Report No: 2012R002

# Four Burrows solar farm, Cornwall

## Summary report on geophysical survey

**Historic Environment Projects**

# Four Burrows solar farm, Truro, Cornwall

## Summary report on geophysical survey

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| **Client** | **Low Carbon Developers** |
| **Report Number** | **2012R002** |
| **Date** | **20 January 2012** |
| **Status** | **Final** |
| **Report author** | **Adam Sharpe BA MIfA** |
| **Checked by** | **Andrew Young, Historic Environment Projects Manager** |
| **Approved by** | **Andrew Young, Historic Environment Projects Manager** |

Historic Environment, Cornwall Council
Kennall Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY
tel (01872) 323603 fax (01872) 323811 E-mail hes@cornwall.gov.uk
www.cornwall.gov.uk

**Acknowledgements**

This study was commissioned by Alex Herbert or Low Carbon Developers and carried out by Historic Environment Projects, Cornwall Council.

The geophysical survey was undertaken by Martin and Anne Roseveare, Archaeophysica Ltd.

The views and recommendations expressed in this report are those of Historic Environment Projects and are presented in good faith on the basis of professional judgement and on information currently available.

**Freedom of Information Act**

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

Historic Environment, Cornwall Council is a Registered Organisation with the Institute for Archaeologists

**Cover illustration**

The scheduled Callestock Barrow, viewed from the south-west.

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# Abbreviations

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| CRO | Cornwall County Record Office |
| EH | English Heritage |
| HER | Cornwall and the Isles of Scilly Historic Environment Record |
| HE | Historic Environment, Cornwall Council |
| NGR | National Grid Reference |
| OS | Ordnance Survey |
| PRN | Primary Record Number in Cornwall HER |

# 1 Summary

Proposals were under consideration for an application for a solar farm at Callestick (Four Burrows) in early 2010, but these initial proposals were abandoned and the scheme was not submitted for planning permission, although an archaeological assessment of the proposal (Sharpe 2010) was produced. The development of this site is now being reconsidered by Low Carbon Developers. In view of the presence of a scheduled bronze age barrow in the north-eastern corner of the site, the Historic Environment Planning Advice Officer (Mid Cornwall), requested that the field within which this barrow is sited be subjected to magnetometer survey to determine the presence or absence of any detectable sub-surface archaeology within its vicinity.

A brief for archaeological recording was issued by the HEPAO, setting out the minimum requirements for archaeological recording at Four Burrows in advance of an application for planning permission for a solar farm, based on the need to assemble the evidence base necessary to identify those heritage assets which would be impacted upon by the development, to identify their significance, and to identify any likely impacts on their settings, whether direct or indirect. Historic Environment Projects, Cornwall Council was commissioned to undertake a re-assessment of the site, drawing together the results of the 2010 assessment and the geophysical survey of the north-eastern field undertaken in late 2011 by Archaeophysica Ltd.

The north-eastern field incorporates a scheduled, though truncated, bronze age barrow into its south-eastern boundary, whilst NMP aerial photo plots suggested a cropmark feature to its south-west.

The 2011 geophysical survey did not confirm the existence of the cropmark features, though did reveal a series of rather fragmentary linear features, together with a probable barrow defined by ring ditch adjacent to the field's north-eastern boundary and another possibly similar (though less well defined) feature adjacent to the north-western boundary of the field.

The report included management recommendations to safeguard the northern ring ditch through exclusion from the development area. The other features were judged likely on the basis of the available evidence to be so poorly preserved that it would not be commensurate to exclude them from the development area, though surface mounts were recommended for the arrays to be sited over the other possible barrow. English Heritage provided advice on the size of a suitable buffer between the scheduled monument and the solar farm, and indicated that they would expect the developer to assist in a programme of improvement works to the barrow.


*Fig 1. The location of the proposed Four Burrows solar farm within the context of west Cornwall.*

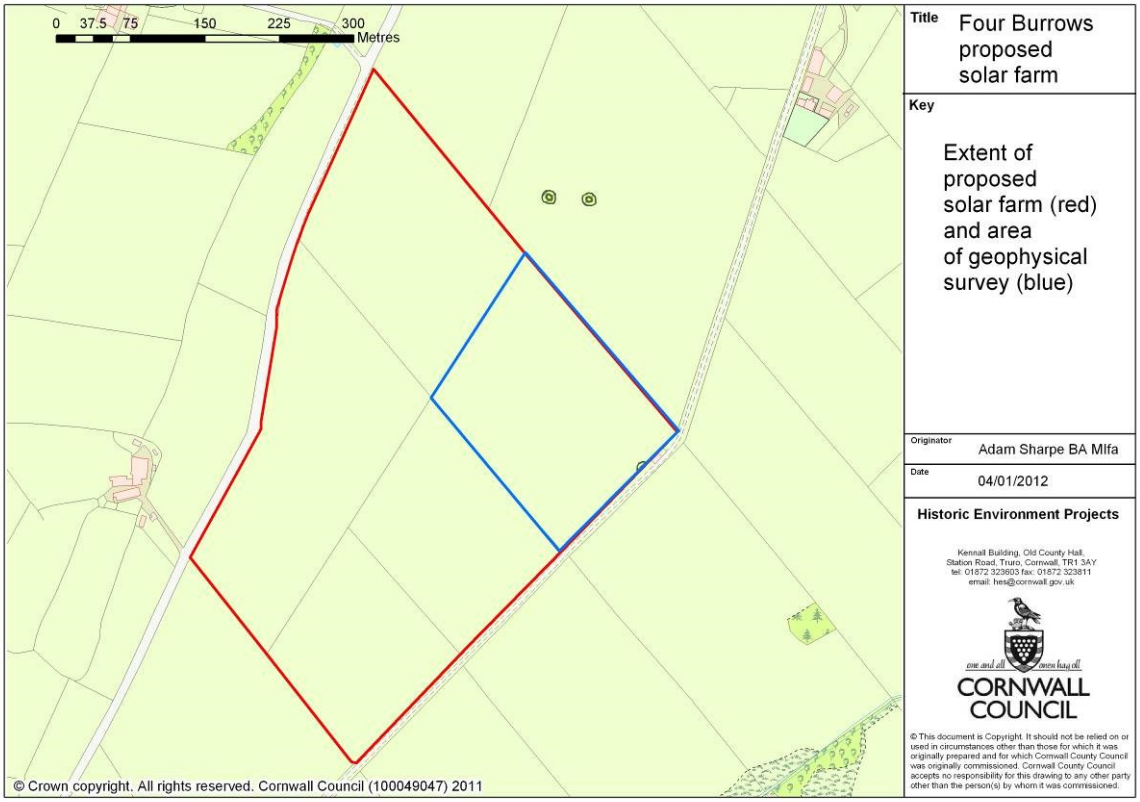


*Fig 2. The extent of the proposed Four Burrows solar farm (red) and the extent of geophysical survey (blue).*

# 2 Introduction

## 2.1 Project background

Proposals were under consideration for an application for a solar farm at Callestick (Four Burrows) in early 2010, but these initial proposals were abandoned and the scheme was not submitted for planning permission. This development of this site is now being reconsidered by Low Carbon Developers. As a result of the recommendations within the original assessment of the site (Sharpe 2010), the north-easternmost of the five fields at Four Burrows had been removed from the area proposed for development given the potential for the below ground survival features associated with the scheduled barrow adjacent to the hedge on the eastern side of the field.

As part of the 2011 proposals, this field is to be re-integrated into the development site (Fig 10). As a result, Dan Ratcliffe, Historic Environment Planning Advice Officer (Mid Cornwall), requested that this field be subjected to magnetometer survey to determine the presence or absence of sub-surface archaeology adjacent to the scheduled barrow.

A brief for archaeological recording was issued by the HEPAO, setting out the minimum requirements for archaeological recording at Four Burrows in advance of an application for planning permission for a solar farm. The brief was based on the need to assemble the evidence base necessary to identify those heritage assets which would be impacted upon by the development, to identify their significance, and to identify any likely impacts on their settings, whether direct or indirect. Historic Environment Projects, Cornwall Council was commissioned to undertake a re-assessment of the site, drawing together the 2010 assessment and a geophysical survey of the north-eastern field undertaken in late 2011 by Archaeophysica.

## 2.2 Aims

The principal aim of the study was to gain a better understanding of the impacts which would result from the construction of a solar farm at Four Burrows, Cornwall.

The objectives were to identify the archaeological potential and significance of the site and to provide the client with advice on the impacts of the proposed development and any mitigation which would be likely to be required should the development proceed.

A further objective was to satisfy the requirements of PPS5 HE6 (information requirements).

The aims of the archaeological geophysical survey were to:

- Undertake an archaeological magnetometer survey
- Produce a report containing the geophysical data and the data in interpreted form
- Inform whether an archaeological evaluation or further archaeological recording of any potential buried remains is recommended.

## 2.3 Methods

### 2.3.1 Desk–based assessment

During the desk-based assessment (DBA) undertaken in 2010, historical databases and archives were consulted in order to obtain information about the history of the site and its surroundings, and the structures and features that were likely to survive within the site boundaries. The main sources consulted were as follows:

- Published sources available at the Cornwall and Scilly HER
- Historic maps including
    - Joel Gascoyne's map of Cornwall (1699)
    - Thomas Martyn's map of Cornwall (1748),

  - OS 1 inch survey (c1810)
  - Perranzabuloe Tithe Map (c1840),
  - 1st and 2nd Editions of the OS 25 inch maps (c1880 and c1907)
- Modern maps
- National Mapping Programme transcripts from aerial photographs
- Other aerial photographs in the Cornwall and Scilly HER
- Historic Landscape Characterisation mapping.
- Cornwall and Scilly Historic Buildings, Sites and Monuments Record (HBSMR)
- Information held as GIS themes on the Cornwall and Scilly HER

The historical and landscape context of the site was also considered during this stage of the assessment in order to establish the likely nature and type of the impacts on heritage assets which would occur within the area surrounding the proposed solar farm.

The principal methodology used to assess impact on the settings of heritage assets within the surrounding landscape in 2010 consisted of the use of computer-generated viewsheds.

A walk-over survey was carried out in 2010 both to determine the presence or absence of archaeological sites within the project area and to field check the Zone of Theoretical Visibility (ZTV) generated by the viewshed analysis to determine impacts on the settings of heritage assets. With the exception of the scheduled barrow and the boundaries enclosing and sub-dividing the site, no archaeological features were found.

