indicative of disturbed ground, containing ferrous/fired litter.

5.17 A series of positive linear and rectilinear magnetic anomalies along the north-eastern edge of the survey area [FG3, FG4 and FG11] almost certainly reflect soil-filled features such as ditches or gullies. These may be the remains of enclosures or field boundaries.

5.18 An area of broad, diffuse magnetic anomalies [FG5] on the southern periphery of the survey area extending into the centre may reflect another palaeochannel or area of infill, possibly again associated with the former lake to the south or with the more recent landscaping.

5.19 An interconnected series of linear positive magnetic anomalies [FG6] probably reflect soil-filled features and may be remains of ditches or gullies. This group of features also incorporates concentrations of dipolar magnetic anomalies. These anomalies may reflect areas of burning or pits infilled with fired and ferrous debris.

5.20 A group of discrete positive magnetic anomalies [FG7] situated to the west of [FG6] may reflect a collection of pits, or possibly natural sink-holes, which have been found in similar clusters elsewhere in this region (Garner-Lahire *et al.* 2005).

5.21 A feature consisting of linear positive and negative magnetic anomalies running parallel to the field boundary [FG8] corresponds to the boundary between ploughed cropland and uncultivated set-aside.

5.22 Weak linear and rectilinear positive magnetic anomalies [FG9] almost certainly reflect soil-filled features such as gullies or ditches. They are obscured by areas of dipolar magnetic anomalies [FG10], probably due to vehicular disturbance and sub-surface debris around the access bridge into the field.

5.23 A number of other isolated linear positive magnetic anomalies have been detected [F12, F13, F14, F15] which are likely to reflect soil-filled features such as ditches or gullies.

5.24 A number of other discrete positive magnetic anomalies [F17, F18, FG19, and F20 - F26] have also been detected in the survey area. These may represent soil-filled features such as pits, or could also reflect natural phenomena such as sink-holes which are known to occur over the Magnesian limestone in this area (Garner-Lahire *et al.* 2005).

6. Conclusions

6.1 A gradiometer survey has been carried out on land at Langwith Farm, Nosterfield, North Yorkshire.

6.2 Features relating to modern land-use were detected, including features possibly related to post-war agricultural land improvements.

6.3 A series of large anomalies which may represent areas of burning or pits infilled with fired or ferrous debris, possibly in association with a series of ditch features, was detected.

6.4 A number of other ditch and pit features were recorded throughout the survey area. Some of the pit features may be of natural origin as sink-holes are a common occurrence across areas underlain by limestone bedrock in this region.

6.5 Features resembling palaeochannels and areas of ancient inundation were detected. These are likely to be related to a lake known to have existed in the early Holocene directly to the south of this survey area.

7. References

Archaeology Data Service 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*. Arts and Humanities Data Service.

ASUD 2001 *Archaeological Investigations at Marne Barracks, Catterick Garrison, North Yorkshire: Phase 1 – Assessment report*. ASUD Report 703, Archaeological Services University of Durham.

ASUD 2005a *Oaklands, Nosterfield, North Yorkshire: geophysical surveys*. ASUD Report 1273, Archaeological Services University of Durham.

ASUD 2005b *A1(T) Dishforth to Barton Improvement, North Yorkshire: geophysical surveys*. ASUD Report 1121, Vols I-III, Archaeological Services University of Durham.

ASUD 2005c *Marne Barracks, Catterick, North Yorkshire: archaeological excavation: assessment*. ASUD Report 1219, Archaeological Services University of Durham.

English Heritage 1995 Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*. London.

Garner-Lahire, J., Spall C. & Toop N. 2005 *Ladybridge Farm, Nosterfield, North Yorkshire: Archaeological Excavation* FAS Ltd, York. Report prepared for Mike Griffiths Associates, accessible at : <http://www.archaeologicalplanningconsultancy.co.uk/mga/projects/noster/speciali.html>

Institute of Field Archaeologists 2002 Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations*. Birmingham.

