

Severn Estuary

Rapid Coastal Zone Assessment Survey

National Mapping Programme



Stephen Crowther & Amanda Dickson
Contributions by Krystyna Truscoe
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Severn Estuary

Rapid Coastal Zone Assessment Survey

National Mapping Programme

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Summary

This report describes the results of an aerial survey to National Mapping Programme (NMP) standards, which forms part of the Severn Estuary Rapid Coastal Zone Assessment Survey (RCZAS). The project is funded by English Heritage and undertaken by the Archaeology Service of Gloucestershire County Council, on behalf of Gloucestershire County Council, South Gloucestershire Council, North Somerset Council, Somerset County Council, Exmoor National Park and Bristol City Council. The NMP survey is part of Phase 1 of the Severn Estuary RCZAS (Mullin 2008), Phase 2 of which will involve targeted fieldwork investigations based on the results of Phase 1.

This is version 2 of this report, revised on the basis of an internal edit and English Heritage comments. It is intended to be the final draft for submission to English Heritage.

The Severn Estuary RCZAS project was initiated primarily to provide an assessment of the Severn Estuary's archaeological resource and to inform the future management of that resource in response to the threat from natural processes such as coastal erosion, which is exacerbated by the estuary's tidal range and strong currents. Human processes are also affecting the shoreline, with ongoing pressure from developments, including marine aggregate extraction, new proposals for coastal defence and realignment measures.

The Severn Estuary RCZAS aims to provide an assessment of the degree and nature of this threat to coastal historic and archaeological assets and to better understand erosion processes (Murphy 2005).

The NMP survey of aerial photographs of the Severn Estuary RCZAS project area is defined by the area between Mean Low Water in the intertidal zone and approximately one kilometre inland of the coastal margin. The project area includes the coastal margin and hinterlands of England only and extends between Gloucester and Beachley on the River Severn's west bank; and between Gloucester and Porlock Weir, Somerset on the Severn's east bank, with the inclusion of the

island of Steep Holm in the estuary. This comprises a total of 498 square kilometres. Located within the counties of Gloucestershire, Somerset, and the City of Bristol, the Severn Estuary RCZAS project area encompasses the coastal elements of such regionally diverse landscapes as the Severn Vale, Bristol city, Walton Ridge, Somerset Levels, Mendip Hills, Quantock Hills, and Exmoor.

The remit of the Severn Estuary RCZAS NMP aerial survey is to identify and record all known archaeological monuments visible on aerial photographs within the intertidal zone and the coastal hinterland. This report sets this information within the context of the archaeological resource within the project area as set out in the project design (Mullin 2005). This report also incorporates relevant archaeological data collated from three other NMP surveys that include parts of the estuarine margins of the Severn Estuary, the Forest of Dean NMP survey (Small and Stoertz 2006), the NMP survey conducted as part of the Quantock Hills Archaeological Survey (Riley 2006) and results from the NMP survey of Brean Down, conducted as part of the Mendip Hills Area of Outstanding Natural Beauty (AONB) project (Truscoe 2007).

A total of 928 new monument records have been identified and created in the National Monument Record (NMR) database, and 373 existing records have been revised. At least 334 (35 percent) of the new sites identified relate to the fishing industry in the intertidal zone, clearly demonstrating the importance of aerial photography within this environment in understanding past activities along the Severn Estuary coastline. Further aerial reconnaissance and fieldwork investigations of the intertidal zone would facilitate further research and analysis and would complement previous work.

The exploitation of marine resources within the intertidal zone of the Severn Estuary often took the form of numerous well-constructed fish traps and weirs, which range in date from the 10th to the 20th centuries. Few of the fish traps have been dated scientifically but it is likely, by analogy with the East of England, that at least some may be Middle Saxon in date. Medieval and post-medieval period features dominated the sites identified and recorded by the NMP survey in the Severn Estuary's hinterland, and relate mainly to agricultural land use and

settlement. Archaeological evidence of land reclamation and flood defences illustrate past attempts to control and manage the estuarine landscape.

The number of Second World War coastal defensive sites identified by the RCZAS was far more than previously recorded, and will provide an interesting comparison with other surveys, as for example in East Anglia (Albone *et al.* 2007; Hegarty and Newsome 2007).

Acknowledgements

The project was funded by the English Heritage Historic Environment Enabling Programme and monitored by Peter 'Buzz' Busby (Project Officer). Helen Winton acted as NMP Quality Assurance Officer.

All aerial photographic sources were provided by the National Monuments Record Enquiry and Research Service team, in particular Luke Griffin; and the Cambridge University Unit for Landscape Modelling (ULM). HER data was provided by Tim Grubb at Gloucestershire County Council Archaeological Service (GCCAS), David Evans of South Gloucestershire Council, Stuart Cakebread and Vince Russett of North Somerset Council, Chris Webster at Somerset County Council and Peter Insole from Bristol City Council.

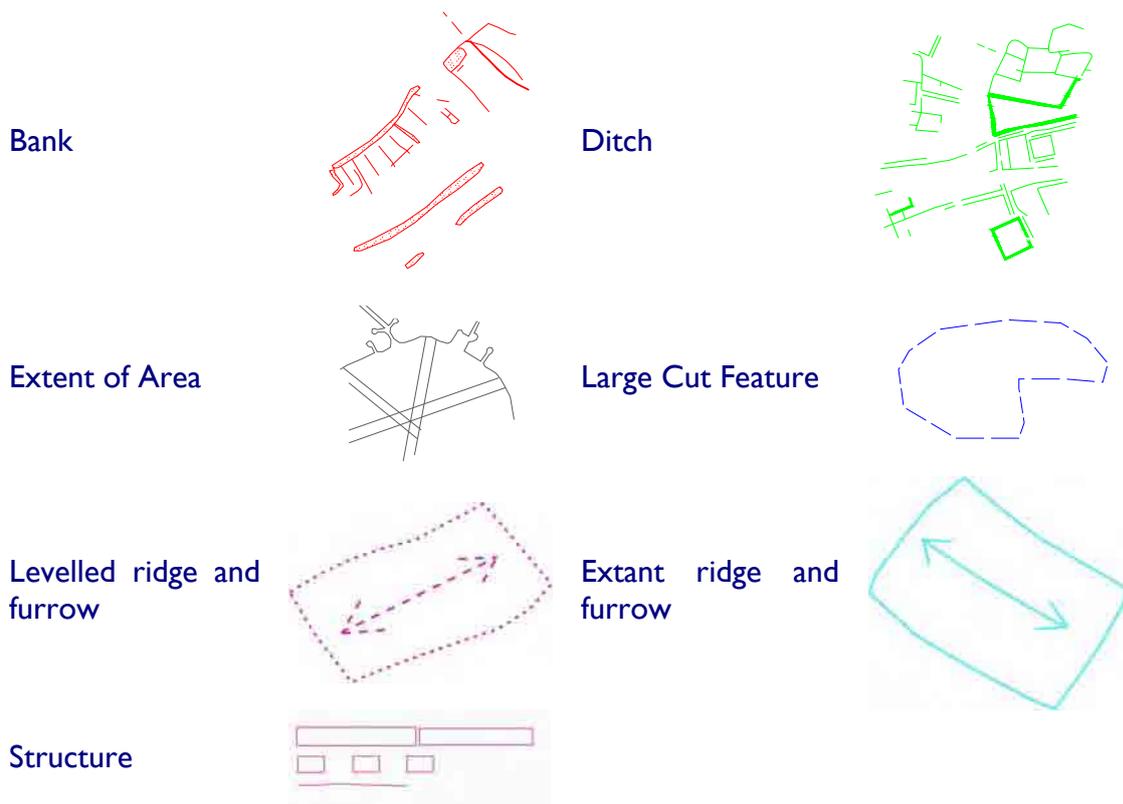
Sincere thanks go to Mr John Tickner of John Tickner Photography, Keighley, West Yorkshire, for his generous and kind access to his colour photographs of the fishing industries of the Severn Estuary and his permission to reproduce them in this report. Also grateful thanks to Catriona Newman of Burnham-on-Sea.com for providing photographs and her kind permission to reproduce them. Weston-super-Mare Library kindly provided access to their reference material and photographic collection relating to the towns fishing history and permission to use the images. Grateful acknowledgement goes to Paul Adams and Sharon Bishop of English Heritage for permission to reproduce their photographs. Thanks to Richard McDonnell for sharing his past research, and to Dr Richard Brunning of Somerset County Council and Nick Russell of English Heritage for their advice and kind permission to use their photographs in this report, and Dr Stephen Rippon at Exeter University for his generous co-operation.

Additional thanks go to Dave Mullin and Toby Catchpole at Gloucestershire County Council Archaeological Service for their support and for providing valuable information, as well as to members of the English Heritage staff who provided training and assistance on all aspects of the project, particularly Sharon Bishop, Cathy Stoertz and Helen Winton. Krystyna Truscoe of Somerset County Council analysed and interpreted the test lidar data at Bridgwater Bay, Somerset and Elmore in Gloucestershire and completed part of the RCZA mapping covering

Brean Down. This report was edited by Helen Winton, Toby Catchpole and Adrian Chadwick.

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Mapping Conventions



These are the mapping conventions used in the map layouts throughout this report unless otherwise stated. See Appendix 3 for the standard NMP map conventions and layouts.

I. Introduction

Severn Estuary RCZAS Introduction

This report presents the results of the archaeological aerial survey of the Severn Estuary, conducted to National Mapping Programme (NMP) standards by staff of Gloucestershire Archaeology Service based with the Aerial Survey and Investigation team of English Heritage at the National Monument Record Centre (NMRC), Swindon.

The Severn Estuary, the second largest estuary in the UK, has unique conditions that result in an intertidal zone that is extensive, macrotidal and receives sediment from many sources. The archaeology of the Severn Estuary in England reflects the variety of topographic landscapes along its length, the historical importance of fishing and the river's economic importance as a seaway. This resource is potentially threatened by a combination of factors: coastal erosion, the second highest tidal range in the world, strong tidal currents, marine aggregates extraction, managed coastal retreat and the construction of sea defences, and potential major infrastructure projects. Consequently, understanding the nature of the Severn Estuary's archaeological resource and its extent will assist in determining the likely impact of such threats (Mullin 2005).

The Severn Estuary Rapid Coastal Zone Assessment Survey (RCZAS) is a project that aims to:

- Better understand the erosion processes occurring in the River Severn Estuary in England;
- Assess the degree and nature of threat to coastal historic resource;
- Present an analysis of coastal change from the Palaeolithic to the present;
- Record all known archaeological features within the inter-tidal zone and to set this within the context of the archaeological resource in the immediate coastal hinterland;
- Enhance knowledge of the archaeological resource for developing management and research priorities in respect of specific sites and areas of potential.

(Mullin 2005)

The Archaeology Service of Gloucestershire County Council was commissioned by English Heritage to undertake Phase I of the project, using staff from Gloucestershire and Somerset County Councils. A steering committee comprises representatives from English Heritage and local authority archaeologists from the Councils of Gloucestershire, South Gloucestershire, Bristol City, North Somerset and Somerset; as well as the Environment Agency and Exmoor National Park.

The Severn Estuary RCZA project area is defined as the land between Lowest Astronomical Tide (Chart Datum) and 1km on the landward side of Mean High Water (MHW) (Mullin 2005). The inclusion of an assessment of surviving archaeological remains of the immediate coastal hinterland provides a context for the archaeology identified and recorded within the intertidal zone.

