

Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

**Site at Tyringham Road
Lelant, Cornwall**

Centred on NGR (E/N): 154420,037227

Report: 1705LEL-R-1

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Project archive

Report	Adobe PDF format
Copies of report figures	Adobe PDF format
Raw and processed grid & composite files.....	DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata.....	DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata.....	DW Consulting TerraSurveyor 3 formats
GIS project, shape files and classification schema	
GIS project.....	Manifold 8 '.map' file
GIS shape files.....	ESRI standard
GIS classification schema.....	Adobe PDF format
AutoCAD version of the survey interpretation.....	AutoCAD DXF

Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type: twin-sensor fluxgate gradiometer
Date: 4 May 2017
Area: 0.4ha
Lead surveyor: Mark Edwards BA
Author: Ross Dean BSc MSc MA MifA

1.2 Clients

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch Nr Exeter, Devon EX5 4QL

1.3 Location

Site: Site at Tyringham Road, Lelant
Civil Parish: St Ives
County: Cornwall
Nearest Postcode: TR26 3LH
NGR: SW 54420 37227 (point)
NGR (E/N): 154420,037227 (point)

1.4 Archive

OASIS number: substrat1-285463
Archive: At the time of writing, the archive of this survey will be held by Substrata. Depending on local authority policy, an archive of the unprocessed data may be deposited with the Archaeological Data Service

1.5 Introduction

This report presents the results of an archaeological magnetometer survey at the above site, hereafter referred to as the survey area. It has been prepared for AC Archaeology Ltd on behalf of clients. The survey area location is shown in Figure 1.

1.6 Summary

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

One magnetic anomaly group was mapped as representing a potential linear archaeological deposit. A linear trend was noted in the dataset which probably represents historical ploughing.

2 Survey aims and objectives

2.1 Aims

To establish the presence or absence, extent and character of any archaeological features and deposits within the survey area.

2.2 Survey objectives

1. Complete a magnetometer survey across agreed parts of the survey area.
2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
3. Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
4. Accurately record the location of the identified anomalies.
5. Produce a report based on the survey that is sufficiently detailed to inform any subsequent development on the survey area about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

4 Site description

4.1 Landscape and land use

The survey area, comprises one plot on the western side of Lelant as shown in Figure 1. The northern boundary comprises the A3074 Tyringham Road and residential properties. Residential properties also border the plot to the east and south. The western edge is bounded by agricultural land. The plot was cleared of trees and vegetation before the survey commenced but patches of vegetation remained as indicated in Figure 2.

4.2 Geology

The bedrock across the site is of the Devonian Porthtowan Formation which generically comprises interbedded slaty mudstone and sandstone. The subordinate sandstone beds are up to 2m thick and are typical turbidites. The superficial deposits for the site were not mapped in the source used (British Geological Survey, undated).

5 Archaeological background

5.1 Historic landscape characterisation

‘Medieval farmland’

The agricultural heartland, with farming settlements documented before the 17th century AD and whose field patterns are morphologically distinct from the generally straight-sided fields of later enclosure, with either medieval or prehistoric origins (Cornwall Council, undated).

5.2 Summary of archaeological background

The Cornwall Historic Environment Record (HER) was examined via the Heritage Gateway (Historic England, undated) to gain an appreciation of historic assets pertinent to the geophysical survey data within 500m of the survey area perimeter.

This Section is not designed to provide a comprehensive understanding of the historic environment of the surrounding area and should not be used as a source for further work.

The HER entries are summarised in Table 1. There are no recorded historic assets within or adjacent to the survey area. In the larger area, there is a possible Romano-British fort site now forming the Lelant Churchyard which lies approximately 620m to the northeast of the survey area centre. There is placename evidence for an early medieval cemetery site approximately 480m to the southwest. Remnants of an early medieval to modern field system lie approximately 660m to the northeast and a medieval and post-medieval field system lies 670m to the northwest. Evidence for post-medieval mining can be found to the northwest, southwest and southeast.

6 Results, discussion and conclusions

6.1 Scope and definitions

This survey was designed to record magnetic anomalies. A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can result from changes in the magnetism of underlying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface artefacts can also create magnetic anomalies.

The terms 'archaeological deposit', 'structure' and 'feature' refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity, excluding recent land maintenance and farming.

Magnetic anomalies cannot be regarded as physical archaeological deposits, structures or features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits, structures and features.

