

# **POSSIBLE ROMAN FORTS IN PEMBROKESHIRE: HARGLODD ISAF AND KILPAISON BURROWS GEOPHYSICAL SURVEYS 2014**



Prepared by  
Dyfed Archaeological Trust  
For Cadw



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## POSSIBLE ROMAN FORTS IN PEMBROKESHIRE: HARGLODD ISAF AND KILPAISON BURROWS GEOPHYSICAL SURVEYS

Gan / By

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HARGLODD ISAF AND KILPAISON BURROWS:  
GEOPHYSICAL SURVEYS**

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## **POSSIBLE ROMAN FORTS SURVEYS, PEMBROKESHIRE: GEOPHYSICAL SURVEY 2014**

### **SUMMARY**

*Two possible Roman fort sites were identified in Pembrokeshire from aerial photography and LIDAR data analysis, and were supported by sufficient circumstantial evidence to warrant a more detailed investigation. The first site is located at Harglodd Isaf Farm (SM 7751 2590) and the second at Kilpaison Burrows (SM 89460062). Both areas were subjected to the same methods of survey using a Bartington Grad 601-2 gradiometer.*

*Cadw grant-aided Dyfed Archaeological Trust to undertake the geophysical survey of the sites in the hope of identifying and characterising possible buried archaeological remains and determining if the sites do indeed represent Roman forts. The fieldwork was undertaken in February and March 2014.*

*At Harglodd Isaf, the possible Roman fort was identified from parch-mark evidence which showed a potential L-shaped, rounded corner of a fort and its network of ditches. An area roughly 1ha in size was surveyed across the cropmark and the rest of the field to establish its potential as a Roman fort site. This initial survey did not produce results that would indicate the presence of a Roman fort as the anomalies in the survey area do not resemble the anticipated layout of a fort as indicated from the aerial photographic evidence. The results would indicate a network of regularly laid out former field boundaries. The observed parch-mark coincides with a slight shoulder of land as viewed from the ground, and it is believed that that is responsible for the aerial photo results.*

*At Kilpaison Burrows, the site was identified from the chance observance of LIDAR data during a desk-based assessment of the area. It was identified as a ditch like feature visible through the sand dunes with rounded corners forming the western half of projected rectangular enclosure. Upon visiting the site it was deemed a good candidate as the topography supported the LiDAR observations, including indications of the eastern side of the enclosure and its general aspect was very suitable for a fort site. Three survey areas totalling roughly 5ha, were established over the northern half of the potential site. The results are very subtle and do not suggest the, significant remains of a feature such as a Roman fort are present. During on site conversation with the tenant farmer, we were informed that this area was reclaimed from the sand dunes in the 1970s and that the process had involved levelling of said dunes.*

*Although neither site has produced evidence supporting the possible Roman fort interpretation of the parch-mark/LIDAR data, the recent confirmation of a Roman fort at Wiston has certainly greatly increased the potential for further military remains to be present in the county. The possible fort at Harglodd Isaf can be discounted, but the possibility of a fort or rectangular enclosure of Romano-British origin at Kilpaison Burrows cannot. It is possible that the levelling of the sand dunes has significantly truncated or removed any remains that may have been present.*

## **INTRODUCTION**

### **Project commission**

Two potential Roman fort sites were identified in Pembrokeshire; Harglodd Isaf (SM 7751 2590) and Kilpaison Burrows (SM 8946 0062).

Both sites are considered under sufficient risk of damage to warrant further investigation to establish whether or not this potential was true. Harglodd Isaf is currently under agricultural management (the field is deep ploughed) and therefore any potential remains would need a management plan, while at Kilpaison Burrows the risk of accidental damage was considered high (through further sand dune management).

Cadw provided grant aid to Dyfed Archaeological Trust to undertake the geophysical survey of the sites in the hope of identifying and characterising possible buried archaeological remains. The fieldwork was undertaken in February and March 2014.

### **Scope of the project**

The project aim was to ascertain whether possible sites identified from aerial photographs, LIDAR and other data are Roman forts through geophysical survey using a gradiometer. The information from the survey could then be used to identify any future work required on the sites and to provide scheduling recommendations if necessary.

In addition to clarifying the character of the site, the project offered an opportunity to address two objectives, identified in the Roman Wales section of the 'Introducing a Research Framework for the Archaeology of Wales', namely archaeology of the early campaign years and interaction between Roman occupiers and the indigenous population. The work will also allow the enhancement of the Dyfed Historic Environment Record (HER).

### **Report outline**

Because of the limited nature of this project, together with the considerable archaeological evidence in the wider area, this report is restricted solely to the results of the geophysical survey.

### **Abbreviations**

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

## Timeline

The following table illustrates the approximate dates for the archaeological periods discussed in this report:

PERIOD	APPROXIMATE DATE
PALAEOLITHIC	c.120,000 BC – c.10,000 BC
MESOLITHIC	c.10,000 BC – c.4400 BC
NEOLITHIC	c.4400 BC – c.2300 BC
BRONZE AGE	c.2300 BC – c.700 BC
IRON AGE	c.700 BC – c.43 AD
ROMAN	c.43 AD – c.410 AD
EARLY MEDIEVAL	c.410 AD – c.1086
MEDIEVAL	c.1086 – c.1536
POST MEDIEVAL	c.1536 – c.1900
MODERN	c.1900 onwards

**Table 1:** Archaeological and historical timeline



## THE SITES

### Harglodd Isaf: Location and Archaeological Potential

At Harglodd Isaf, the potential fort occupies land which is gently sloping from the east to the west, c.2km to the east of the city of St Davids (Figures 1 & 2). It is located across 3 irregularly shaped fields to the southeast of the farm itself, across a shallow stream valley running northeast to southwest.

