

CROMWELL ROAD, MILFORD HAVEN: GEOPHYSICAL SURVEY



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CROMWELL ROAD, MILFORD HAVEN GEOPHYSICAL SURVEY

Gan / By

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SUMMARY

The proposed development of an area off Cromwell Road, Milford Haven (NGR SM 9050 0722) required a geophysical survey of the area prior to further consideration of the planning permission. This was deemed necessary due to the site's location adjacent to the Priory Rath, an Iron Age hillfort and Scheduled Ancient Monument (PRN 3173, SAM PE 186). The clients, Pembrokeshire County Council, commissioned Dyfed Archaeological Trust Field Services to carry out the geophysical survey in September 2009. The survey was undertaken using a fluxgate magnetometer (gradiometer).

Several features of archaeological interest were recorded across the site. A curvilinear ditch with enclosed activity may represent part of an annex to the main hillfort. Several circular enclosures situated on flatter ground may also represent prehistoric hut circles also associated with the hillfort but located beyond its main defences. No further defensive ditches associated with the hillfort were revealed.

A series of further curvilinear and linear ditches throughout the site represent features of archaeological interest but were harder to interpret. It is unclear at this stage if these features are associated with the hillfort or represent unconnected boundary and drainage ditches. At least one of the linear features would appear to correspond with a later post-medieval trackway connected to a now demolished public house. Evidence of this public house appeared to be recorded within the western edge of the site.

A series of roughly parallel linear banks were revealed running across the site that may be evidence of later ploughing activity.

Numerous other discrete pits and magnetic anomalies were also revealed across the site.

All interpretation at this stage is speculative and further archaeological investigation would be required in order to obtain a better understanding of the function and date of these archaeological features.

INTRODUCTION

Project commission

The proposed development of a field on Cromwell Road, Milford Haven (NGR SM 9050 0722) required a geophysical survey of the area prior to further consideration of the planning permission.

The site is located in close proximity to the visible remains of Priory Rath, an Iron Age hillfort and Scheduled Ancient Monument (PRN 3173, SAM PE 186). Given the site's location it was considered that further archaeological material associated with this site may exist in the proposed development area and may be adversely affected by the proposed development. Therefore, the archaeological advisors¹ to the Local Planning Authority (Pembrokeshire County Council) recommended that a geophysical survey be carried out across the area of proposed development to detect archaeological features. Pembrokeshire County Council commissioned Dyfed Archaeological Trust Field Services to carry out the geophysical survey in September 2009.

Scope of the project

The project was designed to establish whether a geophysical survey, using a gradiometer, could detect archaeological features on this site that could be affected by any subsequent development.

Report outline

This report describes the location of the site along with its archaeological background before summarising the geophysical survey results and the conclusions based on those results.

Abbreviations

Sites recorded on the Regional Historic Environment Record (HER²) are identified by their Primary Record Number (PRN) and located by their National Grid Reference (NGR). Scheduled Ancient Monuments (SAM). Gradiometer readings are measured in nanoTesla (nT).

¹ Dyfed Archaeological Trust Heritage Management

² Held and managed by Dyfed Archaeological Trust, Shire Hall, Llandeilo.

THE SITE

Location and Archaeological Potential

The site lies at SM 9050 0722 on the eastern side of Cromwell Road, which gives access to modern industrial and housing estates at the northern end of the town of Milford Haven. The site also lies adjacent to the village of Priory at the northern end of Hubberston Pill that feeds out into the Milford Haven Waterway 1.8km to the south.

The site covers an area of c.3.3 hectares, with relatively level ground occupying the southeast corner of the site before it begins to drop off to the north, becoming very steep as it drops down to a stream-line along the northern boundary. The top of the site gives clear views to the north and west, with Thornton Rath (PRN 3172) and the upper reaches of Hubberston Pill clearly visible. The site is bounded to the north by a stream and hedgeline, and to the east by modern fencing and scrub. Beyond these boundaries lies the Thornton Industrial Estate and Business Park. To the south the site is bounded by an old stone and hedge field boundary beyond which lies the remains of the Priory Rath, to the southwest by modern fences and housing, and the west by a fence and hedgeline alongside Cromwell Road.

