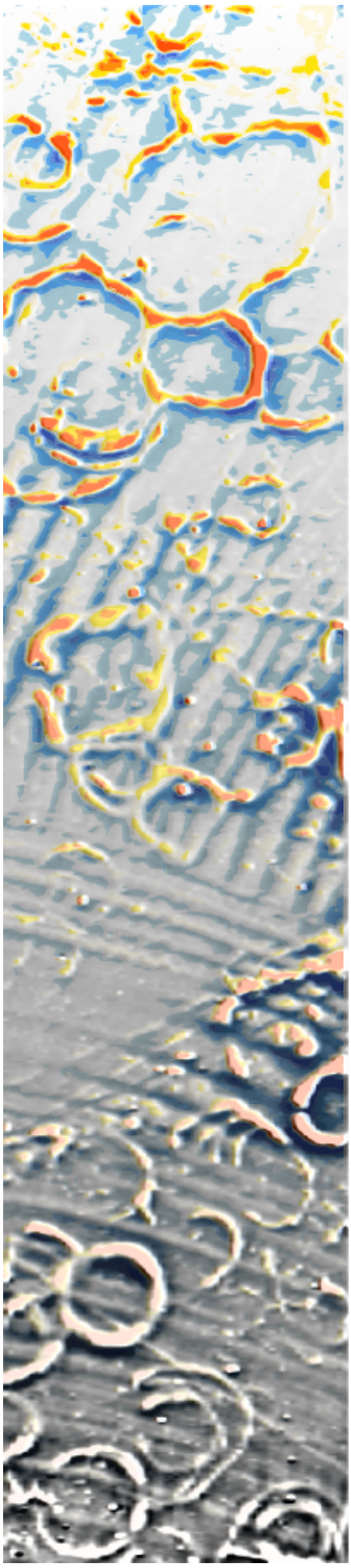

Dodman Point, Cornwall

Geophysical Survey Report

Produced for the National Trust

Unlocking Our Coastal Heritage Project

Project code NTC124

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Non-Technical Summary

A magnetic survey was commissioned by the National Trust to prospect land on Dodman Point for buried structures of archaeological interest, under the aegis of the Unlocking Our Coastal Heritage project.

A variety of buried structures have been found, mostly former elements of the extant field system, however, there is a scatter of earlier structures, including a barrow and some enclosure ditches. There is weak evidence in the northern part of the area for a possible prehistoric field system.

Digital Data

Item	Sent to	Sent date
CAD – Vector Elements	Jim Parry email	01/08/13

Audit

Version	Author	Checked	Date
Interim	MJR		
Draft Final	MJR, ACKR	ACKR	01/08/13
Final			
Revision			
OASIS			

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1 Introduction

Land at Dodman Point was surveyed using ArchaeoPhysica's sledge mounted caesium vapour magnetometer array as part of the National Trust's Unlocking our Coastal Heritage project, to prospect for buried structures of archaeological interest. This was to complement an earlier survey by GSB Prospection.

1.1 Location

Country	England
County	County
Nearest Settlement	St. Austell
Central Co-ordinates	200216, 39652

Approximately 12 hectares were surveyed across twelve pasture fields.

1.2 Constraints & variations

No constraints were encountered or variations necessary.

2 Context

2.1 Archaeology

The following information is quoted verbatim from the brief (Parry, 2012):

"The Dodman is the site of a large promontory fort or cliff castle formed by a large bivallate rampart ('the Bulwarks') up to 750m long crossing the headland and enclosing an area of at least 20 ha at the southern, seaward end. This form of monument is generally associated in Cornwall with the Iron Age (c.700 BC – 43 AD). Within the enclosed area lies a medieval strip field system, part-fossilised by later boundaries but also surviving as earthwork banks and lynchets between strips. Sketch surveys were made by Peter Sheppard in the 1970s and by Ann Preston-Jones in the 1990s.

A National Trust 'greyback' volume (National Trust 1986) briefly described the features then known from fieldwork and documentary evidence. The site was assessed in 2003 as part of English Heritage's Monument Protection Programme (MPP), as a result of which the area previously designated as a Scheduled Monument (SAM 590) was expanded considerably (SM 32970). Scheduling was previously confined to the ramparts and the field system on the plateau, but did not include the flanks; it now extends to the whole of the area of the headland within the promontory fort ramparts together with a small area outside on the western side. The revised scheduling incorporates a concise description of the visible archaeological remains, including the ramparts, two Bronze Age barrows, medieval field system, traces of quarrying, 'cliff gardens', a late eighteenth or early nineteenth century watch house or signal station and a late nineteenth century stone cross (see Appendix 3 for full listing).

