THE LYONESSE PROJECT
ISLES OF SCILLY

PROJECT DESIGN REV 04

Historic Environment Service (Projects)

Cornwall County Council

A Submission to English Heritage

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Cover illustration

The Isles of Scilly (© The Gibson Collection)

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Abbreviations

ACHWS Advisory Committee on Historic Wreck Sites

ACoP	Approved Code of Practice
AMS	Accelerator Mass Spectrometry
AONB	Area of Natural Beauty
BSAC	British Sub Aqua Club
CBA	Council for British Archaeology
CCC	Cornwall County Council
CISMAS	Cornwall and Isles of Scilly Maritime Archaeology Society
CAU	Cornwall Archaeological Unit (now HES)
DCMS	Department for Media, Culture and Sport
Defra	Department for Environment, Food and Rural affairs
EH	English Heritage
GIA	Glacial Isostatic Adjustment
GIS	Geographical Information System
HER	Historic Environment Record
HES	Historic Environment Service, CCC, formerly CAU
HISAR	School of History and Archaeology, University of Cardiff
HWM	High Water Mark
HWTMA	Hampshire and Wight Trust for Maritime Archaeology
IMAG	Isles of Scilly Maritime Archaeology Group
LAT	Lowest Astronomical Tide
MFA	Marine and Fisheries Agency
NMR	National Monuments Record
OSL dating	Optically stimulated luminescence dating
RCHME	Royal Commission on the Historic Buildings of England
RCZAS	Rapid Coastal Zone Assessment Survey
RIB	rigid inflatable boat
SMC	Scheduled Monument Consent
SWRDA	South West Regional Development Agency

Description of the Project

1 Summary description

The aims of the Lyonesse Project are to reconstruct the evolution of the physical environment of the Isles of Scilly during the Holocene, the progressive occupation of this changing coastal landscape by early peoples and their response to marine inundation and changing marine resource availability. Of particular importance nationally will be the collection and analysis of data that will increase knowledge of sea level change during the past 8,000 years. The project, which will extend over a 2-year period, includes geophysical survey to identify submerged sediments and archaeological remains and biostratigraphic analysis of coastal, intertidal and submerged sediments at selected locations around Scilly. The results of Year 1 will be disseminated in a combined interim report, assessment and Updated Project Design, with a final project report being prepared at the end of Year 2.

The project, which will be co-ordinated by Cornwall County Council's Historic Environment Service, will include experts from Cardiff and Plymouth Universities as well as local interest groups such as Isles of Scilly Maritime Archaeological Society (CISMAS) and the Isles of Scilly Maritime Archaeology Group (IMAG) and others in the local diving community on Scilly.

2 Background

2.1 The Isles of Scilly

The Scillonian archipelago of approximately 200 islands, islets and rocks situated 45km (28 miles) south-west of Land's End (Fig 1) is self evidently a unique environment of exceptional quality, with the relationship between the land and sea providing a very strong and distinctive cultural identity. The archipelago contains wide expanses of shallow subtidal and intertidal environment flooded by rising relative sea level during the Holocene. It has long been known that the islands in their current form are a result of past sea level rises that flooded early sites. It is therefore a valuable microcosm for studying continuous sea level rises within an historical context as well as for research and recording important sites that will be lost and investigating how past populations adapted to their shifting shores.

2.2 Lyonesse

"So all day long the noise of battle roll'd
Among the mountains by the winter sea,
Until King Arthur's table, man by man,
Had fallen in Lyonesse about their lord."

Alfred Lord Tennyson

The land of Lyonesse is a legendary, low-lying country which once extended westwards from Land's End to the Isles of Scilly. Elizabethan antiquaries, such as Camden, collected reports current in the 16th century stating that, *Lethowstow,* the Cornish name for this area, contained fair-sized towns and 140 churches and was suddenly engulfed by the sea. Camden heard rumours of a lighthouse far west of anything standing in his own time The Seven Stones reef was said to be the remains of a town called the 'City of Lions' and fishermen reported that their nets brought up fragments of masonry and windows (Camden 1586; Dunbar 1958; Ashe *et al* 1968, 194-200).

Although much of this can be dismissed as fantasy, inundation legends are found in many other parts of north-western Europe, eg *Ker-Is* off Brittany and *Cantrer'r Gwaelod* [the Lowland Hundred] now situated in Cardigan Bay, and such stories may have their origins in folk memories of submergences that occurred during the prehistoric period (North 1957, 149-80; Ashe *et al*, 1968, 199).

The 'Hedges and Ruins' on Samson Flats in the Isles of Scilly were first noted by Dr William Borlase in the 18th century (Borlase 1756). OGS Crawford visited Scilly in 1926 to examine these submerged walls and concluded that Scilly, rather than the Seven Stones, was the lost land of Lyonesse (Crawford 1927), although he later considered in an editorial for *Antiquity* that these features might instead be the remains of medieval fish traps (Crawford 1946).

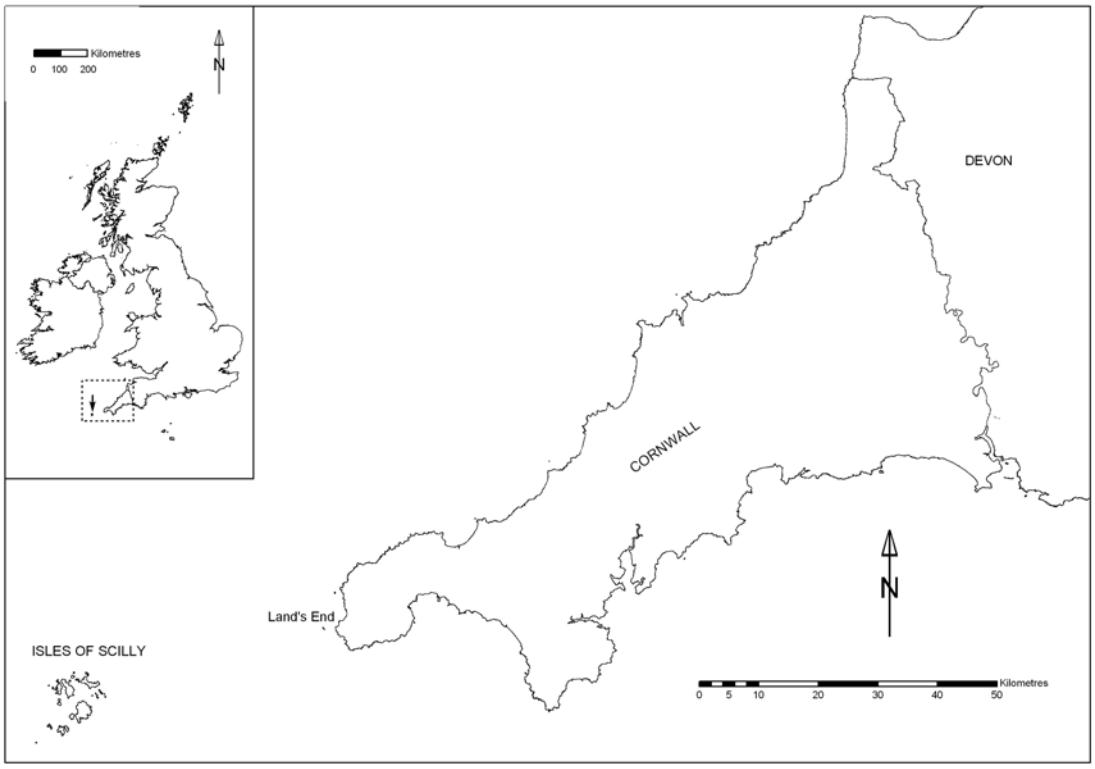

Fig 1 Location map: the Isles of Scilly

2.3 Previous work

2.3.1 A drowned landscape

In 1985 a seminal archaeological model for the submergence of Scilly was published by Charles Thomas. In the absence of radiocarbon dates, sea level change since 3000 BC was calculated by plotting the vertical position of intertidal stone remains which could be broadly dated from artefacts and analogy with sites elsewhere. Place-name evidence was also used for the medieval period and later (Thomas 1985).

2.3.2 The coastal erosion project 1989-1993

Over a five year period from 1989-93, with funding from English Heritage, the Cornwall Archaeological Unit (CAU – now HES), in conjunction with the AM Lab and Bristol University, implemented a small-scale recording and sampling programme in Scilly to assess the palaeoenvironmental potential of early coastal sites, including intertidal peat deposits at three locations: Par Beach, St Martin's; Crab's Ledge, Tresco; and Porth Mellon, St Mary's. The results were presented in *The Early Environment of Scilly* (Ratcliffe and Straker

1996) and *The changing landscape and coastline of the Isles of Scilly; recent research* (Ratcliffe and Straker 1997).

The excellent preservation within the sampled peats of pollen, plant macrofossils and indicated that they can provide valuable information on the vegetational history of the islands and the process of coastal change. Diatom preservation was patchy but better at the base of organic sediments (Ratcliffe and Straker 1996).

Radiocarbon measurements obtained provided dates for peat formation which range from the late Mesolithic to the early medieval period. Most are not true peats but minerogenic sediments containing varying amounts of organic material. Forest beds are rarely associated with these deposits, providing a contrast with the submerged forests documented around the Cornish coast (with the possible exception of the submerged peat in St Mary's Roads discovered in 2005). The radiocarbon dates suggest that the disparity between sea level change in Scilly and Cornwall may be less than proposed by Thomas (Ratcliffe and Straker 1996). However, there are only two reliable index points for Scilly that meet satisfactory stratigraphic criteria (Massey *et al*, 2008) and both the current interpretations of sea-level change are highly speculative.

Nineteen peat deposits at twelve locations have been recorded in the intertidal zone. Most of these were discovered during coastal erosion project or by local amateur archaeologists who reported their findings to CAU (Ratcliffe and Straker 1996). As well as shelves of peat exposed on the beach surface, buried and subtidal bands have also been identified; most recently an extensive deposit of peat was identified in about 6m of water in between Pots Reef and Crow Rock off St Mary's by a local diver Todd Stevens.

2.3.3 Other palaeoenvironmental work

The early development of the Isles of Scilly, particularly during the last Ice Age has been the subject of much speculation and research (Scourse 1985, 1986, 1991, 2006 and references therein). Data from the Holocene has been accumulating slowly and often in a fragmentary way. In 1984 sampling and pollen analysis was carried out at Higher and Lower Moors, mires located behind coastal barriers on St Mary's (Scaife 1984, 1986a, 1986b). These are still the two longest pollen sequences from Scilly (both in terms of depth and time span) and have provided a general background vegetational history which is at least partially fixed by radiocarbon dating (a few dates were obtained from Higher Moors, the longest sequence which dates back to the middle Mesolithic).

Peat deposits of varying depths are also known to exist behind other coastal barriers, such as shingle banks and dunes. Higher and Lower Moors on St Mary's are the best examples, but peats are also known in Big Pool, St Agnes, and in The Pool on Bryher. These and other fragmentary pollen sequences are reported in Scourse (1986, 2006).

Following the 1989-93 project, archaeological work associated with the implementation of coast protection schemes included the sampling of intertidal peat deposits at two other locations; Porth Coose on St Agnes (Johns *et al* forthcoming) and Old Town, St Mary's (Ratcliffe and Straker 2000). The radiocarbon date for the top of the Old Town sequence calibrates to AD 420-660, suggesting that this wetland became inundated by sand sometime in the late Roman to early medieval periods.

A small amount of non-archaeological sampling work has also taken place at Big Pool, St Agnes, where two bands of peat were found during a search for sedimentological evidence for the effects of tsunami related to the Lisbon AD 1755 earthquake (Foster 1991). A couple of radiocarbon dates were obtained for the lower (medieval) band.

In September 2006, Todd Stevens took a sample from the submerged peat deposit in the

Crow Bar area, according to a methodology provided by Vanessa Straker, EH Regional Science Adviser; this has been sent to the University of Plymouth for analysis.

2.3.4 RCHME survey 1996/7

During 1996/7 the RCHME carried out surveys of archaeology and peat exposures below HWM at Crab's Ledge, Bathinghouse Porth, Tresco Flats and Appletree Bay, Tresco; Green Bay, Bryher and the stone row and a wave-cut line at Par Beach St Martin's. Fixed survey points were established to allow for re-survey and re-levelling and the digital survey, completed in April 1997, was successfully downloaded into the Isles of Scilly Council GIS. Unfortunately the digital data seems to have been lost and this data only exists as hard copy.

2.3.5 The Rapid Coastal Zone Assessment for the Isles of Scilly

In 2003/4 HES carried out a Rapid Coastal Zone Assessment Survey (RCZAS) for English Heritage, which included reconstructions of the topography of the Scillonian batholith using OS and Admiralty chart data (Fig 2) The RCZAS recommended a multi-disciplinary approach to area survey and verification to locate possible archaeological sites and shipwrecks using high resolution sidescan sonar, multibeam bathymetry, caesium magnetometer and CHIRP and boomer sub-bottom profiling, complemented by diver inspection and a broader marine and intertidal environmental assessment (Johns *et al* 2004).