The site borders the remains of Priory Rath (PRN 3173), a hillfort probably occupied at some time during the Iron Age (700 BC – 43 AD), although it may have its origins during the later Bronze Age (2300 – 700 BC). The current field boundary runs along what is currently recognised as the northernmost outer ditch of the hillfort. However, similar hillfort sites are known to have further external enclosures and settlement and the topography of this particular site allows for a significant area of roughly level land at both the top and bottom of the natural slope to the north of the hillfort within the development area. A similarly sized hillfort (Thornton Rath PRN 3172) lies c.700m to the north. The record of a standing stone (PRN 34503) c.50m to the west of the site suggests further possible Prehistoric activity in the area. During the medieval period a small Priory (PRN 3176) was built at the upper end of Hubberston Pill c.150m to the west of the site, but on the opposite banks of the river.

18th and 19th century maps are not very detailed for this area but appear to indicate little development in this proposed development area, although the site had presumably been enclosed as farmland by this time. The Ordnance Survey map of 1875 indicates that the Mason's Arms public house had been established alongside Cromwell Road. The main pub building with its surrounding enclosure and outbuildings extended into the field. This site has since been demolished and is indicated only by a kink the current field boundary and an area of scrub. A trackway also connected the Mason's Arms to a small quarry bordering the northeastern corner of the site. By the early 20th century the quarry was gone and terraced housing was being established along Cromwell Road, encroaching into the southwestern corner of the field. Recent development to the north has included the dumping of material into the northeastern corner of the field, now fenced off. The field itself is currently grazed by horses, with rough grass across the site and thick scrub developing along the southern and eastern boundaries.

METHODOLOGY

A fluxgate magnetometer (gradiometer) was used for the survey. This detects variations in the earth's magnetic field (full specifications are in appendix 1). Readings were taken on traverses 0.5m wide and every 0.25m within a 20m x 20m grid across the whole site. A strip 20m to 30m wide was left unsurveyed against the northeastern boundary of the site due to the obvious presence of underground services and barbed wire fencing that would have distorted any results from this area.

RESULTS

Limitations

The survey was undertaken between the 16th and 21st of September 2009. The weather was generally dry and warm. The field was generally under low pasture with occasional patches of higher vegetation. Some dense vegetation lay around the perimeter of the field, especially to the southeast and northwest, which prevented surveying in these areas. Obvious underground services and wire fencing prevented surveying against the north-eastern perimeter of the field. In general the field sloped to the north, with steep slopes to the northeast. The sloping nature of the field may have caused some variations in data collection, however pacing lines were used throughout the survey and any variations in the data collections are likely to have been small.

The field was clearly crossed in places by underground services, with iron manhole covers along the northern edge of the field. The field boundaries also contained wire fencing, and various items of ferrous detritus had been dumped on the relatively flatter ground amongst the higher vegetation at the southeastern edge of the field. These may all have caused significant anomalies or created shadows masking archaeological features in their vicinity. The field itself was still being grazed by horses at the time of the survey, but these were unshod and had no other accoutrements that could have affected the survey results.

The underlying geology consists of Lower Old Red Sandstone (British Geological Survey 1994) with stagnogley topsoil. This did not appear to cause any problems with the survey.

Processing and presentation

Processing was performed using *ArchaeoSurveyor 2.2.0.x*, detailed explanation of the processes involved are described in Appendix 1. The data is presented with a minimum of processing but the presence of high values caused by underground services, large ferrous objects and wire fencing tends to hide fine details and obscure archaeological features, thus the values were 'clipped' to a range from 10nT to -10nT to remove the extreme values allowing the finer details to show through. During the survey various processes such as changes to instrument set-up, instrument drift, variations in orientation amongst others cause directional effects that are inherent to magnetometers that can produce 'striping' in the processed data, thus much of the survey was 'destriped'.

The processed data is presented as a grey-scale plot overlaid on local topographical features surveyed in using a Trimble TST (figure 3). The main magnetic anomalies have been identified and plotted onto the grey-scale plot (figure 4) as a level of interpretation.

Geophysical interpretation

(Results Fig 3 and interpretation Fig 4)
Only the major features are discussed.