Mapping of archaeological features on the Dodman from air photographs has been undertaken as part of English Heritage's National Mapping Programme (NMP). This resulted in the plotting of a number of linear features, most probably representing medieval and post-medieval divisions within the field system, together with three broadly circular features which may represent ditches associated with further barrows.

Geophysical surveys have been carried out over a substantial area inside and outside the Bulwarks in recent years (GSB Prospection 2004; 2005; 2006). This has confirmed the locations of ring ditches underlying two previously known barrows and revealed another penannular ditch nearby. It has also identified traces of probable prehistoric field systems in fields immediately outside the Bulwarks and of medieval and post-medieval field boundaries within the enclosed area on the headland. A possible internal quarry ditch has been located on the south side of the main bank of the Bulwarks, with clusters of anomalies possibly

representing pits nearby."

The last point about clusters of anomalies representing pits is worth re-visiting. At some sites there is an association between occupation debris and the areas just inside the defences and if this is also the case here then an alternative interpretation for the anomalies is that they represent a band of accumulated occupation debris.

2.2 Environment

Superficial 1: 50000 BGS	None recorded
Bedrock 1:50000 BGS	Early Devonian Dodman Formation - Siltstone and Mudstone, Interbedded (DMN)
Topography	Fairly level throughout
Hydrology	Mostly free draining although locally variable
Current Land Use	Pasture
Historic Land Use	Mixed agricultural
Vegetation Cover	Grassland
Sources of Interference	Fences, gates etc.

The Devonian bedrock is likely to support sufficient natural susceptibility enhancement to allow the detection of features cut into the bedrock or with fills containing former topsoil.

3 Methodology

3.1 Survey

3.1.1 Technical equipment

Measured variable	Magnetic flux density / nT
Instrument	Array of Geometrics G858 Magmapper caesium magnetometers
Configuration	Non-gradiometric transverse array (4 sensors, ATV towed)
Sensitivity	0.03 nT @ 10 Hz (manufacturer's specification)
QA Procedure	Continuous observation
Spatial resolution	1.0m between lines, 0.3m mean along line interval

3.1.2 Monitoring & quality assessment

The system continuously displays all incoming data as well as line speed and spatial data resolution per acquisition channel during survey. Rest mode system noise is therefore easy to inspect simply by pausing during survey, and the continuous display makes monitoring for quality intrinsic to the process of undertaking a survey. Rest mode test results (static test) are available from the system.

3.2 Data processing

3.2.1 Procedure

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

Process	Software	Parameters
Measurement & GNSS receiver data alignment	Proprietary	
Gridding	Surfer	Kriging, 0.25m x 0.25m
Reduction of diurnal and large spatial changes	Proprietary	2D highpass 50m
Imaging and presentation	Manifold GIS	

The initial processing uses proprietary software developed in conjunction with the multisensor acquisition system. Gridded data is ported as data surfaces (not images) into Manifold GIS for final imaging and detailed analysis. Specialist analysis is undertaken using proprietary software.

General information on processes commonly applied to data can be found in standard text books and also in the 2008 English Heritage Guidelines "Geophysical Survey in Archaeological Field Evaluation" at http://www.helm.org.uk/upload/pdf/Geophysical_LoRes.pdf.

ArchaeoPhysica uses more advanced processing for magnetic data using potential field techniques standard to near-surface geophysics. Details of these can be found in Blakely, 1996, "Potential Theory in Gravity and Magnetic Applications", Cambridge University Press.

All archived data includes process metadata.

3.3 Interpretation framework

3.3.1 Resources

Numerous sources are used in the interpretive process which takes into account shallow geological

conditions, past and present land use, drainage, weather before and during survey, topography and any previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available.

A report by GSB Prospection (Stephens, 2005) for adjacent areas of the headland was consulted.