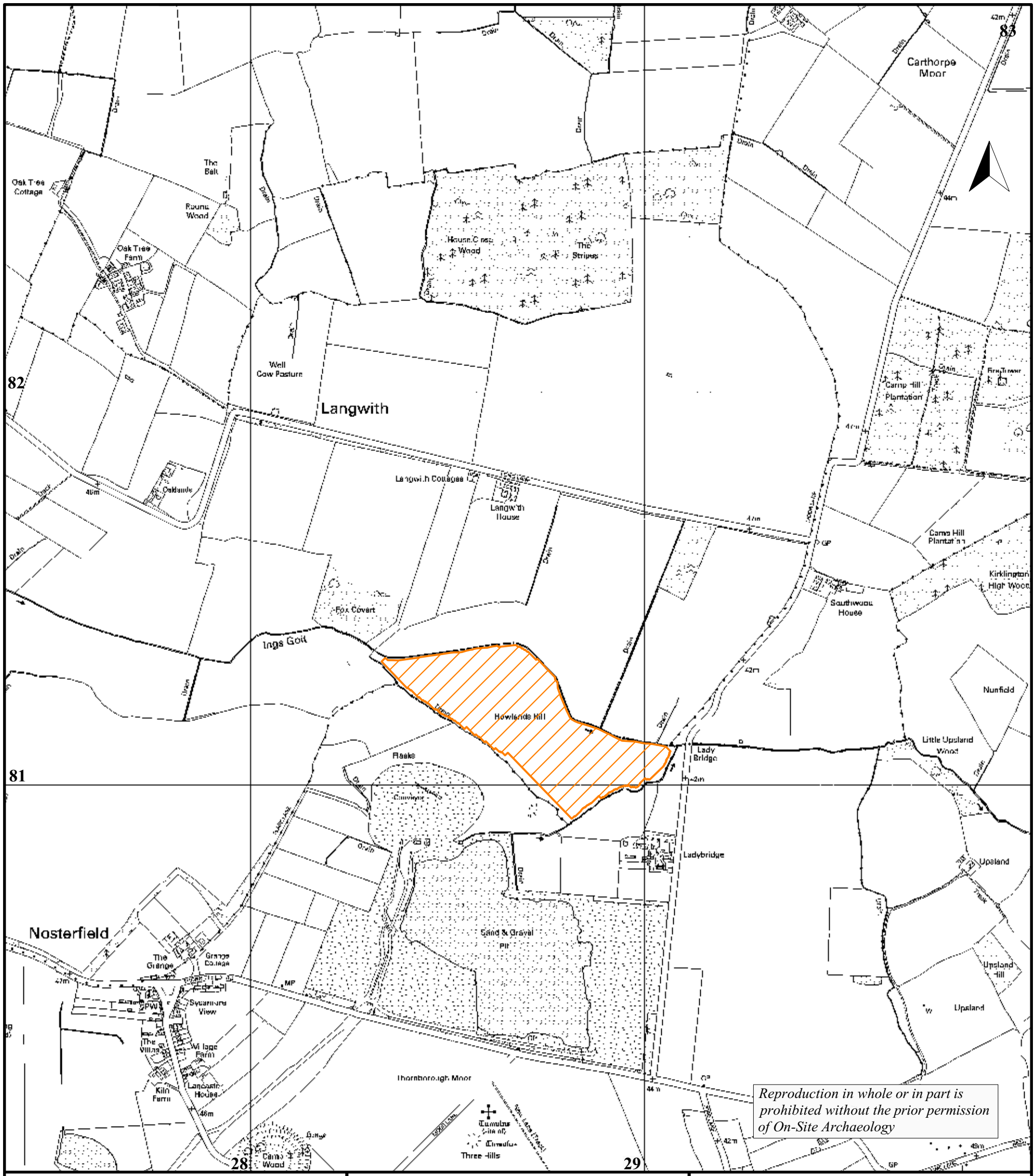

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Figure 1

Location map

on behalf of
On-Site Archaeology

0 500m

scale 1:10 000 - for A3 plot

geophysical survey area

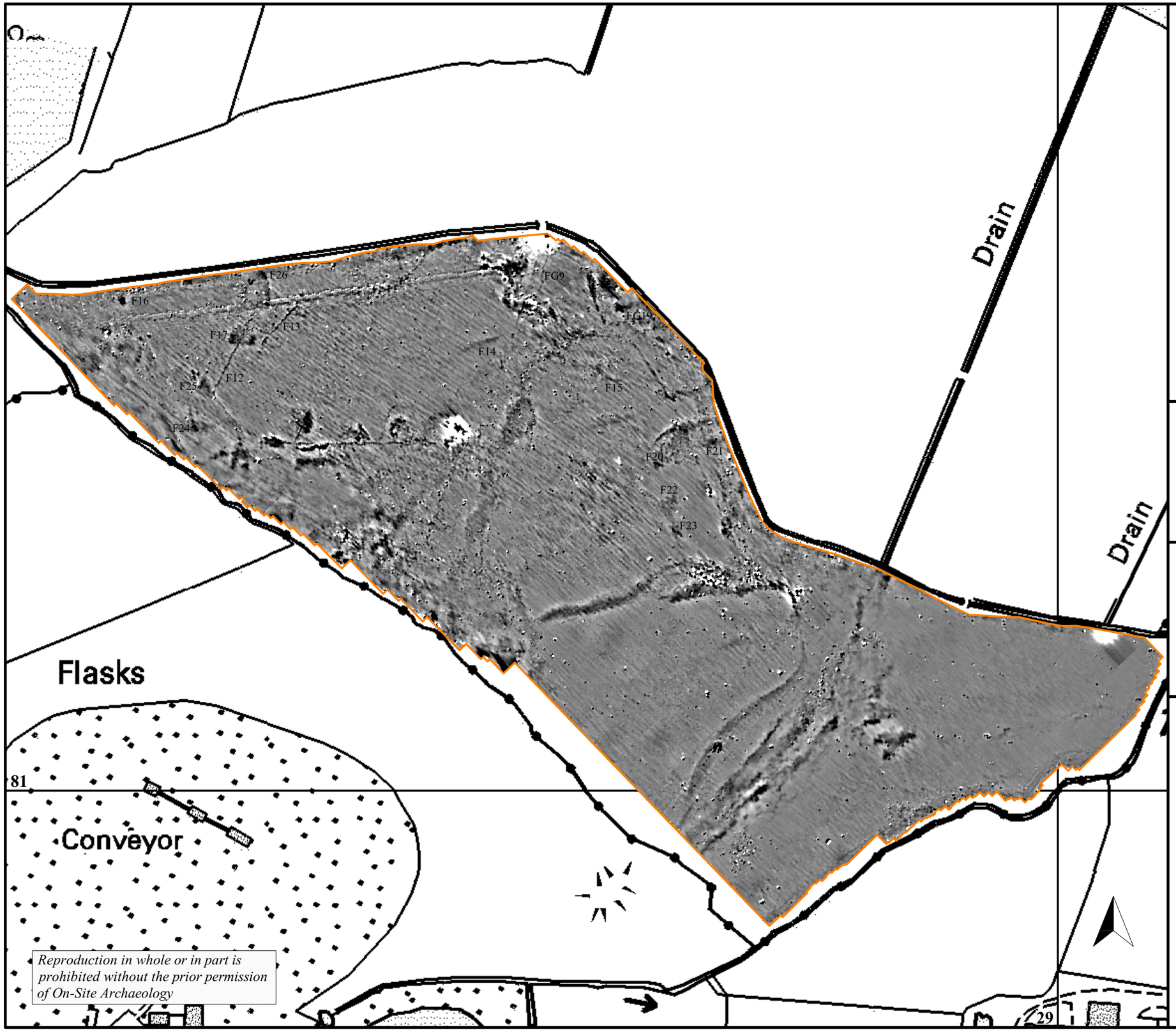

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Figure 2