Three linear features are immediately apparent crossing the surveyed area, consisting of bipolar readings of alternating positive and negative responses. Two run ENE-WSW, one southeast-northwest, and all represent modern services. Similarly a circular feature against the NE edge of the survey, giving bipolar readings, is a large manhole cover and the linear feature that passes through it in a southeast-northwest direction is the corresponding service trench. An area of dark positive readings along the southeastern edge of the site represents an area close to wire fencing and modern ferrous detritus.

Against the southern edge of the site was a curvilinear feature (1) enclosing an area roughly 45m across. Such linear positive readings are often indicative of infilled ditches, caused by the infilling soil giving a different magnetic reading to the original soils through which the feature is cut. In this case the strong signal suggests a relatively wide ditch, possibly up to 2m wide. This is situated on relatively high ground, with a gradual slope to the north and northwest. Its location adjacent to the Priory Rath Hillfort may indicate an association between the two, with the curvilinear ditch (1) enclosing an annex to the main hillfort. A gap in the curvilinear feature to the east may represent an entranceway. To the south of, and possibly enclosed by, this curvilinear feature is an area of small mainly positive readings (9) that are often caused by small infilled cut features. These could represent archaeological features such as pits, or natural depressions, tree and animal activity but possible association with an enclosure ditch (1) may indicate an area of general archaeological activity.

A long curvilinear feature (2) runs across the site from southwest to northeast. Again positive readings suggest an infilled ditch, which fades out to the south. Topographically this feature runs along the base of the main slope across the site, and may therefore represent an old field boundary or similar boundary separating the hill slope from more level ground along the valley base.

On higher ground at the southeast area of the site lie two curvilinear features (3), again the positive readings suggesting they are infilled ditches. Adjoining negative readings along the northern edge of these linear features in places may indicate associated earthen banks built up on one side of the ditches. These features are difficult to interpret, the direction of their curves appears to disassociate them from the Priory Rath Hillfort defences and they are located across both the generally flatter ground and extending partway down the northward sloping ground. It is unclear from these results if these features represent deliberately created ditches or are the by-product of some other activity such as ploughing.

Located on the lower ground to the west are two almost circular positive linear responses (4), again indicative of infilled ditches. These ditches enclose circular areas between 8m and 12m in diameter. Such circular features are often typical of prehistoric hut circles, especially given their proximity to the Iron Age hillfort although in this case clearly sited outside the confines of the hillfort. Similar circular features may be suggested on the higher ground to the east (8), again outside the hillfort, but readings from this area are masked and distorted by ferrous detritus prevalent in this area. A slightly smaller sub-circular feature to the northeast (5) is situated on the edge of very steep slopes down to a stream-line and in that case may represent some form of natural feature.

Running almost east - west across the site is a linear feature (6), the positive readings suggesting another infilled ditch. A long linear feature such as this may represent a field boundary ditch or field drainage, but it runs across the gradual northward slope of the site and would appear an unusual location for either a boundary or drainage ditch. It does run in the general direction of a 19th century public house that formerly stood on Cromwell Road and may therefore be associated with a route to that site.

A short distance to the north is another linear feature (7) consisting of fainter positive readings. This feature roughly follows the line of a trackway or footpath depicted on the 1st edition Ordnance Survey map of 1875 leading from the Mason's Arms public house towards a quarry and Steynton village beyond, and therefore the most likely explanation is that this feature represents the worn and subsequently infilled trackway.

In the southwest corner of the site are a series of roughly parallel linear features (10), caused by negative readings. Such negative readings are often indicators of underlying earth banks. Associated with these banks are possible faint traces of adjoining positive readings, suggesting an adjoining ditch. Such results often represent ploughing remains. Similar linear features can be detected throughout the site (11).

An area of dipolar readings appear close to the western boundary of the site (12). Such readings indicate a spread of magnetic debris representing general ground disturbance that could originate from either dug or mixed earth, or a spread of ferrous material. These readings come from an area close to the former site of a public house, identified on various 19th and early 20th century map sources, and therefore is likely to be general activity associated with that site. Specific individual features, such as pits and boundary ditches, cannot be distinguished.

Spread throughout the site are small points and areas of both negative responses and bipolar responses. The major negative features are identified on figure 4 in pink, the bipolar features in yellow. These features could represent a range of activities - archaeological, natural and modern. Negative responses typically identify infilled features, which could result from pits, tree bowls and burrows amongst others. Bipolar results are often indicative of ferrous objects, these could be naturally occurring iron-rich rock or buried and discarded ferrous objects of undetermined date.