### 2.3.2 Fieldwork – geophysical survey

A geotechnical survey of the north-eastern field at the Four Burrows site has been commissioned by Low Carbon Developers from Archaeophysica, and its results are summarised in this report.

Geometrics MagMapper G858 caesium vapour magnetometers were used for the survey, using a high performance sledge mounted acquisition system. The four sensors were sited approximately 0.3m above the ground surface to maximise sensitivity while decreasing the strengths of anomalies from surface, whilst a line separation of 0.5m was used. The along line interval was approximately 0.25m following English Heritage guidance. As the ground conditions were suitable the instruments were deployed as an array mounted on a specially constructed nonmagnetic high performance sledge towed by a quad bike, offering a faster rate of coverage, less contact with the ground and a stable measurement platform. The sled-based approach avoids the need for extensive grid set out because real time tracking is provided by a GNSS receiver mounted on the sledge. Coverage can be guided by real time track plotting visible to the driver who also monitors instrument data, positioning quality and survey resolution through continuous display on a ruggedized laptop mounted on the quad.

The field data was subjected to normal potential field processing techniques including reduction of the background regional field and splitting of the resultant residual field into different depth models through analysis in the frequency domain, yielding a shallow data set modelling anomalies likely to originate within the upper 3m of ground and also a pseudo-gradient data set which models the response of a 1m vertical gradiometer.

The data was presented as a series of greyscale images overlaid onto map data georeferenced to the Ordnance Survey grid. A separate catalogue map graphically highlights the most significant anomalies regardless of their origin and also provides a numerical key to a detailed anomaly catalogue included within the Archaeophysica report. Significant aspects of the results are discussed, and were accompanied by a

detailed methodological description, and justification and analysis of the geophysical environment and its impact upon or presence within the data.

The geophysics report has been made available to Historic Environment Projects, Cornwall Council, and its findings have been incorporated into the HEP assessment report (this report) and will form the basis of recommendations for any further investigative work or other archaeological mitigation required on the site.

### 2.3.3 Post-fieldwork

On completion of the project and following review with the HE Project Manager the results of the study were collated as an archive in accordance with: *Management of Research Projects in the Historic Environment (MoRPHE) English Heritage 2006*. The site archive will initially be stored at ReStore, with the eventual aim of deposition at Cornwall Record Office.

An archive report (this report) has been produced and supplied to the Client. This report will be lodged with the Cornwall and Scilly Historic Environment Record (HER) and made available for public consultation once a planning application for the site has been made. A copy of the report will be supplied to the National Monuments Record (NMR) in Swindon, to the Courtney Library of the Royal Cornwall Museum and to the Cornish Studies Library. All digital records will be filed on the Cornwall Council network.

An English Heritage/ADS online access to the index of archaeological investigations (OASIS) record has been made covering this assessment project.

# 3 Location and setting

The site proposed for the Four Burrows solar farm is centred at SW 76459 49624, and consists of five large fields extending to 81,175m$^2$ (8.17 Ha) immediately to the east of the A3079 road from Chiverton Cross to Newquay (see Figs 1 & 2). A former farm track defines the eastern edge of the area proposed for the site. The proposed solar farm is at an average of 110m OD, occupying a level site on a ridge of land which slopes to the west and south along which the A3079 runs from south-west to north-east. The land falls away towards a small valley to the north east occupied by Little Lambriggan and another to the south east occupied by Callestick Vean.

The field forming the north-easternmost of this group was subjected to geophysical survey during December 2011.

## 3.1 Geology and soils

The British Geological Survey (BGS GIS datasets) records the bedrock geology of the site as being mudstones and sandstones of the Gramscatho Group dating from the mid to the late Devonian period.

The soils are Denbigh 2, which are described as loams overlying shale bedrock. These are generally well-drained but some finer soils in this type can be adversely affected by groundwater. This soil type tends to be used for dairying in the lowlands and for stock rearing on higher ground.

## 3.2 Historic Landscape Characterisation

(See Fig 8)

The Historic Landscape Characterisation of the land proposed for the solar farm at Four Burrows is Recently Enclosed Land (Post-Medieval), that is, land which was, during the medieval period, open downland, but which was subsequently enclosed during the creation of new farms or as a result of the expansion of existing farms into adjacent downland (Herring 1994). Fields of this type are typically large, rectilinear and have grid-like patterns of field boundaries. Some of the surrounding upland area remained open during this period, and was enclosed during the 20$^{th}$ century (REL 20$^{th}$ century),

whilst there are small pockets of Anciently Enclosed Land (AEL) to the east which were probably enclosed during the medieval period. The presence of a round within REL a little to the north at Callestock Veor (MCO7693) and a nearby Middle Bronze Age house both lying close to one of these areas of AEL suggests that this area of upland lay very close to land which had been occupied throughout later prehistory and would have provided important unenclosed upland grazing during this period. The land at Four Burrows remained open downland during the medieval period.

The site was recorded by the Ordnance Survey in 1809 (Fig 3) and the Perranzabuloe Tithe Map of 1840 (Fig 4) as being part of Penhallow Downs, an area of former downland which the OS mapping dating to *circa* 1877 (Fig 5) shows was subsequently completely taken into agricultural use.

Recent Cornwall County Council vertical aerial photographs (Fig 11) showed the area proposed for the solar farm as having recently being in arable use, though most of the surrounding land was under pasture; no trace of the cropmark features recorded by the NMP (Fig 6) were visible on this source.

# 4 Designations

## 4.1 National

Bronze Age barrow (HER MCO2297) which is sited just to the south-east of the northern corner of the application site was designated as a scheduled monument (National Monument 29620) on 26 January 1973.

Other significant heritage assets within the landscape neighbouring the proposed site include the scheduled extant elements of the Four Burrows barrow cemetery 1Km to the south (MCO2600, MCO2601, MCO2602, MCO2603, SM 29602), the documented and cropmark elements of this barrow cemetery (MCO31940) and the three barrows documented just to the east (MCO1919), the scheduled Creeg Tol barrow at Silverwell 1.25Km to the southwest (MCO2498, SM 29621), two scheduled ploughed down barrows in the fields immediately to the north of the site (MCO2845 and MCO2846, SM 29619, see Fig 7 for location) and a scheduled round at Callestick Veor (MCO7693, SM 32944) just under one Km to the north.

## 4.2 Regional/county

No regional or county designations apply to the site or to the landscape within 1Km of its boundary.

# 5 Access

The land is bordered to the north-east by the A3079 and to the south-west by a farm track which is currently a bridleway. There is no formalised public access into or through the area proposed for the solar farm.

# 6 Current land use

The fields proposed for the solar farm at Four Burrows have tended to be used either for arable production or sheep grazing within recent years.

# 7 Site history

The site of the proposed solar farm occupies an area formerly known as Penhallow Downs, an area of open downland extending to about 2,645,000 $m^2$ (2,645 Ha) in 1809 and aligned north-east – south-west between Penhallow, Callestick and Four Burrows

(Fig 3). This large area of unenclosed land is shown on Martyn's Map of 1748, though is not named in this source. The name Penhallow probably derives from the Cornish *Pen* meaning end and *Hal* meaning a low-lying rather poorly-drained area, almost certainly the valley to the north-west of Penhallow.

Such open, elevated areas of downland would typically have been used as open commons in prehistory, farming settlements in the surrounding lowlands having mutually agreed rights to make use of them as open grazing land, as hunting grounds and as sources of fuel. These rights persisted through to the medieval period when they were codified. Such downland might witness occasional episodes of small scale and more intensive agricultural use during periods of land pressure or improved climate, areas of prehistoric and medieval outfields being found on the fringes of such uplands. There are, however, no surviving indications that this was the case on Penhallow Downs itself, though a round (a late prehistoric enclosed farmstead) is sited a little to the north of Callestick Veor (MCO7693, scheduled monument 32944), close to the site of a middle bronze age house.

As well as open grazing land, these elevated downs were also frequently the sites of often visually prominent barrows or barrow groups during the Bronze Age, these ceremonial sites being associated with kin groups in the surrounding lowlands. Other ceremonial and funerary activities are known to have taken place in the vicinity of these upstanding monuments, but these tend to leave no above-ground traces, and are generally only detected and recorded through geophysical survey or through open area archaeological excavation in advance of developments. The process of improvement of such downland during the 19$^{th}$ century was often achieved using deep ploughing, sometimes employing ploughs worked between paired traction engines; where this occurred it often resulted in the destruction of much of the formerly-surviving shallow sub-surface archaeology. It is not known, however, whether such methods of agricultural improvement were used at Penhallow Moor, and, in the absence of evidence to the contrary, it should be assumed that sub-surface archaeology, if formerly present, will survive to some degree.

One such barrow, formerly known as 'Callestock Barrow' is sited within the area proposed for the solar farm (Fig 9), though it has been historically truncated on its south-eastern side by the creation of a farm lane. With the exception of a pair of cropmark parallel banks and a mound (MCO31932) in the eastern part of the area proposed for the solar farm, the HER does not show any additional features. However, the aerial photo plot (Fig 6) derived from aerial photographs dating from 1946 to the present day depicts a series of circular features in the landscape immediately to the south-east. Some of these may be small, ploughed out mine shafts associated with the nearby Callestick and Perran Wheal Virgin lead mine (MCO11910) or its extension to the north, Great Callestock mine (MCO12126); others have the appearance of prehistoric enclosures, suggesting that there is the potential for buried archaeological features deriving from early settlement or related activity on the fringes of the Downs, and perhaps extending up onto them. Parallel linear features near Heather Farm immediately to the east of the Downs have the appearance of ploughed out medieval outfield banks; again, this activity might have extended further onto the Downs than is suggested by the aerial photo record.

A process of map regression helps to understand the recent landscape history of Penhallow Downs. By 1809 (OS mapping, Fig 3) the process of enclosure of the downland between Truro, St. Agnes and Mitchell was already well under way, and Penhallow Downs was one of the last large blocks of remnant downland in this area. The 1809 OS mapping shows it to have been fringed by enclosed land, some of this being former medieval farmland, but the majority was made up of grids of field boundaries extending across considerable areas of the landscape, indicating relatively recent intake, probably during the decades immediately predating this mapping. The mapping conventions used by the OS for the 1809 mapping suggest that the Downs

were in rough, heathy grassland which was traversed on its western side by a track from Three Burrows (Chiverton Cross) to Penhallow.