The reader is referred to section 7.

6.2 Results

Figure 2 shows the interpretation of the survey data which includes the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers.

Figure 2 and Table 1 comprise the analysis of the survey data.

Figures 3 and 4 are plots of processed data as specified in Table 3. Figure 5 is a plot of unprocessed data with its metadata.

6.3 Discussion

6.3.1 General points

Discussion scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

Data collection

Data collection along the survey area edges and within the survey area was restricted as shown in the figures due to the presence of magnetic materials and vegetation. Strong magnetic responses shown in Figures 3 to 5 are likely to relate to these materials except where otherwise indicated in Figure 2 and Table 1.

Anomaly characterisation and mapping

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology when they are associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 1.

Anomalies thought to relate to natural features and recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent ferrous objects. They are only mapped if they could influence the analysis of anomaly groups thought to have an archaeological origin.

6.3.2 Data relating to historic maps and other records

No magnetic anomaly groups related to previously recorded historical assets.

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly group **1** may represent a linear archaeological deposit such as a filled ditch.

No other anomaly groups were characterised as representing potential archaeological deposits or features.

6.4 Conclusions

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

One magnetic anomaly group was mapped as representing a potential linear archaeological deposit. A linear trend was noted in the dataset which probably represents historical ploughing.

7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

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8 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

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Historic England (undated) *Heritage Gateway* [Online], Available: <http://www.heritagegateway.org.uk/gateway/>

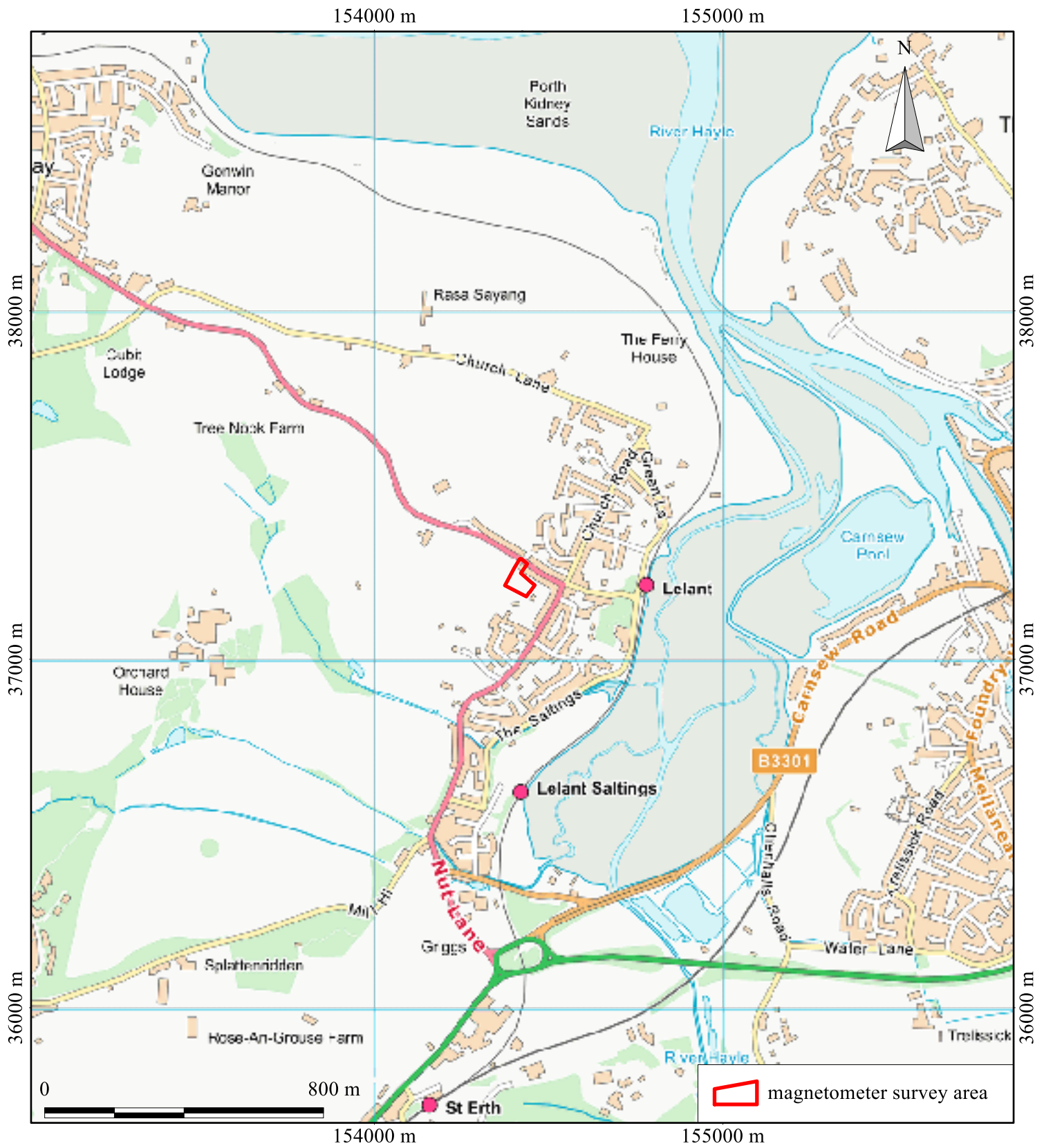
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation* [Online], Available: <https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/> [March 2017]