CONCLUSIONS

This survey has revealed a variety of archaeological features across the site. The presence of the Priory Rath Hillfort adjoining the site may indicate many of these features are related to Prehistoric activity in the surrounding landscape around the main defended hillfort enclosure. This would appear a distinct possibility for ditch (1) that may represent an annex to the main hillfort, and circular features (4) and (8) that may represent outlying settlement beyond the recognised defences of the hillfort.

Further linear ditches across the site (2), (3) and (6) are harder to explain and could have been caused by a variety of activities that may not necessarily be associated with the hillfort, but nevertheless may represent features of archaeological interest.

Features (7) and (12) would appear to be closely associated with general activity and a trackway around the Mason's Arms public house, as depicted on 19th and early 20th century map sources.

Linear features (10) and (11) running across the site may be indicative of later agricultural activity.

No further outlying defensive features associated with the main area of Priory Rath Hillfort are apparent within the site. Given the strength of other responses within the site it is likely if further defences existed they would have been revealed by the survey.

Although the geophysical survey has produced clear results of archaeological interest, any interpretation of these features is tentative and further archaeological work would be required to positively identify the function and dates of these features.

ACKNOWLEDGEMENTS

I would like to thank Andy Shobbrook from Dyfed Archaeological Trust for his assistance with this survey and Simon Ratty for the background research.

ARCHIVE DEPOSITION

The archive will initially be held by DAT, before being passed to the National Monument Record, Aberystwyth.

SOURCES

British Geological Survey 1994 The Rocks of Wales 1:250,000

Clark A J 1996 *Seeing Beneath the Soil* (2nd edition). Batsford, London

Ordnance Survey 1875 First Edition 1:2500 Pembrokeshire.XXXIII.10 & 14

Ordnance Survey 1887 First Edition 1:10560 Pembrokeshire.XXXIII.SW

Ordnance Survey 1908 Second Edition 1:2500 Pembrokeshire.XXXIII.10 & 14

APPENDIX 1: METHODOLOGY AND INSTRUMENTATION

Geophysical Survey Instrumentation

A fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of surveying large areas.

The survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer, which uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies.

The instrument detects variations in the earth's magnetic field caused by the presence of iron in the soil. This is usually in the form of weakly magnetised iron oxides, which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil therefore contain greater amounts of iron and can therefore be detected with the gradiometer. There are, however, other processes and materials that can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs which usually produce very high readings and can mask the relatively weak readings produced by variations in the soil. Archaeological features such as hearths or kilns also produce strong readings because fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the surrounding soil leading to a more generalised magnetic enhancement around settlement sites.

Not all surveys produce good results as anomalies can also be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material within the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in features being un-detectable. It must therefore be stressed that a lack of detectable anomalies cannot be taken to mean that there are no below ground archaeological features.

The Bartington Grad601 is a hand-held instrument and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 1.0m apart. Their Mumetal cores are driven in and out of magnetic saturation by an alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output (Clark 1996).

The gradiometer can detect anomalies down to a depth of approximately one metre. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The instrument is capable of detecting changes as low as 0.1nT.

Geophysical Survey Data Collection

The gradiometer includes an on-board data-logger. Readings in the surveys were taken along parallel traverses of one axis of a grid made up of 20m x 20m squares. The traverse intervals were either 0.5m or 1.0m apart. Readings were logged at intervals of 0.25m along each traverse giving 3200 readings per grid

square (medium resolution on 0.5m traverses), or 1600 readings per grid square (low resolution on 1.0m traverses).

Geophysical Survey Data presentation

The data was transferred from the data-logger to a computer where it was compiled and processed using ArchaeoSurveyor 2 software. The data is presented as grey-scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. A separate grey-scale plot with interpretation of the main features is also included as necessary.

Geophysical Survey Data Processing

The data is presented with a minimum of processing although corrections are made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some noisy or very complex sites can benefit from 'smoothing'. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of low pass filtering can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

Reliability

Geophysical survey is an immensely useful tool but it should be realised that while a survey will detect a wide range of features, it may not detect *all* buried features. A gradiometer survey detects changes in magnetic flux density and relies on there being a detectable difference between the archaeology and the substrate. This may not occur for many reasons (e.g. a cut feature being backfilled with subsoil). It must therefore be stressed that a lack of archaeological responses from a geophysical survey does not prove that there is no archaeology present.