3.3.2 Magnetic

Interpretative logic is based on structural class and examples are given below. For example a linear field or gradient enhancement defining an enclosed or semi-enclosed shape is likely to be a ditch fill, if there is no evidence for accumulation of susceptible material against a non-magnetic structure. Weakly dipolar discrete anomalies of small size are likely to have shallow non-ferrous sources and are therefore likely to be pits. Larger ones of the same class could also be pits or locally-deeper topsoil but if strongly magnetic could also be hearths. Strongly dipolar discrete anomalies are in all cases likely to be ferrous or similarly magnetic debris, although small repeatedly heated and in-situ hearths can produce similar anomalies. Reduced field strength (or gradient) linear anomalies without pronounced dipolar form are likely to be caused by relatively low susceptibility materials, e.g. masonry walls, stony banks or stony or sandy ditch fills.

3.4 Standards & guidance

All work was conducted in accordance with the following standards and guidance:

- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008.
- "Standard and Guidance for Archaeological Field Evaluation", Institute for Archaeologists, 2008.

In addition, all work is undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

All personnel are experienced surveyors trained to use the equipment in accordance with the manufacturer's expectations. All aspects of the work are monitored and directed by fully qualified professional geophysicists.

4 Catalogue

Label	Anomaly Type	Feature Type	Description	Easting	Northing
1	Linear enhanced dipolar	Fill - Ditch?	Uncertain, but possibly a former field boundary or field division given that the field system here is multiphase and highly modified. There appears to have been extensive use of strip cultivation in this area, perhaps used a flower fields	200127.6	40077.7
2	Linear enhanced dipolar	Fill - Ditch?	See [1], which is parallel	200129.2	40058.3
3	Linear enhanced dipolar	Fill - Ditch	See [1]	200181.6	40081.3
4	Linear enhanced dipolar	Fill - Ditch?	See [1]	200192.3	40077.3
5	Linear enhanced dipolar	Fill - Ditch?	This might relate to the former field boundary a few metres to the west	200150.2	40093.6
6	Linear enhanced (group)	Fills - Natural?	These anomalies are ambiguous and although they appear to define small enclosures they might also reflect aspects of the geological structure	199806.5	39874.5
7	Linear enhanced	Fill - Natural?	See [6]. This is a more major example, being wider and more magnetic and it is interesting that it has similarities with the interesting field shapes just here, which might suggest that it has or had some surface expression. A man-made origin is possible	199830.0	39861.4
8	Linear enhanced dipolar	Fill - Ditch	A narrow (<1m) ditch fill appears to broadly follow the course of [7], perhaps a field boundary reflecting a natural feature?	199827.6	39844.8
9	Linear enhanced dipolar	Fill - Ditch	See [8] which appears to be to the same feature	199854.6	39899.1
10	Linear enhanced dipolar	Fill - Ditch?	Narrow, less than 1m wide, unknown function	199854.6	39821.0
11	Linear enhanced	Fill - Ditch?	This appears not to be natural (although this is open to debate) and passes beneath the present field boundary. It is one of a set of ambiguous linears (see also [10] and [13]) in this area	199893.5	39789.2
12	Linear enhanced (group)	Fills - Natural? / ditches?	See [6]	199876.8	39863.0

13	Linear enhanced dipolar	Fill - Ditch	Narrow, less than 1m wide, unknown function but apparently closing off the southern end of the present field	199890.7	39768.6
14	Linear enhanced	Fill - Natural? / ditch?	See [6]	199906.6	39862.6
15	Discrete dipolar enhanced (sample)	Fill / natural - Pit? / rock?	Within this region of relatively uniform background magnetic field (smooth texture) some small (1 - 2m diameter) moderately magnetic discrete dipolar anomalies are apparent. These could be pit fills but could also be isolated magnetic stones. None that are highlighted are sufficiently magnetic to be likely to be ferrous debris	199999.8	39853.9
16	Linear enhanced dipolar	Fill? - Ditch?	See [13] which is an identical structure in a similar physical context	199970.5	39795.2
17	Linear enhanced dipolar (group)	Fills - Ditches	Although former field boundaries have not been catalogued these examples are highlighted because they include a series of small closes against the outside (north) of the rampart of the Iron Age promontory enclosure and might suggest the former presence of smallholdings	200019.7	39810.2
18	Linear enhanced	Fill - Ditch	This is interesting because it respects the small enclosures [17] and the likely cultivation headland [18] but then passes west as if to continue the line of [16] and perhaps also [13]. If so, a band of land about 25m wide has been enclosed along the northern side of the rampart	200024.0	39830.5
19	Area enhanced	Fill? / natural - Cultivation?	Former cultivation headland? Typically this could be a natural feature but it is apparently constrained between field boundaries which implies an artificial origin	199926.0	39668.2
20	Linear enhanced dipolar	Fill - Ring ditch	Of 14m diameter with an encircling ditch less than 1m wide. It is bisected by a later field boundary	200121.3	39743.2
21	Linear reduced	Structure - Path?	Possible path or former path - some of these thread like reduced field anomalies seem to connect or be aligned upon field gates	200049.0	39708.3
22	Linear reduced	Structure - Path?	See [21]	200074.4	39634.8
23	Area enhanced	Fill? / natural - Cultivation?	Similar to [19] but here not constrained by field boundaries	200064.5	39618.6
24	Linear reduced (group)	Structures - Paths?	See [21]	200073.2	39661.8
25	Linear reduced	Structure	Stony bank / ditch with peaty fill or wall footings? The anomaly is clear but interpretation is complicated because it appears to not relate to or respect the present or known former landscapes in any way	200005.4	39598.7