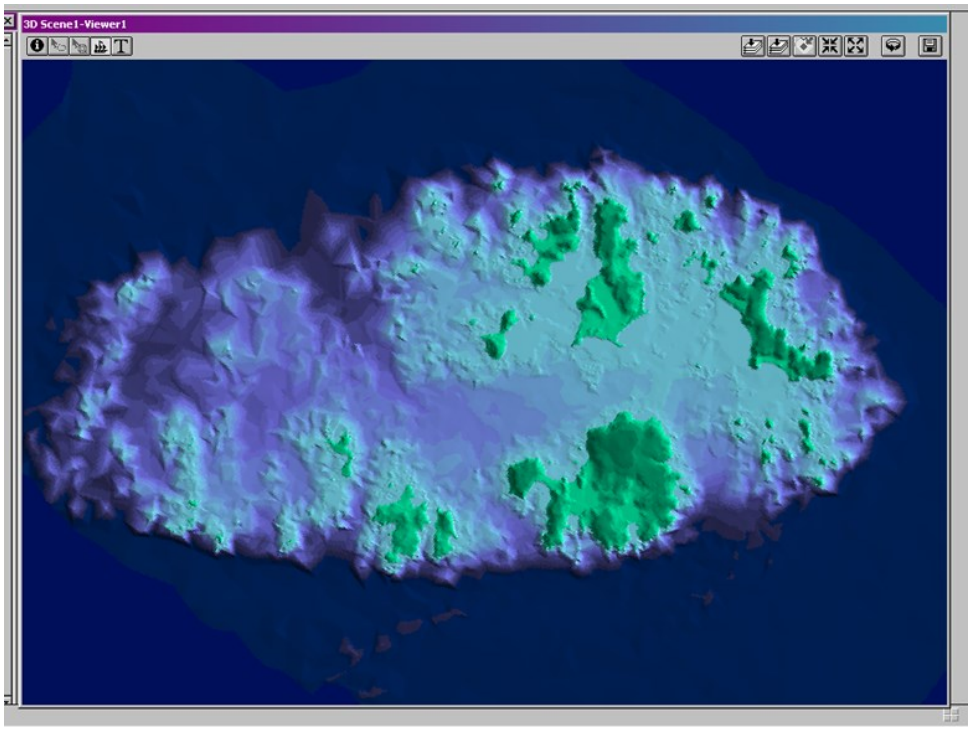

Fig 2 The Scillonian batholith (HES)

3 The Lyonesse Project

3.1 Proposal

Building upon the previous work undertaken in the Isles of Scilly, we propose an integrated investigation of the evolution of Scilly during the Holocene drawing on an

unusually wide spectrum of expertise: palaeotidal modelling, marine geophysics, Holocene geology and palaeoecology, archaeology, and history.

3.2 Layout of project design

This project design is based on the revised brief and format described in the EH documents '*Commissioned Archaeology Programme Guidance for Applicants: Release 1.2, June 2006'*, and '*Management of Research Projects in the Historic Environment*' (MoRPHE).

4 Research aims and objectives

4.1 Research/understanding aims

4.1.1 Research aim 1: to reconstruct the evolution of the physical environment of Scilly during the Holocene

- By undertaking geophysical mapping of intertidal and subtidal peats, palaeosols and cultural remains.
- By developing a more refined methodology for the use of geophysical techniques to identify intertidal and subtidal sediments and cultural remains.
- By obtaining a series of palaeoenvironmental sequences which will provide information on the changing character of early coastal environments and further resolve the question of sea level rise in Scilly. The previous data includes only a few radiocarbon ages and outline palaeoenvironmental data and cannot be used to answer the questions concerning rates of sea level rise and the nature of early environment and response to sea level rise in Scilly.
- By reconstructing integrated timeslices of coastlines and potential changes in tidal range, sediment transport and currents.

4.1.2 Research aim 2: to investigate the progressive occupation of this changing coastal landscape by early peoples, their response to marine inundation and changing marine resource availability

- By exploring the potential for assessing the consequences for terrestrial archaeological sites (especially settlements) and sediment sequences of inundation in its various forms and duration(s) under various conditions (high/low energy seas, sheltered location etc.). This aspect could be particularly interesting and useful in the debate concerning present-day responses to imminent threat of inundation due to sea-level rise.
- By establishing a series of new sea level index points for the Isles of Scilly to reconstruct the rate and magnitude of sea level change over the key periods of human occupation.
- By comparing sea level change over key periods with NMR and HER data so as to explore spatial relationships between the coast edge and occupation and so obtain greater understanding of the original landscape context of the surviving archaeological sites and monuments by an appreciation of their relationship to the contemporary coastline (eg were many early prehistoric sites now located at or below high water mark originally inland?).

4.1.3 Research aim 2: to explore past and present climate change and sea level rise

- By reconstructing integrated timeslices of coastlines and potential changes in tidal range, sediment transport and currents.
- By providing baseline data on local relative sea-level change as input for estimating future sea level rise in Scilly which can feed into climate change forums such as Defra's FutureCoast and conferences organised by Coastal Management for Sustainability (CMS) Coastal Futures, etc. Predictions for future sea level rise in Scilly depend on determining isostatic trends in the islands. This will be one of the main outputs from the project. We will use this data alongside estimates of past and future eustatic sea level change to estimate future sea level rise in Scilly. It should be noted that current estimates of sea level rise do not include changes due to local steric and other oceanographic and atmospheric effects (cf Gehrels and Long 2008)

4.2 Management and methodological aims

4.2.1 Management and methodological aim 1: to develop geophysical techniques for mapping submerged palaeolandscapes

- By testing a survey and sampling method for intertidal and subtidal peat over a large area that will be an exemplar providing practical support to project development elsewhere. This will build on the experience and results projects such as the Mount's Bay Survey (CISMAS 2008) and the Seabed in Archaeology Project (Wessex Archaeology 2008).

4.2.2 Management and methodological aim 2: to improve management of the historic environment

- By undertaking GIS mapping of the results and updating of the Isles of Scilly HER and the Maritime Record of the NMR to provide an important tool for future management the marine and coastal historic environment.
- By assisting in the definition of Scheduled Monument areas which extend subtidally to inform the future management of Scheduled Monuments.
- By formulating recommendations for a minimum standard for preparation of characterisations and 'plans' of landscape-scale sites, monuments and palaeoenvironmental resources. These will be presented as set of recommendations in the final report

4.3 Outreach aims

4.3.1 Outreach aim 1: to promote better understanding of the islands' historic environment

- By raising the profile of archaeological and historical investigation in the islands.
- By giving interpretative talks, information and presentational materials to enable both locals and visitors gain a better understanding of Scilly's past.

4.3.2 Outreach aim 2: to promote local community action:

- By encouraging local volunteers will be encouraged to join in and find out about what is going on. Involvement will take many forms, according to individual's interests, skills or time. It may be in participating in the practical work,

contributing to educational materials, researching old documents or photographs, for example.

- By engaging with local divers and educating them to identify and report on peat exposures during the course of their dives.

5 Business case

5.1 The national context

5.1.1 The 1997 survey of England's coastal heritage

The 1997 survey of England's coastal archaeology for English Heritage and RCHME highlighted the importance of submerged peats and forests owing to the richness of the biological evidence they contain (Fulford *et al* 1997). The report outlined the potential of such deposits for addressing the problem of the hunter gatherer/agricultural transition and for providing information on later prehistoric exploitation of coastal environments and coastline change. In its discussion of survey methodologies, it acknowledges the wide range of expertise required when dealing with such sites and the value of studying remains not only in the intertidal zone but also in the adjacent subtidal zone and immediate coastal hinterland (careful thought being given in research designs as to the way in which the different zones will inform each other).

The following statement contained within the report is particularly relevant to this project design (given the relatively recent dates obtained for some of the submerged peat deposits in Scilly). *On a national basis, a key objective if we are to improve future predictions of sea-level rise is to develop our knowledge of vertical sea-level changes during the last 2000 years. Direct and proxy sea-level data are available, but there are few high resolution investigations for this most recent time period...For archaeologists and sea-level researchers, there is more to be gained from collaborative studies of the last 2000 years than for any other period in the Holocene."* (Fulford *et al* 1997).

Under the heading *Regional priorities: a provisional assessment* the entry for Scilly reads as follows:

Drowning of the landscape: continue to search for further physical and environmental evidence which will shed light on the evolution of the islands in their present form*

*Survey of field walls and associated features in the intertidal zone in association with their dry land counterparts**

Continue to monitor archaeological resource exposed in the intertidal zone (Fulford *et al* 1997).

5.1.2 The National Heritage Act (2002)

The National Heritage Act (2002) enabled English Heritage to assume responsibilities for maritime achaeology in English coastal waters, modifying the agency's functions to include securing the preservation of ancient monuments in, on, or under the seabed, and promoting the public's enjoyment of, and advancing their knowledge of ancient monuments, in, on, or under seabed. Initial duties include those formerly undertaken by the Government's Department of Culture, Media and Sport (DCMS), in respect to the administration of The Protection of Wrecks Act 1973.

English Heritage aims to discover, enhance and make more widely available knowledge about our maritime culture, whether it be in the form of shipwrecks, harbours, coastal defences, fish-traps, iconography or settlements. In order to relate to our maritime cultural heritage and understand how it has shaped our society today it is necessary to understand

the significance, meaning and function of the traces of maritime activity left to us in the archaeological recored. This needs to be done in a way which integrates seamlessly with what we know of our past derived from terrestrial investigations and initiatives.

Exploration and increased understanding of this unique record will better inform us about our past and how to protect our heritage for the benefit of present and future generations.

5.1.3 Taking to the Water

English Heritage's intitial policy for the transition of responsibility under the 2002 Act was set out in in 'Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England (Roberts and Trow 2002). In this policy document the priorities for research and development were described thus: Subject to the provision of adequate resources, English Heritage will undertake a programme of research designed to provide a more robust basis for the understanding and management of the maritime historic environment. In doing so we will place the greatest emphasis on work designed to strengthen the national record of maritime sites and landscapes, and work designed to enhance the practical and theoretical basis for site management. The types of project seen as high priority include:

- remote sensing projects, including aerial photography, geophysical, geo-technical and bathymetric survey. English Heritage believes that remote sensing techniques, which are rapid and comparatively inexpensive survey tools, will play a fundamentally important role in the future management of the marine historic environment;

  - The Lyonesse Project aims to develop geophysical and bathymetric survey to assist management of the marine historic environment.

- studies designed to improve our understanding of marine site environments and to enhance our ability to assess and predict site stability.

  - The Lyonesse Project aims to improve our understanding of marine site environments in Scilly and contribute towards our ability to assess and predict site stability.

- studies designed to improve understanding of drowned landscapes and paleoenvironments. Such landscapes have a tremendous potential for the preservation of archaeological evidence of the exploitation of coastal and marine resources and for use in predicting the nature, scale and pace of coastal change.

  - The Lyonesse Project aims to to improve our understanding of the drowned landscape and palaeoenvironment of the Isles of Scilly.

5.1.4 Making the Past Part of our Future

The EH Corporate Objective which forms the primary driver of the project is:

1A: Ensuring that our research addresses the most important and urgent needs of the historic environment (English Heritage 2005).

5.1.5 English Heritage Research Agenda 2005-2010

The primary activity type for this project is

1. Research

Research Theme: A – DISCOVERING, STUDYING AND DEFINING HISTORIC ASSESTS AND THEIR SIGNIFICANCE

Research: Programme 2 – Spotting the gaps: Analysing poorly understood landscapes, areas and monuments (English Heritage 2005b).

5.1.6 SHAPE Sub-Programme

The combination of Corporate Objective and Activity Type is codified as 1A-1-A2 converted to 11112.110 in SHAPE 2008, EH's guidance for external grant applications (English Heritage 2008).

Sub-Programme Name	**New Frontiers: Mapping our marine heritage**			
Sub-Programme Number	**11112.10**			
Corporate Objective	1A: Ensuring that our research addresses the most important and urgent needs of the historic environment			
Activity Type and Programme	RESEARCH A2: Spotting the gaps: Analysing poorly understood landscapes, areas and monuments			
Sub-Programme Description	Projects developing the fundamental evidence base for out offshore and intertidal zone historic environment. Exemplar projects may include: • Sub-surface remote-sensing surveys) • Offshore and intertidal field surveys • Aerial or satellite surveys • Synthesis or modeling of hydrological data			
Reason for EH Support	Critical requirement to build up evidence-base for submerged landscapes, structures, artefact or ecofact concentrations, wrecks and palaeoenvironmental resources to feed into marine planning			
Research categories	**NABS**	**SETI Primary purpose**	**Frascati Defintion**	**Research Areas**
	1.2	B	Specific Applied	Humanities
Similar Sub-Programmes	Separate from 11111.240 Historic Seascape Characterisation, which will build on this. Will inevitably cross-cut on a range of Programme A1 Sub-Programmes, but used here specifically for seabed projects			

5.2 The Regional context

- South West Archaeological Research Framework Draft Report - Research Aim 23: ***Improve our understanding of past climate and sea-level changes together with their effects on the peoples' relationships with landscapes and the sea***.

- A Strategy for the Historic Environment in the South West. English Heritage. 2004. Regional Priority 4; ***Increase our understanding of the South West's coastal and maritime historic environments and wetland landscapes as a matter of urgency. Work with those responsible for managing these environments and, where appropriate, seek adequate protection.***

- The Isles of Scilly AONB Management Plan 2004-2009: Architecture, the Historic Environment and Heritage. Broad Aims ***AH1 Appropriate management regimes ensure the survival of terrestrial and marine archaeology***, ***AH3 The cultural land and seascape of the AONB has widespread understanding and appreciation***. Policy ***AH4 Ensure that the character of the Islands' marine and terrestrial historically valuable sites and architecture are safeguarded and all sites and buildings with important character or historic value are***

appropriately maintained. AH7 To support the sustainable use of the archaeology and heritage value o the AONB as an economic resource bringing benefit to the communities of the AONB. Key Actions: **AH9 To ensure that comprehensive baseline data about the extent and condition of the Islands' archaeological and historic resource are available to the AONB for 'state of the AONB monitoring'; and where possible to the public. AH11 To produce interpretation materials designed to improve awareness and understanding of Scilly's archaeology and heritage resource.**

5.3 Climate change and sea level rise

The prospect of climate change is one of the biggest challenges facing humankind in the early 21st century. Climate refers to the average weather experienced over a long period of time. This includes temperature, wind and rainfall patterns. The climate of the Earth is not static, and has changed many times in response to a variety of natural causes. Climate change is already happening. Globally, the ten hottest years on record have all occurred since the beginning of the 1990s, natural factors cannot explain recent warming. Current climate models predict that global temperatures could warm from between 1.1 to 6.4°C by the end of the century, depending on the amounts of greenhouse gases emitted and the sensitivity of the climate system (IPCC, 2007).