Appendix 1 Figures

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features (see Section 6.1).

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.



British Grid
 centre X: 154424.43 m, centre Y: 37235.53 m

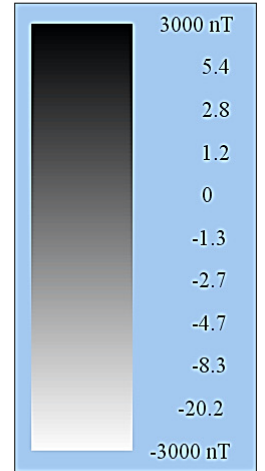
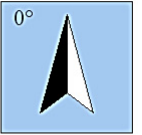
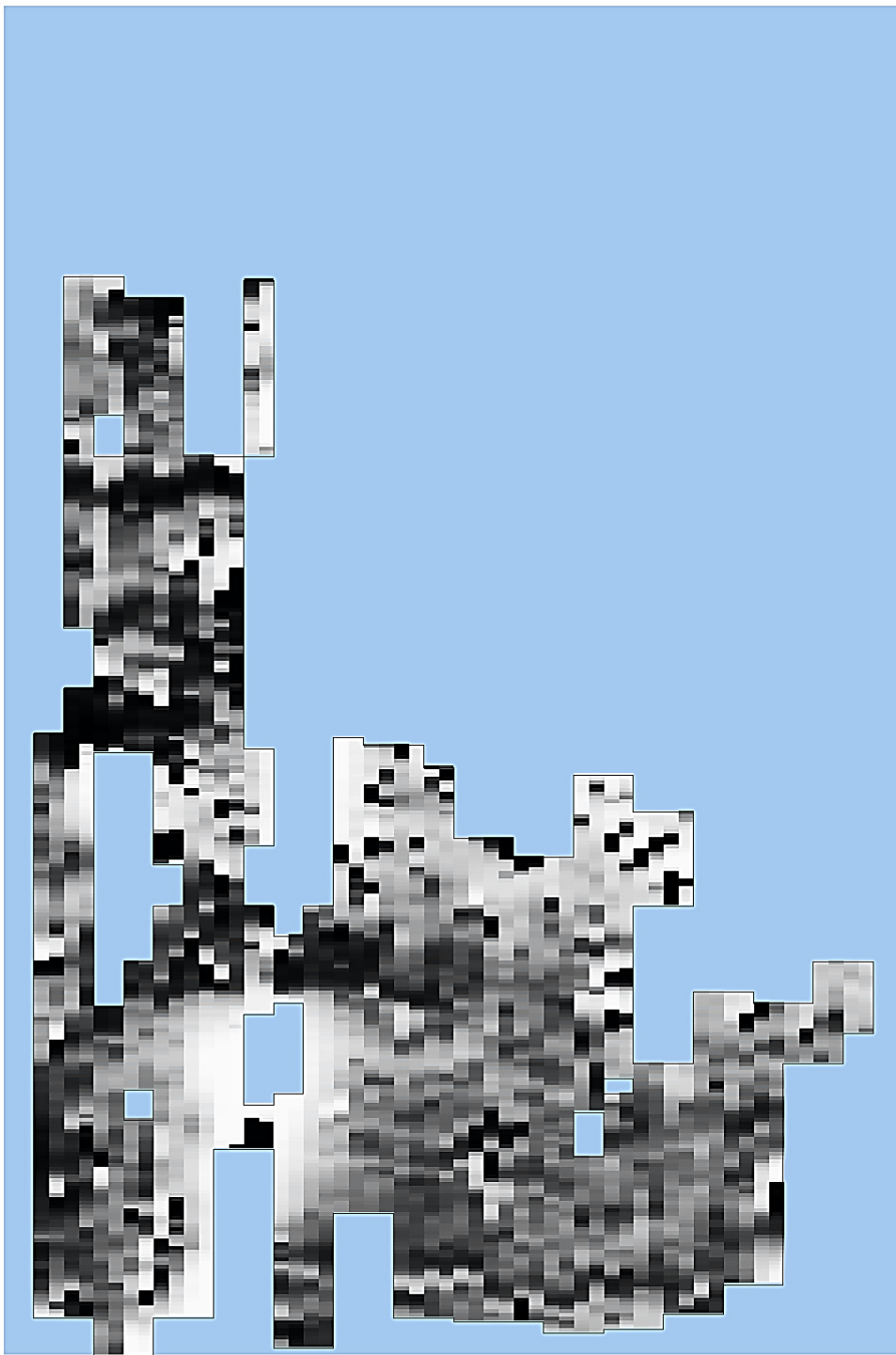
Geophysical survey: Copyright Substrata Limited.
 Base map: Ordnance Survey data © Crown copyright
 and database right 2017