Grid locations

The survey grids were located by measurements to fixed points such as cliff edges and metal survey markers located during the survey (Fig 4: A2, B and B2).

Bibliography

Clark A J 1996 *Seeing Beneath the Soil* (2nd edition). Batsford, London



Figure 1: Location map, based on the Ordnance Survey.

Reproduced from the 1995 Ordnance Survey 1:50,000 scale Landranger Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Cambria Archaeology, The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No AL51842A

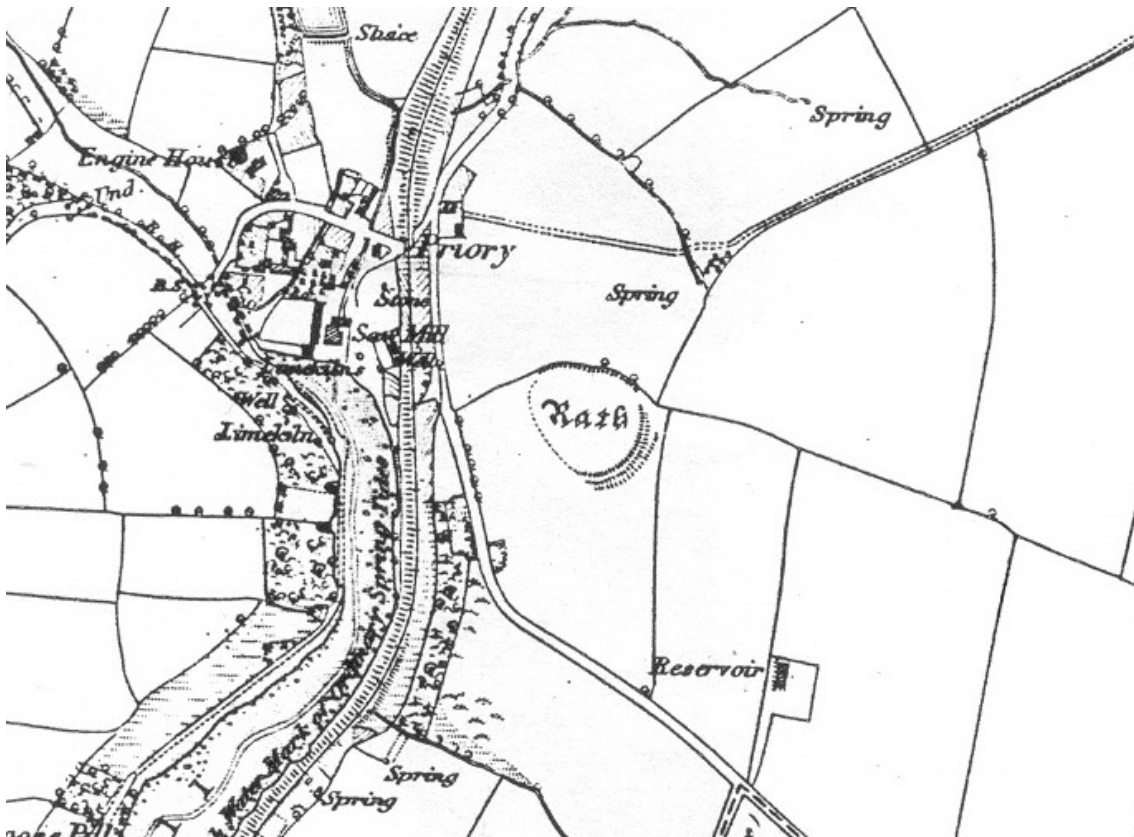


Figure 2: Extract from the 1st edition 1:10560 Ordnance Survey map showing the site to the north of Priory Rath Hillfort crossed by a trackway leading from the Mason's Arms public house.



Photo 1: Aerial photograph of Priory Rath Hillfort taken from the northwest, also showing the surveyed site. Photograph undated.