The 1809 OS mapping did not depict Callestock Barrow (MCO2297) but did depict the pair of barrows to its north-east (MCO2845 and MCO2846), a further pair of now lost barrows to the north-east again (MCO2299), a now ploughed-down Iron Age round at Callestick Veor (MCO7693) at the northern end of the Downs, and an otherwise unrecorded probable barrow in recently enclosed land just to the west of the Downs at about SW 76318 50010.

By 1840, the Perranzabuloe Tithe Map (Fig 4) showed that Penhallow Downs had been renamed Callestock Common, which was recorded in the accompanying apportionment as being in heathy pasture. It can be seen from this mapping that little improvement of the Downs had occurred between 1809 and 1840.

By *circa* 1880, the OS 1st Edition 25" to the mile mapping (Fig 5) showed that Penhallow Downs had been completely improved to agriculture, having been parcelled up into large fields by a grid of field boundaries. A farm road had also been created across the Downs from Four Burrows to Callestock via Higher Callestock, in the process truncating Callestock Barrow. No changes to the arrangement of these fields was recorded on the 2nd Edition OS 25" mapping dating to 1908.

The surviving three barrows at Callestock were scheduled in 1973.

# 8 Archaeological sites recorded within the survey area

### Mound and linear features, HER No MCO31932, SW 76640 49538

The site consists of a pair of parallel ditches, each 140m long, which were mapped for the Cornwall Mapping Project by the National Mapping Project (NMP) team as cropmarks showing on vertical aerial photographs dating to 1946 (see NMP plot Fig 7). The south-easternmost of the ditches appears to be overlain by (or possibly to terminate on) a sub-rectangular ditched feature which may include an internal mound. This ditched feature measures 20m x 12m in plan, but is of uncertain function and date. No trace of this feature can be seen at surface, though it appears to occupy a low knoll on the high ground adjacent to the extant barrow (below).

### Bowl Barrow 425m south west of Higher Callestick Farm, HER No MCO2297, Scheduled Monument 29620 (DCO911), SW 76712 49549

This barrow near Higher Callestock Farm was noted in the scheduling description as being '*first described by Thomas in 1851 as Callestock Barrow'*. The barrow was, at the time, described as being 55 feet (16.76m) in diameter. Prior to the enclosure of the downland this would have been a prominent feature on the crest of the ridge, and was one of a group making up a small barrow cemetery on Penhallow Downs. In turn, this cemetery was one of several in the former downland landscape between St. Agnes Beacon, Truro and Mitchell on hilltop and ridgetop locations which would have been mutually intervisible during the period in which they were constructed. The barrow groups would have continued to have been significant landscape features until the loss of the downland in which they stood during the late 18th century during a significant expansion of enclosed farmland in this part of Cornwall in reaction to a rapid expansion of the mining and urban population of the County at the time. Over time, agricultural activity would have resulted in the wholesale removal or the gradual ploughing down of many of the surviving barrows.

Callestock Barrow was cut in half during the creation of a farm track across Penhallow Downs when this area was enclosed to agriculture. The surviving part of the barrow is noted as having a diameter of 20m and a height of 2.0m and butts the hedge bounding the farm trackway to the south-east, projecting 4.5m into the field. The scheduling

description notes that '*the site is barely visible on vertical aerial photographs'* and that it '*has a dip around the edge where the plough has come too close*'. The barrow was scheduled on 26 January 1973 as Cornwall 826. The scheduling was revised in 1997 and its national number is now 29620.

The barrow is currently very overgrown with brambles, gorse and other scrub; ploughing has taken place up to its edge, exposing some large pieces of quartz which might be part of its original construction or alternatively the result of field clearance. It is unclear whether the barrow originally had an external ditch. If so, this has become infilled. Agricultural rubbish has been dumped around the periphery of the barrow.

During the Bronze Age, barrow cemeteries were highly important elements of the cultural landscape of Cornwall, representing as they did combinations of deliberately highly-visible territorial markers, ancestral shrines and the focii for a range of ceremonial activities carried out by kin groups and clans. Such sites existed in what had long been open landscapes, within which they were the most visible and significant elements.

During the succeeding Iron Age and the Romano-British period which followed, despite what were probably very considerable changes in culture and beliefs, as well as more than one reorganisation of the ways in which land was controlled and managed, these prominent indicators of ancestral beliefs seem to have been respected, surviving as landscape monuments. To an extent, this may have been as much a result of the absence of any significant changes in the ways which the uplands of Cornwall were used – as open downlands, they continued to be valuable areas for communal rough grazing, for hunting and fuel gathering, and there would have been little pressure for the removal of the ancestral monuments they contained. They seem to have been left undisturbed, indeed, they may have been valued as way markers on tracks across the open moors and downs.

During the medieval period and into the post-medieval period, despite some encroachment in to the uplands due to the land pressure brought on by a gradually expanding population, a large proportion of Cornwall's bronze age barrows seem to have survived. From the late 18$^{th}$ century on, however, this situation was to change markedly in response to a rapidly rising population brought about by the development of industrial-scale mining activity and the concomitant development firstly of extensive miners' smallholdings carved out of the downs and, not long after, by the need to provide food for the occupants of burgeoning new urban centres such as Camborne and Redruth and the rapid growth of Truro, as well as by the development of many smaller industrial settlements during the early 19$^{th}$ century. Pressure on the downlands of central Cornwall was considerable during this period, and, along with the loss of huge areas of formerly open land, many former barrow cemeteries were also swept away during the creation of new farmland.

Despite its scale, this process was not ubiquitous, however, and some barrow groups or parts of barrow groups survived. The surviving 2,500 year old ceremonial earthworks are still impressive monuments, providing important visual clues as to the character and arrangement of a much earlier landscape than the one we occupy today. They also have significant archaeological potential in that on the occasions when cairns and barrows have been excavated (or partially excavated) using modern scientific techniques, many have been demonstrated to have been constructed in a series of separate (and probably deliberately distinct) phases indicating that this type of ceremonial site had a complex life-cycle from its initial creation to its completion. Barrows also seal their pre-construction land surfaces, providing opportunities for paleo-environmental sampling which can provide the pollen grains which contribute to our understanding of prehistoric vegetation cover in Cornwall; they may also contain organic material which can provide material suitable for high precision $C_{14}$ dating techniques, as well as artefactual material which may throw light on past cultures and beliefs. Undamaged barrows and cairns are, however, relatively rare these days, as a substantial number were plundered by treasure hunters, or were dug into by

antiquarians. Barrows and cairns also come in a range of forms whose differences are likely to have been culturally significant, though which are not currently fully understood.

Below-ground archaeological remains associated with barrows and included within such ceremonial areas could potentially include other smaller features such as pits, mortuary platforms, groups of post-holes, activity areas or flint scatters. Previous archaeological work in similar former upland areas suggests that these barrows are likely to be accompanied by evidence for a wider range of ceremonial activity; archaeological investigation would be required if the scale and significance of any features making up the ceremonial landscape surrounding this particular barrow were to be fully understood.

**Boundaries defining the five fields making up the proposed application site, centred SW 76459 49624**

The five fields making up the proposed site of the Four Burrows solar farm are part of a large group occupying the former Penhallow Downs (otherwise Callestock Common). The regular widths of the fields and the parallel alignment of the north-west – south-east aligned boundaries between Callestick Veor to the north and Pendale to the south strongly suggests that most of the Downs were enclosed as a single event. The evidence also suggests that this event post-dated the formalisation of the road from Three Burrows (Chiverton Cross) to Penhallow, whose route originally ran across open downland near its western edge (as can be seen on Fig 3) and which retains its original course, cutting through the western side of these blocks of fields. The western boundary of the enclosure block follows a strong continuous boundary from Chiverton Cross in the south which runs north-eastwards to the east of Silverwell and on to Penhallow and Lambourne in the north, and which denotes the boundary between the former downs and the enclosed land to its north-west. The eastern boundary of the enclosure block seems to have followed the minor road from Lambourne back through Callestick and Callestick Vean, beyond which it diverted to the south to run along the ridge through the Four Burrows barrow cemetery and back to Three Burrows.

Whilst there is evidence for the removal of one of the original boundaries in the field to the north of the application site, the majority of the original primary boundaries have survived. Some subsequent sub-division of the original enclosures is evident to the north of the application site around the farmstead of Higher Callestick (originally Higher Callestock) suggesting that this was inserted into the fieldscape as a secondary feature, as was Little Lambriggan which overlies its western edge and others such as Pendown and Pendale to the south. The primary process therefore seems to have consisted of the system of parallel boundaries, the creation of settlements within the enclosed downs occurring slightly later.

These field boundaries consist of low Cornish hedges 2.0m wide averaging 1.25m high – all are of a very similar build style, confirming that they were constructed in a single phase. These are generally vegetated with grass and brambles, though some sections of the eastern and internal boundaries have developed scrub tree cover – principally blackthorn and some small sycamores. Most fields have only one gateway into them. The straightness of the boundaries and their regular grid layout are typical of those defining Recently Enclosed Land. The boundaries defining and dividing the site proposed for the solar farm are in good condition and are part of a larger associated system which extends to the north and south.

# 9 Results of geophysical survey

A 3.4Ha area (the full extent of the north-eastern field at Four Burrows) was surveyed by Archaeophysica Ltd at the end of December 2011 using a caesium vapour magnetometer array based on a quad-towed sled system as described above, Section 2.3.2.

Variation was found in magnetic background across the site as a result of differences in soil depths (which were generally thin, though which showed some localised variation in depth) and the effects of soil waterlogging. In the north-western corner of the field these effects were most pronounced, resulting in reduced contrast within the data. The survey results suggested that these soils may be particularly prone to waterlogging (see Section 3.1 above), this being displayed in the responses from a number of linear features showing as reduced field anomalies, this being interpreted as the effects of peat having developed in the bases of ditches which had become waterlogged. Enhanced soil depths and waterlogging were considered most likely to be the cause of reduced data definition in the northern corner of the field. In one case (feature [7/8]) the same feature was found in different sections as both enhanced and reduced field anomalies, and it is suggested that the latter was the result of peat formation in this fashion. There is no strong evidence for deep ploughing across the site, possibly because the soil is relatively shallow.

The data (Fig 13) indicates the presence of a number of anomalies which are likely to represent features of archaeological origin.

Most interesting of these is feature [6] near the centre of the field adjacent to its north-eastern boundary, which takes the form of a fairly well defined *circa* 12m diameter ring ditch. Given its location and form, this seems likely to be a further element in the local barrow cemetery, and is similar in dimension to the pair of badly ploughed down bowl barrows 140m to the north (scheduled monument 29619). A second possibly significantly ploughed down barrow, feature [2], showed up in the data as an ovoid area of anomalous magnetic texture with weak evidence for an enclosing ditch on its western side which lies adjacent to the central point on the north-western boundary. Of possible significance is that this putative barrow seems to be enclosed within a rectangular ditched feature, of which the northern and eastern elements can be seen in the survey data (feature [3]).