26	Linear enhanced	Fill - Ditch?	Cultivation feature - former field division?	200139.5	39638.8
27	Linear enhanced (group)	Fills - Ditches?	See [26]	200195.5	39631.3
28	Linear reduced	Structure? - Path?	Possible path or former path - some of these thread like reduced field anomalies seem to connect or be aligned upon field gates. See also [21]	200187.5	39565.0
29	Linear reduced	Structure? - Path?	See [28]	200210.2	39580.9
30	Linear reduced	Structure	Service?	200237.9	39551.9
31	Linear reduced	Structure	Service? This looks as though it also passes through the field to the north but if so it is obscured by former cultivation furrows	200249.9	39530.5
32	Linear enhanced	Fill / structure - Ditch?	Service or boundary division? This and [31] run alongside a service apparently connected to an infrastructure installation further out on the headland	200259.4	39551.5
33	Linear reduced	Structure?	Service?	200274.5	39551.1
34	Linear enhanced	Fill - Cultivation?	A band of magnetic ground, approximately 4m wide and parallel to two other and a former field boundary. A cultivation features seems a plausible interpretation	200284.8	39551.9
35	Linear enhanced	Fill - Cultivation?	See [34]	200295.5	39554.7
36	Linear enhanced	Fill - Cultivation?	See [34]	200307.0	39558.2
37	Linear enhanced dipolar	Fill - Ditch	Enclosure ditch, unknown purpose and less than 1m wide so probably agrarian	200155.8	39453.1
38	Linear enhanced dipolar	Fill? - Ditch?	Uncertain	200282.4	39457.0
39	Linear enhanced dipolar	Fill - Ditch	See [42] which is probably a similar feature. This fill is a little over 1m wide	200309.4	39471.7
40	Linear enhanced	Fill - Cultivation / ditch?	Between 3m and 4m this band of magnetic ground might be the base of a former lynchet or similar land division	200309.8	39456.6
41	Linear reduced	Structure	A possible stony / sandy strip approximately 1m wide, perhaps an element of a former field boundary, division or cultivation	200312.6	39446.3
42	Linear enhanced dipolar	Fill - Ditch	Narrow (< 1m) wide fill, perhaps part of a previous field system. It is parallel to [39], [40] and [41] which lends weight to this impression	200301.0	39436.0

5 Discussion

5.1 Introduction

The sections below first discuss the geophysical context within which the results need to be considered and then specific features or anomalies of particular interest. Not all will be discussed here and the reader is advised to consult the catalogue (ibid) in conjunction with the graphical elements of this report.

5.2 Principles

In general, topsoil is more magnetic than subsoil which can be slightly more magnetic than parent geology, whether sands, gravels or clays, however, there are exceptions to this. The reasons for this are natural and are due to biological processes in the topsoil that change iron between various oxidation states, each differently magnetic. Where there is an accumulation of topsoil or where topsoil has been incorporated into other features, a greater magnetic susceptibility will result.

Within landscapes soil tends to accumulate in negative features like pits and ditches and will include soil particles with thermo-remanent magnetization (TRM) through exposure to heat if there is settlement or industry nearby. In addition, particles slowly settling out of stationary water will attempt to align with the ambient magnetic field at the time, creating a deposit with depositional remanent magnetization (DRM).