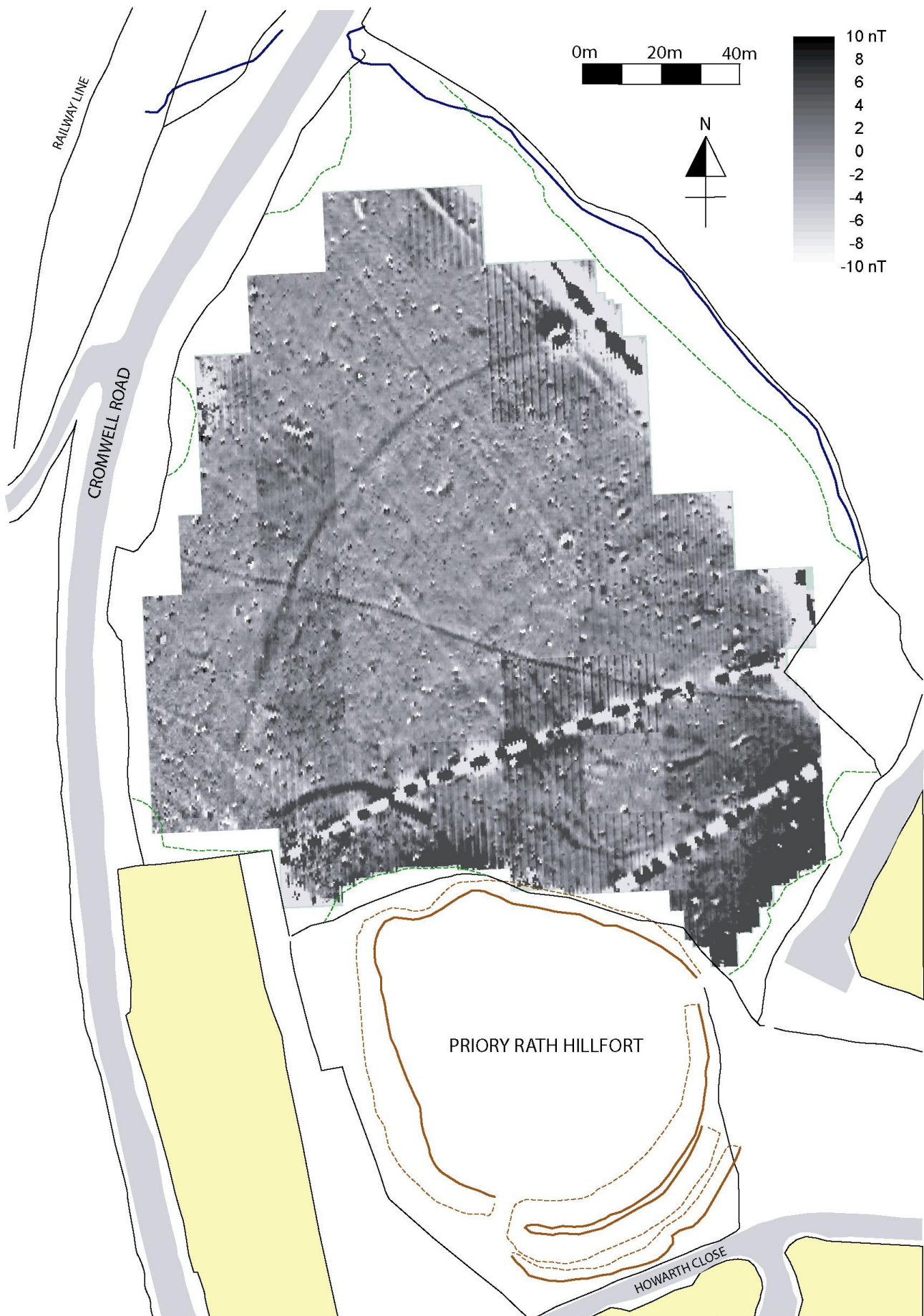


Figure 3: Processed gradiometer survey, grey-scale, overlaid on geographical features.