For the UK, climate change means warmer temperatures, wetter winters and drier summers, less snow, storm surges (storm events on Scilly damage the whole economy) and higher sea levels, leading to flooding of coastal areas, the Environment Agency's latest prediction for sea level rise in Scilly is 0.6m by 2050. Across the globe, there may be severe problems for regions where people are particularly vulnerable to changes in the weather. Flooding, droughts, food shortages and the spread of disease are commonly predicted. The social, environmental and economic costs of climate change could be huge. Retreating from coastal areas in some locations, such as the Isles of Scilly, may not be viable, and the cost of protecting them very expensive (*ibid*).

Climate change presents a significant challenge to the UK and to the international community. There are also enormous opportunities to take action. Government, business and individuals all have a part to play, and all of us can benefit from rising to the challenge of climate change.

English Heritage's policy on climate change is set out in the recently published booklet *Climate Change and the Historic Environment* (English Heritage 2008). English Heritage also aims to learn and disseminate the lessons the past can provide on living in a low-carbon economy and in a changing environment. In particular, working in partnership with others they will:

- encourage improved understanding of past climate change and human adaptation to it;

  - The aim of the Lyonesse Project is to investigate past climate change in the Isles of Scilly and early peoples' response to marine inundation and changing marine resource availability.

English Heritage will focus their climate change-related research on a number of issues:

- learning relevant **lessons from the past** (including better understanding of climate change mechanisms drawn from the record of long-term environmental change and sustainable approaches to living drawn from past low-carbon societies);
- initiatives to **improve our ability to monitor the impacts of climate change on the historic environment**;

- initiatives to improve our ability **to predict changes to the historic environment arising from climate change** (such as the modelling based on the forthcoming IKIP08 scenarios);
- tools to support **decision-making for the long-term** (such as the suitability of tree species for planting in historic landscapes or the appropriateness of investment in particular coastal defence schemes both of which need to consider the implications of up to 100 years of climate change;
- strategies for the **future management of their estate** in a changing climate.

- The Lyonesse Project has the potential to contribute to all these issues.

English Heritage's research priorities will continue to evolve, informed by dialogue within the environmental, heritage, architecture and construction sectors and by improvements in our understanding of climate processes and the mitigation and adaptation measures required to respond to change (English Heritage 2005, 14).

5.4 The Lyonesse Project team

The conjunction of a number of factors; the nature of the Scillonian environment, the existence of the relevant geological and archaeological archives, development of GIS and the maturity of all the component disciplines, means that we are now in a position to provide an integrated insight into the evolution of a coastal environment through time in unprecedented detail. We believe that the Lyonesse Project could become a benchmark study which will formulate new integrated methodologies for understanding the relationships between human society and economy and the changing coastal environment.

The proposed multi-disciplinary team will bring a combination of skills and expertise to the Lyonesse Project (see section 12).

5.5 Organisational strategies driving the project

5.5.1 Historic Environment Service, Cornwall County Council

The Historic Environment Service (Projects) is the contracting arm of the Historic Environment Service of Cornwall County Council (HES). HES is committed to conserving and enhancing the distinctiveness of the historic environment and heritage of Cornwall and the Isles of Scilly by providing a number of services including:

- Conservation works to sites and monuments
- Conservation surveys and management plans
- Historic landscape characterisation
- Town surveys for conservation and regeneration
- Historic building surveys and analysis
- Maritime and coastal zone assessments
- Air photo mapping
- Excavations and watching briefs
- Assessments and evaluations
- Post-excavation analysis and publication
- Outreach: exhibitions, publication, presentations

HES has been undertaking projects in the Isles of Scilly since the mid-1980s, and produced the first archaeological management plan for Scilly in1989, commissioned by EH. Arising of the recommendations of this report, EH commissioned the five year rolling programme of coastal monitoring and palaeoenvironmental sampling in Scilly, the results of which are presented in *'The Early Environment of Scilly'* (Ratcliffe and Straker 1996). This document made recommendations for further work on sea level rise, archaeological sites and the palaeoenvironment of Scilly, for many reasons the work was not undertaken and the 1996 recommendations were reiterated in the RCZAS for Scilly (Johns *et al* 2004). The Lyonesse Project would see the completion of the programme of work in Scilly which began in the 1980s.

The project also provides a capacity-building opportunity to develop expertise in maritime archaeology within the local historic environment service, which can be seen as an important development in a maritime county.

- ***To conserve, maintain and enhance the coast*** is a priority in the CCC Environment and Heritage Service Plan for 2007-08.

5.5.2 CISMAS

The Cornwall and Isles of Scilly Maritime Archaeology Society (CISMAS) was formed in 2004 in order to promote maritime archaeology in Cornwall and the Isles of Scilly. The society currently has over 80 members, about 75% of which are divers.

The first project undertaken by CISMAS was a two year survey of the debris field around the wreck of *HMS Colossus* (1798) in the Isles of Scilly. This project was facilitated by a grant of £25,000 from the Local Heritage Initiative. Other projects undertaken include recording of ship timbers, a museum display and publication of a booklet about *HMS Colossus*.

The society is currently working on a major maritime survey of Mount's Bay in Cornwall; this project is assisted by a grant from the Heritage Lottery Fund. CISMAS is also involved in several projects on the Isles of Scilly including survey on the protected wreck sites at *Tearing Ledge* and *Bartholomew Ledges* and on the wreck of *HMS Firebrand* (1707).

5.6 Benefits to the public

The project will be inclusive and seek to involve the local community, divers and maritime archaeological societies. An information day about the project will be held in St Mary's each year. Benefits to the public:

- Volunteer involvement in the project through CISMAS and IMAG will enable skills to be learnt in archaeological recording techniques and cultural resource management.

- Production of interpretative materials will enable both locals and visitors gain a better understanding of Scilly's past.

- Local volunteers will be encouraged to join in and find out about what is going on. Involvement will take many forms, according to individual's interests, skills or time. It may be in participating in the practical work, contributing or researching old documents or photographs; we will ask local divers for help and educate them to identify peat during the course of their dives.

- The project team will provide a specific presentation to the Isles of Scilly AONB Management Group.

- The project will benefit the Council of the Isles of Scilly in regard of the management of the marine historic environment. The HER for Scilly is maintained by Cornwall County Council and the Council for the Isles of Scilly will be provided with copies of the HER updated with the results of this project.

6 Project scope

The work will be structured into two vertical modules:

1) focussing on the evolution of the physical environment in terms of sea-level change, vegetation cover and land use. Outputs will be; a) a new sea-level reconstruction for Scilly based on securely dated index points with accurate and precise indicative meaning, b) Reconstructions of the landscape and vegetation of drowned land surfaces and their relationship with submerged archaeological structures. The sea-level reconstruction will be used as a further test of GIA models (cf Massey *et al*, 2008) and will inform predictive modelling of future sea level rise and feed into climate change forums and reviews.
2) focussing on the marine/intertidal/coastal archaeology and anthropology. This will include developing approaches to plotting submerged terrestrial landscapes. Trial outputs will include recommendations for a minimum standard for preparation of characterisations and 'plans' of landscape-scale sites, monuments and palaeoenvironmental resources.

The acquisition of data in such shallow marine environments is not trivial and will require the integration of a number of different approaches: remote sensing, chartered vessel, small boat and on foot at low tide. This integrated survey will therefore constitute a single, lateral, cross-cutting module of central importance to two proposed vertical modules. For instance, sub-bottom profiles will contain information on submerged peats (module 1) and submerged field walls (module 2). There will also be lateral links between the two modules so that the structure becomes tightly integrated: the relative sea level curve will inform the minimum age of drowned archaeological structures, will define the landscape space in which occupation could occur at any particular time, and will inform ideas on resource use and likely transport routes. The new relative sea-level data will furthermore be valuable for providing constraints for GIA models of the British Isles (cf Massey *et al*, 2008) The Celtic Sea province is a region underrepresented in terms of existing sea-level index points and yet appears from the GIA models to have relatively rapid rate of crustal subsidence. The new data will have implications for the size, extent and melting history of the last British Ice Sheet and the viscoelastic structure of the Earth. These implications will be of potential international significance.

7 Interfaces

The Lyonesse Project will build upon the work undertaken by Prof Charles Thomas (Thomas 1985), during the 1988-93 Coastal Monitoring Programme (Ratcliffe and Straker 1996), other palaeoenvironmental work (eg Scaife 1984; Ratcliffe and Straker 2000) and the 1996 RCHME surveys.

The project will assimilate the results of any recent and new discoveries made during research and development-led archaeological work undertaken in Scilly eg archaeological recording during improvements to the quays on the off-islands of Bryher, St Agnes and St Martin's (Johns 2008).

The project will run in tandem with the 'Islands in a Common Sea' project, an ongoing partnership between HES and Cardiff University's School of History and Archaeology (HISAR) which seeks to:

- to reinvigorate archaeological research into the archaeology of Scilly;
- to further develop knowledge of the early environment, society and settlement on the islands;
- to explore the relationship between Scilly and the Southwest British mainland
- to enhance understanding of the archaeology of the Atlantic façade; and
- to continue research into cultural and economic responses to physical and climatic marginality on islands.

The 'Islands in a Common Sea Project' commenced in 2005 and has sought funding on a year by year basis, having been supported by the British Academy, the Heritage Lottery Fund, the Scheduled Monument Management Programme (to which English Heritage, Cornwall Heritage Trust and Cornwall County Council contribute), the Isles of Scilly AONB Sustainable Development Fund and HISAR's own research fund. The project will not be undertaking fieldwork in 2009, but continuing research and consolidating the results of previous work. Jacqui Mulville and Charlie Johns are the co-directors of the project; we will establish formal communication by letter and e-mail.

Another important interface will be with the EH project 'Defending the Isles of Scilly' (Brodie 2008), a 3-year project commencing in 2008, which although focussing on military structures will also consider the general threat to the life of the Islands and the risk to other low-lying communities from climate change.

The project can also link into Interpretation Strategy for the Isles of Scilly currently being prepared for the Council of the Isles of Scilly and the AONB Partnership by Red Kite Environment, which seeks to develop key themes for heritage interest.

The project team will liaise with Eleanor Breen the Assistant Planning Officer (Conservation) and Historic Environment Field Advisor for the Council of the Isles of Scilly.

The project will utilise the expertise and local knowledge of CISMAS who are currently undertaking a number of maritime projects in Cornwall and the Isles of Scilly, including the Mount's Bay and *Colossus* stabilisation trials. The proposed Samson Flats intertidal field survey by CISMAS, planned to take place in June 2008 and 2009, will provide an important dataset for the project (Camidge and Randall 2009).

The project will have strong synergies with ongoing research at the University of Plymouth being pursued by the Plymouth based participants. It will develop further work on sea-level reconstruction in southwest England and testing of GIA models (Massey *et al* 2008), with current projects funded by SWRDA, Devon County Council and First Group. The work on landscape change and human interaction will complement work on prehistoric landscape change in south-west England and projects currently running in and funded by Dartmoor and Exmoor National Parks.

Detailed data on the submerged peat deposits should be incorporated into EH's near and offshore peat database that EH's palaeoecologist Zoe Hazell has compiled and the project team will discuss this with Zoe.

8 Constraints

The Isles of Scilly is a unique and sensitive landscape. This is reflected in the multitude of local, national and international designations whose intention is to protect, preserve and enhance the islands, their features and habitats. Thus consultation on these proposals will need to be wide, in order to avoid any disturbance or damage to significant features. There are currently 26 Sites of Special Scientific Interest (SSSIs) covering a total area of *c*789 ha, of which approximately 50% is located on the unenclosed land of the inhabited islands. The sea and seabed lying within the 50m depth contour surrounding the islands was defined as a 'Marine Park', having the status of a Voluntary Marine Nature Reserve. The candidate Special Area of Conservation (cSAC) designated under the EU Habitats Directive extends some way beyond the 50m depth contour. The cSAC area is one of twelve marine SACs selected around the UK to protect the marine environment and develop approaches and techniques for the management and monitoring of SACs. The Isles of Scilly Special Protection Area (SPA) and Ramsar sites are comprised of all or parts of 14 component SSSIs and are designated for their breeding seabirds. Scilly was given national landscape designation as a Heritage Coast and Area of Outstanding Natural Beauty (AONB) by the Countryside Commission in 1975, with confirmation by the Minister in the following year.

Many of the sites that will be surveyed and sampled during the project are within Scheduled Monument Areas and Scheduled Monument Consent (SMC) will be required prior to any work being undertaken, a full methodology will be needed for SMC to be considered.

A permit from the Marine and Fisheries Agency and a licence from the Crown Estate will be required for sampling of seabed deposits; there will be no cost for the latter (Charles Green pers comm). Consent from the Duchy of Cornwall for work in the coastal and intertidal zone will also be applied for.

HES will obtain necessary consents and licences at the commencement of the project.

9 Communications

The project team will communicate with each other via a scheduled e-meeting, e-mail correspondence and a team meeting at the beginning of Year 2.

We will communicate externally with EH through e-mails, Highlight Reports, project review meetings and the team meeting at the beginning of Year 2.

Public information days will be held in St Mary's in a suitable venue such as the Council Chamber or Isles of Scilly museum to communicate the results of each year's fieldwork.

The project will be signposted on OASIS and a digital project summary will be prepared for EH at the beginning of the project.

Project web pages highlighting the aims of the project and results will be hosted by HES, the School of History and Archaeology, University of Cardiff and the School of Geography, University of Plymouth.

Project progress review reports will include highlights.

An interim report will be prepared at the end of the first year and a final report disseminated at the end of the project. The results of the project will be disseminated through papers given at academic and professional conferences as well as through the reports.

10 Project review

At each stage the project manager will provide the EH Project Officer with a written progress report and time will be allowed for nine meetings with the Project Officer during the course of the project. It might be prudent to review progress after one year and treat year one as a pilot project. The application of marine geophysics in shallow water with the project aims is not well established and may benefit from reappraisal.

11 Health and Safety

11.1 Health and safety statement

The Historic Environment Service is a section of the Planning, Transportation and Estates, Cornwall County Council. The Unit follows the County Council's "Statement of Safety Policy" and also the Planning Directorate's "Statement of Safety Policy". For more specific policy and guidelines the Unit uses the manual "Health and Safety in Field Archaeology" (2002) endorsed by the Standing Conference of Archaeological Unit Managers and also the Council for British Archaeology's Handbook No. 6 "Safety in Archaeological Field Work" (1989).