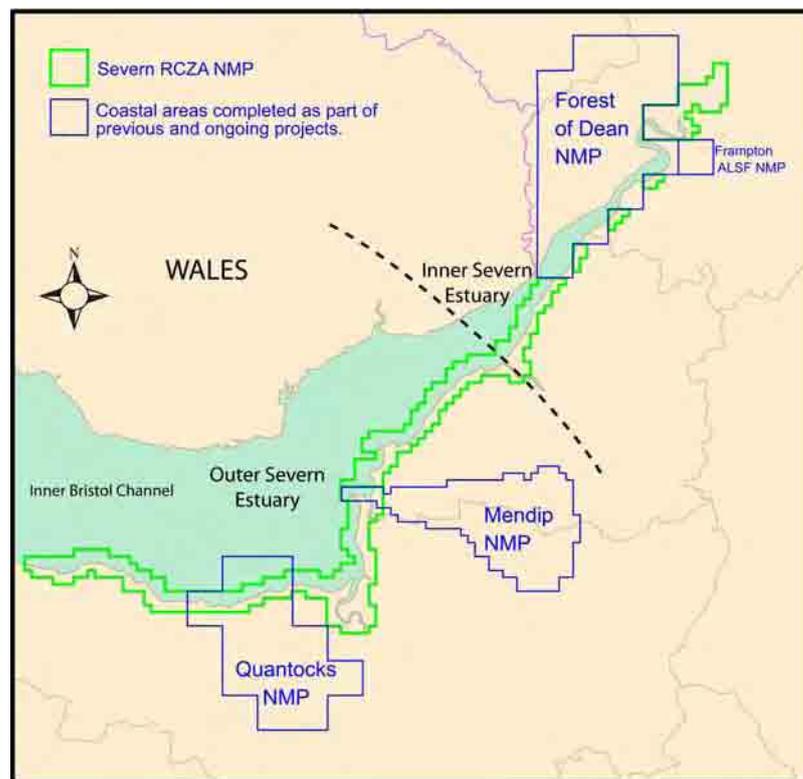


Figure 1-1 The Severn Estuary RCZAS aerial survey project area, with adjacent NMP projects. Note the division of the Severn Estuary into inner and outer zones for the purposes of this report.

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Background map acquired from the Ordnance Survey

The RCZA survey area on the south and east bank extends from Gore Point at Porlock Bay, Somerset, to the present tidal limit at Maisemore Weir,

Gloucestershire. The River Severn's English west bank, between Maisemore and Beachley Point, has also been included. The project is one of the longest stretches of coast considered by an RCZAS (Mullin 2005) (Figure 1). The area surveyed for the Severn Estuary RCZAS comprises 498 square kilometres including 2km² of Steep Holm Island and its intertidal area, situated in the Severn Estuary to the west of Weston-super-Mare. This report also considers the areas covered by NMP projects in the Forest of Dean (Small and Stoertz 2006), the Quantocks Hills (Riley 2006) and Mendip Hills (Truscoe 2008). In total, this is about 195 square kilometres along the Severn Estuary.

In the industrial area of Avonmouth and Bristol docks (quartersheet ST 57 NW), roughly 14km² of the project area was omitted from the NMP survey, although about 2km² of the intertidal area of the River Avon and Avonmouth between Mean Low Water and Mean High Water, was assessed. A major aim of the project is to provide archaeological information about areas potentially under threat from coastal change. Therefore a decision was made to omit current urban areas as these would inevitably be prioritised in any future plan for sea defences. Urban areas such as Avonmouth are also those most affected by current and projected development, and the archaeology of those areas are likely to be researched and protected through the planning process. Major infrastructure projects were therefore not covered by the RCZA in any detail.

The Severn Estuary RCZAS is being undertaken in two phases. Phase 1 is a desk-based assessment that enhances archaeological knowledge, assesses the archaeological resource and analyses coastal changes and the threat posed by the latter (Mullin 2008). In Phase 2, the results of the Phase 1 survey will assist in the formulation of the RCZAS project design for targeted fieldwork. The project aims to enhance the archaeological record for the intertidal zone and the data collected will be added to the National Monument Record (NMR), a summary of individual sites is available through Pastscape (<http://pastscape.english-heritage.org.uk/>). This will also be disseminated to the relevant county Historic Environment Records (HER) and local government departments; and through this portal the data will be available for public access (Mullin 2005; South Gloucestershire Council 2006). The results of both phases of the Severn Estuary RCZAS will inform strategic and local management policies such as Shoreline Management Plan 2, which aims to provide a

basis for sustainable coastal defence policies within the estuary, and to set objectives for the shoreline's future management (Severn Estuary Partnership 2002/2003). The results will also be relevant during scoping for proposed developments, such as the Severn Tidal Energy Barrage. All reports produced by the RCZAS will be made available from the maritime and coastal archaeology pages of the English Heritage's website which can be viewed, along with earlier RCZAS reports at <http://www.english-heritage.org.uk/server/show/nav.18390>.

NMP Methodology

NMP methodology entails the interpretation, digital transcription and recording of all archaeological features visible on aerial photographs, from the prehistoric period up to the mid-20th century, including all Second World War features and structures. Archaeological mapping and interpretation on the Severn Estuary RCZAS commenced in April 2006, and was completed by the beginning of April 2008. This was undertaken through a systematic and detailed examination of all available oblique and vertical photographs derived from a number of sources. The main sources were the vertical and oblique aerial photographic collection of the National Monuments Record (NMR), held at the National Monument Record Centre (NMRC) at English Heritage in Swindon. The project was also carried out in collaboration with Cambridge University's Unit for Landscape Modelling (ULM): their contribution being the loan of material from the Cambridge University Collection of Air Photographs (CUCAP) (see Appendix 2 for details). Online internet sources such as Google Earth (<http://earth.google.com/>), Flash Earth (www.flashearth.com/) and Live Local (<http://maps.live.com/>) proved useful in providing recent aerial photography,

Photographs were rectified using the University of Bradford's aerial photographic rectification software (Aerial 5) and Ordnance Survey 1: 2500 scale mapping. Archaeological features were traced from rectified photographs using AutoCAD 2004 and Autodesk Map 3D 2007 onto 1: 25000 Ordnance Survey base maps. NMP drawing conventions were used throughout (see Appendix 3 for details). New sites and amendments to existing sites were recorded on the Monuments module of the NMR AMIE database, which was then transferred to the English Heritage corporate GIS, for which a summary is available on PastScape

(<http://www.pastscape.org.uk/>). Information will be disseminated electronically to the main RCZA database and GIS at Gloucestershire County Council, as well as to the other relevant county councils Historic Environment Records and Sites and Monuments Records.

Other sources of information used to enhance the archaeological understanding of the features identified in the aerial survey were:

- Relevant geological information from British Geological Survey maps;
- Historic Ordnance Survey mapping;
- The National Monument Record, relevant County Historic Environment Records, and Sites and Monument Records;
- Weston-super-Mare reference library;
- Published and unpublished texts relevant to the geology, archaeology, and history of the project area;
- Internet online research resources - e.g. the Pillbox Study Group, the Anti-Aircraft Forum, Subterranea Britannica and commercial photographic collections.

In the NMP survey, variations to the minimum standard of NMP methodology were in accordance with caveats set out in section 7.4 (Aerial Photographic Information) of the Severn Estuary RCZAS project design (Mullin 2005). Archaeological sites identified within urban areas such as Gloucester, Bristol, Avonmouth and Weston-super-Mare have not been mapped. Similarly, modern complexes such as large Second World War features (airfields, anti-aircraft batteries, barrage balloon defences and munitions factories) were mapped as polygons only. Within those areas, however, where individual structures or archaeological features such as pillboxes were already recorded on the National Monuments Record as a result of The Defence of Britain Project (2002) or other research these structures were mapped and recorded individually and their AMIE records amended accordingly. Similarly, where archaeological features within these areas were considered pertinent to a wider landscape context, this too was also recorded.

Photographic Coverage

Most of the aerial photographic coverage examined was taken from the National Monuments Record collection at Swindon. A total of 12715 aerial photographs from the National Monuments Record were viewed as part of the survey, of which 10976 were vertical photographs and 1739 were specialist archaeological oblique or specialist military photographs.

The quality and quantity of information from historic aerial photographic coverage of the survey area was variable. For the whole RCZA project area, the vertical photographic coverage taken by the Royal Air Force (RAF) during the Second World War and the immediate post-war years provided much useful information not only in respect to military wartime coastal defences, but also for mapping and interpreting the medieval and post-medieval agricultural landscape. For example, post-war vertical photographic sorties were flown at advantageous times of day and season, revealing widespread areas of ridge and furrow in Gloucestershire and South Gloucestershire. Much of this good quality photography was taken in optimum conditions for revealing earthwork features, with a low sun angle casting shadows and the earthworks themselves were also in excellent condition prior to post-war agricultural changes.

The RAF wartime vertical and oblique photographic sorties provided the most revealing images for mapping the anti-invasion and military sites, many of which had been removed, dismantled or decommissioned by 1946. Where both oblique and vertical wartime images were available along a continuous coastal stretch such as between Minehead and Blue Anchor Bay; they documented anti-invasion coastal crust defences whose complexity had not been previously appreciated. The vertical air photographs provided good control for mapping, and the oblique images provided a high level of detail. In contrast, RAF aerial photography was not useful for identifying small, fragmentary or partially submerged archaeological features such as fish weirs or traps in the intertidal zone, due to a combination of photographic quality, flying height and inundation by the sea due to unfavourable tides.

Archaeological features located within the intertidal areas were best seen in detail on English Heritage's specialist archaeological oblique photographs taken since the 1980s, particularly around Stert Flats and Berrow Flats in Bridgwater Bay, and Porlock Bay to Blue Anchor Bay. These photographs were taken at a relatively low height and revealed features such as fragmentary post alignments and partially buried fish traps. They also provided clarity of detail for the larger monuments, as on the V-shaped fish weirs ranks. Within the intertidal zone, these features were most clearly observed in their wider landscape context on the high quality, vertical aerial photographs taken by Ordnance Survey sorties in the 1960s, 1970s and 1980s, many of which were fortuitously flown when the tide was at low ebb.

Few of the aerial photographs from CUCAP were targeted in the intertidal zone, many being general views of landscape and urban areas. They were therefore not well suited to archaeological prospection of the NMP survey area.

The Environment Agency (formerly The National Rivers Authority) possesses aerial photographs for the Severn Estuary taken in 2000 and 2003. In 1992 The Environment Agency also conducted a survey of the Lower Severn from Worcester to Avonmouth, resulting in a collection of about 300 photographs which were archived at Tewkesbury (Mullin 2005). Unfortunately, the collection has subsequently been moved, and despite attempts to locate and access them at the Environment Agency's archives at Bath, they were not available for assessment at the time of this report. Any potential information that the Environment Agency sorties may have yielded, however, is also available via on-line access to recent aerial imagery provided by Google Earth, Live Local and Flash Earth aerial photographic platforms.

Light Detection And Ranging (lidar) Assessment Survey

Data was assessed from two lidar surveys from areas chosen within the RCZA project, using grid ASCII data provided by The Environment Agency. Lidar (Light detection and ranging) is an airborne remote sensing method in which height differences on the land surface are measured. Slight changes in elevation can be picked up and this survey technique results in a detailed digital terrain model in which archaeological sites can be identified; sometimes even sites thought to have

been levelled by ploughing. Overall, the lidar survey was a complementary tool to aerial survey. For example, in some cases where ridge and furrow was recorded from aerial photographs as being levelled, the lidar survey identified them as extant earthworks. Where the lidar did not seem able to add significantly to the data gained from the aerial survey was in the intertidal zone of the Somerset trial area. While additions were made to the number of fish weirs, the majority could not be identified on lidar. The fact that some new sites were recorded, however, shows the potential of this survey technique in an inaccessible environment. The fact that lidar data is georeferenced also aids in locating of features in areas of few fixed control points.

The data was processed by Aerial Survey and Investigation, English Heritage and the lidar survey results have been assessed, mapped, interpreted, incorporated into the NMP survey and recorded in the AMIE database. A detailed analysis of the lidar is described in Appendix 4 (Truscoe 2007).