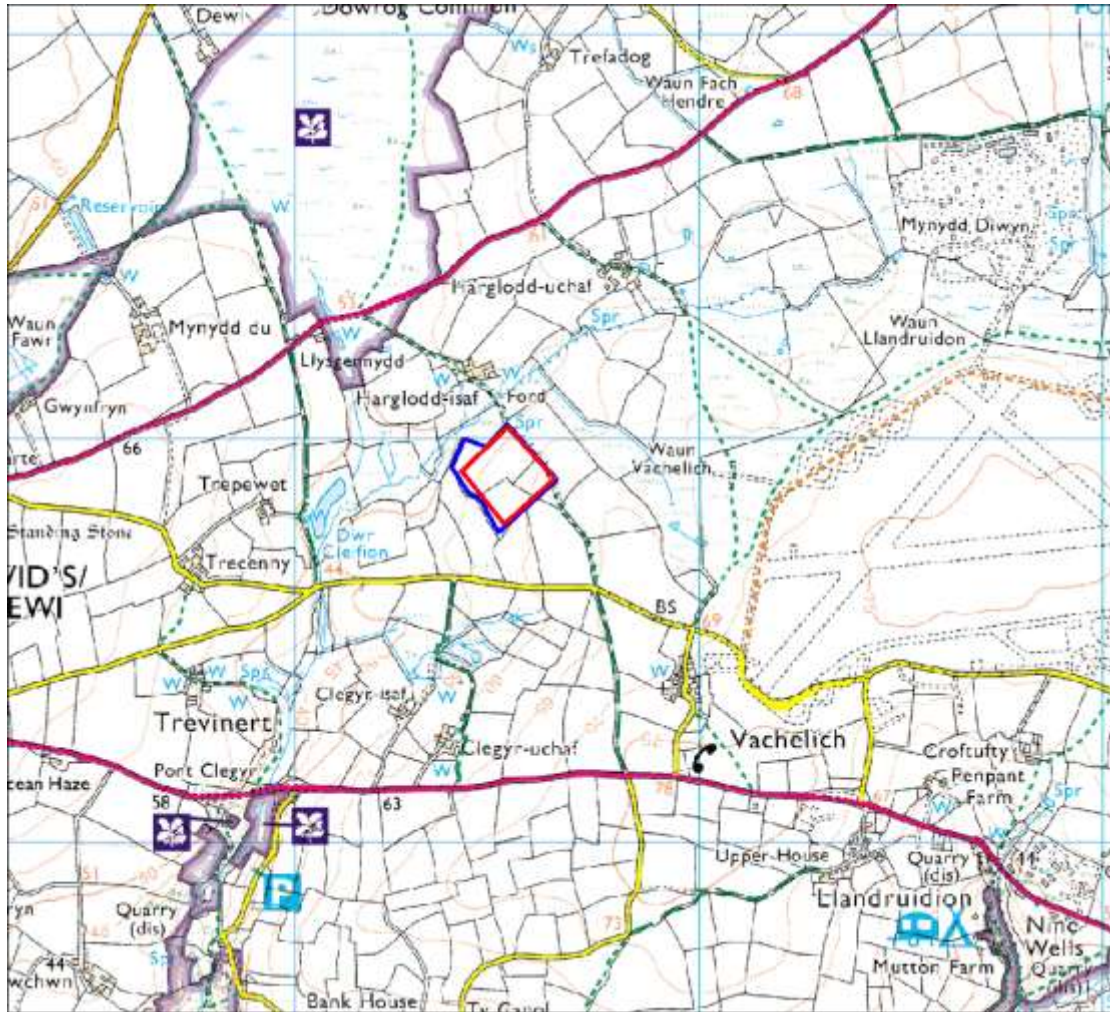
The underlying solid geology consists of Unnamed Extrusive Rocks of the Neoproterozoic period.

The 1955 meridian aerial photograph of the site showed a strong parchmark and cropmark, suggesting a rounded corner and straight sided feature within the irregularly shaped field system (Photos 1 and 2). It suggests strongly at a playing card shaped feature which are typical of Roman fort layouts, set out on a northeast to southwest alignment. This coupled with the location's proximity to the suggested route of the Via Julia Maritima 0.2km to the south, and being a suitable distance (c.25km) from the next nearest Roman fort at Wiston, supports this sites candidacy as a potential Roman Fort.



**Figure 1:** Location map of Harglodd Isaf, based on the Ordnance Survey.

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**Figure 2:** Location of the survey area at Harglodd Isaf  
with the potential fort location (in red)

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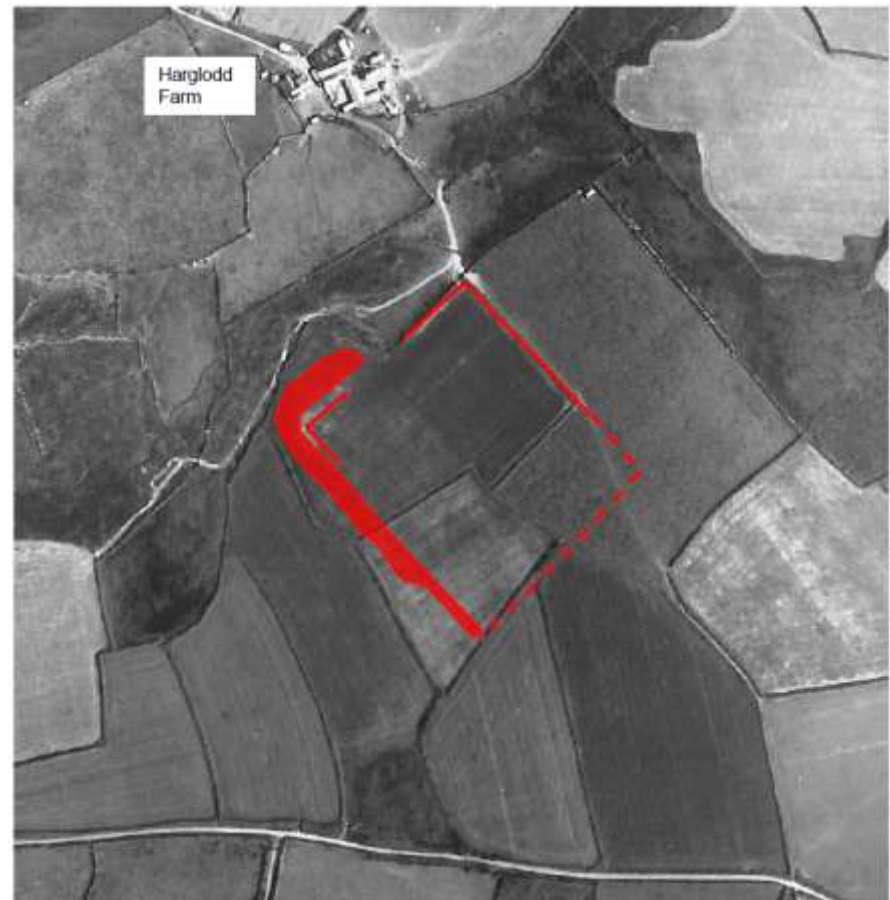
It should be noted that more recent aerial photography of the site has not provided any further supporting evidence, however no known archaeological investigation has been made of the site previously.