Prior to carrying out on-site work HES will carry out a Risk Assessment.

All diving operations for the project will be undertaken by CISMAS under the supervision of Kevin Camidge. CISMAS will be diving according to BSAC regulations and under HSC's Scientific and Archaeological ACoP

11.2 Insurance

As part of Cornwall County Council, HES is covered by Public Liability and Employers Liability Insurance.

CISMAS is covered by £5,000,000 Public Liability Insurance through the CBA Group Insurance Scheme.

The University of Plymouth and University of Cardiff staff are covered by Public/Products Liability, Employers Liability and Travel Insurance.

Resources and programming

12 Project team structure

12.1.1 HES Staff

Charlie Johns, BA (Hons), MIFA, Project manager

As a Senior Archaeologist with HES (1991- present) Charlie has special responsibility for developing the Service's maritime capacity and for projects in the Isles of Scilly; notably directing the excavation of the Bryher Iron Age sword and mirror burial in 1999 (Johns 2002-3), updating 'Scilly's Archaeological Heritage', the popular archaeological guide to the islands, in 2003 (Ratcliffe and Johns 2003) and compiling the Isles of Scilly Rapid Coastal Zone Assessment Survey (RCZAS) for English Heritage in 2003-4 (Johns *et al* 2004). Since 2005 he has co-directed the 'Islands in a Common Sea' research project in Scilly with Dr Jacqui Mulville of Cardiff University (Johns et al 2006; Mulville 2007; Johns and Mulville 2007), and has been awarded the title Honorary Research Fellow in Cardiff University's School of History and Archaeology.

Maritime projects include the HMS *Scylla* assessment for the National Marine Aquarium, Plymouth (Johns, Camidge, Holt and Tapper 2004); the *Royal Anne Galley* Marine Environmental Assessment (MEA) for English Heritage (Camidge, Johns and Rees 2006; 2008), the South West Wave Hub assessment for Halcrow (Johns, Camidge, Rees and Tapper 2006); England's Historic Seascapes Scarborough to Hartlepool pilot project (Val Baker *et al* 2007) and Historic Seascape Characterisation National Method (Tapper and Johns 2008) for English Heritage; and the Falmouth Cruise Project assessment for Haskoning Uk Ltd (Johns *et al* 2008).

Charlie will co-ordinate the project to ensure that it is carried out to the agreed standards. His tasks will include liaison with the EH Project Officer and the project staff, the monitoring of the project budget and ordering equipment and producing the interim and final reports. He will also undertake the key validation checks, processes and documentation required for project designs, reports and archives prior to publication, dissemination and deposition as described below in Section 13.4.

Bryn Tapper, BA (Hons), Senior Archaeologist (GIS)

Since joining HES in 1999 Bryn has been developing the Geographical Information System (GIS) in conjunction with the Historic Environment Records Team. Bryn has had advisory roles with the successful World Heritage Site Bid project for Cornish Mining, the Cornwall & Scilly Urban Survey and the Cornwall Industrial Settlements Initiative. He has been involved in Historic Landscape Characterisation and numerous small-scale projects and surveys. He undertook the GIS mapping for the Isles of Scilly Rapid Coastal Zone Assessment Survey and has given numerous presentations of the use of GIS in Cornish Archaeology. In 2006-7, Bryn provided GIS expertise during the ALSF-funded England's Historic Seascapes; Scarborough to Hartlepool Pilot Project (Tapper *et al* 2007; Val Baker *et al* 2007) and in 2007-8 developed the national methodology for Historic Seascape Characterisation for EH (Johns and Tapper 2008).

Bryn will undertake GIS mapping GIS mapping of the results and update of the Isles of Scilly HER and the Maritime Record of the NMR. He will also generate illustrative material for the reports, including maps and interpretative models.

12.1.2 Specialists

12.1.2.1 CISMAS

Kevin Camidge, Dip Arch MIFA, Marine Archaeologist

Kevin is an experienced marine archaeologist based in Penzance who has worked extensively in the Isles of Scilly. In recent years he has carried out work for English Heritage on HMS *Colossus* in the Isles of Scilly (eg Camidge 2005 and 2006) and is also involved in several other projects on the Isles of Scilly including survey on the protected wreck sites at *Tearing Ledge* and *Bartholomew Ledges* and on the wreck of *HMS Firebrand* (1707). He is working has worked in partnership with HES on many projects including the *Royal Anne Galley* MEA (Camidge *et al* 2006) as well as leading the Mount's Bay Survey, undertaken by the Cornwall and Isles of Scilly Maritime Archaeological Society (CISMAS).

Kevin will undertake day to day supervision of the geophysical survey fieldwork and will be onboard the boat during all surveying and diving operations. He will direct the diving operations, bathymetric survey, sidescan survey and all sampling and monitoring operations, assess and interpret the results of the geophysical survey and contribute to the annual and final reports.

David McBride, Skipper

Based in the Isles of Scilly, David is a skipper and commercial diver H.S.E.3 Hard Hat, Wet Bell, Construction & Inspection. Professional Photographer Dip IIP, offshore photo technician, specialist underwater photographer and videographer. Previous clients include Global, 2W, Infabco, Occidental, Westlands, Marconi, Comex, Oceaneering, SWEB, Underwaterworld magazine, Western Morning News, Royal Navy and English Heritage.

David is the skipper of the *Tiburon*, a 35ft offshore 105 hull and a 430HP diesel engine, which will be chartered for the geophysical survey fieldwork and sampling of submerged deposits.

Phillip Rees MSc C.Sci C.Geol F.G.S, Marine Geologist

Phillip has recently been appointed as a Chartered Scientist for his work in the marine environment. He has not only has had extensive experience in conducting studies of the seabed in all parts of the world but in recent years has been involved in coastal engineering projects around the Cornish coast and in 2004 co-ordinated a marine environmental study in Mount's Bay (Hyder Consulting Ltd 2004).

Phillip will assist with the geophysical survey and the sampling of seabed deposits and contribute to the geological background section of the reports..

Luke Randall

Luke is an archaeology student at Bradford University who has worked on a number of CISMAS projects and is an experienced diver and geophysical survey assistant.

Luke will assist with the geophysical survey and sampling of submerged deposits.

12.1.2.2 IMAG

Todd Stevens, Diver

Todd Stevens is an experienced local diver and founder of the IMAG, an informal group that came into existence in 2002 when the NAS held Part 1 and II training courses in Scilly. There are seven members in total although only four are involved on a regular basis. They have their own boat and are interested in all aspects of island history.

Todd, and other IMAG members, will provide local knowledge; help with logistics and sampling of submerged deposits.

12.1.2.3 University of Plymouth staff

Dan Charman, PhD, Palaeoenvironmentalist

Dan is a Professor in the School of Geography. His experience and expertise cover a range of palaeoenvironmental techniques and applications. Of particular relevance to the Lyonesse project are his work on Holocene landscape change and settlement on Bodmin Moor (eg Gearey *et al*, 2000a; 2000b), multi-proxy work on climate change and settlement in the southwest uplands (eg Charman *et al*., 1998, Amesbury *et al*, 2008). He has recently collaborated with Gehrels on reconstructing sea-level change in the southwest (Massey *et al*, 2008). He has written more than 100 research publications, including 3 books and >60 refereed journal papers.

Dan will jointly supervise (with Jacqui Mulville) the palaeoenvironmental sampling of peat deposits known and newly discovered in both intertidal and submerged zones. Dan will direct the work on palaeoenvironmental analysis and collaborate with the rest of the Plymouth specialists on these analyses. He will be responsible for reporting results of palaeoenvironmental analyses and contributing to annual and final reports.

Ralph Fyfe, PhD, Palynologist

Ralph is lecturer in environmental change in the School of Geography. He has worked extensively on questions concerning prehistoric and historic land use and landscape change. Of particular relevance to the Lyonesse project is his work in south west England on spatial aspects of prehistoric and historic land management (eg Fyfe *et al*, 2003a; Fyfe *et al*, 2003b; Fyfe *et al*, in press), the nature and archaeological significance of prehistoric woodland cover (eg Caseldine and Fyfe, 2006; Fyfe, 2007) and climate change and prehistoric settlement (eg Amesbury *et al*, 2008). He has carried out numerous archaeological evaluations for a variety of organisations, including English Heritage, County Councils, National Parks and Archaeological Consultancies.

Ralph will provide expert advice and assistance on palynological sampling and analysis, and will contribute to field sampling and site selection.

Roland Gehrels, PhD, Sea-level reconstruction

Roland is Professor in the School of Geography. He has 18 years experience in the use of foraminifera to reconstruct sea-level change from coastal sediments. He has published extensively on this area including leading the work on sea-level change in southwest England (eg Gehrels *et al* 2001, Massey *et al* 2008) and applying understanding of past sea-level change to future scenarios for the southwest (eg Gehrels 2006). He has written extensively on Holocene sea-level change including 48 refereed papers.

Roland will provide expert advice and assistance on foraminifera analysis and interpretation of sea level data, and will contribute to field sampling and site selection.

Katie Head, PhD, Palaeoenvironmentalist

Katie is a research technician in Quaternary science. She is a skilled palynologist as well as having experience of working with foraminifera and diatoms and on marine and non-marine sites. She has 9 years experience in palaeoenvironmental research and ran a palynology laboratory at The University of Worcester. She has also worked extensively on a variety of archaeological consultancy projects in the Midlands and the South West (eg Head and Mann 2005; Head 2004). She has experience of publishing both reports and

journals (eg Head *et al* 2006).

Katie will undertake the majority of the palaeoenvironmental laboratory analysis, including identification of plant macrofossils, and will contribute to data interpretation and report writing.

12.1.2.4 University of Cardiff Staff

Jacqui Mulville, BSc (Hons), PhD, Bioarchaeologist

Jacqui is Senior Lecturer in Bioarchaeology in the School of History and Archaeology at the University of Cardiff. She is an experienced environmental archaeologist with over 25 years experience and has previously worked as an English Heritage Regional Science Advisor integrating promoting and supporting archaeological science in commercially funded projects. Mulville is also an experienced field archaeologist, leading excavations on the British mainland and islands with a focus on inter-disciplinary research and the close integration of archaeological science with more traditional strands of analysis. One strand within her work is the archaeology of islands with on-going research into the Western Isles and the Isles of Scilly (co-directing the parallel 'Islands in A Common Sea' project, funded by the British Academy, Cardiff University and the Isles of Scilly AONB Sustainability fund). She has collaborations with many other leading research groups and she has authored or co-authored >40 published works with *c* 10 in peer-reviewed journals.

Jacqui will undertake the joint supervision with Dan Charman of the paleoenvironmental sampling, both submerged and intertidal. Jacqui will also be in charge of the logistics of transport to and from the sampling locations. Once protocols are established sampling of all known paleoenvironmental locations will be undertaken. Jacqui will direct the survey of the intertidal archaeology using GPS and traditional survey methods. She will assess and interpret the results of the archaeological survey and liaise with Steve Mills and Dan Charman to ensure the full integration of the archaeological and environmental survey data and to contextualise the results from fieldwork within the broader archaeological background of the islands and will contribute to the annual and final reports.

Steve Mills, BA (Hons), MA, PhD, Field Surveyor/GIS expert

Steve is Lecturer in IT Applications in the School of History and Archaeology at the University of Cardiff. He has over 10 years experience as a field surveyor using total station (EDM) and GPS integrated with GIS mapping on a wide range of archaeological projects both in the UK and abroad. Recent projects he has carried out surveys for include the 'Islands in a Common Sea' project, the Southern Romania Archaeological Project, the Battle Moss multiple stone rows project (Caithness, Scotland) and the Remediated Places project (Çatalhöyük, Turkey). He has previously worked for the HES as a GIS mapper on the successful Cornish Mining World Heritage Site Bid and the Cornwall & Scilly Urban Survey. He maintains the web pages for the Cardiff School of History and Archaeology and for the 'Islands in a Common Sea' project.

Steve will assess the RCHME surveys carried out in 1996/7 with the aim integrating this into the project GIS and locating the surveyed features and survey points in the field. He will undertake EDM and/or GPS surveys of the terrestrial and intertidal sites and peat exposures, draw up the surveys incorporate the results into the project and contribute to the annual and final reports.

12.1.2.5 English Heritage

John Meadows, PhD, Assistant Scientific Dating Coordinator

John has been with the Scientific Dating Team since 2005 and has been involved professionally in scientific dating since 2002.

John's contribution will be radiocarbon sample selection and Bayesian chronological modelling of radiocarbon and OSL measurements (this is now relevant to the age-depth profiles for the longer palaeoenvironmental sequences, as well as in building a sea-level curve.

12.1.2.6 Helen Roberts (HR) Luminescence Geochronologist

Helen is a lecturer in Quaternary Science at Aberystwyth University, where she has been based for the last 10 years. During this time she has helped to develop the Aberystwyth Luminescence Research Laboratory's international reputation for excellence in luminescence research through the development of both pure and applied research strands. The laboratory retained its NERC Recognised Facility status (held since 1996) following an application submitted in 2007 by the Director of the laboratory and Helen, and remains the only such Recognised Facility for luminescence in the UK. Helen's current research interests focus on the development and application of luminescence geochronology, with particular interest in rates of geomorphic change, and studies of deposits of wind blown sediments. She has experience of working in coastal settings, including work with English Heritage based at Dungeness, SE UK, and Gwithian, Cornwall. Helen has published 24 peer-reviewed publications in international journals in the last 8 years.

Helen will undertake Optical Stimulated Luminescence (OSL) dating of sand deposits

12.1.2.7 Consultants

Julie Jones BA, Archaeobotanist

An experienced freelance archaeobotanical specialist based in Bristol, Julie has carried out palaeoenvironmental assessments and analyses for numerous HES projects.

Julie will undertake identification and analysis of plant macrofossils.

Janice Light BSc – Malacologist

An experienced freelance malacologist, who Julie has also worked on many projects with HES.

Janice will undertake identification and analysis of mollusca.