A short distance to the south-east of possible barrow [2], a narrow curving ditch (feature [4]) may also originally have enclosed a barrow. The anomaly is not clearly defined, however, and no traces of a barrow were detected within the arc.

Feature [5] represents a narrow linear anomaly which extends across most of the field from east to west. Again, this seems to represent a formerly waterlogged ditch. Its orientation makes it clear that it predates the laying out of the 19$^{th}$ century field system, and it may represent a former boundary ditch across the downs, perhaps one separating areas of commons to its north and south.

Three further linear anomalies likely to be deliberately-created ditches were detected (features [7/8], [11] and [9]. Feature [7/8] appears to terminate on feature [5] at its northern end and may be related to it. It is, however, wider than feature [5], and is limited in extent. Likewise, feature [9] in the north-eastern corner of the field is well defined, but appears only to have been of limited length, and cannot be associated with other features revealed by the survey. Feature [11] in the southern corner of the site is a narrower anomaly, appearing possibly to terminate on feature [10], which has been interpreted as a elongated hollow within which peaty deposits had built up – possibly a former trackway which had become hollowed into the ground surface. Again, feature [11] is short and does not appear to relate to the other linear features revealed by the survey.

The linear features and ditched mound plotted by the NMP (MCO31932) in the eastern part of the field did not show up in the geophysical survey. It may be that their form renders them invisible to magnetometer survey, or they may have been completely ploughed away since the mid 20$^{th}$ century.

It is unclear why these linear anomalies should be so fragmented and so apparently unrelated to one another. They do not appear to be part of a coherent system and their interpretation must remain, at present, unclear. The absence of evidence in the recent survey for the linear features (MCO31932) which showed up on aerial photographs,

coupled with the fragmentary nature of the linear features showing up in the geophysics might point to loss through agricultural activity during recent decades and the vulnerability of what remains to further ground disturbance

A number of small, discrete anomalies appear across the whole of the field. These do not appear to have any coherent patterning, and have been interpreted as the effect of small ferrous objects brought to this area within manuring scatters.

# 10 Synthesis

Throughout prehistory, during the medieval period and until the early decades of the 19th century, the landscape around the application site had been open downland. Its enclosure was almost certainly driven by a need to produce food for the rising and increasingly urban population which developed in mid-Cornwall as a result of its industrialisation during the late 18th century and the first decades of the 19th century. However, the topography, elevated location and relatively short history of cultivation of this area of former downland resulted in it being relatively poor arable land, and it is now economically far more marginal than it had been at the time of its creation, when most food was grown locally.

The archaeology of this area reflects its landscape history. As set out in Section 3.2, these long-established uplands provided important areas of rough grazing for farmers occupying the settlements surrounding them. They were also often the focus for ceremonial activities in prehistory, and sited barrows and cairns, these often being prominently-located, often within clusters. Examination of what is known about the wider landscape indicates the hilltop or ridgetop locations of many of these barrow groups. At this site, the surviving scheduled Callestick Barrow in the northern part of the site proposed for the solar farm and the scheduled ploughed down pair to its north-west can be seen to have been part of a larger cluster of such sites, consisting of at least five barrows and probably more. All but one were ploughed down following the enclosure and improvement of his area of the downs, but survive, to some degree or another, as sub-surface archaeology. Unless such ploughing has been to very significant depths, the basal elements of these often-complex ceremonial structures may well survive, preserving important palynological, dating and cultural evidence.

The fragmentary linear features revealed by the geophysical survey do not appear to be part of a coherent whole, possibly as a result of the repeated ploughing of thin soils, may date to any period between prehistory and the post-medieval period, and are, on presently available evidence, un-interpretable.

# 11 Policies and Guidance

The following section brings together policies and guidance, or extracts from these, referred to in this report and/or used in the development of the assessment and its methodology.

## 11.1 Planning Policy Statement 5 (PPS5), 'Planning for the Historic Environment'

### 11.1.1 Policy HE9.6

HE9.6 'There are many heritage assets with archaeological interest that are not currently designated as scheduled monuments, but which are demonstrably of equivalent significance….The absence of designation for such heritage assets does not indicate lower significance and they should be considered subject to the policies in HE9.1 to HE9.4 and HE10.'

### 11.1.2 Extracts from Policies HE9.1 to HE9.4 and HE10

Policies HE9.1 to HE9.4 and HE10, referred to in Policy HE9, include the following;

- HE9.1 'There should be a presumption in favour of the conservation of designated heritage assets and the more significant the designated heritage asset, the greater the presumption in favour of its conservation should be. Once lost, heritage assets cannot be replaced and their loss has a cultural, environmental, economic and social impact. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting.'

- HE9.2 'Where the application will lead to substantial harm to or total loss of significance local planning authorities should refuse consent unless it can be demonstrated that: (i) the substantial harm to or loss of significance is necessary in order to deliver substantial public benefits that outweigh that harm or loss….'

- HE10.1; 'When considering applications for development that affect the setting of a heritage asset, local planning authorities should treat favourably applications that preserve those elements of the setting that make a positive contribution to or better reveal the significance of the asset. When considering applications that do not do this, local planning authorities should weigh any such harm against the wider benefits of the application….'

### 11.1.3 PPS5 English Heritage guidance

The English Heritage and DCMS (Department for Culture, Media and Sport) document 'PPS5 Planning for the Historic Environment: Historic Environment Planning Practice Guide' provides guidance on PPS5 and its application.

This refers to the need, for decision-making in response to an application for change that affects the historic environment, of providing and assessing, at a level appropriate to the relative importance of the asset affected, information on the asset and its extent, on its setting, and on the significance of both of these aspects. Section 5, 54 states that 'Heritage assets may be affected by direct physical change or by change in their setting. Being able to properly assess the nature, extent and importance of the significance of a heritage asset and the contribution of its setting is very important….'

Section 5 on Policies HE6 to HE 12, 58, notes among appropriate actions (in point 5) 'Seek[ing] advice on the best means of assessing the nature and extent of any archaeological interest e.g. geophysical survey, physical appraisal of visible structures and/or trial trenching for buried remains.'

The section on Policy HE10 defines setting as follows;

'113. Setting is the surroundings in which an asset is experienced. All heritage assets have a setting, irrespective of the form in which they survive and whether they are designated or not. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance, or may be neutral.

114. The extent and importance of setting is often expressed by reference to visual considerations. Although views of or from an asset will play an important part, the way in which we experience an asset in its setting is also influenced by other environmental factors such as noise, dust and vibration; by spatial associations; and, by our understanding of the historic relationship between places. For example, buildings that are in close proximity but not visible from each other may have a historic or aesthetic connection that amplifies the experience of the significance of each. They would be considered to be within one another's setting.'

## 11.2 Hedgerow Regulations

Under the current, 1997 Hedgerow Regulations, owners wishing to remove all or part of a hedgerow considered to be historically important must notify the Local Planning Authority (LPA). Criteria determining importance include whether the hedge marks a pre-1850 boundary, and whether it incorporates an archaeological feature. The LPA may issue a 'hedgerow retention notice' prohibiting removal.

# 12 Likely impacts of the proposed development

## 12.1 Types and scale of impact

Two general types of archaeological impact associated with solar farm developments have been identified as follows.

### 12.1.1 Types of impact, construction phase

Construction of the solar farm could have direct, physical impacts on the buried archaeology of the site through the installation of mountings for solar panels and associated control plant, through the undergrounding of cables, and through the provision of any works compound, together with any permanent or temporary vehicle access ways into and within the site.

### 12.1.2 Types of impact, operational phase

A solar farm might be expected to have a visual impact on the settings of some key heritage assets within its viewshed during the operational phase, given the scales of such developments and the introduction of large areas of new materials into the rural landscape.

### 12.1.3 Scale and duration of impact

The impacts of a solar farm on the historic environment may include positive as well as adverse effects. For the purposes of assessment these are evaluated on a seven-point scale:

**positive/substantial**

**positive/moderate**

**positive/minor**

**neutral**

**negative/minor**

**negative/moderate**

**negative/ substantial**

**Negative/unknown is** used where an adverse impact is predicted but where, at the present state of knowledge, its degree cannot be evaluated satisfactorily.

The assessment also distinguishes where possible between **permanent** and **temporary** effects, or between those that are **reversible** or **irreversible**, as appropriate, in the application of the scale of impacts.

### 12.1.4 Potential and residual impacts

Potential adverse impacts may be capable of mitigation through archaeological recording or other interventions. In the assessments forming Section 12.2, where appropriate, both 'potential' and 'residual' impacts are given; that is, expected impacts 'before' and 'after' such work. A proposed mitigation strategy is outlined below in Section 13.

## 12.2 Assessment of impact

Overall, the impacts of the proposed solar power installation on the archaeological resource are assessed as having a potential scored as **negative/moderate** without appropriate mitigating work. Impacts on potential sub-surface archaeology within the development site could be reduced to **negative/minor** provided that the recommended mitigation is undertaken.

The assessments supporting this general statement are outlined in the following sub-sections. To comply with current policies and guidance (Section 11) assessments of impact in terms of different aspects of the archaeological resource are required - its individual sites, the settings of sites, HLC, and field boundaries. There are inevitably areas of overlap between these categories of impact; the assessment has been adjusted accordingly to avoid 'double counting' of impacts.

### 12.2.1 Impact on archaeological sites within the development area

Ground disturbance associated with the installation of supports for the arrays, cables or ancillary works during the construction phase could result in permanent, irreversible loss of below ground remains of the archaeological sites within the area, or elements of these. The works if deeper than current topsoil levels might affect buried cut features.

The scale of impact will vary with the significance of the individual site, and with the proportion of the whole site which would be affected. Notably, buried features could be disturbed, truncated or removed. This impact is considered to be **negative/moderate** to **negative/significant** in relation to the probable barrow sites, with a residual impact of **negative/minor** to **neutral** provided that appropriate mitigating work is carried out. For the remainder of the site the likely impacts are assessed as **negative/minor**. These impacts, if not avoided, would be **permanent** and **irreversible**.