As a consequence, magnetic survey is nearly always more a case of mapping accumulated magnetic soils than structures which would not be detected unless magnetic in their own right, e.g. built of brick or tile. As a prospecting tool it is thus indirect. Fortunately, the mechanisms outlined above are commonplace and favoured by human activity and it is nearly always the case that cut features will alter in some way the local magnetic field.

5.2.1 Instrumentation

The use of the magnetic sensors in non-gradiometric (vertical) configuration avoids measurement sensitisation to the shallowest region of the soil, allowing deeper structures, whether natural or otherwise to be imaged within the sensitivity of the instrumentation. However, this does remove suppression of ambient noise and temporal trends which have to be suppressed later during processing. When compared to vertical gradiometers in archaeological use, there is no significant reduction in lateral resolution when using non-gradiometric sensor arrays and the inability of gradiometers to detect laminar structures is completely avoided.

Caesium instrumentation has a greater sensitivity than fluxgate instruments, however, at the 10 Hz sampling rate used here this increase in sensitivity is limited to about one order of magnitude.

The array system is designed to be non-magnetic and to contribute virtually nothing to the magnetic measurement, whether through direct interference or through motion noise. There is, however, some limited contribution from the towing ATV.

5.3 Character & principal results

5.3.1 Geology

The background texture of the magnetic data is fairly uniform and most visible in the northern parts of the site, coincidently outside the IA defended area. Elsewhere the same texture is overlaid by strong broad striation from former cultivation and relict boundaries. Indeed, most texture evident at the site is due to the combination of ancient and more recent cultivation.

Overall anomaly strengths are significant which is in keeping with soils derived from Devonian rocks in this area.

5.3.2 Land use

A striking aspect of the result is the large number of removed boundaries that between them further sub-divide the strip field system evident at the site. Some strips are only about 20m wide, others slightly wider. Most of the western examples are orientated northeast - southwest but there are signs that in the eastern (not surveyed) part of the headland they may have been aligned north - south. In the southeast corner there are signs of east-west aligned ridge and furrow (or similar, e.g. lazy bed) cultivation.

Within some of the strips there are apparently ad hoc lateral divisions separating strips into blocks. One of these is a Cornish hedge but most seem just to be single ditches.

There are signs that the strips once continued westwards into the scrubby clifftop areas. The geophysical data has revealed few signs of previous field systems which might suggest that the headland was open ground prior to the enclosure of the strip fields. Whether these individual fields represent consolidation of holdings across earlier strips, or were established from the start as fields, is uncertain.

5.3.3 Archaeology

Much that has been found appears to relate to the former and partly extant strip field system although discrete anomalies associated with early features are evident. Obvious examples include ring ditch [20], probably a small (c. 15m diameter) barrow and close to another example detected by an earlier survey (Stephens, 2005) in the adjacent field.

At the northern end of the site a complex [6], [12] and [14] of enhanced field linear anomalies might have a natural origin, or might represent the remains of prehistoric enclosures. If the latter, the anomalies might present ditches or shallow bodies of buried former topsoil, e.g. small lynchets formed by colluvium accumulated against boundaries and since levelled.

Further south [10] and [11] might, in this context, represent parts of the same complex although their identification as such would necessarily be tentative at best.

Short elongated areas of enhanced magnetic fill [19] and [23] may be natural but could also represent discrete areas of past activity resulting in either modification of the soil through heat or by broad fills. On balance [23] seems more likely to be natural than [19] and is perhaps due to an intrusive structure within the Dodman Formation.

At the southern end of the site there are various linear fills that appear to be of interest. Ditch [37] could easily be a section of enclosure ditch from an earlier field system and fills [39] and [42] to the east might be further elements of the same complex or parts of another.

5.4 Conclusions

The survey has shown that a variety of buried structures exist, especially former elements of the extant field system and others that may be related. There is a scatter of structures of definitely or potentially earlier date, in particular a ring ditch, probably a barrow, and several isolated ditch fills that self evidently are not elements of any known field system.

5.5 Caveats

Geophysical survey is a systematic measurement of some physical property related to the earth. There are numerous sources of disturbance of this property, some due to archaeological features, some due to the measuring method, and others that relate to the environment in which the measurement is made. No disturbance, or 'anomaly', is capable of providing an unambiguous and comprehensive description of a feature, in particular in archaeological contexts where there are a myriad of factors involved.