2. Landscape Character

2.1. Introduction

The diverse and complex relationships between the underlying geology and geomorphological processes combine to create a unique variety of conditions that prevail along the Severn Estuary. The diverse landscapes created within the RCZAS project area reflect not only its varied geology and topography, but also its human uses throughout history.

This chapter describes briefly the geology of the Severn Estuary and its landscape character and landuse. The coastal hinterland and the intertidal zone are divided into two sections. The following two figures (Figure 2.1 and 2.2) give geographical locations for towns and villages referred to within the main text in this Chapter.

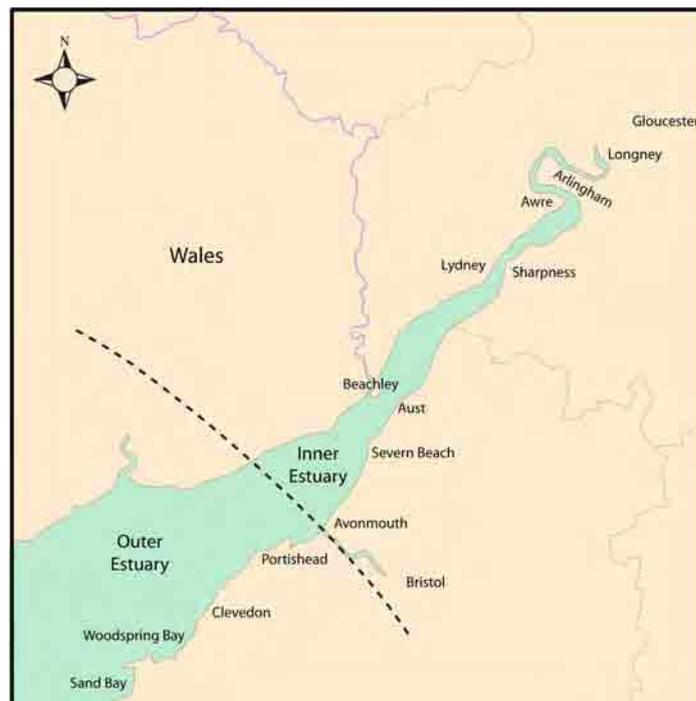


Figure 2-1 The inner Severn Estuary

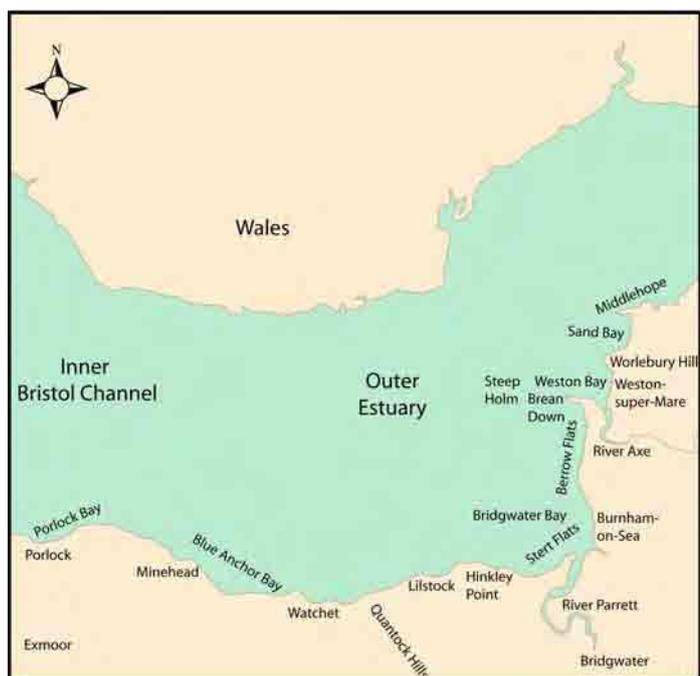


Figure 2-2 The outer Severn Estuary

The project encompasses five distinct, recognised Joint Character Areas: The Severn Vale; Bristol, Avon Valleys and Ridges; Somerset Levels and Moors; Quantock Fringes; Quantock Hills; Exmoor (Countryside Agency 2006a, 2006b, 2006c, 2006d, 2006e, 2006f). Section 2.3 summarises these diverse regional landscapes within the coastal hinterland of the Severn Estuary and the potential influence on the archaeological resource.

2.2 Solid and Drift Geology

The geology of the Severn Estuary is structurally complex. As shown in the simplified geology map at Figure 2.3, most of the Severn Estuary is comprised of soft Triassic (248-213 Ma) and Jurassic (213-144 Ma) rocks overlying older, harder rocks of the Carboniferous (360-290Ma) and Mid-Devonian (408-360 ma) periods.

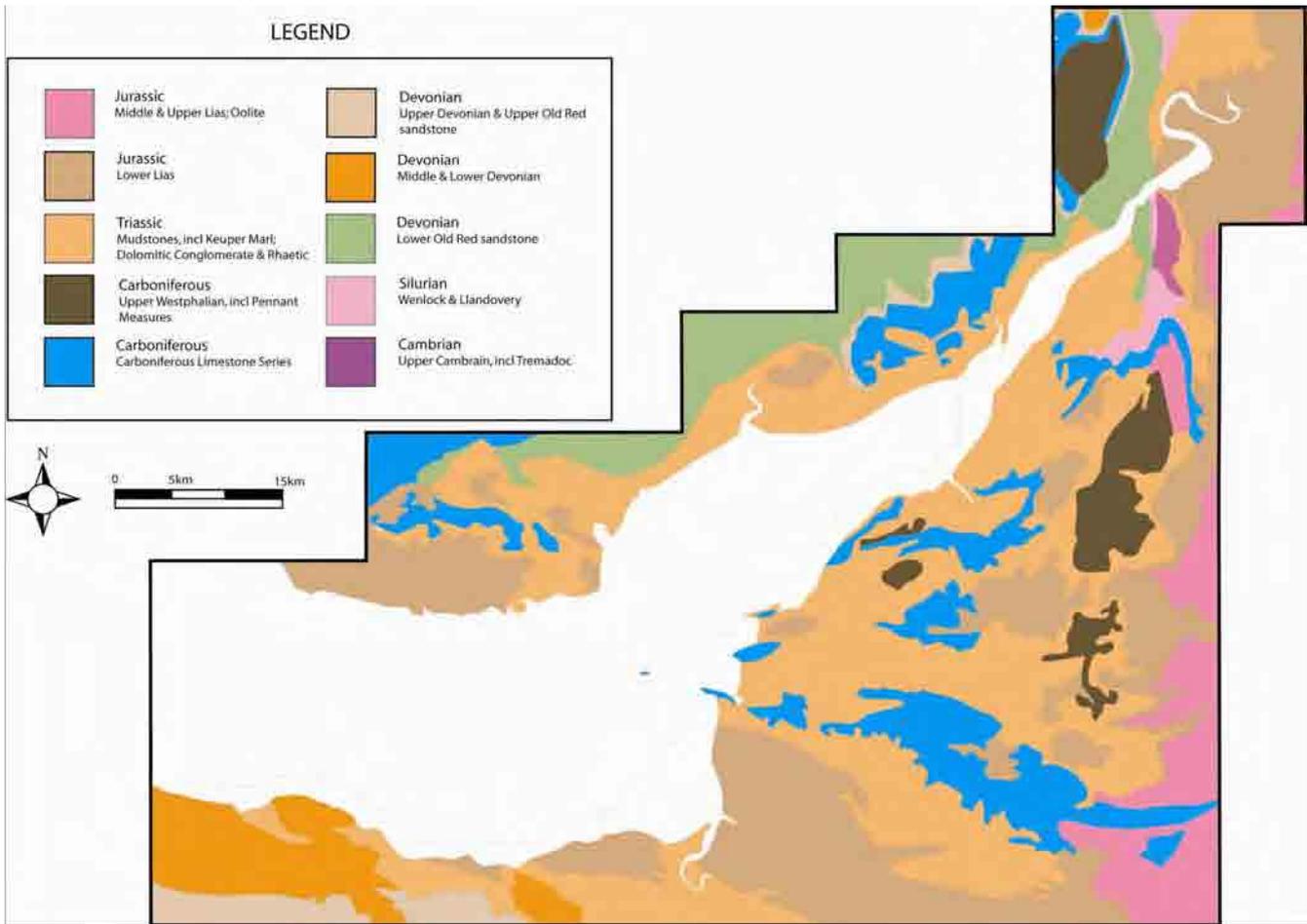


Figure 2-3 Simplified geology map of the Severn Estuary. (Based on the British Geological Map of the United Kingdom south, 3rd edition solid, 1979 (1: 625000 scale) Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved

Older strata have become exposed along parts of the coastline due to folding events creating anticlines and synclines. Over time, the younger rock formations of an anticline erode more easily due to their relative softness, therefore exposing the older, more resistant strata on the surface which now form the uplands of Exmoor, Quantock Hills, Brean Down, Steep Holm, Worlebury Hill, Middlehope, and the Walton Ridge (Barne *et al.* 1996). These upland inliers appear to have been sites for early settlement since prehistoric times. Bronze Age cemeteries, Iron Age hill forts, and Roman settlement were visible as earthworks on aerial photographs attesting to the continued importance of these upland hills and ridges and the survival of the archaeology.

The upper reaches of the River Severn meander through a flat, low-lying flood plain underlain by Triassic rocks, known as Keuper Marls or Mercia mudstone and bands of hard Rhaetic Limestone interspersed with layers of softer rocks (Pilbeam 2006). These rocks are exposed along the estuarine margins of the Severn, for example at Aust Cliff, South Gloucestershire (Dreghorn 1968: 44). The Triassic rocks in turn are overlain by the Lower Lias (bands of clays and limestones) from the Jurassic period, which are exposed at Hock Cliff, South Gloucestershire.

There are also thick Quaternary deposits laid down during glacial periods by rivers and ice-sheets and a series of gravel terraces deposited in response to changes in global climate or glacio-isostasy (Cunliffe 2006). The river terrace gravels have been particularly important for early settlement and with their free draining properties are conducive to cropmark formations visible on aerial photographs.

Further down the Severn Estuary in between the upland inliers are very low-lying wetlands known as Levels which consist of late Quaternary (12000 yrs/recent) deposits underlain by Triassic or Jurassic strata. The Somerset Levels can be separated into four distinct basins (Figure 2.4):

- The Gordano Moors is the smallest basin situated and enclosed by the coastal ridge, Walton Ridge, between Clevedon and Portishead and the Failand ridge.
- The Northern levels situated roughly between Clevedon and Weston-super-Mare.
- The Central Somerset Levels and Southern Somerset Levels, both located south of the Mendip Hills which are separated from each other by the Polden Hills.

All of these basins originated as broad estuaries after the last ice age, following inundation by rising sea levels. Over time, these estuaries developed into waterlogged marshes through deposition of silt and production of peat (English Nature 1997b). The development of these peat and silt deposits, known as the Wentlooge formation, is discussed later in this chapter.