As the purpose of the survey was to assess the site's potential as a Roman fort, it was decided that a sample strip of survey should be made across the site to include the features identified from the aerial photograph (the possible fort defensive ditches) and the interior of the enclosed area (where buildings, roads etc could be). This way an initial assessment could be made of potential internal features as well as the external limits, without committing to an extensive survey. The results of this assessment meant that only 1 day of survey was necessary at this location.





**Photo 1:** Aerial photograph of the site at Harglodd Isaf, taken in 1955 (Meridian Airmaps).



**Photo 2:** Aerial photograph of the site taken in 1955 (Meridian Airmaps) with basic interpretation of parchmark/cropmark features overlain

### **Kilpaison Burrows: Location and Archaeological Potential**

The site at Kilpaison Burrows occupies land to the south of the B4320, on an east-west ridge that the road runs parallel to. The site overlies the edge of the ridge, with the northern portion sloping very gently to the north and the southern dropping more steeply to the south. The site lies c.9km to the west of Pembroke town (Figures 3 & 4). The potential fort is partially overlain with a modern field system set out following a similar axis, but is more strongly indicated in the area of sand dunes and scrub on its eastern edge. The underlying solid geology consists of Pridoli series rocks on the northern side and Ludlow series rocks on the southern. The junction of these two rock types forms the visible ridge that the site occupies.

This site was noted as having the potential to be a Roman fort from a recent desk-based assessment of a nearby area, undertaken by DAT Archaeological Services in late 2013. The coincidence of finds of Roman date in this area has previously indicated that the area may contain a Roman period civilian settlement. Roman coins have also been recovered in this area identified through the Portable Antiquities Scheme. LIDAR data was thus investigated for this area, which revealed topographic features indicating two straight sides and three corners of a rough playing card shaped enclosure (Illustrations 1 & 2). A site walkover suggested that some of the earthworks were visible on the ground also. The potential fort appeared to be laid out on a north to south axis, and is immediately adjacent to a known prehistoric routeway (now largely overlain by the B4320).

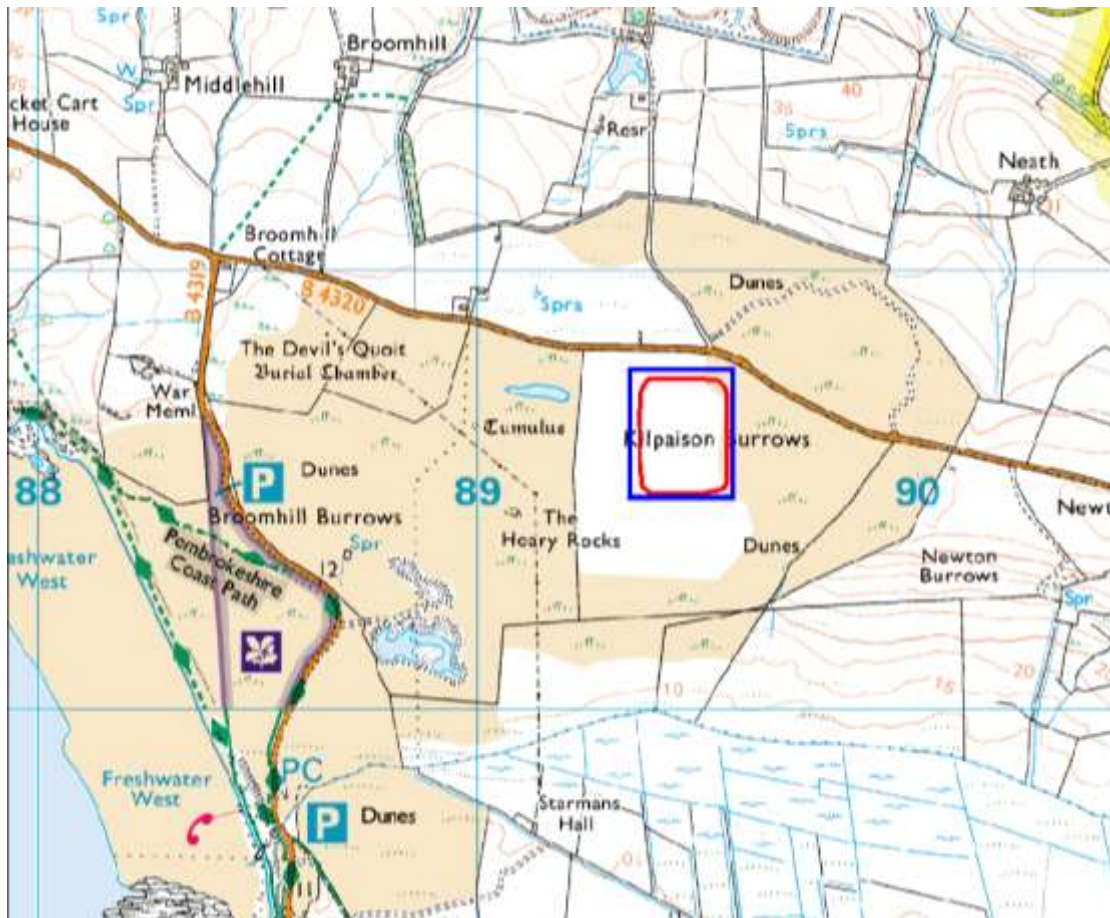
When speaking to the tenant farmer Mr John Hathaway, he indicated that when the previous tenant (his father) and he had reclaimed this land from sand dunes in the 1970s, they cleared a larger area at first than they later enclosed. He stated that they may have chosen this area as it was flatter and therefore easier to do. We were also informed that the southern end of the fort had been used as a sewage burial site by the local council for many years during the late 1970s.