Even if the proposed layout of the solar farm appropriately respects the existence of the scheduled barrow MCO2297 and does not require its removal or the disturbance of buried archaeology within its setting, the creation of the solar farm within the setting of the barrow will inevitably have impacts on it. As noted above, barrows, whether singly or in groups, were created, functioned and also drew much of their significance from their locations with open upland landscapes (URG) which lacked other constructed features, and were intended to be highly visible, both within the local landscape and often from considerable distances.

Processes of land intake resulting in the subsequent inclusion of many barrows within landscapes characterised as REL which are characterised by grid-like arrangements of new stone walls and Cornish hedges inevitably somewhat reduced their visual significance, both locally and from points within the wider landscape. However, the large scale of these new fields tended to preserve some of the open and uncluttered aspects of the former URG landscape. As a result, with the exception of the field walls, Bronze Age barrows are often the only constructed features within REL landscapes. In addition, the locations of many barrows adjacent to later tracks and routeways has also helped to preserve their visibility and, in some cases, their accessibility.

Given anything other than a substantial buffer zone, the solar farm will inevitably impact significantly on the setting of barrow MCO2297 given that the barrow will no longer be an isolated construction, but will be closely surrounded by a large area of one type of artificial feature (the photovoltaic panels), which will inevitably be visually dominant within this part of the landscape. In addition, the solar farm will be enclosed within a high security fence, which, adjacent to the barrow, would also be a visually dominating feature. The likely impact of this scenario has been assessed as **negative/significant**.

It might be possible to mitigate the impacts of the development of the solar farm on the setting of the scheduled barrow through a combination of the provision of a suitable

setting of open ground adjacent to the barrow on its western side and perhaps also by adjusting the layout of the arrays making up this part of the solar farm to draw attention to the barrow. If this could be achieved, the residual impact would be considered to be **negative/moderate** or even **neutral**. Other mitigating actions could include management of the scrub on the barrow, rendering it more visible as a monument.

### 12.2.2 Impacts on historic landscape character

Impacts on the historic landscape character were assessed in 2010 as being likely to be **negative/moderate**. It is now suggested that it might be more appropriate to downgrade this to **negative/minor**.

- Land-take for the project would be substantial but relatively small in comparison with the very large area of the HLC Unit of Recently Enclosed Land of which it forms part and this impact would therefore be **negative/minor**.
- Impact in terms of physical loss during the construction phase of the upstanding earthworks which form the visible components of HLC would be **neutral**.
- Visual impact throughout the operational phase on the legibility of the most significant of such components here, the barrow to the east and the field system extending across the project site, would be **negative/moderate**. The near continuous cover of solar arrays would detract from the integrity of the REL landscape, with loss of visibility of historic open farmland, reduced visibility of semi-natural hedgerows, and low (physical) level but extensive introduction of modern design and materials incongruous in Recently Enclosed Land.
- The impacts on the legibility of HLC would be largely or wholly **reversible** should the solar farm installations be removed in the future.

### 12.2.4 Impacts on the settings of key heritage assets within the wider landscape

The creation of a solar farm made up of tightly-packed dark glass arrays in this fairly prominent location will inevitably introduce new elements into the palette of textures and colours currently experienced by those living in and passing through this landscape, which is currently predominantly given over to agricultural use. However, this is not a new process within Cornwall's former upland landscapes, for although significant areas of built structures such as houses are rare within such areas, they have been the preferred sites for inevitably highly visible sites such as wind farms during recent decades.

In isolation, a single solar farm on this scale is likely to have a relatively localised impact on the overall character of an area of the historic landscape consisting of former Upland Rough Ground (URG) converted to REL, approximately comparable in visual impact from a distance to that of the roofs of a new housing or industrial estate of a similar size in a similar location. Impacts on the overall fabric of the historic landscape would inevitably be **negative**, though the scale of the impacts could be mitigated to some degree through careful design taking into account sensitive heritage assets and other factors and through masking the site from particularly sensitive viewpoints where possible.

Unless sited in particularly sensitive locations such as those immediately adjacent to well preserved, highly visible and readily accessible historic assets, or within areas of landscapes rich in features (whether of single periods, or where they make up palimpsests reflecting long and complex processes of landscape development) impacts on the settings of individual heritage assets are likely to be relatively limited and will reduce rapidly in relation to distance from the sites of the solar farms.

In the case of the proposed solar farm at Four Burrows, although the site lies on a ridge, it is not overlooked locally. The orientation of the site is slightly to the south, and

hence this is likely to be the direction from which it will be most visible, and thus the direction within which it might have its greatest impact on local heritage assets.

The height of the proposed arrays and the hedges around the site would block most views of the solar farm from the east and north, including those from the scheduled barrows and the round sited to the north. To the south most of the fields within the application, as well as the barrow within the site are moderately intervisible with the Four Burrows barrow group 1 Km away on the ridge, whilst to the south-west the whole of the site would be clearly visible from St. Agnes Beacon, which is topped by another very important barrow group. However, this is a very considerable distance from the application site, and a solar farm of this scale and at this site is very unlikely to be visually prominent in the landscape views from the Beacon. Views from the Barrow at Silverwell are blocked by a small coppice of trees, whilst those from the Four Burrows barrow cemetery to the south are restricted by the nature of the topography, by the generally level nature of the application site and by the hedges surrounding it. The impacts on the settings of key heritage assets within the wider landscape surrounding the proposed solar farm are therefore assessed as likely to be **neutral**.

### 12.2.3 Other archaeological impact

Any ground disturbing works here could encounter significant undetected buried prehistoric or medieval remains, resulting in permanent, irreversible loss of these, or elements of them. This potential impact is assessed as **negative/unknown** as specific evidence for the nature and extent of any such remains is limited to that derived from geophysical survey and aerial photography. It is likely that it could be mitigated satisfactorily though archaeological recording, reducing the residual impact to **neutral** or **negative/minor**. These impacts would be **permanent** and **irreversible**.

# 13 Mitigation Strategy

## 13.1 Close design of proposed works to reduce impact

The archaeological assessment indicates that careful design of the proposed solar farm to avoid or reduce particular impacts should be considered. In particular efforts should be made to limit impacts on the setting of the scheduled Callestock Barrow. Following discussions with the English Heritage Assistant Inspector of Monuments (Nick Russell) on 11 January 2012, it was agreed that a 10m buffer from the outer edge of the scheduled area should be allowed for in planning the arrangement of the solar farm, including any security fencing. In addition, English Heritage would seek an assurance from the developer that the scheme would include an agreement to fund and undertake environmental improvements to the scheduled monument. The form of these would have to be agreed with the English Heritage Historic Environment Field Advisor, Ann Preston-Jones, but would be likely to include clearance of scrub from the barrow as well as the clearance of any agricultural or other rubbish which has been deposited within the scheduled area.

In addition, the Historic Environment Planning Advice Officer (HEPAO) may request that areas proposed for the development of the solar farm known to contain significant below ground archaeological remains are excluded from the development, or that such areas of the site are protected from disturbance by the localised use of concrete shoes to support the arrays, rather than ground anchors.

## 13.2 Controlled soil stripping

Controlled soil stripping - that is, direction by an archaeologist of mechanical topsoil and subsoil stripping - is recommended where any area of ground is to be disturbed, including areas such as works compounds and at the location(s) of any sub-station/inverter building(s). This would provide for preservation by record of buried

medieval or earlier artefacts or deposits, and would also allow identification of any further recording or other needs such as wider excavation or sampling.

### 13.3 Excavation

The HEPAO may decide that archaeological excavation would be appropriate for any features of high significance found during the geophysical survey which might be significantly adversely affected by the development of the solar farm, and where these effects cannot be mitigated by other means.

### 13.4 Analysis and presentation of findings

The results of any mitigating archaeological recording outlined above should be compiled and analysed, and significant findings should be presented as required, with publication to professional standards, if appropriate.

## 14 References

### 14.1 Primary sources

Ordnance Survey, *c*1880. *25 Inch Map* First Edition (licensed digital copy at HE)

Ordnance Survey, *c*1907. *25 Inch Map* Second Edition (licensed digital copy at HE)

Ordnance Survey, 2007. *Mastermap Digital Mapping*

Tithe Map and Apportionment, *c*1840. *Parish of Perranzabuloe* (digitised copy of Tithe Map held as an HE GIS layer; microfiche copy of mapping and apportionment held by HE)

### 14.2 Publications

Sharpe, A. 2010, *Proposed Four Burrows solar farm, Perranzabuloe, Cornwall: archaeological assessment*, Historic Environment Projects report 2010R129 for Wardell Armstrong International

### 14.3 Websites

http://www.heritagegateway.org.uk/gateway/ English Heritage's online database of Sites and Monuments Records, and Listed Buildings

## 15 Project archive

The HE project number is **2012003**

The project's documentary, photographic and drawn archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site notes, project correspondence and administration.
2. English Heritage/ADS OASIS online reference: cornwall2-116933.
3. This report text is held in digital form as: Cc\root\Pte\Tru\Groups\Twe\Waste&Env\Strat\Waste&Landscape\Hisoric Environment \Projects\Sites\Sites F\Four Burrows solar farm geophysics 2012003\Report