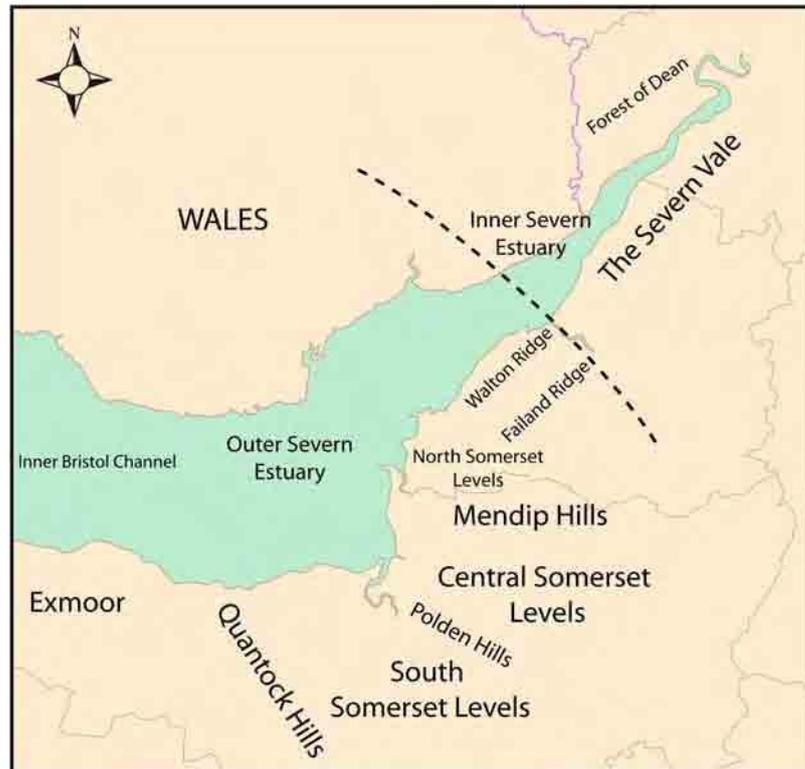


Figure 2-4 The main topographical and landscape regions within the RCZAS project area to which the main text refers

Marine beach deposits of storm gravels and blown sand, produced by the strong prevailing westerly winds, have been deposited on the coast at Steart, Berrow and Weston-Super-Mare. The continual build up of the storm gravels and sand dunes is likely to mask underlying archaeological features, for example the Prehistoric site adjacent to Brean Down excavated by Bell (1990), Riley (1995) and Allen *et al.* (1996). A sequence of human settlement dating from the Bronze Age was uncovered in five metres of blown sand and soil deposits due to coastal erosion. Archaeological features eroding from banks, however, may only be visible in section, and therefore not visible to aerial survey.



Figure 2-5 The folded and faulted rocky coastline near Watchet

NMR 21564/01 26-MAR-2002 © English Heritage (NMR).

West of the River Parrett, lower Jurassic rocks (primarily Lias) occupy the core of a syncline, with Triassic and then Carboniferous rocks exposed on the flanks. The Triassic rocks of the syncline are well exposed at Blue Anchor Bay, on the foreshore near Watchet (Figure 2.5). The local faulting and folding of these Triassic units has produced a wide and rocky foreshore of great geological complexity along parts of this coast (Barne *et al.* 1996). As discussed in Chapter 4, these formations proved problematic for the identification of intertidal archaeological feature, such as fish weirs, from aerial photographs.

Steep cliffs of mid-Devonian sedimentary sandstones, slates, and siltstones dominate the Exmoor coastline, marking the transition between marine and non-marine conditions, with younger Triassic rocks in Porlock Bay and Blue Anchor Bay (Ulf-Hansen and Boyce 1997). Quaternary deposits of undifferentiated river terrace gravels have been laid down in the river valleys around Dunster, on top of which are the alluvial sands, also visible in Porlock Bay and Blue Anchor Bay.

2.3 The Wentlooge Formation

Considerable research has been undertaken into sediment formation in the Severn Estuary. The origin of the post-glacial Holocene (12000 yrs/recent) sediment deposits, known as the Wentlooge Formation, lies in fluctuating climates and sea levels, with marine clays settling out at times of high sea level and peat formation during times of low sea level (English Nature 1997b). Over much of the estuary, the Wentlooge Formation is incomplete; where land reclamation and flood defences occur, the deposit's upper strata have been truncated in places (Allen and Rae 1987). The Wentlooge Formation can be divided into three sub-formations:

1. The Lower Wentlooge Formation, which consists of thick silts with no or few thin peats, dates to around the Mesolithic/Neolithic period (Mullin 2008).
2. The Middle Wentlooge Formation, which consists of thick peats alternating with silts, dates to the Bronze and Iron Age (Mullin 2008).
3. The Upper Wentlooge Formation, which is widely exposed intertidally due to coastal erosion, consists of thick, pale green estuarine silty clays with no peat formed between the Bronze Age and the Romano-British period. In the lower Severn Estuary's tidal wetlands, the Wentlooge surface in many areas was isolated by Roman reclamation (Allen and Rae 1987).

A peat layer is usually found at 20 metres below OD (Ordnance Datum) and is often associated with *in situ* tree stumps. Evidence of these submerged marine forests can still be seen exposed at low tides along the coast and dating suggests the basal peat layers to be about 8500 years old (English Nature 1997b). Between Elmore and the Slimbridge Levels the thick, older Holocene deposits are intertidal silt, sandwiched between which is woodland peat, the top of which is at around five metres OD and dates to 800-200 cal. BC. Above the peat are the deposits of intertidal, laminated grey silty clay and fine sand, which are overlain by grey clay or peaty clay, representing the saltmarsh visible today (Mullin 2008).

At Lydney Level, Berkeley Level, the Vale of Gordano and the Somerset Levels, other Holocene deposits are also known, the silts within which represent intertidal mudflats, salt marsh and tidal wetlands. Underlying the highest saltmarshes, the Rumney Formation is divided into an upper and lower deposit, its formation dating

from the medieval and post-medieval periods. Formed in the 19th century, the Awre Formation is followed by the deposition of the Northwick Formation in the mid-20th century (Mullin 2008)

The accumulation of the peats and silt from Mesolithic to Roman times has created thick Quaternary deposits, burying any earlier archaeology. It is unlikely therefore, that prehistoric features will be located at or near the surface should they survive within the peat layers in the hinterland. This makes the detection of archaeological sites difficult from aerial survey with substantial archaeological earthworks remaining obscured and potential cropmark formation impeded.

2.4 Landscape Character And Landuse Of The Coastal Hinterland

The Severn Vale

Most of the alluvial silt and clayland bordering the Severn Estuary is flat and low-lying, barely rising above 10 metres OD. The exception is Aust Cliff, which rises about 40 metres OD (Figure 2.6). The high tidal range in the Severn Estuary continues upstream all the way to Gloucester as the river meanders through the low-lying plain, which is susceptible to winter flooding despite the construction of flood defence walls along much of its length.

The flood plain is fertile farmland because of the regular deposition of silt and much of the land on the river Severn's east and west bank is agricultural and where soft clays of the Lias (Jurassic rocks) dominate they give rise to heavy but productive soils (Countryside Agency 2006b). Extensive medieval and post-medieval open fields of ridge and furrow dominated the landscape until the 16th century and in some cases the 19th century. The rectilinear pattern of ridge and furrow blocks has shaped the modern landscape and remnants of ridge and furrow are still visible on aerial photographs, for example at Arlingham, as are the once many cider and perry orchards, though these are now much reduced in extent (Countryside Agency 2006b). However, developments in modern agricultural practice mean that increasing areas of these productive soils are being intensively cultivated and consequently, are now potentially more suited to cropmark formation, increasing the visibility of past archaeological landscapes.



Figure 2-6 A view looking east towards Aust Cliff, which rises about 40m above sea level, taken before the first Severn Bridge was constructed. Note the two quays and a wreck in the middle of the picture

NMR RAF/CPE/UK/2484 SFFO-0130 10-MAR-1948 © English Heritage NMR (RAF) Photography

Solis derived from Triassic rocks give rise to silty clay soils, which are prone to flooding. These soils are found south of Alyburton, on the west bank and Berkeley on the east bank. Around Sharpness, soils are dominated by reddish fine to coarse loams, derived from Devonian Old Red sandstone, with a tendency to light seasonal waterlogging (Small and Stoertz 2006). These soils are less productive and due to the frequent flooding common grazing and water meadows dominate the landscape (Landscape Design Associates 2004: 95 & 105). Traditionally, clay soils are less conducive to cropmark formation but under optimal conditions, archaeological landscapes may be visible on aerial photographs (Mills and Palmer 2007).

Much of the coastal landscape of the Severn Estuary has been reclaimed or protected from tidal incursions, which have to be controlled by drains (Small and Stoertz 2006). Reclamation of some of these coastal lands was established in the medieval period, though improvements may have occurred before this, (Allen and Fulford 1990a; 1990b) with the construction of sea and river defences to prevent flooding and tidal inundation. In some places drainage problems are such that the farmland resembles the appearance of the Somerset Levels, with the fields being divided by a regular network of large ditches or rhynes, for example in the parishes of Elmore and Minsterworth, Gloucestershire. The construction of sea and river defences has also created a clearly defined shoreline with dryland areas separated

from wetlands by banks or wharfs punctuated with grouts (tidal outlets), from pills (creeks) and from rhynes.



Figure 2-7 Arlingham peninsula, Gloucestershire. The typical low-lying landscape bounding the upper estuary of the River Severn

NMR 23714/3 24-SEP-2004 © English Heritage (NMR)

The ground, which rises above the flood plain on the east side of the river Severn, is very open with little in the way of wooded areas, with the exception of scattered copses and orchards, as visible on the Arlingham peninsula in Figure 2.7. On the east bank of the Severn Estuary, in the Forest of Dean, the land rises steeply and where the ground is too steep for cultivation, there are large tracts of woodland (Small and Stoertz 2006). Dense forested areas have proven difficult for aerial survey as archaeological earthwork remains are invisible on aerial photographs, yet complementary remote sensing techniques may reveal slight earthworks beneath the tree canopy (Small and Stoertz 2006).

River terrace gravels, which flank the Severn, have been particularly important for early settlement as well as the present day horticultural industry (Countryside Agency 2006b). The main settlement centre is Gloucester, which is on the northeast edge of the survey area. Other major settlement centres include Sharpness on the east bank, largely influenced by industrial activities. The low-lying coastal hinterland of the west bank, south of Awre, is characterised by small

villages, hamlets, and scattered farmhouses linked by narrow winding lanes (Landscape Design Associates 2004). This is also the general settlement pattern on the east bank between Sharpness and Avonmouth (Countryside Agency 2006b).



Figure 2-8 The modern industrial complex at Avonmouth Docks on the banks of the Severn Estuary and River Avon

NMR 23550/17 02-JUN-2004 © English Heritage (NMR)

In the 20th century, the area has seen a great deal of development focused around Gloucester with the expansion of residential areas at Quedgeley and industrial activities adjacent to the Gloucester and Sharpness Canal. Expansion of the riverside industrial complexes at Avonmouth (Figure 2.8) and Lydney as well as the riverside power stations of Oldbury and Berkeley now dominates the Severn Estuary shores. This increased expansion is potentially masking archaeological features, which if not destroyed are buried beneath thick concrete. Excavations in this area have already uncovered Bronze Age pottery, midden material, Romano-British occupation, early medieval burned stone, and medieval and post-medieval earthwork features, summarised in Mullin (2008).

Walton Ridge and Somerset Levels

Moving southwards along the coast, the land rises above the River Avon floodplain to just over 100 metres OD. This elevated ridge of Carboniferous limestone,

known as Walton Ridge, stretches between the towns of Portishead and Clevedon following the coastline (Ahern *et al.* 2005). Southwards beyond Clevedon towards Brean Down, there are further isolated Carboniferous limestone ridges of higher ground at Middlehope, Worlebury Hill and Brean Down which jut out into the Severn Estuary, providing protection for Woodspring Bay, Sand Bay and Weston Bay (Figure 2.9).



Figure 2-9 The headlands of Worlebury Hill in the foreground and Middlehope in the distance jut out into the Severn Estuary, protecting Sand Bay and Weston Bay

NMR 23553/07 02-JUN-2004 © English Heritage. NMR

Woodland covers much of the ridge plateau at Worlebury Hill and between Portishead and Clevedon but pastoral grassland dominates Middlehope and Brean Down. This reflects a soil type which is shallow and has undergone little pedogenesis – the soil is more stony and less organically rich (Ahern *et al.* 2005). Therefore, it is less suitable for arable farming and consequently prehistoric monuments, which remain as earthworks on these upland areas, have not been completely plough levelled. Woodland also limits the effectiveness of an aerial survey as archaeological monuments such as the large ramparts of Worlebury Hillfort are not visible except where there is no tree cover.