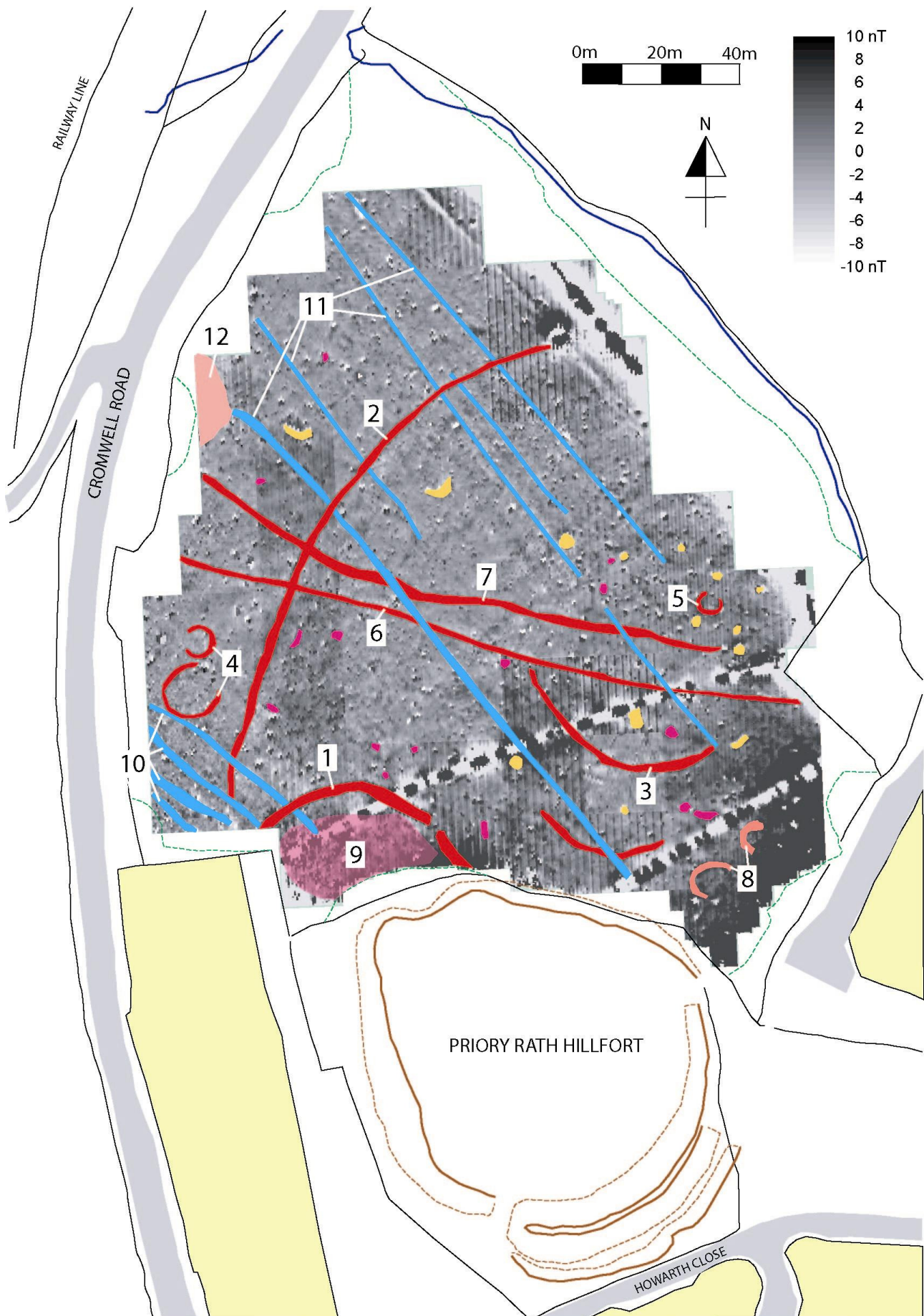


Figure 4: Processed gradiometer survey, grey-scale, with interpretation. Numbers relate to 'Geophysical Interpretation' section in the main text.

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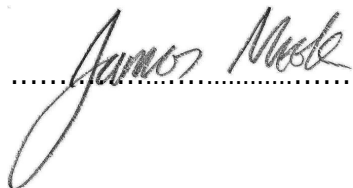
Dyddiad / Date 28/10/09

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by
James Meek

ar ran Ymddiriedolaeth Archaeolegol Dyfed Cyf.
on behalf of Dyfed Archaeological Trust Ltd.

Swydd / Position: Head of Field Services

Llofnod / Signature



Dyddiad / Date 28/10/09

*Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau sydd
gennych ar gynnwys neu strwythur yr adroddiad hwn*

*As part of our desire to provide a quality service we would welcome any comments you may
have on the content or presentation of this report*