As the site suggested possible later interference at its southern area, it was decided to assess as much of the site as possible, and to begin at the northern end, to inform whether further survey would be necessary. Three areas were surveyed which provided enough data to assess the site.



**Figure 3:** Location map of Kilpaison Burrows, based on the Ordnance Survey.

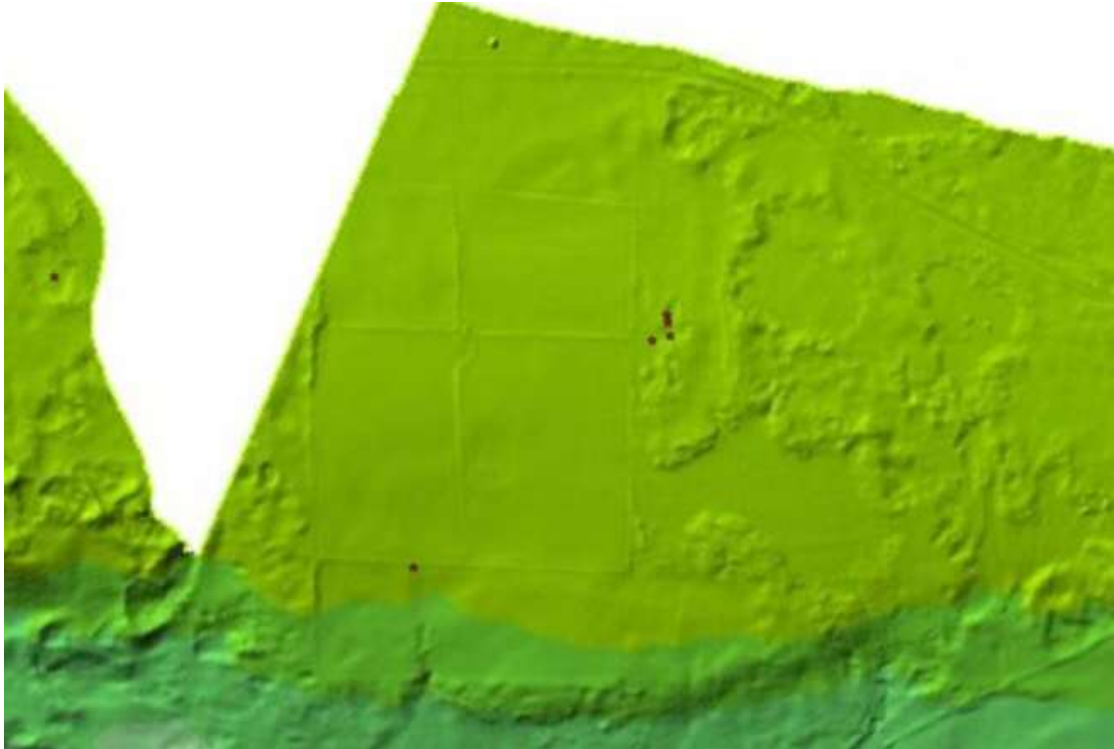
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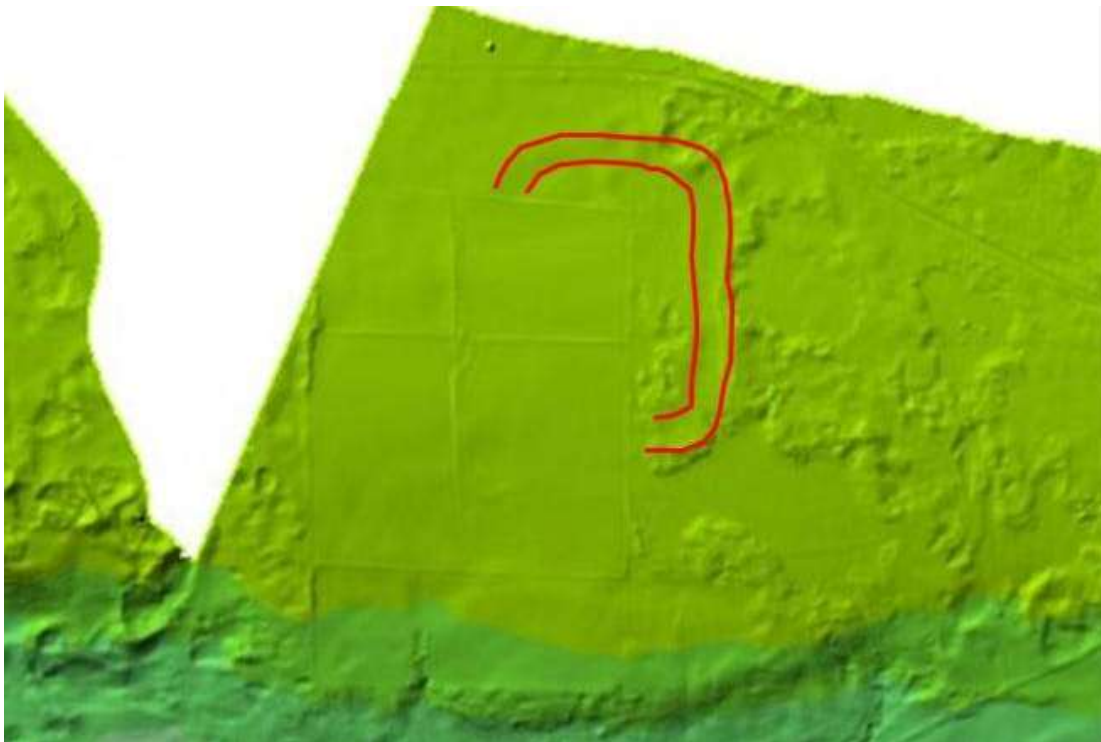
**Figure 4:** Location of the survey area at Kilpaison Burrows with the potential fort location (in red and blue boundary)

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**Illustration 1:** The LIDAR image of the site at Kilpaison Burrows



**Illustration 2:** The LIDAR image of the site at Kilpaison Burrows  
with basic interpretation

## **METHODOLOGY**

A fluxgate gradiometer was used for the survey, which detects variations in the earth's magnetic field (full specifications are in Appendix 1). Readings were taken at a low resolution on traverses 1m wide and every 0.25m within a 20m x 20m grid across the site. In total an area of c.0.84ha was surveyed at Harglodd Isaf and 3.76ha at Kilpaison burrows. A Trimble TST was used to tie the survey grid into the local Ordnance Survey grid.