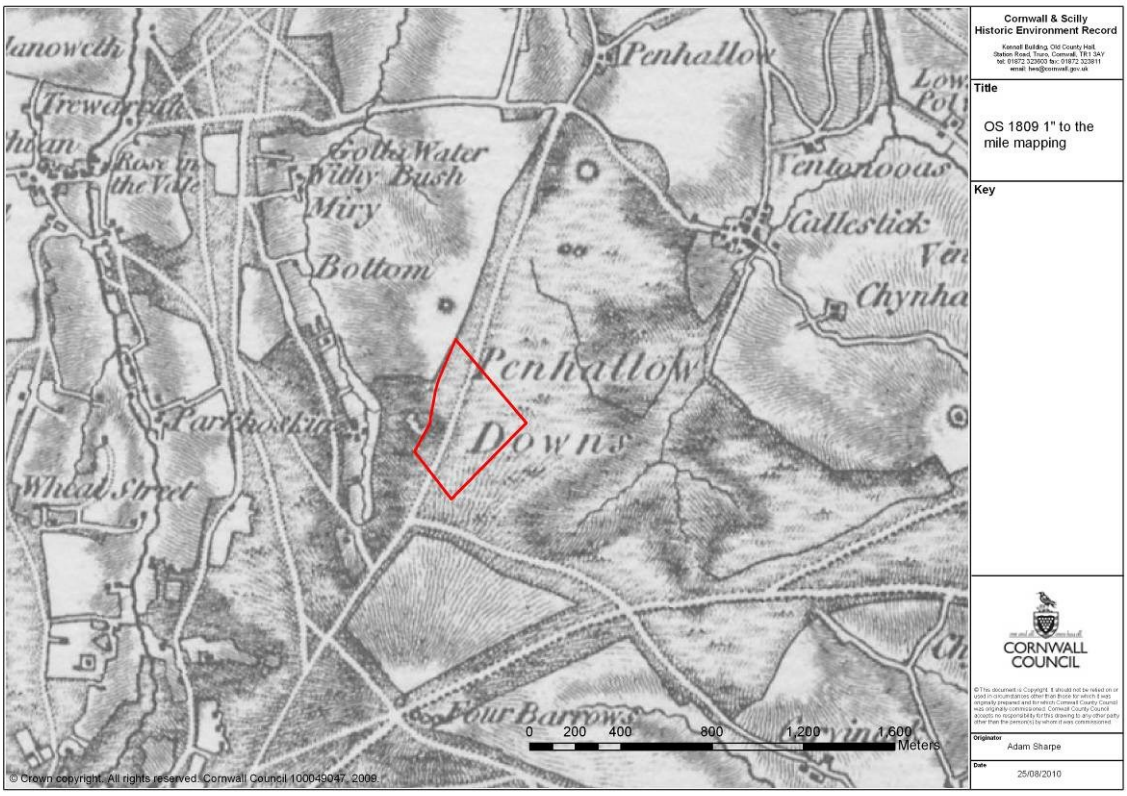


*Fig 3. The site proposed for the solar farm at Penhallow superimposed onto the 1805 OS 1st Edition 1" to the mile mapping. The open nature of Penhallow Downs at the time is evident.*


*Fig 4. Callestock Common (as Penhallow Downs were at that time called) as shown on the circa 1840 Tithe Mapping for Perranzabuloe. As in 1805, the Downs remained unenclosed at this date.*

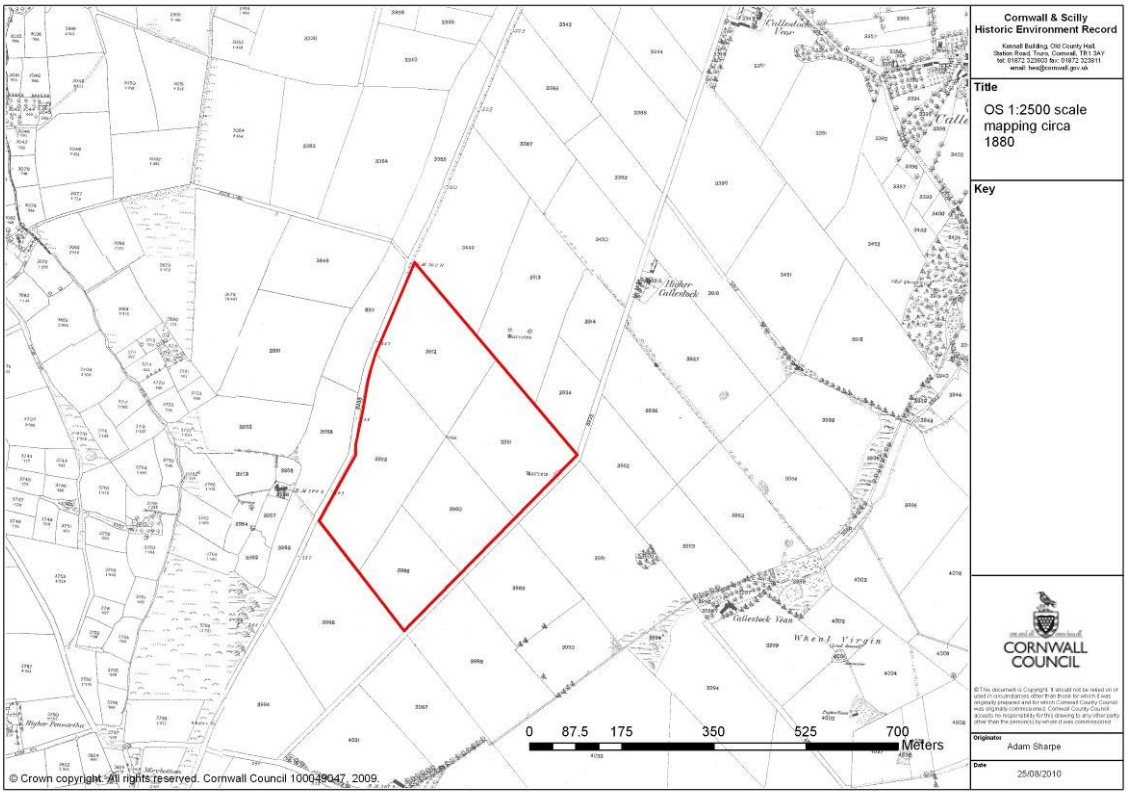


*Fig 5. The site proposed for the Penhallow Solar Farm as shown on the 1st Edition of the OS 25" to the mile mapping circa 1880. The Downs had been fully enclosed by this time.*

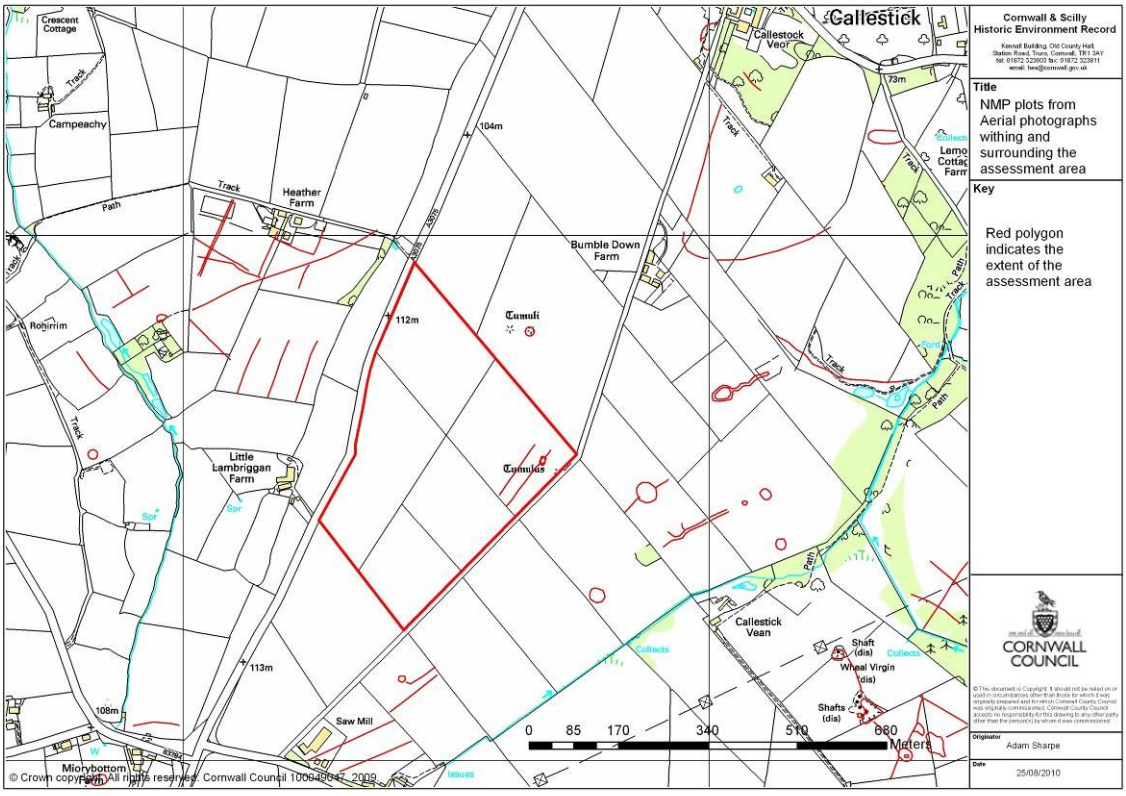


*Fig 6. Features plotted by the NMP from aerial photographs suggesting evidence for surviving sub-surface archaeology within the environs of the site at Penhallow. Two linear ditches and a sub-rectangular feature were plotted in the north-eastern corner of the proposed solar farm adjacent to the 'tumulus'.*

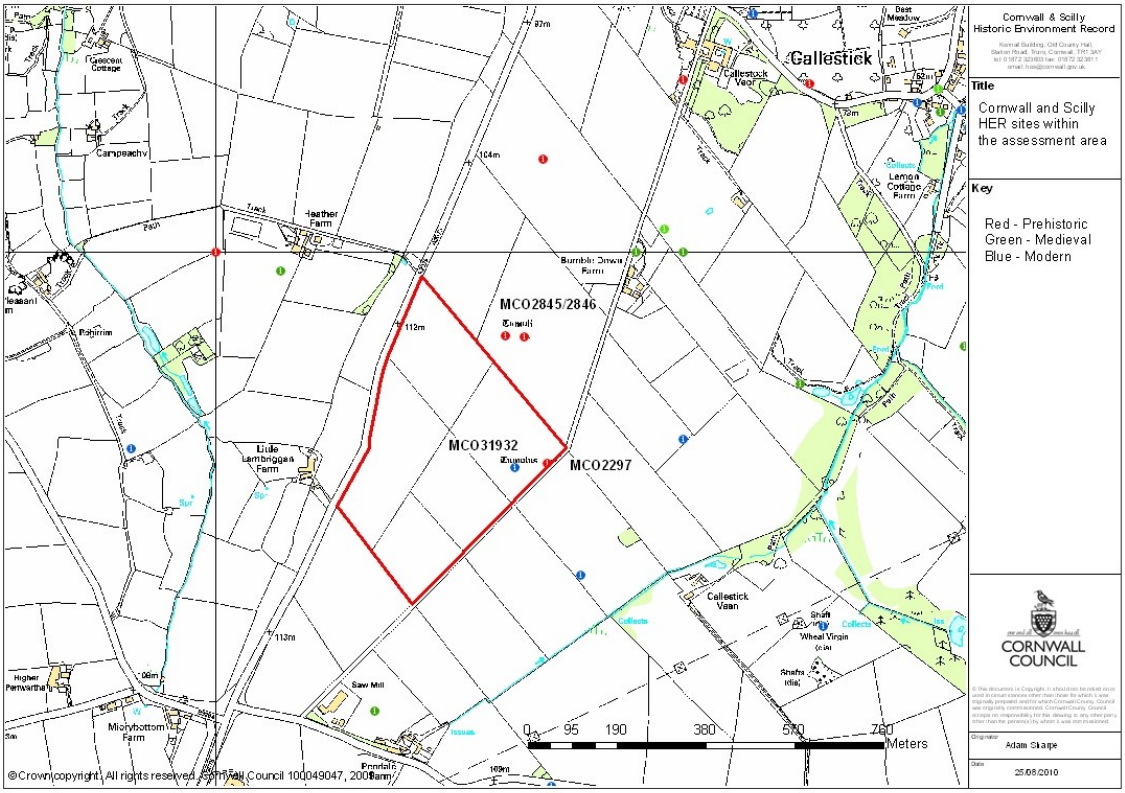


*Fig 7. Sites recorded in the Cornwall and Scilly HER within and adjacent to the proposed Penhallow solar farm. The prehistoric sites (red dots) consist of ceremonial or funerary features within what would have been an open, highly visible section of the local landscape.*