Figure 2-10 The irregular fields which cover much of the Somerset Levels. The fields are separated by larger ditches and rhyes and the fields show the network of cut ditches known as grips, which are part of medieval and/or post-medieval land improvement.

RAF/CPE/UK/1924 2006 16-JAN-1947 © English Heritage (NMR) RAF Photography

The rest of the region is dominated by The Levels of Somerset (Northern, Central and Southern) which are essentially formed from a submerged and reclaimed landscape. The coastal fringes of the levels seen at Bridgwater Bay, Woodspring Bay and Sand Bay comprise extensive saltmarsh and grazing marsh. The natural development of shingle ridges and the construction of sea defences along much of the coastline have prevented tidal inundation and encouraged the transition from salt to freshwater marsh in places, for example at Pawlett Hams, adjacent to the River Parrett (English Nature 1997b).

The elevated sea defences and river banks, wide drains and the network of wet rhyes (Figure 2.10), together with winter flooding, emphasise the importance of centuries of water control in creating the present landscape from a natural marshland (Countryside Agency 2006a). Land reclamation would also have had the effect of consolidating a new land surface due to the prevention of subsequent

inundation and essentially trapped the now obscured previous shore and any coastal archaeological sites behind the flood defences.

The landscape visible today is an extensive area of low-lying flat farmland intersected by a complex network of freshwater and brackish ditches. Many rivers such as the River Parrett and River Axe meander across this low-lying alluvial plain. Although better drainage has allowed an increase in arable cropping, the predominant landuse on the Levels remains pastoral; dairying being one of the major industries of the Somerset Levels (Countryside Agency 2006a).

Somerset Levels and Moors was designated an Environmentally Sensitive Area (ESA), a scheme introduced in 1987, as a result of European Community (EC) legislation, to protect some of the most beautiful areas of the UK (DEFRA 2008). The special character of this wetland landscape and its environs is protected by this designation owing to the importance of its flora and fauna, which has therefore limited modern development in places. The resulting benefits of this scheme have included the protection of historic features, such as ancient field systems.

The present nucleated settlement pattern reflects the underlying geology and topography, with the main villages and towns located on topographical highs above the surrounding low-lying 'wet' landscape, with a near absence of dispersed farmsteads or any buildings on the levels and moors. The larger coastal settlements of Weston-super-Mare, Burnham-on-Sea, and the village of Steart, on the other hand, were sited on the Quaternary deposits of slightly elevated blown sand.

Most of the 20th century development in this area has been along the coastal strip. Tourism has seen the expansion of seaside towns and coastal villages, as at Brea with the first Pontins Holiday camp, bought in 1946 (Butlins Memories 2007). Urban development is also found around Burnham-on-Sea, Bridgwater and Weston-super-Mare where residential and industrial developments are beginning to encroach onto the Levels. The flat coastal land has also provided an ideal location for industrial sites such as Hinkley Power Station built during the 1950s at Hinkley Point.

The Quantock Fringes

West of Hinkley Point, on the coastal Quantock fringes the landscape rises and becomes more rolling and windswept (Countryside Agency 2006c) (Figure 2.11). The main soils present in this region are calcareous clays derived from the Jurassic Limestone's and more light, freely draining soils produced by Triassic mudstones and sandstones. Agriculture dominates the land-use with few other industries past or present. Grassland for dairy, beef cattle, and sheep was the predominant agricultural use but recently there has been a shift to arable cropping and where the richest soils exist, market garden crops and vegetables are grown (English Nature 1998). An increase in arable farming may potentially increase the number of buried archaeological sites visible as cropmarks on aerial photographs.



Figure 2-11 The Quantock Hills coastline. Holiday parks dominate the cliff edges occupying the sites of former Second World War military camps

NMR 21957/09 31-JAN-2003 © English Heritage. NMR

South of the Coast, the land rises above 300 metres OD, forming the Quantock Hills; the plateau is a landscape of exposed heather moorland largely devoid of settlement. The slopes of the hills comprise steep, thickly wooded combes on the western edge and gently undulating, well farmed, slopes on the eastern edge (Countryside Agency 2006e). Soils that develop on the older Devonian Rocks, that compose the Quantock Hills, are relatively free draining and fertile but climatic and

human interference over time has caused the creation of poorly draining thin peaty soils on the highest areas (Riley 2006).

The Quantock Fringes is a densely populated agricultural area with dispersed settlements of hamlets and scattered farmsteads (Countryside Agency 2006c), which are surrounded by regular and irregularly shaped fields when it was turned to agricultural use in the 18th century (Havinden 1981). Blue Anchor Bay is dominated by low-lying wet pasture where meandering streams meet the coast (Countryside Agency 2006c). The region was heavily used during the Second World War though lasting visible impact of this activity on the landscape is limited. Tourism is a significant modern industry, particularly along the coast which boasts numerous caravan and holiday parks, many on the sites of former Second World War military camps.

The Exmoor Coast

Moving westwards, the area around Porlock and Minehead is characterised by a diverse upland landscape with spectacular cliffs and coastline slopes, separated by the flat low-lying bays of Porlock, Minehead. The land of Porlock Bay is low-lying and agriculturally fertile, which on the seaward side ends in a saltmarsh due to the breach of the shingle ridge. As a result, what was once freshwater marsh on the land immediately behind the ridge has been inundated with saltwater (Land Use Consultants 2004: 55). Arable cropping is largely confined to the coastal lowlands at Dunster, Carhampton and Porlock offering a high possibility for the formation of cropmarks visible on aerial photographs.



Figure 2-12 Bossington Hill typifies the upland landscape between Minehead and Porlock Bay. A medieval and/or post-medieval field system can be seen in the centre of the image

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The upland areas comprise steep-sided combes or river valleys, wooded slopes, open moorland and sheltered hollows where much of the upland area is used as open grazing (Countryside Agency 2006f). Between Bossington and Minehead are coastal heathlands (Figure 2.12) of scrub covered cliffs and raw rock exposures, cut by steep combes to the north and wooded slopes to the south. The upland area to the west of Porlock Bay is an area of enclosed farmland bounded by a wooded coastline and combes (Figure 2.13). The dense vegetation of scrub and wooded combes is not suitable to aerial survey yet larger prehistoric earthwork monuments are visible on the open moorland where they have not been destroyed by later agriculture or 20th century military activities.

Part of the NMP survey area lies within the Exmoor National Park (Exmoor National Park Authority 2008) and as such, its landscape is carefully managed. Most 20th century urban development has therefore centred on Minehead, which is by far the largest urban centre on this stretch of coast. Minehead saw much increased expansion and development following the construction of the West Somerset Railway line, which provided a direct link from other parts of the country. Its popularity as a seaside tourist destination in the 20th century is evident by the construction of Butlins Holiday Village on former marshland to the east of

the town. The areas of Bossington Hill and North Hill have been used for military training since the 19th century, but it was not until the Second World War that it was requisitioned by the War Department and used as an area for tank training by allied forces. This has influenced the present day landscape, as many of the small farmsteads dotted around were requisitioned by the military and subsequently abandoned, and left as ruins.



Figure 2-13 The wooded combes around Porlock Bay. Stone fish weirs are also visible bottom-centre of the image on Gore Point

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2.5 The Character of the Intertidal Zone

2.5.1 Introduction

The Severn Estuary, the second largest estuary in the UK, has unique conditions, which result in an intertidal zone that is large wide, macrotidal and receives sediment from many sources. The funnelling effect of the Bristol Channel means that the Severn Estuary's tidal range is the highest in the UK and the second highest in the world, reaching up to 14.5 metres at Avonmouth and up to 9.5 metres at Sharpness (Environment Agency 2007: 53; Buck 1993). Storm surges may increase this level by a further 1.5 metres, threatening lower lying areas with flooding. The estuary is very turbulent as a consequence of this tidal range and spring tides carry an estimated 10 million tons of suspended sediment annually (Buck 1993). Spring tides also form the 'Severn Bore', when large volumes of tidal waters are funneled into a continually narrowing channel, which becomes rapidly shallower as it meets a constriction of the river at Sharpness. This unique combination of attributes

creates the bore, a surging wave up to two metres high that travels up the Severn Estuary at 10 knots for 34 kilometres as far as Gloucester (Dreghorn 1967; Barne *et al.* 1996).

The Severn Estuary and Bridgwater Bay together comprises 90 per cent of south-west Britain's entire estuarine habitat (Barne *et al.* 1996). This habitat is defined as an area just over 55,000 hectares, of which the intertidal area is approximately 16,900 hectares (Buck 1993). With a predominance of mudflats and saltmarshes, the Severn Estuary's intertidal coastline is alluvial with negligible drift and wave action, although a combination of storms and high tides can cause significant erosion. Much of the intertidal sediment is mobile sandflats, with mudflats and saltmarshes found in more sheltered bays (Barne *et al.* 1996). The mud flats and salt marshes have been receiving fine sediment for thousands of years, and are composed of distinct sedimentary surfaces, stratified and grouped on the basis of physical characteristics (Allen and Rae 1987).

The intertidal area can be divided into three broad categories: mud, muddy sand and clean sand, within each of which are further gradations:

- Mudflats form in sheltered coastal areas, such as Stert Flats, where large amounts of riverine silts are deposited. Bridgwater Bay at the southern part of the survey area is a silt sink with a high deposition of sediment.
- Muddy sands are found on the open coast and estuaries where the shore is more sheltered and sediment conditions more stable, such as Berrow Flats and Weston Bay at the southern end of the survey area.
- Clean sands occur in bays and on open coastal beaches where the tidal currents and waves are strong and the consequent sediment mobility causes abrasion and prevents fine silt deposition, such as around Portishead (JNCC 2008).

The middle and lower reaches of the estuary are mostly characterised by a succession of wide, flat bays (Woodspring Bay, Sand Bay, Weston Bay, Berrow Flats and Bridgwater Bay) filled with silt sediments or a mixture of shingle and sands

(Blue Anchor Bay, Madbrain Sands, at Minehead and Porlock Bay), each bay flanked by headlands or promontories which provide protection from scouring tidal forces (see Figure 2.1, 2.2 and 2.3 for locations).

Gloucester to Avonmouth

At Gloucester, the most northerly end of the project area, the River Severn is confined within much narrower banks than further downstream and consequently the intertidal area is far smaller, comprising relatively steep mud slopes. This narrows the area within which archaeological features may be visible. The river broadens at Longney, splitting into multiple channels at Longney Sands, and this continues down river with increasing sand and mud bars for example, around Pimlico Sands at the Arlingham peninsula, and The Noose at Awre. These sandbanks can change rapidly although the main channel and larger sand banks tend to be more stable (Carter *et al.* 2006: 30). This changeability has a consequence on the visibility of material archaeology at any given time. Archaeological features may be visible on aerial photographs one day and invisible the next, covered by large volumes of sediment.

South of Lydney on the east bank and Sharpness on the west bank, the Severn Estuary broadens and is under constant change as the tidal conditions vary. At low tide the broad and irregular coastal strip is exposed to reveal mudflats, sandbanks shingle beaches and bedrock (South Gloucestershire Council 2005: 344).

In general, the archaeology visible on aerial photographs consisted of relatively large structures that relate to the fishing industry. Numerous putt and putcher ranks extend out from the foreshore, which are common features of the inner Severn Estuary but not so further south in the outer Severn Estuary. Large wrecks are also visible in the middle of the estuary attesting to the difficulty in navigating within this environment with its extreme tidal conditions and changeable sand banks.