David Smith, PhD, Insect Specialist

David is lecturer in environmental archaeology at the Institute of Archaeology and Antiquity, University of Birmingham. Current projects includes palaeoentomology of urban settlement in London, the Midlands and East Anglia, palaeoentomology of river and stream deposits in the Trent Valley and its catchments, reconstruction of past land use, woodland and river evolution in the Trent Valley catchment, reconstruction of the landscape and environment of the Cetina River Valley, Croatia, commercial palaeoentomological contracts which includes a wide variety of both archaeological and geological work

David will undertake identification and analysis of insects.

13 Methods statement

13.1 Introduction

The project will involve five main types of work.

- *Geophysical survey of the intertidal and marine zones in the northern part of Scilly.* This will be undertaken using an integrated programme of marine and onshore survey. An initial desk-based audit, including study of seabed descriptions on charts will be undertaken to try and identify exposures of peat and local divers and fishermen will also be consulted. Intertidal peats and exposed archaeology will be surveyed and mapped using standard survey methods and relating all mapped areas to elevation OD. Subtidal and lower intertidal areas will be mapped from a boat using high-resolution side scan sonar, magnetometer and sub-bottom profiling to map the material variation of the sea bed. Key targets will be the distribution of exposed peat horizons and sites of early human activity (eg stone-built hut circles and field boundaries, midden remains, fish weirs). *In situ* calibration of the geophysical survey will be achieved through visual inspection and recording of sites and through the acquisition of surface and cored sediment samples. These calibration tasks will be carried out by trained archaeological divers. The onshore and offshore survey areas will overlap in lower intertidal areas to provide an additional calibration of survey data. The samples will be selected on basal peats from as wide a range of elevations as possible and we will also select several long sequences to generate long records of landscape change from pollen, these are the two things that will inform the sampling. The fieldwork results will be correlated with existing records and documentary sources. The rationale and locations of survey are set out below in Sections section 13.3.

- *A programme of sampling, assessment and analysis at selected peat sites in Scilly including deposits both in the intertidal zone and in the marine area between the islands.* The aim will be to retrieve a wide range of palaeoenvironmental data (pollen, plant macrofossils, wood, foraminifera, and diatoms) from the peats and the intercalated sediments. Sampling and analysis will focus on 1) basal peats to reconstruct sea-level change from radiocarbon ages and analysis of pollen, foraminifera and diatoms, 2) Profiles of the longest sections to reconstruct vegetation and landscape change during key phases of human occupation using pollen analysis and radiocarbon dating. In 1), the aim will be to establish a series of sea-level index points from as wide a range of elevations (and hence age) as possible. We will use peats underlain by bedrock or sediments unlikely to be compressed by overburden to avoid errors in estimates of palaeo-sea level. As part of the sampling process exposed areas of peat will be surveyed and sample points tied into Ordnance Datum.

- *EDM and/or GPS survey of the terrestrial and intertidal peat exposures and palaeonvironmental samples; the submerged archaeology will be tied in by GPS survey, which will u*tilise the fixed survey points established in the mid-1990s by the RCHME if possible.

- *The OSL dating will be undertaken primarily on sand deposits found in the intertidal zone to help in reconstructing the chronology of sea-level history.* In-situ gamma spectrometry measurements, necessary due to the inhomogeneous nature of the sedimentary sequences will be necessary. For each sample, the approach taken would be to isolate coarse-grained quartz using both physical separation and chemical pre-treatment procedures. OSL measurements would be conducted using the Single Aliquot Regenerative Dose (SAR) measurement protocol applied to the coarse-grained quartz, using a range of thermal pretreatments to test the efficacy of the sensitivity corrections applied (Murray and Wintle 2000). A minimum of 24 aliquots would be examined for each sample using the SAR approach, with tests for sample p*urity also being cond*ucted. In addition, dose recovery tests would be conducted to examine the behaviour of the material, and to support the final OSL age determinations (Duller 2008). Laboratory assessments of the radiation dose-rate would be conducted using beta counting and thick-source alpha counting to support the measurements of dose-rate made using a portable gamma spectrometer in the field at the time of sampling. A RDRS report of the final OSL ages would be provided, including full details of the methods applied, the appropriate supporting data (e.g. specimen growth curves and decay curves, preheat plots, equivalent dose distributions, etc.), and discussion of the OSL data and ages.

- *Outreach*: A public information day about the project will be held in St Mary's. Local volunteers will be encouraged to join in and find out about what is going on. We will engage with local divers and educate them to identify on peat exposures during the course of their dives. The local media (television, radio and local newspapers) will be alerted to the work through Cornwall County Council's press office in consultation with English Heritage. The CCC press office will liaise with the EH to identify and develop opportunities for publicity. The project will be documented in a daily blog.

13.2 Overall timetable

It is envisaged that the project will run for two years from April 2009 to 31 March 2011. However planning for the project will need to begin as soon as possible in 2009 because accommodation and survey vessel need to be booked for the first season of fieldwork in September 2009. September is the optimum month for fieldwork in Scilly because of the low tides, the prospect of favourable weather and the availability of accommodation and boats. Guarantees will be provided that the equipment owned by third parties (CISMAS, IMAG, Universities of Cardiff and Plymouth) will be available and fully serviced at the time required by the project.

13.3 Geophysical survey

13.3.1 Sidescan sonar

Sidescan sonar will be used to locate and map areas of exposed peat on the seabed. Peat is a poor sonar reflector, while sand, the predominant material on the seabed in St Mary's Sound, is a very good sonar reflector. The outcrops of peat on the seabed should therefore be easy to locate using sidescan sonar. The sonar images will be georeferenced using a GPS receiver. This technique seems likely to be the best way of locating and recording exposed submerged peat, palaeosoils and cultural remains. By mapping the peats we will get an idea of their extent and position, essentially we will be testing and developing the efficacy of the technique during this project.

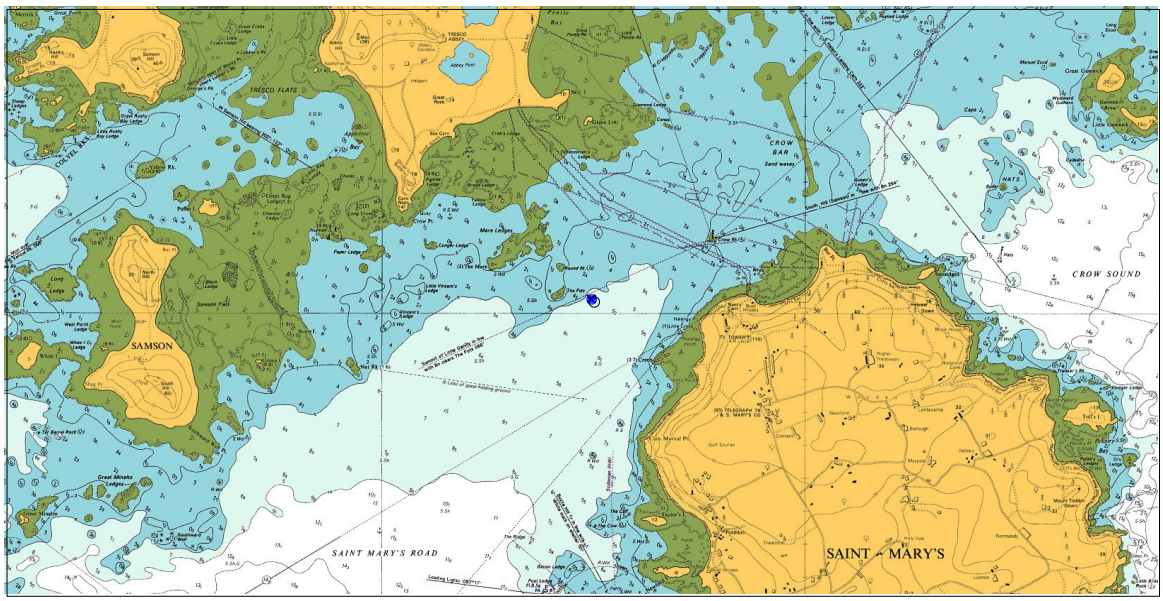

Fig 3 Location and approximate extent of the submerged peat exposure in St Mary's Roads

The submerged peat exposure discovered by Todd Stevens of IMAG in 2005 is located at position 49° 56.087'N 6°19.065'W (WGS 84) in 2006. The exposed peat was reported as occupying an area some 60m in diameter; this is shown in Figure 3 above.

The first task will be to locate this peat outcrop and map its extent using the sidescan sonar (Figs 3-5). This will also allow us to calibrate the sonar to achieve the optimum settings for detecting peat exposures.

Sidescan sonar	
Type	C-Max CM2
Frequency	325kHz
Range	25-150m
Lateral resolution	79mm
Towfish type	Digital
Software	MaxView (C-Max)
Positioning	Garmin 76C WAAS/EGNOS enabled GPS
Recording	MaxView software on laptop computer

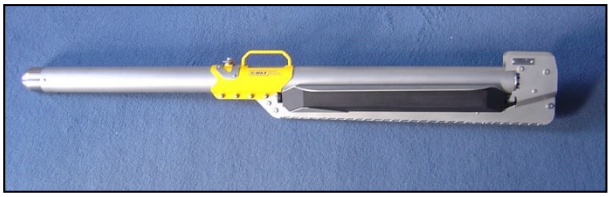

Fig 4 The CISMAS CMax sidescan sonar

Once the sidescan has been calibrated the survey will continue in St Mary's Sound. The total area to be covered is shown as Area 'A' in Figure 5. How much of this is achieved in year one will depend largely on what range setting is used. The CMax sidescan can operate at range settings between 25 and 150m. The initial trials over the area of known peat will demonstrate which range settings are suitable. Sidescan survey will also be undertaken in the area of St Helen's Pool, shown as Area 'B' on Figure 5. The aim is to cover both of these areas by the end of the project, and also Area 'C', if time allows. However, the survey areas may need to be modified in the light of the results obtained at the end of Year 1.

Post-processing of the sidescan sonar data will allow plans of the areas of exposed peat to be input to the GIS database. The sidescan images will also be mosaiced (provided that suitable software can be acquired) to form a continuous image of the seabed surface.

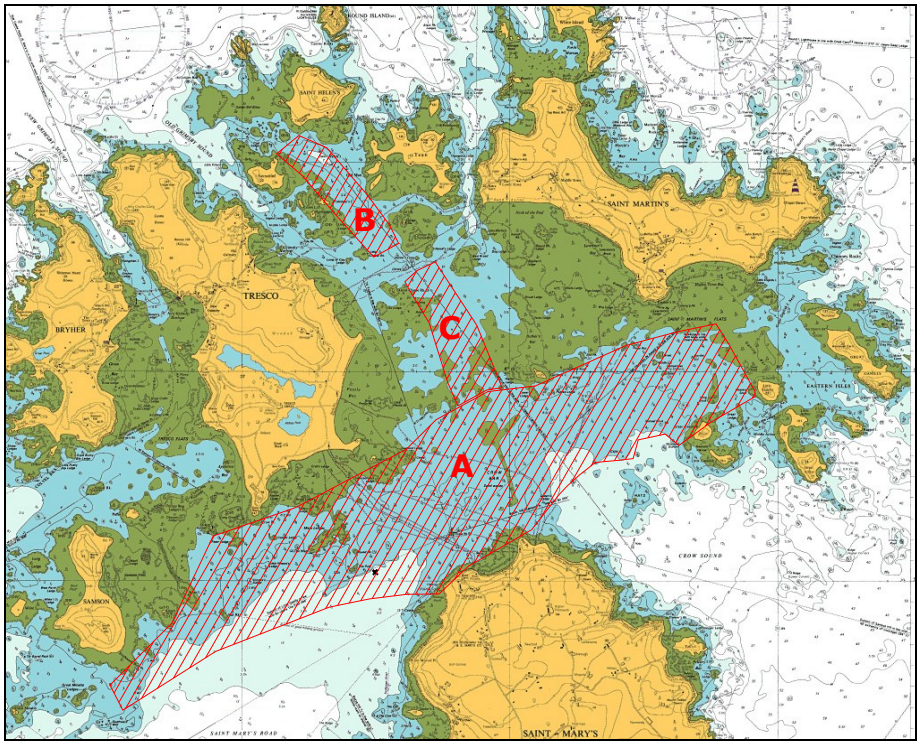

Fig 5 Geophysical survey areas

The sidescan equipment will be loaned to the project by CISMAS and operated during the project by CISMAS members. CISMAS has conducted similar surveys with success on the *Colossus* debris field survey and the Mounts Bay Maritime Survey. There will be a cost of £1000 for loan of the equipment to offset wear and tear and consumables. The loan also includes GPS, bathymetric equipment, laptops power supplies etc (at commercial rates the sidescan alone would cost approximately £4000 for two weeks hire). Written confirmation will be provided that the 'loan' of the sidescan equipment by CISMAS will be honoured with the equipment serviced, fully operational and issues of insurance understood by all parties.

The sidescan mosaic software used will be Hypak 2008 which can be hired from Del Norte at a cost of £40 per day.

13.3.2 Bathymetry

The purpose of the bathymetric survey is to measure depth and chart the seabed terrain. The data used to make bathymetric maps today typically comes from an echosounder (sonar) mounted beneath or over the side of a boat. The amount of time it takes for the sound to travel through the water, bounce off the seafloor, and return to the sounder tells the equipment how far down the seafloor is.

Bathymetry will be recorded at the same time as the sidescan sonar survey. In consequence, the coverage will be the same as that shown for the sidescan in Figure 5 (Areas A, B and C). This will be achieved using a Garmin 250 high resolution single beam sonar (200kHz). Depth, time and corresponding GPS position will be recorded using Site Searcher software from 3H Consulting. In post-processing the depths will be corrected to chart datum (St Mary's) and then used to produce a seabed contour plot using Surfer software. This data will also be input to the project All data produced will conform to the UK GEMINI Discovery Metadata Standard that conforms to ISO 19115. .

Note: Kevin Camidge and Luke Randall have both completed a two-week training course with hydrographic surveyor (specialist in sidescan) in 2006. Since then they have obtained good results with this equipment on a number of projects including the Mount's Bay survey in Cornwall and the *Colossus i*n Scilly. Kevin has also undertaken the processing and analysis of sidescan sonar and bathymetric data on a number of commercial projects including the site of HMS *Scylla* (Johns et al 2004), the South West Wave Hub (Johns *et al* 2006) and the Fal Cruise Project (Johns *et al* 2008).