## **Limitations**

The surveys were undertaken over a total of four days in February and March 2014, 1 day at Harglodd Isaf, and 1 at Kilpaison Burrows. Weather conditions at both sites were fine and generally dry with the occasional brief shower. The fields were bounded by hedgerows, some containing wire fencing or electric fencing, which may have obscured readings taken in their immediate vicinity. The fields at both sites were generally level and under short pasture, although the eastern edge of the survey at Kilpaison consisted of scrubland and sand dunes which restricted survey work. An experienced surveyor undertook all of the survey work therefore any variations in the data collection are likely to have been small.

The underlying geology and soils did not appear to cause any geological distortions of the geophysical survey results.

## **Processing, presentation and interpretation**

Processing was performed using *TerraSurveyor 3.0*, detailed explanation of the processes involved are described in Appendix 1. The data is presented with a minimum of processing (Figures 5 & 7), but the presence of high values caused by ferrous objects tends to hide fine details and obscure archaeological features, thus the values were 'clipped' to remove the extreme values allowing the finer details to show through. The survey was clipped using Standard Deviation values to the following ranges:

- 14.72nT to -13.79nT at Harglodd Isaf
- 5.51nT to -6.2nT in field 1 Kilpaison Burrows
- 3.13nT to -3.29nT in field 2 at Kilpaison Burrows
- 6.84nT to -7.05nT in field 3 at Kilpaison Burrows

During the survey the presence of small surface iron anomalies, typically deriving from modern material, causes spikes in the data. These have been removed using median values in field 1 at Kilpaison Burrows but was not necessary in the other survey areas

The processed data is presented as grey-scale plots overlaid on local topographical features (Figures 5 & 7). The main magnetic anomalies have been identified and plotted onto the local topographical features as a level of interpretation (Figures 6 & 8).

The survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features

will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.

All measurements given are approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.



## **RESULTS**

### **Geophysical Interpretation (Figures 5 to 8)**

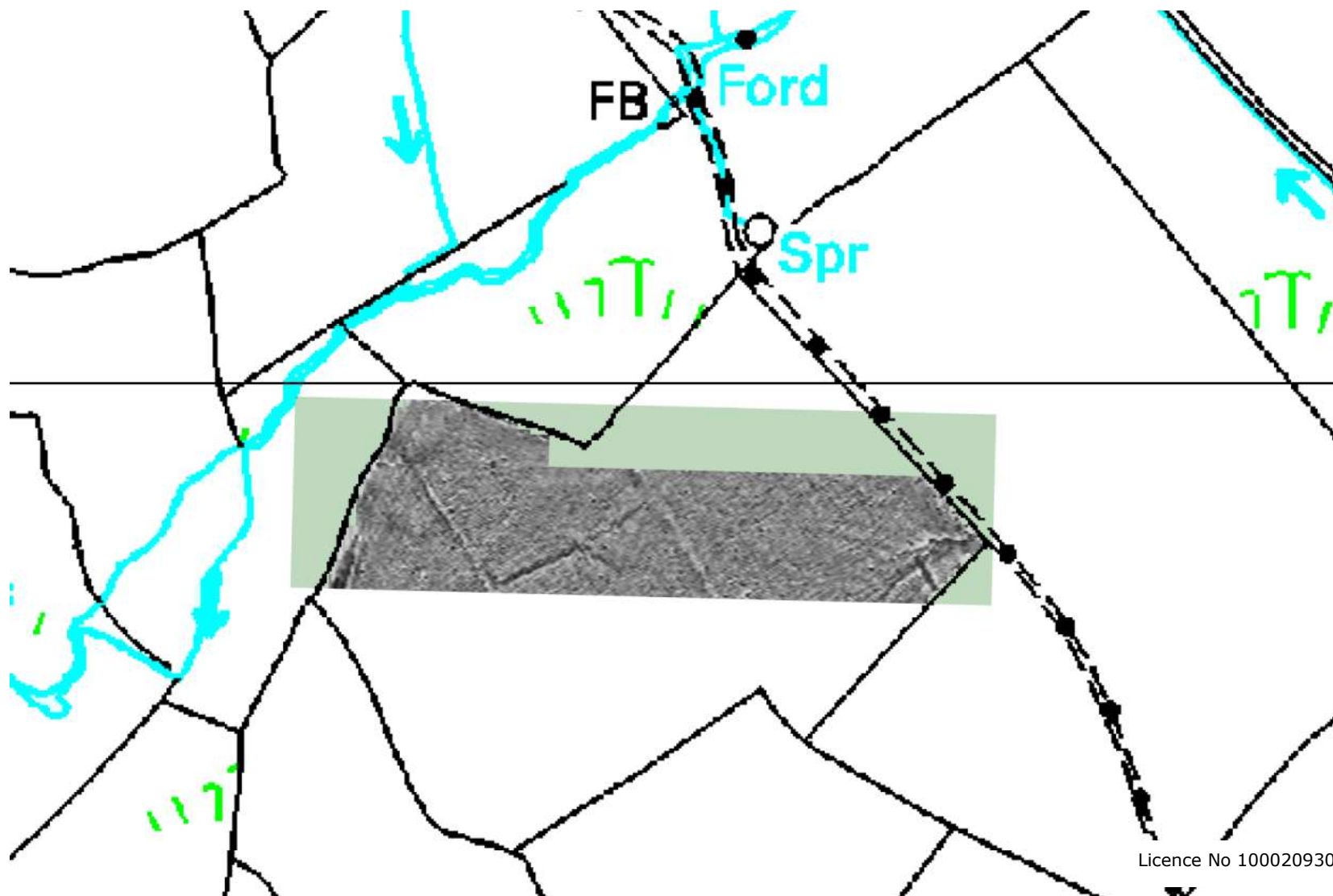
The geophysical survey results show limited complexity, with few archaeological features indicated by them, with the majority of those being ephemeral. Any interpretation from these geophysical results is by its nature speculative and precise details about the context, function, state of preservation and date of any archaeological features would require further intrusive investigation.