Scale: 1:15000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
 Site at Tyringham Road, Lelant, Cornwall
 Centred on NGR (E/N) 154430,037213
 Report: 1705LEL-R-1

Figure 1: location map

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Instrument Type: Bartington Grad 601
 Units: nT
 Direction of 1st Traverse: 0 deg
 Collection Method: ZigZag
 Sensors: 2 @ 0.00 m spacing.
 Dummy Value: 32702
 Dimensions
 Grid Size: 30 m x 30 m
 X Interval: 0.25 m
 Y Interval: 1 m
 Stats
 Max: 3000.00
 Min: -3000.00
 Std Dev: 443.21
 Mean: -37.59
 Median: -1.10
 PROGRAM
 Name: TerraSurveyor
 Version: 3.0.31.0

Processes: 1
 1 Base Layer

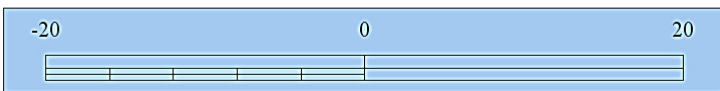


Figure 5: shade plot of unprocessed data

Appendix 2 Tables

County: Cornwall
 Parish: St. Ives
 Source: Heritage Gateway
 Site centre: 154430,037213

HER number	grid reference	designations	type	period	description	distance (m) from site centre	bearing (GN) from site centre
166472	SW 5424 3753		ANTI AIRCRAFT BATTERY	World War Two - 1939 AD to 1945 AD	This was a 40mm bofors gun on a Mk II platform with three Lewis Guns first mentioned in 20 June 1942. The site was built to protect Hayle Harbour, the power station and fuel factory	370	329
52764	SW 5461 3683		PIT	Post Medieval - 1540 AD to 1900 AD	A large circular pit, measuring approx. 23m in diameter, is visible both as a cropmark and earth and stone feature on aerial photographs and was plotted as part of the NMP. It is also recorded on 1907 OS 2nd Edition 1:2500 mapping.	423	155
169402	SW 542 376		FINDSPOT	Romano British - 43 AD to 409 AD	A Roman statera (steelyard) found while trenching in Fir Tree Field at Tree Nook Farm, in or about 1962. The steelyard is of bronze, with one hook detached and broken, and one hook missing. A lead weight on an iron pin, with bulbous end detached and broken. Also an iron nail found with the steelyard and considered to be contemporary.	450	329
52783	SW 5434 3768		PIT SPOIL HEAP	Post Medieval - 1540 AD to 1900 AD	The remnants of a circular pit and associated spoil heaps are visible on aerial photographs and were plotted as part of the NMP. These features are likely to be part of Wheal Towan mine (40404) which operated during the 1800s	476	349
31134.1	SW 54 37		Lann?	Early Medieval - 410 AD to 1065 AD	The place-name of Lelant contains the element 'lann', which suggests an early cemetery site in the vicinity of the present settlement. Graves and a building were discovered during the construction of the St Ives branch line in the latter part of the C19 (31061). This may indicate the original ecclesiastical site, which was moved to the present village and church site when the towns area became inundated with sand.	480	244
52763	SW 5439 3665		DRAINAGE SYSTEM	Post Medieval - 1540 AD to 1900 AD	Located at a cliff base at the Lelant Saltings Station are a series of linear cropmark and earth and stone of the NMP. The banks are the remains of a drainage system likely to be post-medieval in date	564	184
140942	SW 5482 3771		FORT?	Romano British - 43 AD to 409 AD	The form and shape of the Lelant Church churchyard (rectangular with rounded corners, a rampart 7m wide, 1.5m high and ditch 6m wide, 1.2m deep) may fossilise the platform of a Romano-British fort. The position overlooks Hayle estuary with views to St Ives and Godrevy and along the rivers to Angarrack and St Erth, the isthmus to Penwith, St Michael's Mount, St Hilary and Tolroy (which have Roman connections). The church is sited carefully within the graveyard and away from the village (this suggests an earlier existing enclosure). However, there have been no recorded RB finds from the churchyard.	632	38