Avonmouth to Stert Point

From Avonmouth to Sand Bay, the land is bordered by a sea wall, against an intertidal zone of generally muddy Holocene estuarine deposits, with the exception of the area from Portishead to Clevedon, where the foreshore is steep and rocky, and backed by wooded slopes. At Sand Bay, it has been necessary to replace lost beach sand to protect the sand dune systems by the creation of a 'perched' beach (Kirby and Shaw 2004: 35). This loading of new sand may have affected the visibility of buried archaeological structures not just from aerial photographs but also from field survey.

Large parts of the dunes are in retreat, as at Brean (south of Brean Down), although in some places saltmarsh development does suggest some coastal accretion. Encroachment by residential and recreational development has added to the environmental pressure on these systems (Barne *et al.* 1996). From Sand Bay to Stert Point, the shore is composed mainly of mudflats fringed with a flat upper beach of sand, although there is an area of saltmarsh with a lagoon at Berrow and a saltmarsh in Sand Bay. From Brean Down to Burnham-on-Sea, continuous sandflats are backed by sand dunes, with grassland and saltmarsh (Buck 1993).

Generally speaking the archaeology visible on aerial photographs along this stretch of coastline is relatively sparse with a distinct decrease in fishing structures, the exception is Berrow Flats, south of Brean Down. The cause of this apparent lack of archaeological features may not be just a reflection of the geology and topography of the coastline. Other factors that could affect the visibility and survival of archaeological remains must also be considered. Further discussion on this can be found in Chapters 4 and 12.

Bridgwater Bay and the River Parrett estuary

Bridgwater Bay is defined as the coastal area between Brean Down and Hinkley Point, which also includes the mouth of the River Brue and River Parrett (O'Donnell 1995: 3; Langston *et al.* 2003: 6) and includes Berrow Flats, Gore Sand and Stert Flats.

In the Severn Estuary and Bridgwater Bay, tides are a complex and important mechanism for transporting sediment, with muds, sands and gravel each having different transport paths. Between Sand Bay and Bridgwater Bay, both wind and tidal currents influence the sediment system. Such interconnected relationships make it difficult to assess the potential archaeological resource within Bridgwater Bay. The tide may destroy archaeological features or obscure them by the deposition of estuarine sediment.

Bridgwater Bay is a sediment sink and the tidal mudflats can extend over six kilometers wide at lowest tide and exceed 5000 hectares in area (Barne *et al.* 1996). With just under 110 kilometers of shoreline, Bridgwater Bay's intertidal area is about 5150 hectares and its broad tidal flats developed partly due to the shelter from erosive currents provided by the Brean Down peninsula and the Exmoor coastline (Buck 1993; Langston *et al.* 2003: 6). This large tidal range can potentially widen the area within which inter-tidal archaeological features may be visible.

The archaeology visible on aerial photographs in this area is concentrated on Berrow Flats and Bridgwater Bay and comprises numerous fish weirs and traps suggesting how important the sea was for food in past centuries in this region. Local conditions such as the deep linear channel called the Gutterway (O'Donnell 1995: 4-5) (see Figure 5.14) between Stert Island and the mainland has created an ideal location for these weirs and traps, used since the early medieval period onwards to maximise the return of catch.

Stert Point to Porlock

Bridgwater Bay's southern reaches are mud covered: sand and significant deposits of mud dominate the intertidal area between Stert Flats and Watchet (Figure 2.14), although between Stert Point and Hinkley Point the shore has a narrow, continuous shingle ridge border.

From Hinkley Point to Minehead, there are soft and fairly low cliffs susceptible to erosion (Barne *et al.* 1996), with a foreshore comprising a series of rock platforms

at the northern end of the Quantock Hills. Blue Anchor Bay, extends from Blue Anchor to Minehead, and has a wide tidal range and a long beach comprising a broad area of intertidal mudflats and shingle, although Minehead also has a small sandy beach (Buck 1993).



Figure 2-14 On Stert Flats in Bridgwater Bay, the signs are explicit in their warnings on the dangers of venturing onto the mudflats. Hinkley Point nuclear station is in the background.

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West of Minehead, beach sediments vary greatly along the intertidal zone. The foreshore is wide with a cover of sand, shingle, mud or exposed bedrock. Groynes are common along this stretch of coast and shingle littoral drift is eastwards. The intertidal area and shore between Minehead and Porlock Bay are backed by cliffs. Exmoor's 55 kilometres of coastal cliffs have a hog's back profile and form some of England's tallest cliffs.

Porlock Bay's intertidal area consists of shingle (boulders and pebbles) (Barne *et al.* 1996). The beach has a five kilometre long continuous gravel barrier, the longest in western Britain's coastline (Orford 2007). The Porlock shingle ridge is about 28 hectares in area and although an unstable environment, is a habitat for nationally important flora and fauna as well as being of national importance for revealing geomorphological processes, which continue as the ridge is in a state of flux (English Nature 1997c). A major breach of this barrier during the winter of 1996 resulted in subsequent daily flooding in the land behind the barrier, causing the development of saltmarsh (Orford 2007).

The archaeology visible on aerial photographs is mostly concentrated within the sheltered bays at Porlock, Blue Anchor and Minehead, and again reveals the extent

of Somerset's past fishing industry. As mentioned previously, the rocky foreshore on the Quantock fringes made it difficult to identify archaeological remains on the available aerial photographs. As a consequence of a narrow or no tidal range, the area within which intertidal archaeological features is visible will be limited (Hegarty and Newsome 2005: 8), such as on the Exmoor coastline.

2.5.2 Erosion and Accretion in the Severn Estuary's Intertidal Zone

Due to its relatively soft and unconsolidated nature, much of the coast suffers from a process of erosion and accretion in the Severn Estuary. This has been documented historically and can have a direct effect on the survival and visibility of archaeological features within the intertidal zone. This can be illustrated by the following two examples:

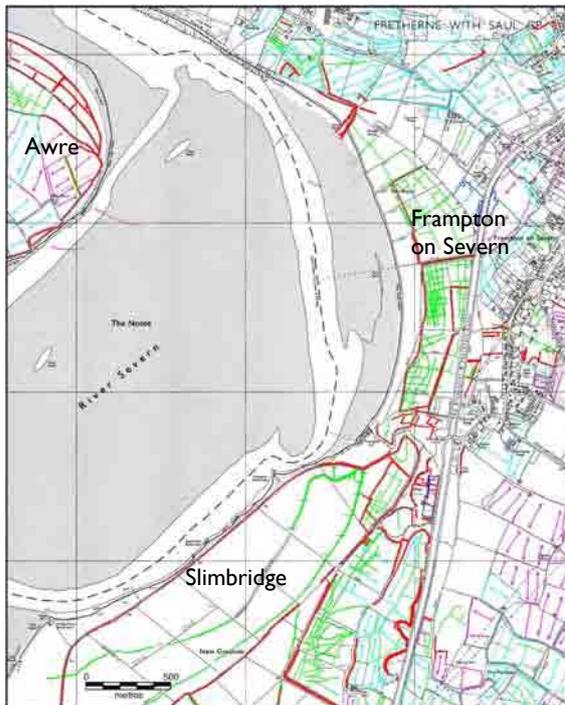


Figure 2-15 Complex patterns of drainage and reclamation at Frampton on Severn and Slimbridge.

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Background map acquired from the Ordnance Survey

From the 17th century between Frampton on Severn village and Slimbridge changes in currents caused deposition of silts creating new land. This new land was then subject to flooding and severe erosion washing away about 280 acres, only to reform again in the 18th century (Herbert 1996; Small and Stoertz 2006). A sea wall was constructed in the 19th century to protect this area, known as 'New Grounds' (Small and Stoertz 2006) and Figure 2.15 shows a number of possible phases of the bank.

Bridgwater Bay has a complex history of erosion and accretion. Around the mouth of the River Parrett, the constant mobility and evolution of its islands (Stert Island, Fenning Island, Slab Island and Dunball Island (aka Humble Island and Cure Island)) has been illustrated by McDonnell (1995b) using cartographic, hydrographic and documentary evidence. McDonnell's research illustrates just how highly unstable these islands are, extending and retreating in response to tidal influences, changing both size and location as a result. Before the formation of Dunball Island in the early 17th century, there was an island called Burland's Oad. Changes to the Parrett's course resulted in Dunball Island joining onto the mainland in the late 1830s at Huntspill (Dunning 2004: 91-112). Fenning Island similarly joined onto the mainland of the Stert peninsular (McDonnell 1995b: 79). Slab Island appeared and disappeared on maps of the 18th century in only 71 years (McDonnell 1995b: 74). Stert Island, once a single piece of land now split into two, is the only remaining true island although it has also been subject to considerable erosion and accretion and has moved its position considerably since the beginning of the 19th century, when two enclosures called 'Warren House' were recorded (McDonnell 1995b: 81-82).

More than a century of erosive processes have taken place at Stert Flats and Steart Village and continue to do so, as shown by the destruction of the RAF air gunnery and bombing range formerly sited on the coastal edge (Figure 2.16). However, this erosion is balanced by accretion between Wall Common and Fenning Island (Carr 1971).

Tidal inundation and flood events are also well documented along the length of the River Severn and the broader Severn Estuary. For example, contemporary accounts of a coastal flooding event along the Severn Estuary and the Bristol Channel in January 1607 tell of the penetration of the sea, many kilometres inland in some places. This resulted in the widespread erosion of coastal wetlands and possibly the destruction of archaeological remains of past coastal settlement or activities. The floodwaters stretched so far inland in the Somerset Levels because the land surface slopes landwards. Once the floodwaters breached the coast, the water flowed inland rather than back to the sea. This catastrophic event was either

caused by a storm surge or tsunami but this is still subject to debate (Bryant and Haslett 2002; Haslett and Bryant 2004).



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Figure 2-16 During a field visit by the NMP team in 2006 (left), this military structure (arrowed) was the only visible remains of the wartime RAF air gunnery range (right) on Wall Common, Steart, demonstrating the processes of coastal erosion and accretion at work in Bridgwater Bay over 60 years.

If inundated from sea level rises and flooding events, coastal wetland environments such as saltmarshes are likely to be heavily affected if they are unable to compensate sufficiently by inland migration. In the past two decades, saltmarsh erosion is evident along the Severn Estuary and the Bristol Channel as widespread destruction of vegetation, the expansion of tidal creeks within the marsh and the marsh retreating as a cliff landwards (University of Southampton 2008). As part of its cyclical system of deposition and erosion, the Severn Estuary's coastal environment has been retreating inland because the balance between the rate of sea level change and the supply of sediment has reached maximum capacity (University of Southampton 2008). This has a direct impact on the survivability of any coastal archaeological remains as well as the visibility of material remains, which may be revealed by further erosion.

Sea level rises in the Severn Estuary are thought to result from a combination of isostatic uplift in northern UK and atmospheric warming leading to mean sea level increases. Using historic sea defences dated through documentary evidence and

fieldwalking, Allen (1991) estimates that a rise of 1.3 metres or more has occurred in the inner Severn Estuary since the later Roman period.

In the past few centuries, coastal mud erosion has resulted from sea level rises. In comparison to the sediment exchanges within the estuary, those with the sea and river inputs are negligible. It has been confirmed through measurement that the coastal mud flat erosion is a long-term process and a trend typical of the whole estuary which, combined with sea level rise, would usually result in the redeposition of this sediment at the landward limit of the alluvium inshore (Kirby 1994).

Intertidal marsh erosion or accretion is heavily dependent on tidal forces. Where the tidal flood is longer than its ebb, resulting from asymmetry in the shallow water tidal curves, the consequent increased velocity on the ebb tide results in a net movement of sediment seawards (University of Southampton 2008). Analysis in the estuary confirms that, in the mudflats of Bridgwater Bay's seaward periphery, mud is accumulating in subtidal sinks and increasing in proportion to the sand there, the sediment having been eroded from the estuarine margin, a process that may have been occurring for the last 600 years (Kirby 1994).