The project team will seek advice from Stuart Leather of Wessex Archaeology regarding their use of geophysical survey techniques at Happisburgh and Pakefield (Wessex Archaeology 2008).

13.4 Palaeoenvironmental sampling

13.4.1 Year 1

The first year will focus on mapping intertidal peat extent and elevation. The work will be carried out during the lowest tides and will use existing data as a starting point to confirm areas of peat and to establish their elevations OD (accurate elevations for all sites were not reported in earlier work). It is expected that we will extend the known areas of intertidal peats due to the period of time that has elapsed since then. An initial assessment of the quality and quantity of material available at the potential intertidal sampling locations will be made. Initial results of offshore survey will be used to identify a test site for offshore peat sampling. Various techniques for land and sea-based sampling will be tested. These will include coring, trenching for monoliths and simple tube sampling. We will use a Russian corer for terrestrial peats. Plant macrofossils and insects will provide better evidence of water salinity than pollen as more precise and bulk samples will be taken for these from wide, shallow slices to match up with the pollen. (Forams and diatoms will provide the best evidence).

We will not use gouge or power augering of palaeoenvironmental deposits as Ratcliffe and Straker (1996) rejected a number of radiocarbon results from power augering as potentially contaminated. Vibro-coring has been used successfully on offshore peat deposits in the past, and will be considered here. Another suitable strategy may be excavation of a trench down the beaches and taking bulk samples from the section face - whilst we may not get long sequences we will at least get good datable short sequences and some understanding of the peat stratigraphy - this is of course likely to take time and substantial effort and possibly require shoring to do. A small mechanical digger would be ideal and may be feasible in Year 2

Collection of OSL samples including *in-situ* gamma spectrometry measurements will be necessary due to the inhomogeneous nature of the sedimentary sequences.

For offshore sampling, we anticipate using diver and diver-assisted sampling. The project team will seek advice from Garry Momber of the Hampshire and Wight Trust for Maritime Archaeology (HWTMA) regarding his use of augering and other sampling techniques at Bouldner Cliff. Sample profiles will be taken from 4-5 locations, selected to represent as wide a range of elevations as possible and including one offshore location. Results from the initial sampling will feed back into the second year of fieldwork, informing on further sample locations, and sampling methods.

Sampling of submerged peat or fossil forest exposures will be undertaken by divers from CISMAS, supervised by Kevin Camidge and advised by Dan Charman.

All samples for palaeoenvironmental and radiocarbon analysis will be stored in a dark cold room (4°C) at the University of Plymouth, where they will be sub-sampled as necessary.

Full analysis of macrofossils, pollen, diatoms and foraminifera of basal peat samples (1-5 samples per location) will be undertaken and selected samples will be radiocarbon dated to test methods and to guide further work. All radiocarbon dates will be based on dating with accelerator mass spectrometry (AMS) which allows dating of small amounts of selected material. Materials to be dated will each be a single identifiable plant macrofossil wherever possible, preferably horizontally bedded plant fragments. Note: Bulk samples will be dated only where the sediment appears to be a true peat, and where there is enough of it to permit radiometric dating.

One profile from the deepest (and therefore oldest) and longest sequence (as indicated by stratigraphic, survey and initial radiocarbon data) will be selected for analysis of a long pollen sequence to reconstruct vegetation change through a period of inundation. The most likely candidate for this is the known submerged peat bed off St Mary's. A pollen stratigraphy based on full counts will be produced for this long sequence will be developed (approx. 20 samples at 500 Total land Pollen). A series of radiocarbon ages will be obtained on plant macrofossil remains to date key transitions in this profile (5-6 dates).

Pollen, diatom and foraminifera preparation and analysis will be undertaken using standard techniques (Moore *et al* 1991; Battarbee *et al* 2001; Gehrels 2002).

13.4.2Year 2

The second year will complete survey of the intertidal peats and check to see if any additional areas have been exposed (previous experience shows that there is inter-annual variability in exposure). Work will focus on sampling a much larger range of intertidal and offshore peats, based on the data collected in year 1, and increasing the range of elevations sampled. Particular efforts will be made to retrieve offshore profiles based on the survey in year 1 and year 2. If the locations from the previous season require further sampling they will be revisited, although it is hoped to keep repeat sampling to a minimum. It is expected that we will sample a further 6-8 locations.

Full analysis of plant macrofossils, beetles, molluscs, pollen, diatoms and foraminifera of basal peat samples (1-5 samples per location) will be made and basal samples will be radiocarbon dated where these analyses indicate they will provide secure sea-level index points. Results will be used to generate a sea-level reconstruction for Scilly.

Pollen analysis on a second long profile will also be undertaken with similar resolution and count levels to the long profile from year 1. The second profile will be selected to represent a different time period of inundation (later/higher or earlier/lower than the first profile) so that a more complete temporal will be covered. As with the first sequence, key transitions in this profile will be dated (5-6 radiocarbon ages).

Selected samples from the long sequences (*c*10) for insect and mollusc analyses will be assessed for content and full counts will be made if warranted by initial assessments. Preparation work will be undertaken at Plymouth, with identifications subcontracted to additional specialists (Julie Jones for plant macrofossils, Jan Light for molluscs and David Smith for insects). The need for and costs for these identifications should be considered contingent upon whether suitable remains are found in the prepared samples.

OSL laboratory measurements undertaken. The OSL and radiocarbon measurements will be combined within a Bayesian framework to provide a precise chronology for sea-level and environmental change. This will utilise the depositional algorithms now available within OxCal 4 (Bronk Ramsey 2008) the development of which was funded by an English Heritage HEEP grant. The approach has been successfully employed in terrestrial settings (Gearey et al in press), however, this project offers the first opportunity to employ it in the

intertidal zone and also to combine OSL and radiocarbon results. The OSL work will follow the methods outlined in Duller (2008).

In the final compilation of the palaeoenvironmental evidence, a full revised sea-level reconstruction for Scilly from the full set of analyses. Reconstructions of landscape and land use change will be developed from the pollen data from long profiles and basal samples. Timeslice maps of changing coastlines will be produced and linked to changing patterns of vegetation from the pollen analysis and the distribution of archaeological structures above and below current sea level.

13.5 Field survey

The GPS and/or total station survey of the terrestrial and intertidal peat exposures and palaeonvironmental samples will be co-ordinated and occur in parallel with the programme of palaeoenvironmental sampling. In addition, associated submerged and intertidal archaeology (eg exposed stone remains) encountered during sampling or already known, will be included in the survey. Where possible all survey will be conducted using GPS; total station survey is included as a back-up for instances when/where satellite reception is restricted or at locations where use of GPS receivers/rovers would be difficult. GPS survey will be conducted using the Trimble Real Time Kinematic system owned by the Cardiff School of History and Archaeology (Trimble 4700 base receiver, with compact L1/L2 antenna with groundplane, using a Trimtalk 450s radio modem to communicate with the rover, another Trimble 4700 with internal radio. The controller is a TSC1. The software is Trimble Geomatics Office). Total station (EDM) survey will use the Topcon 303 also owned by Cardiff School of History and Archaeology. Surveys will be tied into the British National Grid and Ordnance Datum (with heights relative to Newlyn or St Mary's as deemed appropriate for the project) enabling survey data import into the project GIS.

13.5.1 Year 1

Year 1 will begin with an assessment of the RCHME surveys carried out in 1996/7. The aim being to integrate this survey data in the project GIS and, based on resulting maps/plans, to then locate the surveyed features (submerged walls and fragmentary peat beds/exposures) and RCHME fixed survey points in the field where possible (at Appletree Bay, Crab's Ledge and Bathinghouse Porth, Tresco and Par Beach, St Martins). Should location of RCHME surveyed features prove successful, their condition will be re-assessed and combined with new survey as considered appropriate (ie to document and map any changes in extent and condition following 10 year's coastal/intertidal exposure in the period since the RCHME surveys).

13.5.2 Year 2

Field survey in Year 2 will be informed by the year 1 fieldwork and results and will continue in parallel with the palaeoenvironmental sampling strategy ie survey of palaeonvironmental samples – extent of peat deposits, any associated archaeology.

13.6 Outreach

The project provides an opportunity to engage local communities in their cultural and environmental heritage. Liaison with the Isles of Scilly Museum, the Council of the Isles of Scilly Lifelong Learning Department and local newspapers will allow for the advertisement of events and opportunities for volunteer participation.

A public information day will be held at a suitable venue, either the Council Chamber or the Isles of Scilly Museum. This will be advertised on the internet, local TV and radio,

fliers and posters and will consist of illustrated lunchtime and evening presentations and poster display. A member of the team (CJ) will be available throughout the day to discuss the project and answer questions. The will also be an interview on Radio Scilly.

Local divers will be encouraged to participate in the project and help wit the sampling, a number have already expressed an interest and are keen to learn about geophysical survey and sampling techniques.

13.7 GIS

The GIS aspects of the project will be carried out with reference to 'Guidelines for English Heritage projects using GIS' (English Heritage 2004). We will enter a dialogue with the NMR to discuss how the results can benefit the NMR and the best means of data exchange.

13.7.1 Cardiff University:

Software: ESRI ArcGIS 9.2 (Higher Education Chest agreement licence across the University)
Data Output Formats: ESRI shapefiles, grids (rasters) and TINs – subject to agreement with EH.

Existing data: With a Higher Education Funding Council for England licence agreement with EDINA and Digimap registered users have authorised access to the following digital data for research purposes (Steve Mills is registered):

- Modern OS mapping (raster and vector base mapping at a range of scales now including MasterMap);

- Landmark historic OS mapping (County Series maps at 1:2,500 and 1:10560 scales published between
- 1843 and 1939 and National Grid maps at 1:1,250, 1:2,500 and 1:10560/10,000 scales published from1945 to LandLine);

- British Geological Survey vector mapping (1:625,000 solid and drift geology, 1:250,000 solid and drift geology,1:50,000 solid and drift geology, mass movement and artificial ground, BGS Lexicon of named Rock Units);

- New SeaZone Solutions Ltd Marine data (scanned Admiralty Charts and vector hydrospatial data -Bathymetry and Elevation, Natural and Physical features, Structures and Obstructions, Socio Economic and Marine use, Conservation and Environmental Protection and Climate and Oceanography).

- Defra's FutureCoast (http://www.halcrow.com/html/our_projects/projects/futurecoast.htm) and relevant shoreline management data will be used.

More details of the products available to Cardiff University can be found here:

http://edina.ac.uk/digimap/description/

13.7.2 Cornwall HES

Software: ESRI's ArcGIS 9.1
Data formats: ESRI shapefiles, personal geodatabases
Data licensed: OS maps 1:2500, 1:10,000 and 1:25,000 via Isles of Scilly Council and CCC
BGS data: licensed from BGS directly
SeaZone Hydrospatial: licensed from SeaZone Solutions Ltd for duration of the project.

13.8 HER update

Cornwall HES maintains the Historic Environment Record for the Council of the isles of Scilly using EXIGESIS. The HER will be updated with the results of the project at the end of each year.

13.9 Reports

13.9.1 Specialist reports

Specialist reports will be presented as Word documents in digital and hard copy formats with headings such as 'Introduction', 'Methodology', 'Potential for further Analysis', 'Results'. Discussion, Conclusion, References and supported by appropriate tables and illustrations. These will be assimilated into the Year 1 and 2 project reports

13.9.2 Year 1 - Interim report

The report at the end of Year 1 will be a combined interim report and Assessment and Updated Project Design which will inform the team meeting at the beginning of Year 2 (Task 46). It will be a A4 document produced in Word, with A3 foldout illustrations if appropriate, comb-bound with card/acetate covers.

The Year 1 report will include the following contents:

- Summary -
- Introduction - Background, research aims, methodology

Assessment

- Factual data
  - The survey areas and principal findings
  - Summary of geophysical survey results
  - Summary of field survey results
  - Summary of palaeoenvironmental sampling results
  - Summary of C14 datting results
  - Summary of OSL dating results
- Assessment
  - Assessment of geophysical survey results
  - Assessment of field survey results
  - Assessment of palaeoenvironmental sampling results
  - Assssment of C14 datting results
  - Assessment of OSL dating results

Updated project design

- Aims and objectives - Updated research aims

	-	Publication and presentation
• Methods statement	-	Updated methodology for geophysical survey
	-	Updated methodology for field survey
	-	Updated methodology for palaeoenvironmental sampling
	-	Updated methodology for C14 dating
	-	Updated methodology for OSL dating
	-	Updated contents for the Year 2 report
• Resources and programming	-	Staffing
	-	Project management and structure
	-	Equipment and materials
	-	Health and Safety
	-	Project monitoring/milestones
	-	Timetable
• Archive	-	A summary of archive contents
• References	-	
• Appendices	-	Copies of the specialists' assessment reports
• Illustrations	-	Location maps
	-	Copies of relevant historical cartography & plans
	-	Maps, plans and drawings resulting from the archaeological work.)
	-	Illustrative photographs

13.9.3 – Final report

The Year 2 report will be produced in similar formats to the Year 1 report and include the following contents:

• Summary	-	
• Introduction	-	Background, aims, methods
• Results	-	Geophysical survey results
	-	Field survey results
	-	Palaeoenvironmental sampling results
• Discussion	-	A discussion of the results
• Recommendations	-	Recommendations
• Specialists' reports		Specialists' reports as appropriate
• Archive	-	A summary of archive contents and date of deposition
• Illustrations	-	Location maps
	-	Copies of relevant historical cartography & plans
	-	Maps, plans and drawings resulting from the archaeological work.
	-	Finds drawings (if appropriate)
	-	Illustrative photographs

Paper copies and a digital (PDF) copy of the reports, illustrations and any other files will be held in the Cornwall HER. Paper copies and digital copies of the report will be distributed to English Heritage, the Isles of Scilly AONB Management Group to local archives and national archaeological record centres, including the NMR. Suggested distribution within English Heritage is Ian Oxley, Peter Murphy and Chris Pater (Maritime Archaeology Team), Vanessa Straker (South West Regional Science Adviser), Zoe Hazell (Palaeocologist), Simon Ramsden (Team Leader South West Region) and Phil McMahon (IAM for Cornwall and Scilly).