52765	SW 5407 3668		SHAFT	Post Medieval - 1540 AD to 1900 AD	An oval earth and stone mound approx. 28m by 26m is visible on aerial photographs and was plotted as part of the NMP. Another large round mound is also visible at SW 5352 3645 which measures approx. 52m across. The features are the remains of shafts, post medieval in date.	643	214
52770	SW 5494 3764		FIELD SYSTEM?	Early Medieval to Modern - 410 AD to 2050 AD	A concentration of low earth banks form the remains of a rectilinear field system, visible on aerial photographs and plotted as part of the NMP. The banks enclose fields measuring on average 50m by 25m. The date of the field system is not known. It is possible that the field system has a medieval origin.	665	50
31124	SW 541 378		FIELD SYSTEM	Medieval - 1066 AD to 1539 AD Post Medieval - 1540 AD to 1900 AD	The field boundaries west of Lelant appear to be enclosed strips of a medieval open - field system. Recent map editions show that many of the hedge banks have been removed.	673	331
52773	SW 5392 3777		MOUND?	Post Medieval - 1540 AD to 1900 AD	Located on a south facing slope, a circular earth and stone mound measuring approx. 16m across, is visible on aerial photographs and was plotted as part of the NMP. The date and function of this feature is as yet undetermined. It may be mining related and have a post-medieval date	755	318

Table 1: Historic Environment Record entries though relevant to the geophysical survey

<p>Documents Survey methodology statement: Dean (2017)</p>	
<p>Methodology</p> <ol style="list-style-type: none"> 1. The work was undertaken in accordance with the survey methodology statement. The geophysical (magnetometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service (undated). 2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology. 	
<p>Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</p>	
<p>Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p>Data Capture <i>Sample Interval:</i> 0.25m <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN27</p>
<p>Data Processing, Analysis and Presentation Software IntelliCAD Technology Consortium IntelliCAD 8.0 DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office Excel 2013 Microsoft Corp. Office Publisher 2013 Adobe Systems Inc Adobe Acrobat 9 Pro Extended</p>	

Table 2: methodology summary

SITE Instrument Type: Bartington Grad-601 gradiometer Units: nT Direction of 1st Traverse: see below Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing. Dummy Value: 32702	
PROGRAM Name: TerraSurveyor Version: 3.0.31.0	
Stats Max: 18.04 Min: -22.22 Std Dev: 9.28 Mean: -0.90 Median: -0.09	Processes: 9 1 Base Layer 2 Clip at 1.00 SD 3 Clip at 1.00 SD 4 DeStripe Median Traverse: Grids: All 5 De Stagger: Grids: All Mode: Both By: -1 intervals 6 De Stagger: Grids: SubGrid (Area: Top 30, Left 0, Bottom 33, Right 119) Mode: Both By: -2 intervals 7 De Stagger: Grids: SubGrid (Area: Top 26, Left 0, Bottom 29, Right 119) Mode: Both By: -1 intervals 8 Interpolate: Match X & Y Doubled. 9 Clip at 1.00 SD

Table 3: processed data metadata