These erosion and accretion processes can result in the destruction of material remains of human activity by tidal actions within the intertidal zone and foreshore, or obscure archaeological remains by the deposition and accretion of a large volume of sediment. At any given time, we are only seeing a snapshot of the archaeological resource, whether from aerial survey or other survey techniques. Any informed assumptions or deductions on the location or distribution of archaeological remains must consider this. With repeated aerial reconnaissance and additional complementary survey techniques, a more accurate picture may emerge of the archaeological resource in the Severn Estuary.

3. Previous Archaeological Work and Mapping

In addition to the Severn Estuary RCZAS, other significant research has been undertaken on the Severn Estuary in recent years. The following section summarises research projects relevant to the archaeology identified by the RCZAS NMP survey. The work on sea defences in Elmore by Allen and Fulford (1990a; 1990b) and McDonnell's field survey of fish traps on Bridgwater Bay (1995a), are the primary dating source for many of the features identified by the RCZAS. Fieldwork projects such as these have variable levels of certainty in the dating evidence e.g. from potsherds or small finds, or from absolute dating methods such as dendochronology.

The Severn Estuary RCZA Phase I Report (Mullin 2008) provides a comprehensive synthesis of research and fieldwork conducted within the project area and the results of Mullin's analysis are presented as a separate report. Additional information was compiled for an interim report for the Severn Estuary RCZA NMP survey (Dickson and Crowther 2007), but that is now superseded by this report.

The inundated landscape of the Severn Estuary's intertidal zones results in good preservation of organic and palaeo-environmental evidence. Until the 1980s, however, the Severn Estuary's intertidal zone was a relatively neglected area of study. When the Severn Estuary Levels Research Committee (SELRC) began co-ordinating research in the estuary, it tended to concentrate on the area between Gloucester and the River Parrett and the Welsh side of the estuary between Gloucester and Cardiff. Professors Martin Bell, Michael Fulford and John Allen have undertaken major research on both banks of the estuary over a period of 30 years and Dr Stephen Rippon has also worked extensively in and around the Severn Estuary, with particular a focus on the Roman and medieval periods. Many other writers contributed diverse papers to the SELRC annual report *Archaeology in the Severn Estuary*.

Within the sub-tidal Severn Estuary, the Marine Aggregates Survey investigated important archaeological deposits and strata (Burton *et al.* 2007). Maritime records relating to shipwrecks and lost cargoes are available at the public archives of the Maritime and Coastguard Agency's Receiver of Wreck. Other historic

maritime records and charts are held by The Hydrographic Data Centre at the National Hydrographic Office, Taunton (Mullin 2008).

Notable field and aerial surveys significant to the Severn Estuary RCZAS project and report are summarised below, especially those that focus on the intertidal zone. As a general observation, the relatively limited coastal and intertidal archaeological research that has been undertaken indicates that the extent and quantity of the archaeological resource has been significantly underestimated (Mullin 2005).

Summary Of Previous Archaeological Surveys

In Gloucestershire an intertidal survey was conducted at Gravel Banks, Severn Beach and Oldbury-on-Severn in 1998 (Riley 1998a, 1998b), and on the west bank of the River Severn, between Stroat and Woolaston (Townley 1998), both of which identified fish traps and wooden stake structures. Allen (2002) assessed surviving intertidal archaeology at Old Passage, Aust, which was visible on aerial photographs and recorded by the RCZAS project. These previous surveys helped enormously in understanding and identifying the archaeological evidence visible on aerial photographs during the aerial survey.

Little archaeological work appears to have been undertaken in the area of Avonmouth, Portbury and Portishead docklands, nor has there been much research on the coastal strip between Avonmouth and Clevedon (Mullin 2008). The towns of Portishead and Clevedon, however, were the subject of archaeological assessments as part of the Avon extensive Urban Survey (La Trobe-Bateman 1990a, 1990b, 1990c). At Blackstone Rocks south of Clevedon, worked prehistoric flint, flakes and cores were recovered (Sykes 1938).

In the intertidal zone between Wain's Hill in Clevedon and Sand Point, North Somerset, Hildich (1997) conducted a preliminary rapid survey and identified previously unrecorded features in Woodspring Bay, many of the sites being poorly defined stake scatters not visible on aerial photographs viewed as part of the Severn Estuary RCZAS project.

Little archaeological survey work has taken place in the two kilometre wide intertidal zones of Sand Bay and Weston-super-Mare (Mullin 2008). An archaeological assessment of Weston-super-Mare formed part of the Avon Extensive Urban Survey (La Trobe-Bateman 1999) and important work has been carried out at Brean Down, Somerset, by Martin Bell (1990) between 1983 and 1987, Riley (1995) and Wessex Archaeology (Allen et al. 1996). This has revealed a sequence of human settlement dating from the Bronze Age through to the Romano-British period. On top of Brean Down, Grinsell (1971) identified nine Early Bronze Age round barrows, and an Iron Age hillfort has been partially excavated (Burrow 1976). In addition, field systems have been surveyed which are still visible as earthworks on aerial photographs (Riley 1996).

In the 1990s McDonnell (1993, 1994, 1995a, 1995b) undertook a comprehensive field study of archaeological remains in the intertidal area of Stert Flats and Gore Sands in Bridgwater Bay, recording numerous vulnerable and fragile intertidal fishing sites, more modern maritime related structures and a submerged forest off Stolford. Recent dendrochronological analysis was undertaken on Stert Flats for dating a limited sample of the wooden fish weirs. This produced limited results, but provided a felling date after 932AD for one sample and 966AD for another (Groves et al. 2004). More recently, McDonnell (2003b, 2003c) and Brunning (2008b) have conducted a field survey in Bridgwater Bay, sampling and dating many fish weirs and traps.

Between Hinkley Point and Blue Anchor Bay, little archaeological research has been undertaken in comparison to the adjacent Somerset Levels and Exmoor National Park. McDonnell (Ainsworth *et al.* 2007: 12) surveyed aerial photographic evidence in the 1980s for the Area of Outstanding Natural Beauty (AONB). Further inland the South Quantocks Archaeological Survey examined cropmarks sites, and between 2002 and 2004, English Heritage's Archaeological Investigation department (Riley 2006) conducted a field survey. The complementary NMP survey conducted alongside this fieldwork provided an aerial photographic assessment of the Quantock Hills, the results from which are integrated into Riley's analysis (2006). Part of the Quantock Hills survey area includes the intertidal zone of the Severn Estuary RCZAS, and analysis of the mapped features has been included in this report.

McDonnell (1980) used aerial photographs to survey the intertidal area between Lillstock and Porlock Bay, and recorded numerous tidal fish weirs. In Porlock Bay, the RCHME undertook a survey of the submerged forest in 1991 (Canti *et al.* 1995), as did Riley (2001), responding to the threat to archaeological features from marine incursion following breaches of the shingle ridge on the beach. Stone fish weirs and Second World War defences were also recorded. In 2003, one of two worked split oak plank with two cut mortices was recovered from Porlock Marsh and radiocarbon dated to AD780-1020 (McDonnell 2003a).

Studies of coastal change in the Severn Estuary have shown that coastal saltmarsh is retreating at a rate of around one metre every year. The Brean Down excavations suggested that an average of 80mm per year of sand cliff has eroded in the 64 years between 1887 and 1971, a total of seven metres (Bell 1990). Brunning (2008b) states that the mudflats on Stert Flats are vertically eroding at a rate of 16mm each year, which has implications for the future survival of the archaeological evidence. More palaeoenvironmental research needs to be done, both regionally and on individual sites, in order to identify sea level changes, settlement distribution and to evolve new ways of locating deeply buried sites (Rippon 1997a).

4. Factors Affecting The Results

4.1 Visibility

In an aerial photographic survey of an area, one might reasonably expect to be able to locate and identify three main groups of archaeological features: relatively large monuments such as standing buildings and structures, earthworks visible in relief and buried features visible as cropmarks or as soil-marks. The mapping and interpretation of such features, however, can be limited by a wide range of factors such as photographic resolution, flying height, an unfavourable time of day or year for optimal visibility or climatic conditions such as haze. Geological and topographical features such as steep-sided combes, woodland tree cover and heavy surface vegetation such as bracken are also natural limitations to visibility (Wilson 2000: 47).

There is a well-documented history of river and tidal flooding in the Severn Estuary, with consequent alluvium build-up caused by repeated inundations (Witts 2000). The depth of alluvium deposited from such flood events makes the identification of pre-medieval features from aerial photographs problematic. For example, although in the Roman-British period widespread coastal reclamation in the Severn Estuary may have taken place, in the later Roman period there is evidence for marine transgression, the relative sea levels rises resulting in terrestrial deposits being overlaid by marine strata (Brunning 2008a: 47). The deposition of marine silts on the coastal hinterland may thus have contributed to the apparent paucity of Romano-British features identified by the RCZAS aerial survey, having either being buried beneath the silt sediments or destroyed by coastal erosion.

The repeated nature of flood events along the estuarine margins has resulted in settlement being concentrated within those areas less liable to flooding. The longevity of settlement at these locations may also contribute to the lack of visibility of earlier archaeology from aerial reconnaissance.

The remains of widespread ridge and furrow cultivation form a significant historic feature of the landscape between Gloucester and Avonmouth. The lack of

significant woodland cover or urban development results in a very open landscape allowing an unobstructed view of ground features from the air, except where orchards and small copses remain. Given the large ground area visible, there was a noticeable absence of cropmark sites. Even where ridge and furrow earthworks appear to have been ploughed level since it was first assessed on the 1940s aerial photographs, the ridging pattern may still be seen as a slight earthwork or as a cropmark. This dominance of medieval and post-medieval agricultural landscape features on the aerial photographs may be a potential limiting factor to the identification of earlier underlying archaeology, masking any pre-medieval features by burial beneath the cultivation earthworks. In the few locations where ridge and furrow earthworks had been ploughed in recent times, such as to the south of Arlingham village, a number of indistinct and undated cropmark features have become apparent. This suggests that underlying features have survived beneath the ridge and furrow and there is potential for further discoveries of subsurface features visible as cropmarks, resulting from continued ploughing. Romano-British settlements are known in several locations on the alluvial ploughlands south of Arlingham: for example, the Romano-British settlement near Shepperdine is thought to lie beneath ridge and furrow (Allen 1992). Changes in modern farming regimes have resulted in increased levelling of ridge and furrow fields, which may start to reveal more underlying features in the future.

Urban expansion and industrial activities have also masked potential archaeology. North of Avonmouth docks a large area of medieval and/or post-medieval ridge and furrow has been recorded as earthworks on early post-war photography; but instead of being gradually levelled through modern ploughing, extensive industrial estates and complexes have been constructed on top of the medieval and post-medieval landscape, destroying or hiding any earlier archaeological features beneath.

In the low-lying areas of the Somerset coast, not only has there been repeated tidal inundations in the past, some historically documented (Dunning 2004), but there are also grids of post-medieval drainage channels cutting into the earlier agricultural landscape, and more scattered curvilinear blocks of ridge and furrow earthworks. There are also examples of small rectangular enclosures devoid of ridge and furrow, however, such as those to the south of Steart village and on Pawlett Hams

that may relate to windmill sites, former settlements or farmsteads. The almost industrial imposition of land drainage in the post-medieval period may have destroyed more ephemeral archaeological features.