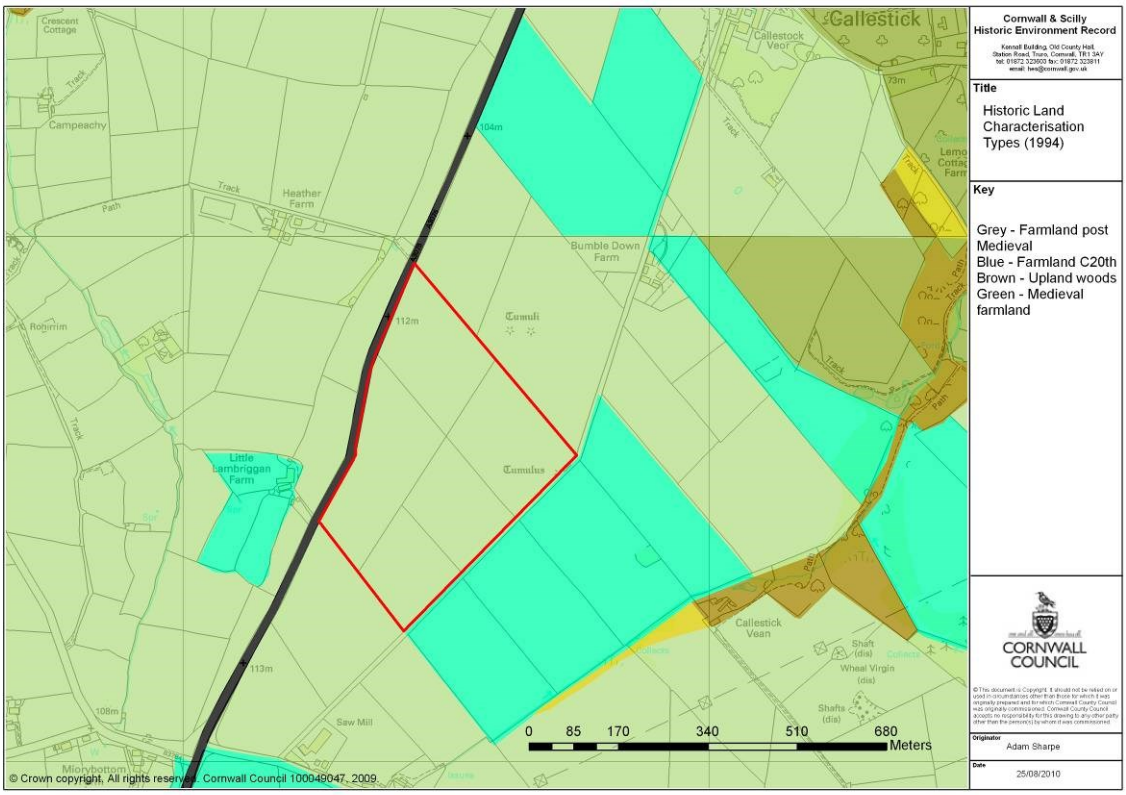


*Fig 8. Historic Landscape Characterisation (HLC) types for the site of the proposed solar farm and its surroundings, clearly showing that the majority of the present landscape elements were created during the 19th and early 20th centuries through the enclosure of former downland.*

*Fig 9. The scrub-grown scheduled barrow (DCO911) adjacent to the hedgeline in the north-eastern corner of the site proposed for the solar farm at Four Burrows.*

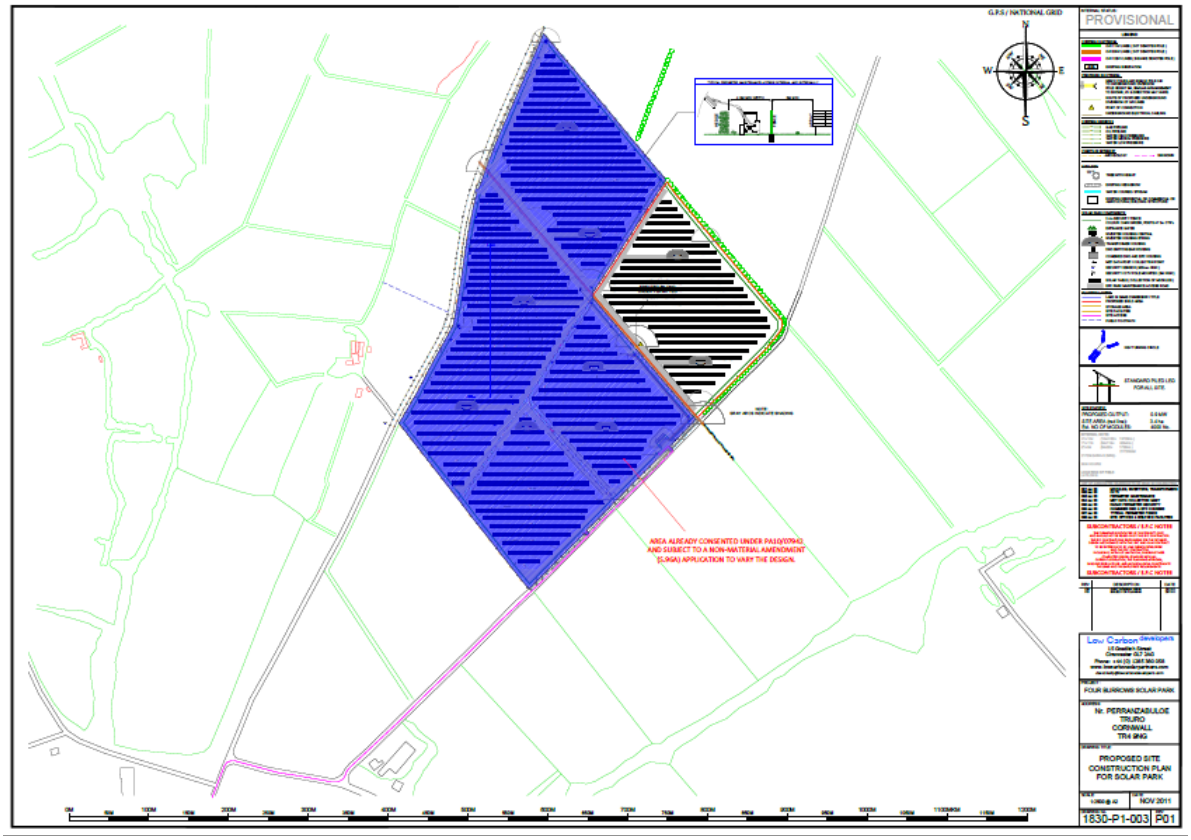


*Fig 10. The draft layout proposed for the solar farm at Four Burrows. Low Carbon Developers drawing 1830 P-003 dated 24.11.2011.*

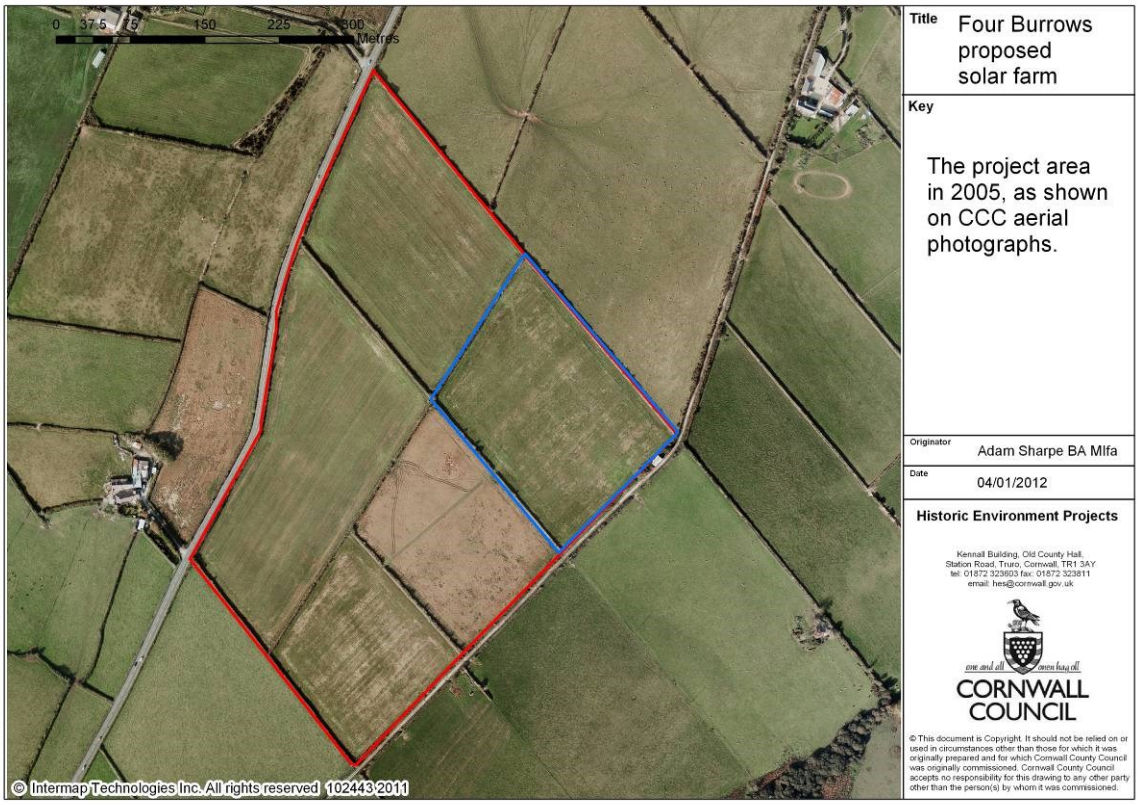


*Fig 11. A Cornwall County Council aerial image of the site dating to 2005 shows the land to have been in arable use at the time, though the surrounding fields were predominantly being used as sheep pasture. The blue line shows the area within which geophysical survey was undertaken in 2011.*