#### **Harglodd Isaf (Figure 5 & 6)**

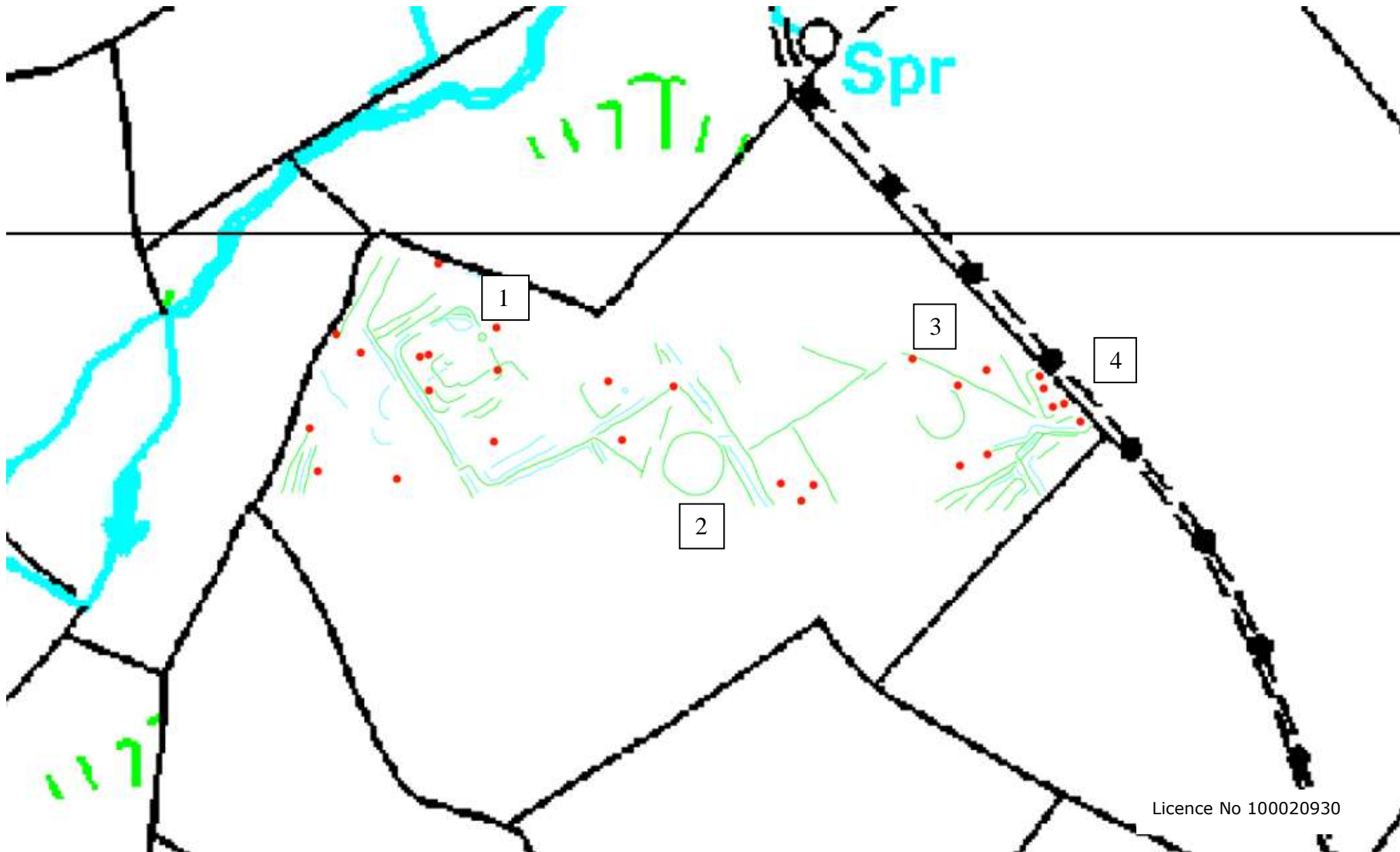
The initial strip of survey targeting the features observed on the aerial photograph from 1955 did not return results indicating the presence of buried features relating to a Roman fort. No anomalies could be observed that followed the same layout as was indicated from the photograph. In fact the anomalies that were identified respect the current field layouts and are therefore likely to reflect the locations of former field boundaries, or in the case of the anomalies running northwest to southeast, the routes of former trackways.

A small number of ephemeral positive and negative readings, indicate small squared and rounded enclosures (anomalies 1, 2, 3 and 4, Figure 6). These may indicate the locations of short lived or temporary enclosures associated with pastoral agriculture. By studying the individual readings of the anomalies it can be seen that the difference between them and the surrounding readings is slight, hence the ephemeral nature of their appearance. There is a strong possibility that anomalies 1, 2 and 4 have been created through misinterpretation of successive plough regimes made at different orientations, as they respect the possible field boundaries and trackways, and the minor ridge and furrow visible in the results.

No evidence can be seen to indicate the presence of features that have been observed in results from other identified Roman Forts, such as successive ditches, grid pattern layouts, etc. It can therefore be stated with some confidence that the anomalies observed do not likely represent those of a Roman fort.



**Figure 5:** The geophysical survey results at Harglodd Isaf located onto OS 1:25000 base map  
North is to top of the page



**Figure 6:** Interpretations of the results at Harglodd Isaf located onto OS base map Positive results are highlighted in green, negative in blue and diploar's in red. North is to top of page.