13.10 Publication

The work is important and if the results merit it CCC will apply to English Heritage for funding to publish a monograph.

13.11 Documentary archive

An ordered and integrated site archive will be prepared in accordance with *Management of Research Projects in the Historic Environment*' (English Heritage 2006b) upon completion of the project. The requirements for final deposition of the project archive will be agreed with EH, but we would anticipate the project archive going to the Isles of Scilly Museum.

13.12 Digital archive

The digital archive will be deposited with the Archaeological Data Service, York (ADS). The project has been discussed with Catherine Hardman, Collections Development Manager at ADS, who has provided a quote for curation of the projects reports and GIS. The policy on the curation of the project geophysics files would be a subject for further discussion with EH.

13.12.1 ADS action breakdown and caveats

Catherine Hardman

13.12.1.1 Methods and actions

The Lyonesse project archive and dissemination work can be divided into 4 sequential actions, which can be broken down further into individual tasks.

13.12.1.1.1 Action 1: Secure digital outputs

All files will be grouped or amalgamated so that they are consistent throughout the dataset. The data (as agreed) will be secured by transfer to the ADS backup and retention facility, where they will be catalogued. Files not already stored in such formats will be migrated to non-proprietary open standard formats in line with ADS preservation policy.

13.12.1.1.2 Action 2: Presentation of digital resource

The ADS intends to emulate the functionality of the desktop software application ArchGIS by creating a web-based GIS application. The resulting interface will to as large a degree as possible include the same functionality as the GIS desk top application, and therefore do justice to the underlying datasets and allow users to explore the maps and underlying data in a variety of ways.

As well as creating a GIS and database-driven interface into the Lyonesse project data, the ADS will also make the individual GIS data files available as simple downloads if required. This would mean that anyone wanting to undertake more detailed research would be able

to construct their own project within a conventional desktop GIS package using the Lyonesse data.

The technology the ADS will use construct the WebGIS interface is ESRI's ArcIMS 9.2. The ADS uses the ArcIMS Java Connector to create the interface. There are also likely to be associated ColdFusion pages containing more detailed information on the data within the maps. These ColdFusion pages would be linked from the map interface.

A record for the project will be entered in the ADS catalogue ArchSearch to aid rapid search and retrieval, links will also be added to the relevant archival listings in the ADS catalogue. Finally, links, branding and contact details will be confirmed among the principal partners. An introductory text to the whole archive will also be sought from the depositors and mounted.

13.12.1.1.3 Action 3: Internal Review

An internal review will then follow among the partners to ensure that they are content with the finished product prior to release. Any corrections agreed between the partners will be carried out according to a specified timetable.

13.12.1.1.4 Action 4: Dissemination

The archives will then be released to the public by announcement on various discussion lists, inclusion in the ADS RSS Newsfeed and by an invited article in the ADS newsletter.

13.13 Project accommodation and infrastructure

The project will be co-ordinated from HES' Truro offices. HES has a computer network running Windows XP Professional. Report texts are generated in Word 2002. Mapping will derive from the OS Mastermap and historic maps via Arcview GIS. Line drawings will be generated using AutoCAD. HES members of the project team each have a Dell PC of adequate specification. The Service has adequate photocopying, scanning and printing facilities.

13.14 Equipment and materials

- Reports - Compact discs to store and transfer documents and drawings.
- Archive - Archive documentation cases for storage of the project's paper archive. Supplied by Conservation Resources UK (tel: 01865 747755). 2 x acid-free document cases for paperwork 12103 (311mm x 260mm x 76mm) Micro Chamber® active quality. CDs to transfer for the digital archive.

13.15 Copyright

Copyright of all material gathered as a result of the project will be reserved to English Heritage, who have their own standard licence for copyright.

13.16 Freedom of Information Act

As Cornwall County 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.

13.17 Standards and quality assurance

HES is an IFA Registered Archaeological Organisation (RAO) and is included on the IFA Register of Organisations.

All recording work will be undertaken according to the Institute for Archaeologists *Standard and Guidance for Archaeological Excavations* (IFA 2001b). Site staff will be expected to follow the IFA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology*.

As part of Planning, Transportation and Estates, Cornwall County Council, the HES has certification in BS9001 (Quality Management), BS14001 (Environmental Management), OHSAS18001 (Health, Safety and Welfare), Investors in People and Charter Mark.

HES has an internal *Review of procedures for validation of key documents* that identifies the key validation checks, processes and documentation required for project designs, reports and archives prior to publication, dissemination and deposition.

For the production of reports the *HES report guidelines* provide the framework and guidance on structure, contents and conventions. The report guidelines also outline what should be covered in checking or editing a report. There are additional *HES illustration guidelines* on figures, drawings and maps.

The Cornwall and Scilly HER has an information standard and guidelines for content and scope, the 'Cornwall and Scilly HER Information and Mandatory Fields Specification', which will ensure that all fieldwork results (land and marine) will produce information that can be directly input into the HER

All data produced will conform to the UK GEMINI (Geo-spatial Metadata Interoperability Initiative)Discovery Metadata Standard that conforms to ISO 19115. This standard which is used by the GIgateway™ metadata service run by the Association for Geographic Information (AGI) and also to the UK e-Government Metadata Standard (e-GMS) which is based on Dublin Core. It is designed for use in GIgateway™, and for other metadata applications in the UK.

All GIS work will be completed in compliance with the *Guidelines for English Heritage projects involving GIS* (English Heritage 2004). All data will be MIDAS and INSCRIPTION compliant.

Environmental data will conform to the IK GEMINI and European Directory of Marine Data standards

http://www.bodc.ac.uk/data/information_and_inventories/edmed/

14 Stages, products and tasks

14.1 List of project tasks

* EH contribution

** CISMAS contribution

*** IMAG contribution

Task no	Date	Task	Performed by	Days
		Year 1 (2009 - 2010)		
		Project Management & Assurance	CJ	3
		Stage 1 Preparation		
Task 1	Mar 2009	Diving ACoP & risk assessment	KC	1
Task 2	April 2009	Obtain licences & consents	CJ	1
Task 3	April 2009	Signposting (OASIS entry and digital summary)	CJ	0.25
Task 4	April 2009	Desk-based audit of IOS peat exposures	CJ	1
Task 5	April 2009	Signposting (webwork)	BT	1
Task 6	April 2009	Agreement on deposition of the project archive	CJ	-
Task 7	June 2009	Import 1996/7 RCHME fixed survey points into the project GIS	SM	1
Task 8	June 2009	Team e-meeting	CJ	0.25
			DC	0.25
			KC	0.25
			JAM	0.25
			FPR	0.25
			SM	0.25
		Stage 2 Fieldwork		
		Geophysical survey		
Task 9	Sept 2009	Install & test sidescan sonar, bathymetry, power supply, GPS and computers aboard boat	DM	1
			KC	1
			LR	1
Task 10	Sept 2009	Locate and map submerged peat exposure in St Mary's Sound using sidescan sonar	KC	1
			DM	1
			LR	1
Task 11	Sept 2009	Sidescan survey and bathymetry in St Mary's Sound (Area A)	KC	3
			DM	3
			LR	3
			FPR	3
Task 12	Sept 2009	Sidescan survey and bathymetry in St Helen's Pool (Area B)	KC	2

Task no	Date	Task	Performed by	Days
			DM	2
			LR	2
			FPR	1
		Palaeoenvironmental sampling		
Task 13	Sept 2009	Initial assessment of sample locations and techniques (marine)	KC	1**
			DM	1
			FPR	1**
			DC	1
			LR	1**
			TS	1***
Task 14	Sept 2009	Sampling of seabed deposits	KC	1**
			DM	1
			FPR	1**
			DC	1
			LR	1**
			TS	1***
Task 15	Sept 2009	Investigation / sampling of submerged forest (Western Rocks)	KC	1**
			DM	1
			FPR	1**
			DC	1
			LR	1**
			TS	1***
Task 16	Sept 2009	Initial assessment of sample locations and techniques (intertidal)	JAM	1
			DC	1
Task 17	Sept 2009	Sampling of inter-tidal peats	JAM	4
			DC	4
Task 18	Sept 2009	Collection of OSL samples including *in-situ* gamma spectrometry measurements	HR	Fee per sample
		Field survey		
Task 19	Sept 2009	Locate 1996/7 RCHME fixed survey points in the field	SM	1
Task 20	Sept 2009	EDM survey	SM	2
Task 21	Sept 2009	GPS survey	SM	2
		Public information days		
Task 22		Preparation of outreach material	CJ	1
Task 23		Public information day (St Mary's)	CJ	1
Task 24		Presentation to AONB management group	CJ	1
		Product – completed fieldwork: survey / geophysical data and		

Task no	Date	Task	Performed by	Days
		samples collected		
Task 25	Oct 2009	Review point 3	CJ	0.5
		Stage 3 Assessment, interpretation and analysis		
Task 26	Oct 2009	Post-processing of sidescan sonar data	KC	3
Task 27	Oct 2009	Post-processing of bathymetric data	KC	3
Task 28	Oct 2009	Interpretation of sidescan sonar data	KC	3
Task 29	Oct 2009	Interpretation of bathymetric data	KC	3
Task 30	Oct 2008 – Jan 2010	Assessment / analysis of palaeoenvironmental data	DC	1
			KH	35
			RF	2
			RG	2
			JAM	3
Task 31	Nov 2009	C14 Dating	JM	2*
Task 32	Nov 2009	OLS sample preparation & analysis	HR	Fee per sample
Task 33	Nov 2009	Draw up field survey results	SM	2
Task 34	Nov 2009	GIS mapping	BT	1
Task 35	Nov 2009	Update HER	BT	1
		Product – completed assessment/interpretation,/analysis of data		
Task 36	Dec 2009	Review point 3	CJ	0.5
		Stage 4 Archiving		
Task 37	Mar 2010	Compile documentary archive	CJ	0.5
Task 38	Mar 2010	Compile digital archive	CJ	0.5
		Product - ordered project archive		
		Stage 5 Interim Report		
Task 39	Mar 2010	Reporting on geophysical survey data	KC	3
Task 40	Mar 2010	Reporting on field survey	SM	1
Task 41		Reporting on palaeoenvironmental sampling	DC	2
			JAM	2
Task 42	Mar 2010	Reporting on C14 dating	JM	1*
Task 43		Reporting on OSL dating	HR	Fee per sam[ple
Task 44	Mar 2010	Compile and edit interim report	CJ	5
		Geological section	FPR	2
Task 45	Mar 2010	Disseminate report	CJ	0.5
		Product – completed disseminated interim report		

Task no	Date	Task	Performed by	Days
Task 46	Mar 20101	Review point 3	CJ	0.5
		Year 2 (20010 - 2011)		
		Project Management & Assurance	CJ	3
		Stage 6 Preparation		
Task 47	April 2010	Renew licences & consents	CJ	1
Task 48	Jan 2010	Signposting (update webwork)	BT	1
Task 49	June 2010	Team meeting	CJ	1
			DC	1
			KC,	1
			JAM	1
			FPR	1
			SM	1
		Stage 7 Fieldwork		
		Geophysical survey		
Task 50	Sept 2010	Install & test sidescan sonar, bathymetry, power supply, GPS and computers aboard boat	KC	1
			DM	1
			LR	1
Task 51	Sept 2010	Continue sidescan sonar survey and bathymetry in St Mary's Sound (Area A)	KC	3
			DM	3
			LR	3
			FPR	2
Task 52	Sept 2010	Continue sidescan sonar survey and bathymetry in St Helen's Pool (Area B) and Area C	KC	3
			DM	3
			LR	3
			FPR	2
		Palaeoenvironmental sampling		
Task 53	Sept 2010	Sampling of seabed deposits & photography	DC,	1
			KC	3**
			FPR	3**
			DM	3
			LR	3**
			TS	3***
Task 54	Sept 2010	Sampling of intertidal deposits	DC,	4
			RF	4
			RG	3
			JAM	3
Task 55	Sept 2010	Collection of OSL samples including *in-situ* gamma spectrometry measurements	HR	Fee per sample
		Field survey		

Task no	Date	Task	Performed by	Days
Task 56	Sept 2010	EDM survey	SM	2.5
Task 57	Sept 2010	GPS survey	SM	2.5
		Public information days		
Task 58	Sept 2010	Preparation of outreach material	CJ	1
Task 59	Sept 2010	Public information day (St Mary's)	CJ	1
Task 60	Sept 2010?	Presentation to AONB management group	CJ	1
		Product – completed fieldwork: survey / geophysical data and samples collected		
Task 61	Oct 2010	Review point 3	CJ	0.5
		Stage 8 Assessment, interpretation and analysis		
Task 62	Oct 2010	Post-processing of sidescan sonar data	KC	3
Task 63	Oct 2010	Post-processing of bathymetric data	KC	3
Task 64	Oct 2010	Interpretation of sidescan sonar data	KC	3
Task 65	Oct 2010	Interpretation of bathymetric data	KC	3
Task 66	Oct 2010 to-Jan 2011	Assessment / analysis of palaeoenvironmental data	DC	2
			KH	40
			RF	2
			RG	5
			JAM	4
		Mollusc ids	JL	4
		Insect ids	DS	4
		Plant macrofossils	JJ	20
Task 67	Oct 2010 to-Jan 2011	C14 dating	JM	5*
Task 68	Oct 2010 to-Jan 2011	OLS sample preparation & analysis	HR	Fee per sample
Task 69	Nov 2010	Draw up field survey results	SM	2
Task 70	Nov 2010	GIS mapping	BT	1
Task 71	Nov 2010	Update HER	BT	1
		Product – completed assessment/interpretation,/analysis of data		
Task 72	Dec 2010	Review point 3	CJ	0.5
		Stage 9 Archiving		
Task 73	Mar 2011	Compile documentary archive	CJ	0.5
Task 74	Mar 2011	Compile digital archive	CJ	0.5
		Product - ordered project archive		
		Stage 10 Interim Report		