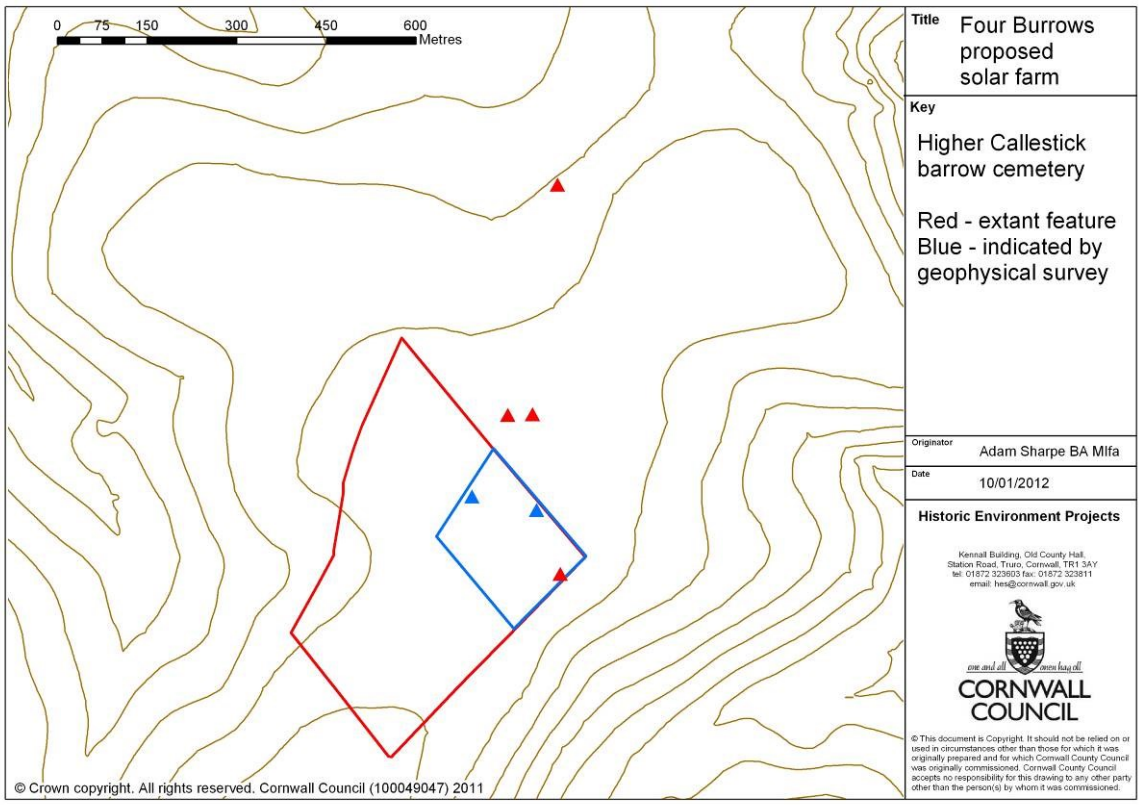


*Fig 12. The known extent of the Higher Callestick bronze age barrow cemetery, showing its ridgetop location.*

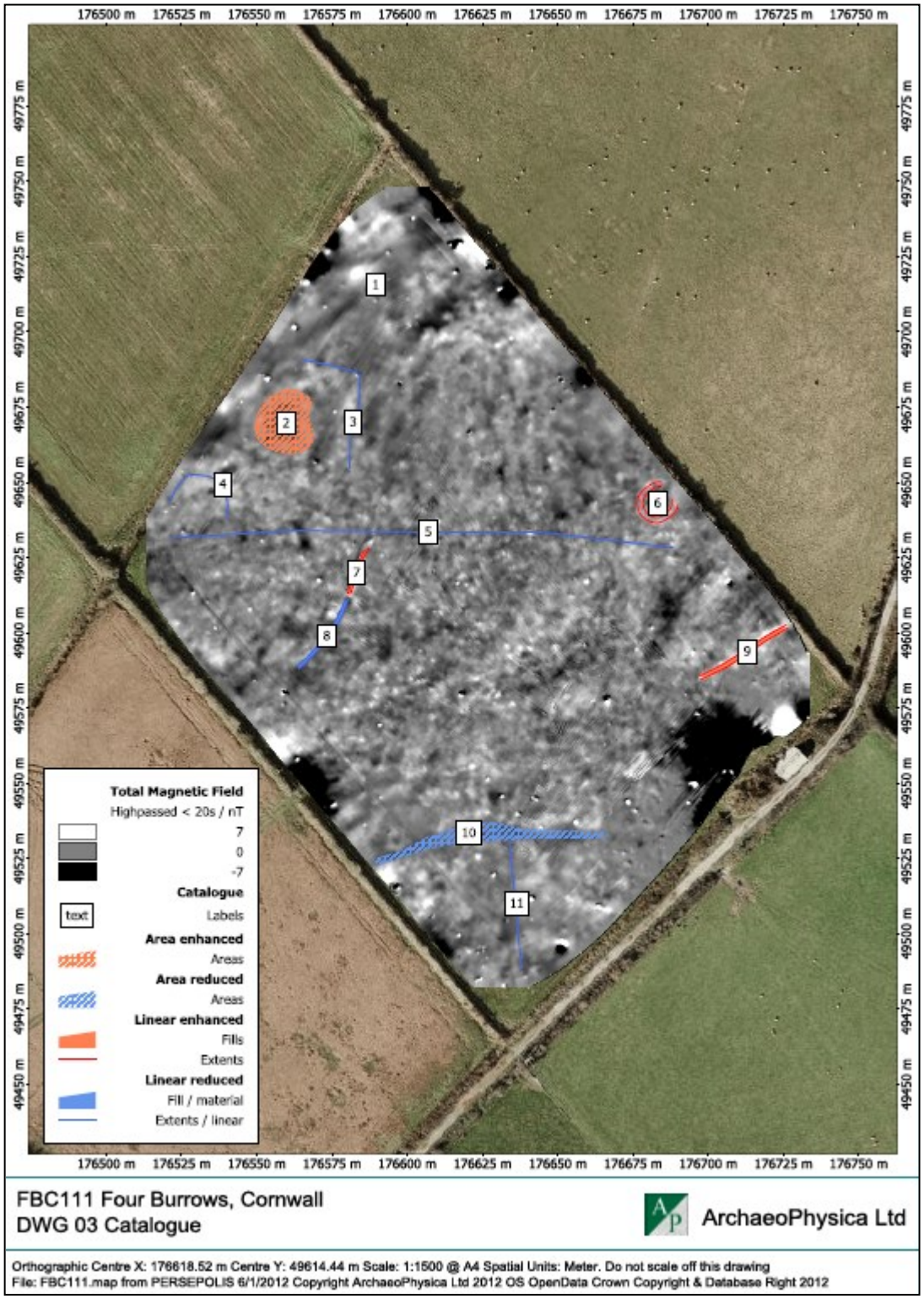


*Fig 13. The interpreted geophysical data plot for the north-eastern field at the proposed Four Burrows solar farm. Of particular interest are the ring ditch [6] and the possible barrow [2].*

*Fig 14. Looking south-west along the eastern boundary of the north-eastern field, showing the impressive size and overgrown nature of Callestock Barrow.*

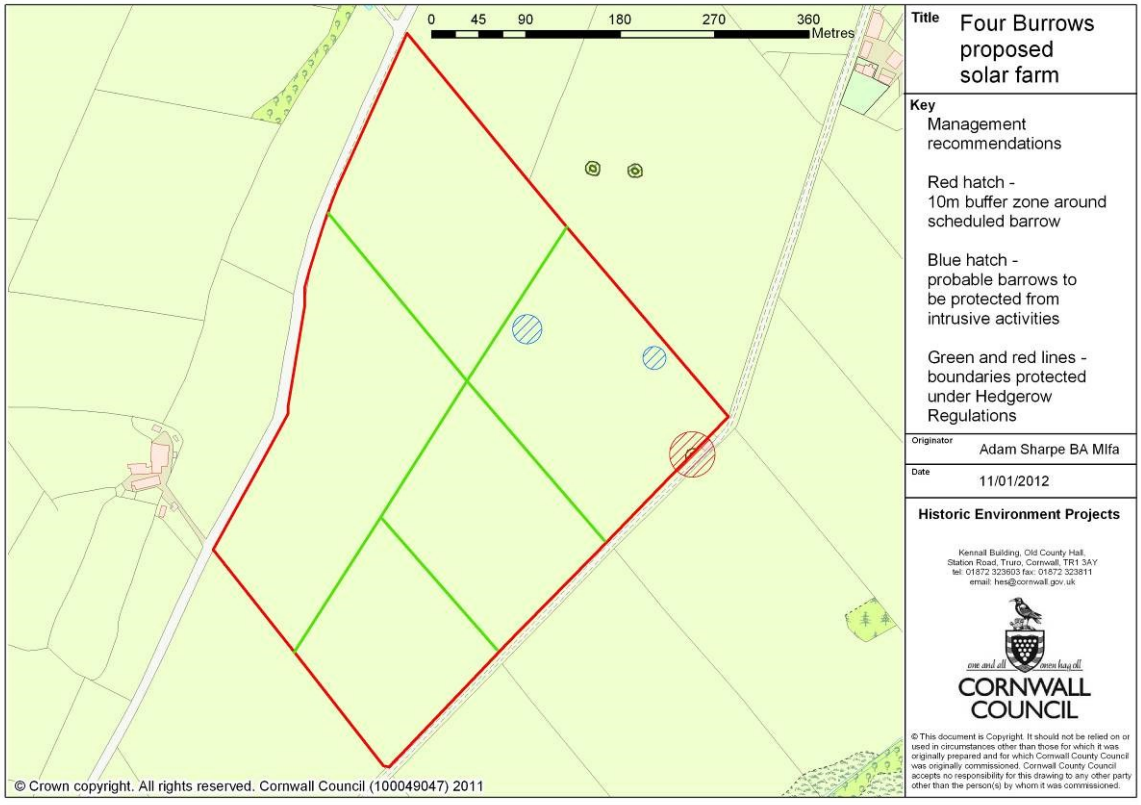


*Fig 15. Management recommendations for the proposed Four Burrows solar farm.*