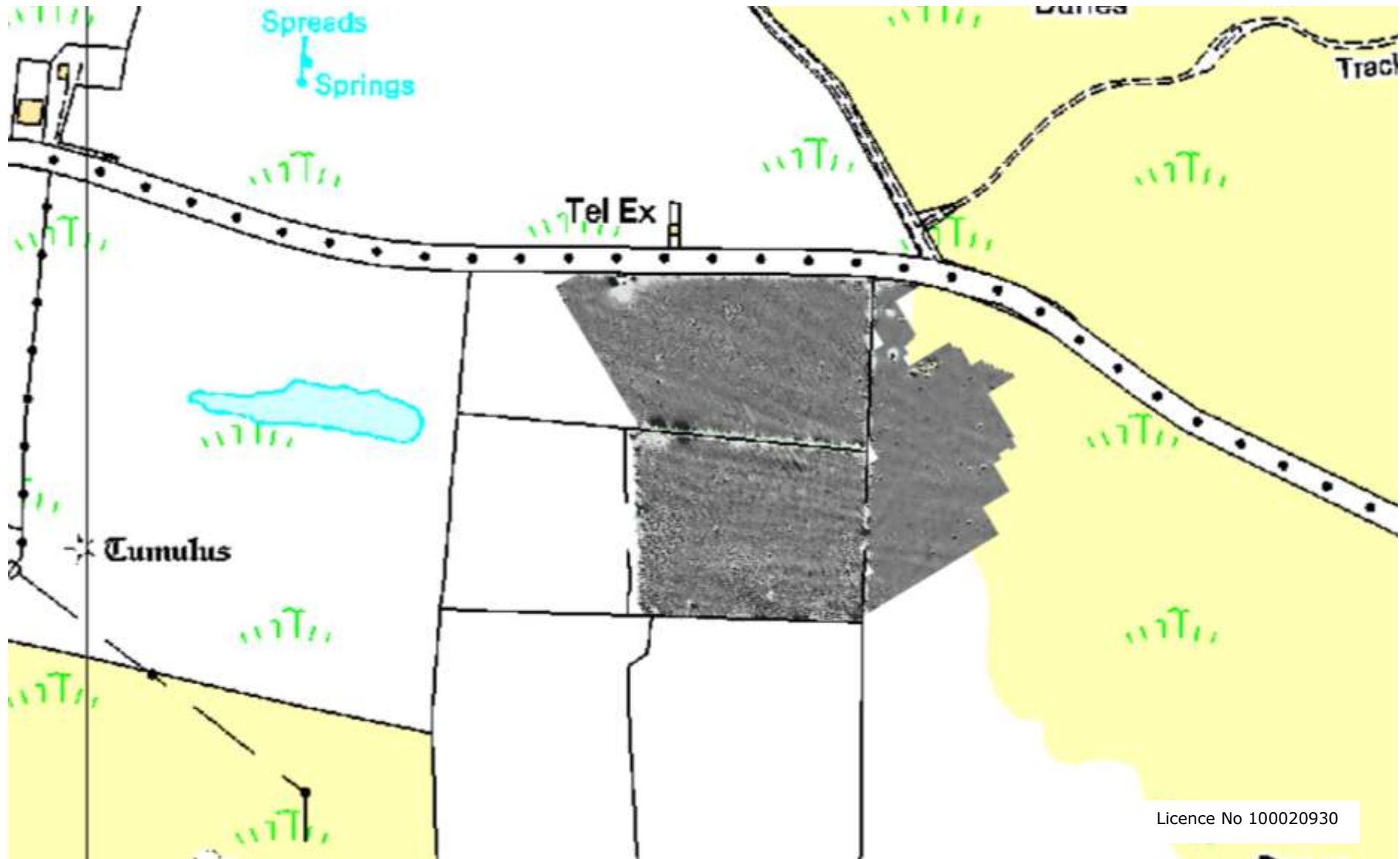
### **Kilpaison Burrows (Figure 7 & 8)**

The survey extended over the northern half of the identified anomalies; however the 3 surveyed areas did not produce results that would indicate strongly the presence of a Roman Fort. The results provided a good indication of the direction of geological fault lines, as well as that numerous small dipolar anomalies that indicate the presence of small ferrous objects. No anomalies were observed that reflect the observations made from the LIDAR data.