Geomagnetic survey

on behalf of
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0 100m

scale 1:2500 - for A3 plot

outline of survey area

15.52
12.47
9.42
6.37
3.37
0.28
-2.77
-5.81
-8.86
-11.91
-14.96 nT

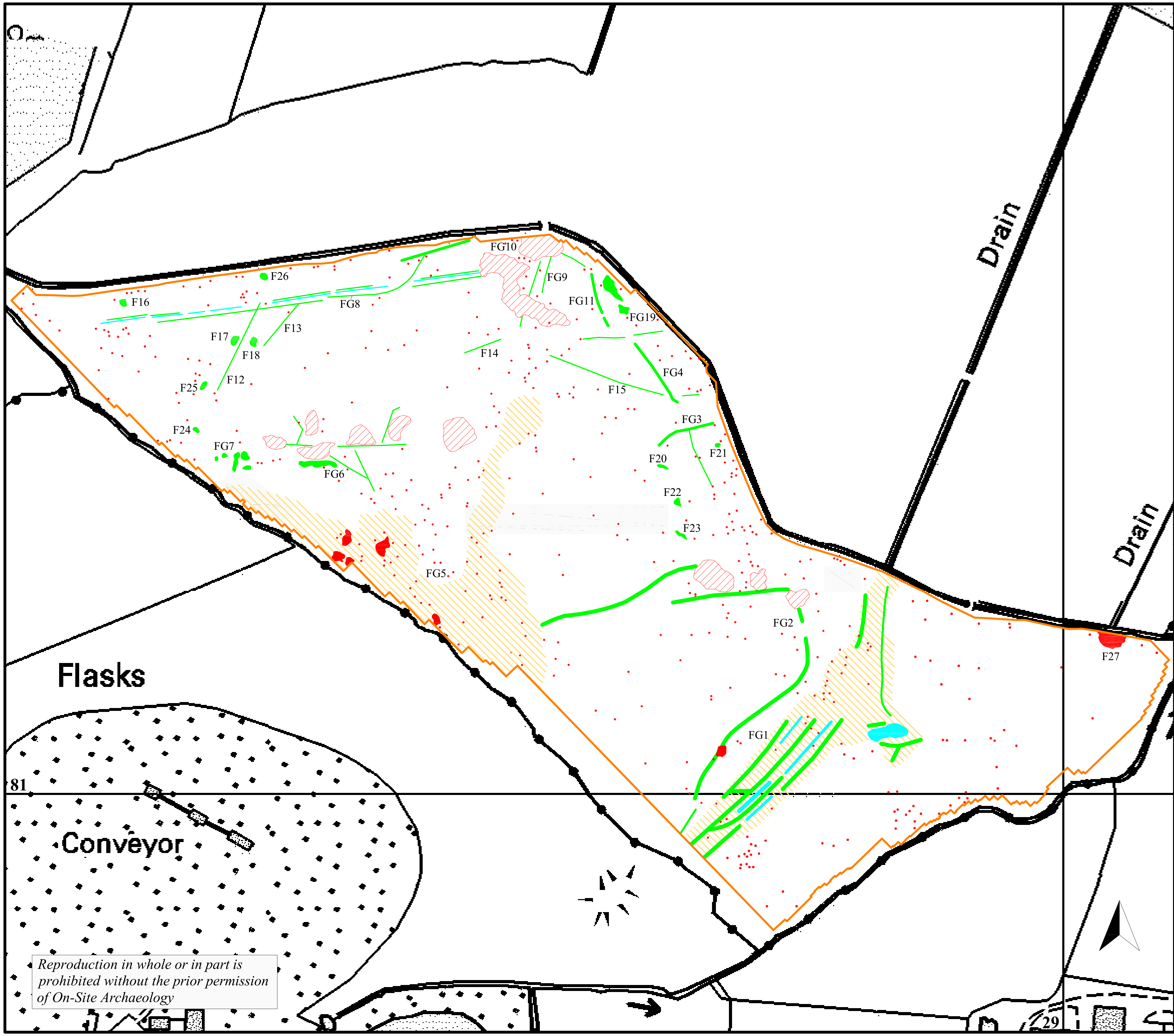

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Figure 3

Geophysical interpretation

on behalf of
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0 100m
scale 1:2500 - for A3 plot

- outline of survey area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies
- broad and diffuse magnetic anomalies