The measured anomaly is generated by the presence or absence of certain materials within a feature, not by the feature itself. Not all archaeological features produce disturbances that can be detected by a particular instrument or methodology. For this reason, the absence of an anomaly must never be taken to mean the

absence of an archaeological feature. The best surveys are those which use a variety of techniques over the same ground at resolutions adequate for the detection of a range of different features.

Where the specification is by a third party ArchaeoPhysica will always endeavour to produce the best possible result within any imposed constraints and any perceived failure of the specification remains the responsibility of that third party.

Where third party sources are used in interpretation or analysis ArchaeoPhysica will endeavour to verify their accuracy within reasonable limits but responsibility for any errors or omissions remains with the originator.

Any recommendations are made based upon the skills and experience of staff at ArchaeoPhysica and the information available to them at the time. ArchaeoPhysica is not responsible for the manner in which these may or may not be carried out, nor for any matters arising from the same.

5.6 Bibliography

Parry, 2012, "Unlocking Our Coastal Heritage Project: The Dodman, Nr Mevagissey, Cornwall – Brief for Geophysical Survey", the National Trust, unpublished

Stephens, 2005, "Geophysical Survey Report 2005/24 – Dodman Point ll", GSB Prospection, unpublished

5.7 Acknowledgements

Jim Parry, National Trust archaeologist, and the National Trust wardens are thanked for their help and support throughout the survey.

6 Appendices

6.1 Project metadata

Project Name	Dodman Point, Cornwall
Project Code	NTC124
Client	the National Trust
Fieldwork Dates	23rd - 24th May 2013
Field Personnel	D Rouse, G Britton
Data Processing Personnel	ACK Roseveare
Reporting Personnel	MJ Roseveare, ACK Roseveare
Draft Report Date	31st July 2013
Final Report Date	

6.2 Qualifications & experience

All work is undertaken by qualified and experienced geophysicists who have specialised in the detection and mapping of near surface structures in archaeology and other disciplines using a wide variety of techniques. There is always a geophysicist qualified to post-graduate level on site during fieldwork and all processing and interpretation is undertaken under the direct influence of either the same individual or someone of similar qualifications and experience.

ArchaeoPhysica meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel". The company is one of the most experienced in European archaeological prospection and is a key professional player. It only employs people with recognised geoscience qualifications and capable of becoming Fellows of the Geological Society of London, the Chartered UK body for geophysicists and geologists.

6.3 Safety

Safety procedures follow the recommendations of the International Association of Geophysical Contractors (IAGC).

Principal personnel have passed the Rescue Emergency Care – Emergency First Aid course and CSCS cards are being sought for those members of staff currently without them.

All personnel are issued with appropriate PPE and receive training in its use. On all sites health and safety management is performed by the Project Geophysicist under supervision by the Operations Manager.

Health and safety policy documentation is reviewed every 12 months, or sooner if there is a change in UK legislation, a reported breach of such legislation, a reported Incident or Near Miss, or changes to ArchaeoPhysica's activities. Anne Roseveare, Operations Manager, has overall responsibility for conducting this review and ensuring documentation is maintained.

We are happy to confirm that ArchaeoPhysica has suffered no reportable accidents since its inception in 1998.

6.4 Archiving

ArchaeoPhysica maintains an archive for all its projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by ArchaeoPhysica on all material it has produced, the client having full licence to use such material as benefits their project.

Archive formation is in the spirit of Schmidt, A., 2001, "Geophysical Data in Archaeology: A Guide to Good Practice", ADS.

Access is by appointment only. Some content is restricted and not available to third parties. There is no automatic right of access to this archive by members of the public. Some material retains commercial value and a charge may be made for its use. An administrative charge may be made for some enquiries, depending upon the exact nature of the request.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

In addition, there are paper elements to some project archives, usually provided by the client. Nearly all elements of the archive that are generated by ArchaeoPhysica are digital.

It is the client's responsibility to ensure that reports are distributed to all parties with a necessary interest in the project, e.g. local government offices, including the HER where present. ArchaeoPhysica reserves the right to display data from projects on its website and in other marketing or research publications, usually with the consent of the client. Information that might locate the project is normally removed unless otherwise authorised by the client.