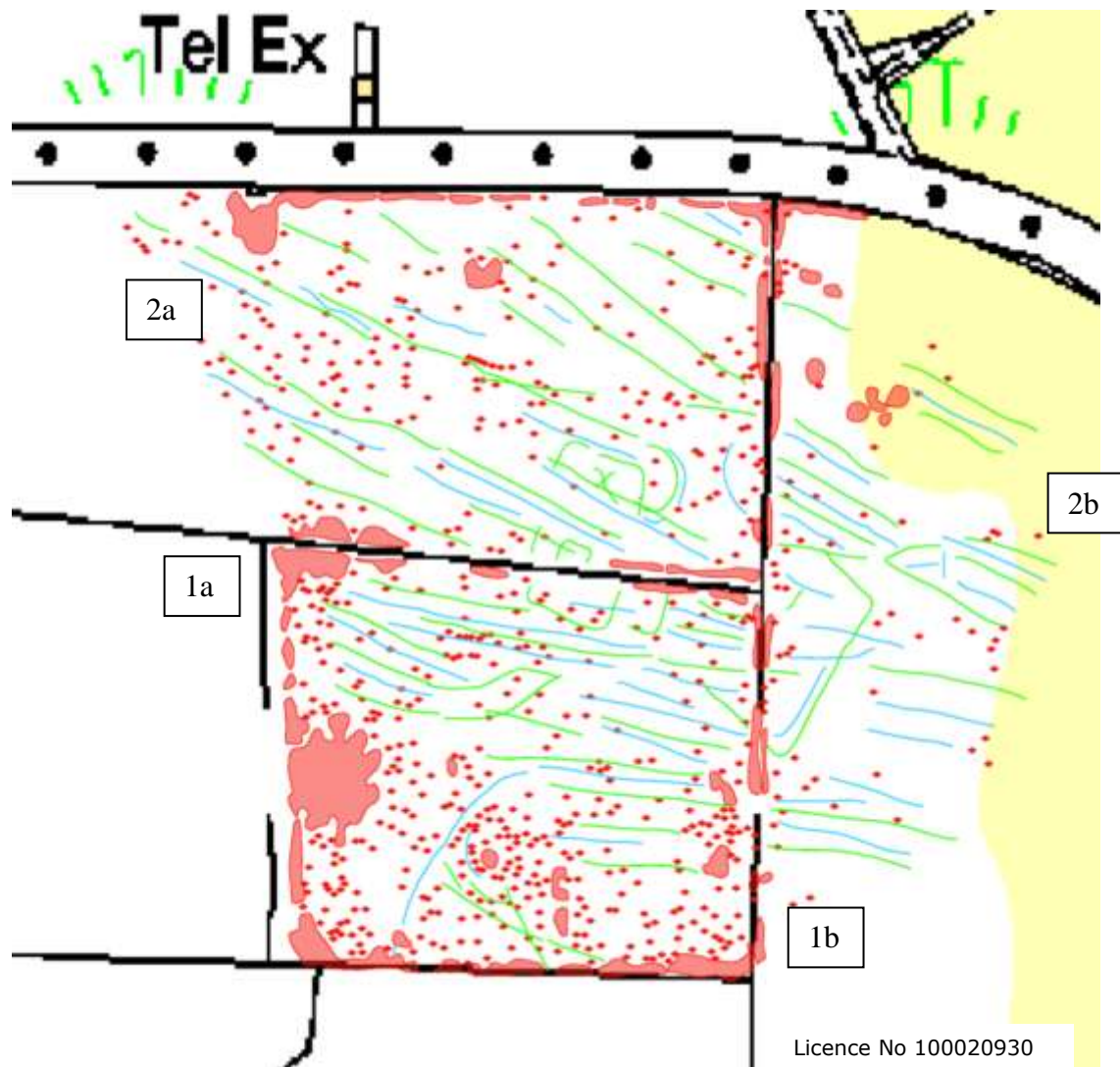
The geological fault lines run roughly east to west in alternating bands, and given their clarity, it can be assumed that there is only a narrow band of superficial geology overlying the solid geology.

There are 2 linear concentrations of small dipolar anomalies (labelled 1 and 2, Figure 8), possibly indicating the routes of former fence lines or other temporary barriers, or possibly a simple metallised surface where a trackway used to exist. These theories have been postulated as temporary barriers may involve lost small ferrous construction materials such as nails or wire, while the readings also bear visual similarities with the known trackway running north to south on the western edge of field 2. The larger dipolar areas reflect the presence of large ferrous objects such as fences, gates or buried waste.

There are only 2 groups of ephemeral positive and negative anomalies over the whole survey (labelled 3 and 4), that indicate activity other than that already discussed. They both overlap the present day field boundaries and can therefore be expected to predate the modern layout. They may indicate short lived or temporary enclosures of uncertain purpose, but it should also be noted that they appear align with the anomalies that have been interpreted as being geological and so may be related to that.



**Figure 7:** The geophysical survey results at Kilpaison Burrows, orientated to north and located over OS base map. North to top.



**Figure 8:** The interpretation of the results at Kilpaison Burrows, orientated to north and located over OS base map. Positive results are highlighted in green, negative in blue and dipolar in red.

## **CONCLUSION**

In conclusion, the sites at Kilpaison Burrows and Harglodd Isaf have been subjected to an assessment of their potential as Roman forts, using geophysical techniques. Neither site returned results that would support this potential and so it must be assumed that these sites are not those of Roman forts

At Harglodd Isaf, the parchmark observed in the Meridian aerial photograph (photo 1) is likely to represent a low shoulder of land observed in the field during survey, rather than an earthwork. The anomalies observed in the survey results are thought to represent former field boundaries or tracks, and these are not the same as those observed in the aerial photograph. They are not thought likely to be the remains of a Roman fort as they bear little resemblance to previous examples.

At Kilpaison Burrows, the feature observed in the LIDAR data is thought to actually represent a mixture of the edge of the sand dunes and ground works undertaken in the 1970s by the tenant farmer when reclaiming the land prior to cultivation, and the underlying geological features.

There does remain the very slight possibility that a Roman fort did exist on this site but that it was effectively removed by the land clearance in the 1970s, however this is felt to be very unlikely.

Feature 3 and 4 could be remains of something that has been truncated horizontally, but the form they have does not mark them as high potential as Roman sites. Given the quiet nature of the readings it may well be that these are simply geological faults or dykes.

The potential for the remains of Roman forts to exist further west of Carmarthen has already been established after the successful identification of the Roman fort at Wiston by Dyfed Archaeological Trust. It is thought likely that further military sites will exist in the area but the locations have yet to be found. Further similar investigation at other candidate sites in future will help narrow down this search to further enrich the regional archaeological narrative.



## **ACKNOWLEDGEMENTS**

The survey was undertaken by Edward Davies of Dyfed Archaeological Trust and Pete Crane of Pembrokeshire Coast National Park Authority. I am indebted to Sara Beynon (Harglodd Isaf) and John Hathaway (Kilpaison Burrows) for allowing access to their land, and to the National Trust for giving permission to survey their land (Kilpaison Burrows).

## **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.

Burnham, B. C., & Davies, J. L., 2010, *Roman Frontiers in Wales and the Marches*  
RCAHMW, Aberystwyth

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

Ordnance Survey 1889 1<sup>st</sup> edition 1:2500 Map, Pembrokeshire XXIII.15



## **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 thermoremanent 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 1.0m apart. Readings were logged at intervals of 0.25m along each traverse giving 1600 readings per grid square (low resolution on 1m traverses).

## **Geophysical Survey Data presentation**

The data was transferred from the data-logger to a computer where it was compiled and processed using TerraSurveyor 3.0 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 field boundaries located during the survey.

## **Bibliography**

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

# **POSSIBLE ROMAN FORTS IN PEMBROKESHIRE, HARGLODD ISAF AND KILPAISON BURROWS: GEOPHYSICAL SURVEYS**

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Paratowyd yr adroddiad hwn gan / This report has been prepared by

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.... Dyddiad / Date 02/04/2014

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith  
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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



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