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Figure 4

Archaeological interpretation

on behalf of
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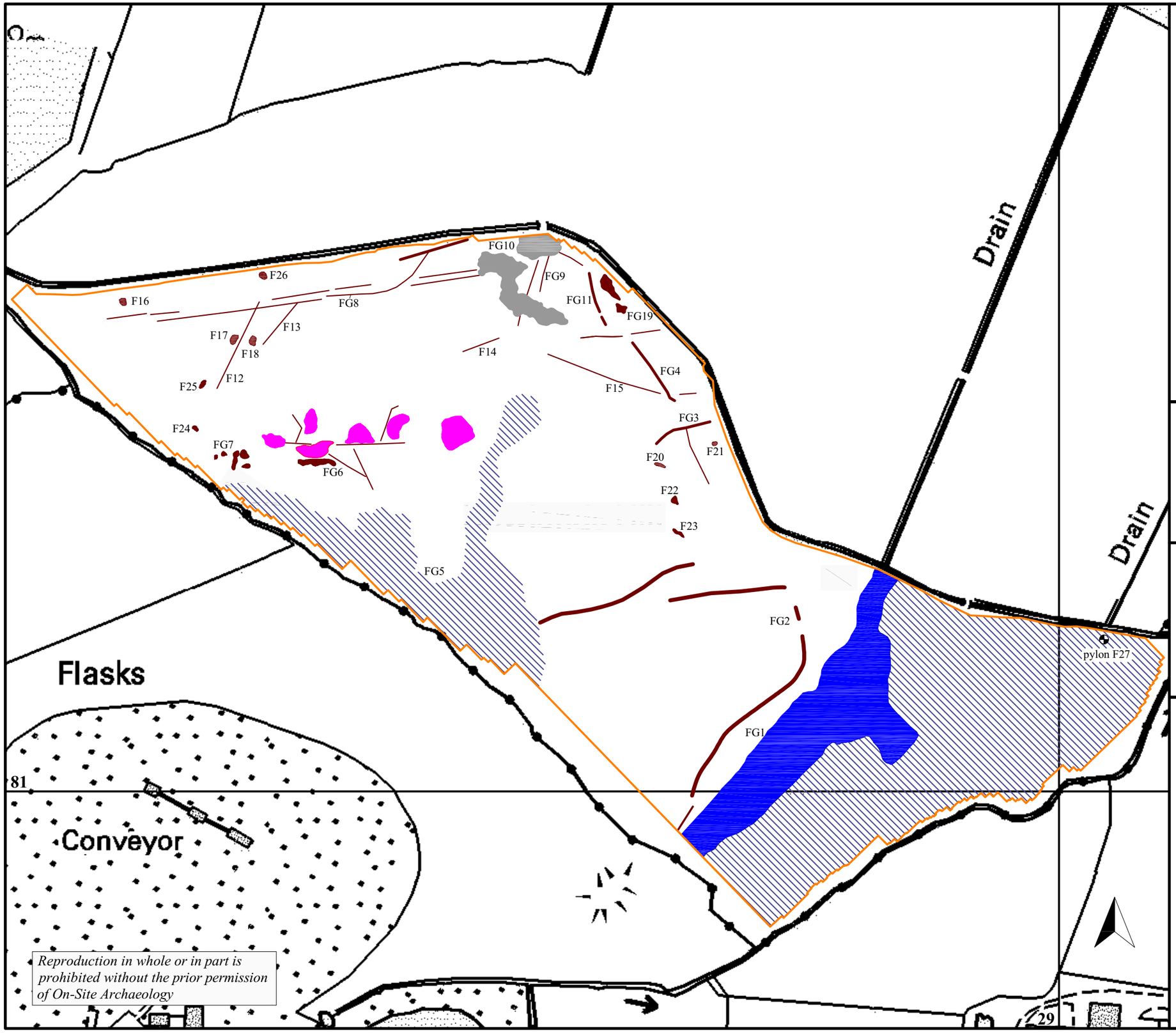
0 100m
scale 1:2500 - for A3 plot

- outline of survey area
- possible soil-filled features
- areas of infilling
- disturbed ground
- possible pits/burning
- palaeochannel



Appendix I

Land at Langwith Farm, Nosterfield, North Yorkshire

Trace plot of geomagnetic data, 1:2000 @ A3