Task no	Date	Task	Performed by	Days
Task 75	Mar 2011	Reporting on geophysical survey data	KC	3
Task 76	Mar 2011	Reporting on field survey	SM	1
Task 77	Mar 2011	Reporting on palaeoenvironmental sampling	DC	2
			JAM	2
Task 78	Mar 2011	Reporting on C14 dating	JM	2*
Task 79		OSL RDRS report	HR	Fee per sample
Task 80	Mar 2011	Compile and edit report	CJ	5
		Geological section	FPR	2
Task 81	Mar 2011	Disseminate report	CJ	0.5
		Product – completed disseminated interim report		
Task 82	Mar 2011	**Review point 3**	CJ	0.5
Task 83	Mar 2011	**Curate digital archive**	CH	fee

14.2 List of project staff and responsibilities

NAME	TITLE	TASK
HES staff		
Charlie Johns (CJ)	Project Executive/Project Manager/Senior Archaeologist	General Project Management, Project Assurance; **Year 1** Task 2 Obtain licences & consents; Task 3 Signposting; Task 4 Desk-based audit; Task 6 Agreement on archive deposition; Task 8 Team e-meeting; Task 22 Preparation of outreach material; Task 23 Public information day; Task 24 AONB presentation; Tasks 25, 34 and 46 Review points; Tasks 37 & 48 Compile archive; Task 41 Compile report; Task 45 Disseminate report. **Year 2** Task 47 Renew licences & consents; Task 49 Team -meeting; Task 58 Preparation of outreach material; Task 59 Public information day; Task 60 AONB presentation; Tasks 61, 72& 82 Review points; Tasks 73 & 74 Compile archive; Task 80 Compile report; Task 81 Disseminate report.
Bryn Perry Tapper (BT)	Senior Archaeologist (GIS)	**Year 1** Task 5 Webwork; Task 34 GIS mapping; Task 35 Update HER. **Year 2** Task 48 Update webwork;

NAME	TITLE	**TASK**
		Task 70 GIS mapping; Task 71 Update HER.
Specialists		
Kevin Camidge (KC)	Marine Archaeologist	**Year 1** Task 1 Diving ACop & risk assessment; Task 8 Team e-meeting; Task 9 Install sidescan; Task 10 Locate& map submerged peat; Task 11 Sidescan survey & bathymetry in Area A; Task 12 Sidescan survey & bathymetry in Area B; Task 13 Assess sample locations & techniques; Task 14 Seabed sampling; Task 15 Investigation of Western Rocks; Task 26 & 28; Post-process & interpret sidescan data; Task 27 & 29 Post-process & interpret bathymetric data; Task 39 Report on geophysics. **Year 2** Task 49 Team meeting; Task 50 Install sidescan; Task 51 Sidescan survey & bathymetry in Area A; Task 52 Sidescan survey & bathymetry in Areas B & C; Task 53 Seabed sampling; Tasks 62 & 64 Post-process & interpret sidescan data; Tasks 63 & 65 Post-process & interpret bathymetric data; Task 75 Report on geophysics.
David McBride (DM)	Skipper	**Year 1** Task 9 Install sidescan; Task 10 Locate& map submerged peat; Task 11 Sidescan survey & bathymetry in Area A; Task 12 Sidescan survey & bathymetry in Area B; Task 13 Assess sample locations & techniques; Task 14 Seabed sampling; Task 15 Investigation of Western Rocks. **Year 2** Task 50 Install sidescan; Task 51 Sidescan survey & bathymetry in Area A; Task 52 Sidescan survey & bathymetry in Areas B & C; Task 53 Seabed sampling.
Phillip Rees (FPR)	Marine Geologist	**Year 1** Task 8 Team e-meeting; Task 11 Sidescan survey & bathymetry in Area A; Task 12 Sidescan survey & bathymetry in Area B Task 14 Assess sample locations & techniques; Task 15 Seabed sampling; Task 16 Investigation of Western Rocks; Task 44 Geological contribution to report **Year 2** Task 49 Team meeting;

NAME	TITLE	**TASK**
		Task 51 Sidescan survey & bathymetry in Area A; Task 52 Sidescan survey & bathymetry in Areas B & C; Task 53 Seabed sampling.; Task 80 Geological contribution to report
Luke Randall (LR)	Geophysical survey assistant	**Year 1** Task 9 Install sidescan; Task 10 Locate& map submerged peat; Task 11 Sidescan survey & bathymetry in Area A; Task 12 Sidescan survey & bathymetry in Area B; Task 13 Assess sample locations & techniques; Task 14 Seabed sampling; Task 15 Investigation of Western Rocks. **Year 2** Task 50 Install sidescan; Task 51 Sidescan survey & bathymetry in Area A; Task 52 Sidescan survey & bathymetry in Areas B & C; Task 53 Seabed sampling.
Dan Charman (CD)	Palaeoenvironmentalist	**Year 1** Task 8 Team e-meeting; Task 13 Assess marine sample locations & techniques; Task 14 Seabed sampling; Task 15 Investigation of Western Rocks; Task 16 Assess intertidal sample locations & techniques; Task 17 Intertidal sampling; Task 30 Assess palaeoenvironmental samples; Task 41 report on palaeoenvironmental samples. **Year 2** Task 49 Team meeting; Task 53 Seabed sampling; Task 54 Intertidal sampling; Task 66 Assess palaeoenvironmental samples; Task 77 report on palaeoenvironmental samples.
Ralph Fyfe (RF)	Palynologist	**Year 1** Task 30 Assess palaeoenvironmental samples. **Year 2** Task 66 Assess palaeoenvironmental samples.
Roland Gehrels (RG)	Sea-level change	**Year 1** Task 30 Assess palaeoenvironmental samples. **Year 2** Task 66 Assess palaeoenvironmental samples.
Katie Head (KH)	Palaeoenvironmentalist	**Year 1** Task 30 Assess palaeoenvironmental samples. **Year 2** Task 66 Assess palaeoenvironmental samples..
Jacqui Mulville (JAM)	Bioarchaeologist	**Year 1** Task 8 Team e-meeting; Task 18; Task 16 Assess intertidal sample locations & techniques;

NAME	TITLE	**TASK**
		Task 17 Sample intertidal peats; Task 30 Assess palaeoenvironmental samples; Task 41 report. **Year 2** Task 49 Team meeting; Task 54 Intertidal sampling; Task 66 Assess palaeoenvironmental samples; Task 77 report on palaeoenvironmental samples.
Steve Mills (SM	Field Surveyor	**Year 1** Task 7 Import RCHME survey points into GIS; Task 19 Locate RCHME survey points; Task 20 EDM survey; Task 21 GPS survey; Task 33 Draw up surveys; Task 40 Report on survey. **Year 2** Task 49 Team meeting Task 56 EDM survey; Task 57 GPS survey; Task 69 Draw up surveys; Task 76 Report on survey.
John Meadows (JM)	Assistant Scientific Dating Co-ordinator	**Year 1** Task 31 C14 dating; Task 42 C14 reporting. **Year 2** Task 67 C14 dating; Task 78 C14 reporting.
Helen Roberts (HR)	Luminescence Geochronologist	**Year 1** Task 18 Collection of OSL samples; Task 32 OSL sample preparation & analysis; Task 43 OSL report. **Year 2** Task 55 Collection of OSL samples; Task 68OSL sample preparation & analysis; Task 79 OSLRDRS report.
Julie Jones (JJ)	Analysis of plant macrofossils	**Year 2** Task 66 Analysis of plant macros
Janice Light (JL)	Analysis of molluscs	**Year 2** Task 66 Mollusc ids
David Smith (DS)	Analysis of insects	**Year 2** Task 66 Insect ids
Catherine Hardman (CH)	Collections Development Manager, The Archaeology Data Service (ADS)	Curation of digital archive (Task 83).

14.3 Timetable

The work will commence in March 2009 and be completed by March 2011.

No	Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	Year 1 2009-2010															
	Stage 1 Preparation															
	Project management – book accommodation, survey vessel & equipment															
1	Diving ACoP & risk assessment															
2	Obtain licences & consents															
3	Signposting (OASIS entry and digital summary)															
4	Desk-based audit of IOS peat exposures															
5	Signposting (webwork)															
6	Agreement on deposition of the project archive															
7	Import 1996/7 RCHME fixed survey points into the project GIS															
8	Team e-meeting															
	Stage 2 Fieldwork															
9	Install & test sidescan sonar, bathymetry, power supply, GPS and computers aboard boat															
10	Locate and map submerged peat exposure in St Mary's Sound using sidescan sonar															
11	Sidescan survey and bathymetry in St Mary's Sound (Area A)															
12	Sidescan survey and bathymetry in St Helen's Pool (Area B)															
13	Initial assessment of sample locations and techniques (marine)															
14	Sampling of seabed deposits															

No	Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
15	Investigation / sampling of submerged forest (Western Rocks)															
16	Initial assessment of sample locations and techniques (intertidal)															
17	Sampling of intertidal peats															
18	Collection of OSL samples															
19	Locate 1996/7 RCHME fixed survey points in the field															
20	EDM survey															
21	GPS survey															
22	Preparation of outreach material															
23	Public information day (St Mary's)															
24	Presentation to AONB															
25	Review point 3															
	Stage 3 Assessment, interpretation and analysis															
26	Post-processing of sidescan sonar data															
27	Post-processing of bathymetric data															
28	Interpretation of sidescan sonar data															
29	Interpretation of bathymetric data															
30	Assessment / analysis of palaeoenvironmental data															
31	C14 Dating															
32	OSL sample preparation and analysis of															
33	Draw up field survey results															
34	GIS mapping															
35	Update HER															

No	Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
36	Review point 3															
	Stage 4 Archiving															
37	Compile documentary archive															
38	Compile digital archive															
	Stage 5 Interim Report															
39	Reporting on geophysical survey data															
40	Reporting on field survey															
41	Reporting on palaeoenvironmental sampling															
42	Reporting on C14 dating															
43	Reporting on OSL datinf															
44	Compile and edit interim report															
45	Disseminate report															
46	Review point 3															
Year 2 (2010 - 2011)																
	Stage 6 Preparation															
47	Renew licences & consents															
48	Signposting (update webwork)															
49	Team meeting															
	Stage 7 Fieldwork															
50	Install & test sidescan sonar, bathymetry, power supply, GPS and computers aboard boat															
51	Continue sidescan sonar survey and bathymetry in St Mary's Sound (Area A)															

No	Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
52	Continue sidescan sonar survey and bathymetry in St Helen's Pool (Area B) and Area C															
53	Sampling of seabed deposits & photography															
54	Sampling of intertidal deposits															
55	Collection of OSL samples															
56	EDM survey															
57	GPS survey															
58	Preparation of outreach material															
59	Public information day (St Mary's)															
60	Presentation to AONB															
61	Review point 3															
	Stage 8 Assessment, interpretation and analysis															
62	Post-processing of sidescan sonar data															
63	Post-processing of bathymetric data															
64	Interpretation of sidescan sonar data															
65	Interpretation of bathymetric data															
66	Assessment / analysis of palaeoenvironmental data															
67	C14 dating															
68	OSL sample preparation & analysis															
69	Draw up field survey results															
70	GIS mapping															
71	Update HER															
72	Review point 3															

No	Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	Stage 9 Archiving															
73	Compile documentary archive															
74	Compile digital archive															
	Stage 10 Interim Report															
75	Reporting on geophysical survey data															
76	Reporting on field survey															
77	Reporting on palaeoenvironmental sampling															
78	Reporting on C14 dating															
79	OSL RDRS report															
80	Compile and edit final report															
81	Disseminate report															
82	**Review point 3**															
83	Curate digital archive															

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16 Appendix: Risk Log

Risk no	Description	Probability	Impact	Countermeasures	Estimated time and cost	Owner	Updated
1	Boat time might be lost due to bad weather.	This is a **MEDIUM** risk	This is a **HIGH** impact as without the collection of geophysical data and underwater samples…	DM would make best use of high tides and weather conditions to get full coverage as required.	Standard practice in the maritime contracting industry is to add a factor of 20% to 25% to allow for adverse weather (and this is on normal, more benign sites) The actual cost of being prevented from working due to the weather is quantifiable as a daily cost but the number of days this will apply to is not - **£1,500 per day**	**KC/ DM**	
2	Geophysical survey equipment malfunction	This is a **MEDIUM** risk	This is a **HIGH** impact as without the collection of geophysical data…	Will have a Geophysics Engineer onboard for the sub-bottom profiling	**£1,500 per day**	**KC/FPR**	
3	Boat breakdown	This is a **MEDIUM** risk	This is a **HIGH** impact as without the collection of geophysical data and underwater samples…	DM to have boat serviced before commencement of project.	**£1.,500 per day**	**DM**	
4	The project being delayed due to staff illness or staff change.	This is a **LOW** risk. Normal CCC sickness allowances have been built into the 200 working day year. This should be sufficient to cover most eventualities.	This would have a **HIGH** impact. It is difficult to include provision for long-term sicknesses. Staff changes cannot be predicted, but would require more time and resources for either continuing with a reduced team or for taking on and	Other than the existing standard CCC sickness allowance being built into the working year no other countermeasures can be taken. Staff changes cannot be predicted and will be dealt with as and when they arise. If the project team is reduced, an appraisal of the effect on the project progress and	On the basis of a six month training period, during which the person being trained and the person doing the training are effectively working at half speed, taking on new staff will add the equivalent of six months salary plus overheads to the project costs. This is estimated as **£20,000**.	**CJ**	

Risk no	Description	Probability	Impact	Countermeasures	Estimated time and cost	Owner	Updated
			training new staff.	results will be carried out; this will inform decisions about whether a variation should be sought at this stage.			
5	The C14 dates not ready in time for report.	This is a **MEDIUM** risk	This would have **LOW** impact, the report might be delayed	Consider undertaking the fieldwork earlier in Years 2 and 3	No extra time or cost incurred	**CJ/JMe**	

The total contingency fund recommended for the project (based on worst case scenarios) is **£30,000 per year**.