Documentary sources attest to changes in river courses, such as the River Parrett where the land bordering the river banks is subject to significant and continual fluvial erosion and alluviation (Dunning 2004). As described in Section 2.5.2, McDonnell (1995b) has charted the history of four islands using documentary, hydrographic and cartographic evidence: Stert Island, Fenning Island, Slab Island and Dunball Island. The evidence illustrates that these islands are highly unstable, changing both size and location in response to tidal influences. This ongoing process is visible on aerial photographs of 'The Island', land formerly called Dunball Island which joined to the mainland around the turn of the 18th and 19th century (McDonnell 1995b: 76) and whose 19th century sea defence banks have subsequently been eroded during the 20th century. Although the island names remain constant, the land is subject to a process of continual formation and reformation, destruction and renewal. Due to this instability, structures such as the walls documented on Dunball (or Humble) Island and enclosures on Stert Island (Dunning 2004: 91-112; McDonnell 1995b: 81-82), will not have survived. The sequence of medieval or post-medieval earthwork bank defences constructed to protect reclaimed land such as on Pawlett Hams are thus likely to be the earliest archaeological features visible on aerial photographs. Conversely, unless recorded on early maps or aerial photographs, where land has been eroded away, archaeological features such as sea or flood defences will have been destroyed.

Cropmark and lidar evidence for a large, palaeo-channel and relict salt marsh system has been transcribed in the area between Brent Knoll and the Polden ridge. This is believed to be the location of the former River Siger. This fluvial and salt marsh system formed around the late Iron Age and persisted until the early medieval period (Brunning and Farr-Cox 2005: 14). The very size and complexity of this buried fluvial system may be a contributory factor limiting the visibility of archaeological deposits, as the depth of tidal silts may have served to mask subsurface features and old land surfaces, preventing the formation of cropmarks (q.v. Hegarty and Newsome 2005: 5-6).

Extensive coniferous tree plantations on upland areas and heavily wooded steep-sided combs on the coastal fringes around Porlock and Minehead mask earthworks such as field systems and cairns; and some known from topographic field surveys were not visible on the aerial photographs. In addition, many of the high altitude vertical photographs of these areas did not show smaller earthwork features such as cairns or stone monuments. Identification was also made more difficult by moorland vegetation, which applied even to oblique photographs. Within the RCZAS survey, upland areas west of Minehead and at Quantoxhead were used during the Second World War for tank training activities, and these disturbed or destroyed potential archaeological sites.

There are two main factors limiting the visibility of archaeological features on intertidal areas of Stert and Berrow Flats in Bridgwater Bay, Porlock Bay, Minehead Bay and Blue Anchor Bay. Firstly, much of the photographic coverage for this area was not taken at the optimum time for the mapping of intertidal features, which would have been at the lowest tidal ebb with the maximum area of mudflats exposed. Secondly, in years when sorties have been flown and the intertidal area was exposed, many more ephemeral archaeological features have probably been obscured by the marine silts. These silts appear to be highly mobile, periodically exposing and then re-covering the archaeology in intertidal areas up to a depth of two metres (McDonnell 1995a). Few photographic sorties coincided with low tidal conditions and favourable silt movements; this limited the usefulness of the aerial photographs for archaeological survey in these areas.

It should also be noted that most of the wooden fish weirs and traps recorded from vertical photographs by the Severn Estuary RCZAS aerial survey were only visible as linear depressions in the mud, formed by tidal forces scouring material from around the remains of wooden posts embedded in the estuarine mud. Only when oblique aerial photographs were available was it possible in a few instances to identify individual wooden posts. The mapping of the intertidal areas therefore probably does not reflect the full extent of fishing structures and other archaeological features located there.

On the coastline of the Quantock Hills NMP survey area, extensive geological formations in the intertidal zone with extreme folding of the rock strata also made

the identification of archaeological features from aerial photographs alone extremely challenging (H. Winton pers. comm.). It is therefore likely that features identified in that area may not represent all of surviving archaeology. Field survey would thus provide a more comprehensive assessment.

There was a paucity of recent oblique photographic coverage in some sections of the Severn Estuary RCZAS project area mostly due to airspace restrictions placed on aircraft flying into certain zones. Between Purton and Fretherne, the Slimbridge Wildfowl and Wetlands Trust is a restricted area from September to April due to large numbers of migrating birds. A large area of restricted airspace around Avonmouth and Gordano is a consequence of commercial air traffic using Bristol Airport and Bristol Filton Airport and the latter's aircraft development centre where testing of aircraft such as Concorde and the Airbus A380 has occurred. In the area of Woodspring Bay and Middlehope, a long standing military weapons testing range in the intertidal area also restricts access to airspace. Other current restrictions apply to the power stations at Oldbury, Berkeley and Hinkley for security reasons following the terrorist attacks in the USA in September 2001. There are further flying restrictions between Watchet and Hinkley, possibly for military training purposes (D. Grady pers. comm.). Gaps in the post-war aerial photography in parts of the Severn Estuary, particularly that taken by the Ordnance Survey, may also reflect similar restrictions placed on airspace. Post-war RAF bombing ranges at Aust Cliff, Middlehope, Brean Down, Stert Flats, and Lilstock would also have had flying restrictions.

Despite these challenges some recent specialist oblique archaeological aerial photography has been undertaken by Damien Grady of English Heritage in areas such as Bridgwater Bay in 2000, with excellent results. This work is the exception, however. The lack of aerial archaeological focus on the intertidal zone also reflects to some extent a long-standing disinterest in the intertidal zone. Only at the end of the 20th century has there been a growing interest in the archaeology of the Severn Estuary's intertidal zone, with increasing numbers of fieldwork and field survey projects being undertaken (e.g. Brunning, 2008b; Hildich 1997; McDonnell 1995a; Nayling, 1999; Riley, 1998b).

4.2 Methodology Within The Intertidal Zone

Mapping of the intertidal area, particularly to the lowest tidal reaches in the area of Stert Flats, proved to be time-consuming due to the amount of image rectification required to achieve an acceptable level of accuracy away from land. It is fortunate that in 1963, an Ordnance Survey aerial sortie captured vertical images of the Burnham-on-Sea, Gore Sand and Stert Flats area when conditions were most favourable for the visibility of features. Commencing over Burnham-on-Sea, the run continued out into the estuary with many of the subsequent prints being entirely over the mudflats (Figure 4.1). To be able to georeference these images, it was necessary to rectify the first photo in the run using accurate land-based control points, and then rectify every subsequent photograph in the sortie run in order to retain as accurate control as possible, using each previous rectified image to locate acceptable control points.

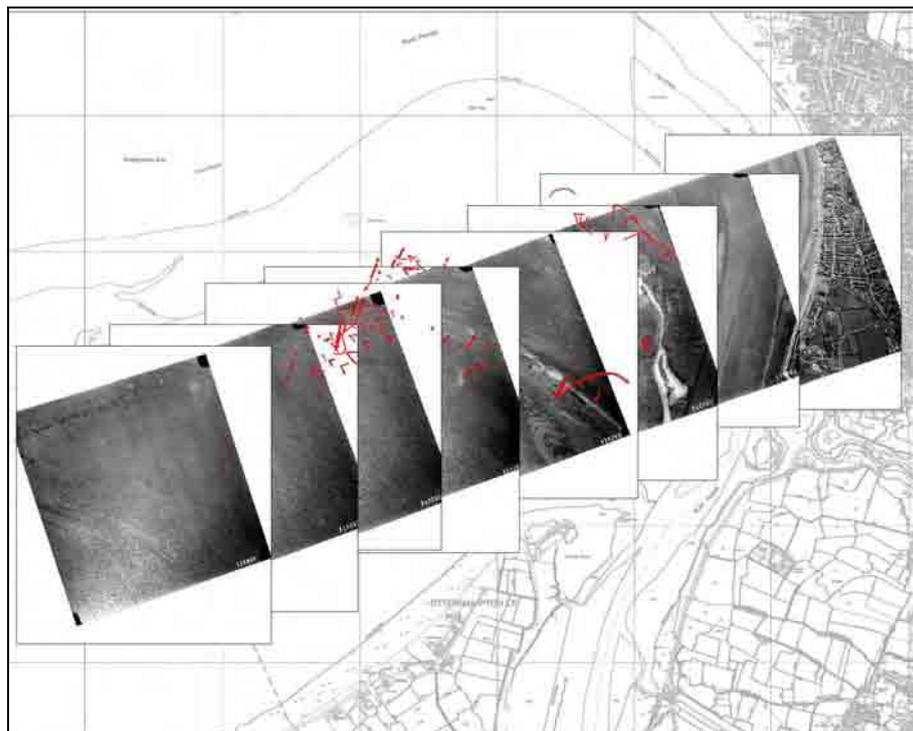


Figure 4-1 One aerial photographic sortie; using subsequent photographs to aid rectification in Bridgewater Bay where there were few or no suitable control points

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Background map acquired from the Ordnance Survey.

As no land-based control points were present, it was necessary to use the myriad branching water channels. Whilst every effort was made to ensure as accurate rectification and mapping as possible, it is likely that a greater margin of error for georeferencing has occurred than the usual NMP standard (see Appendix 3), due to

the lack of conventional controls. The relative relationships between features such as individual fish weirs and traps will have been retained, however. Oblique photographs of the intertidal features taken by English Heritage in 2000 were rectified using the vertical images to identify controls, so a similar caveat applies to the precise location of features mapped in the intertidal area using these images.

It was deemed prudent to use the methods described above rather than use an 'extent of area' polygon that would have provided limited mapping from which to draw any inferences and we believe this would have downplayed the potential of aerial photographs. The recent oblique photography taken in 2000 has been especially important in revealing many hitherto unknown fishing structures in Blue Anchor Bay, which were not visible on any earlier vertical photographs nor identified from previous surveys. Given this success, it is hoped that further aerial reconnaissance in the future will lead to identification of even more intertidal fisheries in the bays along the outer Severn Estuary.

5. The Intertidal Zone

5.1 Introduction

Fishing is economically important for settlements and manors along the Severn Estuary throughout the medieval, post-medieval and early modern periods. By the medieval period many people ate a wide range of fish. These were dried, cold smoked, salted or pickled to provide a source of protein throughout the year (Turner 2005). The RCZAS aerial survey recorded significant archaeological remains of this important and extensive fishing industry in the Severn Estuary intertidal zone. It is probable that many other features and structures remain unidentified by Phase I work, either buried beneath the intertidal muds, obscured by the estuary's waters or too ephemeral to be visible on aerial photographs.

This chapter describes the RCZAS aerial survey results from north to south along the RCZAS project area, in order to present a coherent analysis of the archaeological features recorded along this significant length of coastline. In an assessment of an intertidal zone using aerial photographs, one might expect to identify and interpret only those archaeological features either wholly or partially exposed by the shifting mud deposits. These might include large structures associated with fishing, shipwrecks and aircraft crash sites, and objects or debris such as buoys, as well as military remains. Discrete or isolated features such as pegged timbers or stakes are harder to identify and require specialist oblique archaeological aerial photographs.

As shown in Figure 1.1, the Severn Estuary RCZAS project area has been divided at Avonmouth into an inner Severn Estuary and outer Severn Estuary, reflecting topographic and geographic changes as the Severn Estuary broadens from the narrow confines of the River Severn into the wider estuary. Avonmouth is a natural boundary, where there is a change of coastal topography. The low-lying alluvial ploughlands of the Vale of Berkeley, north of Avonmouth, give way to a more upland landscape south of the river Avon, with Walton Ridge rising between Portishead and Clevedon. Avonmouth is the point at which the Severn Estuary's tidal range reaches its maximum at around 14.5m. Avonmouth also appears to mark a change in the archaeological features of the intertidal zone recorded by the RCZAS aerial survey. Between Awre and Avonmouth, numerous putt or putcher

fish weirs are recorded on the inner Severn Estuary's intertidal zone (Figure 5.2). South of Avonmouth and beyond, however, the morphology and construction methods of the intertidal fish traps identified by the RCZAS aerial survey change significantly.

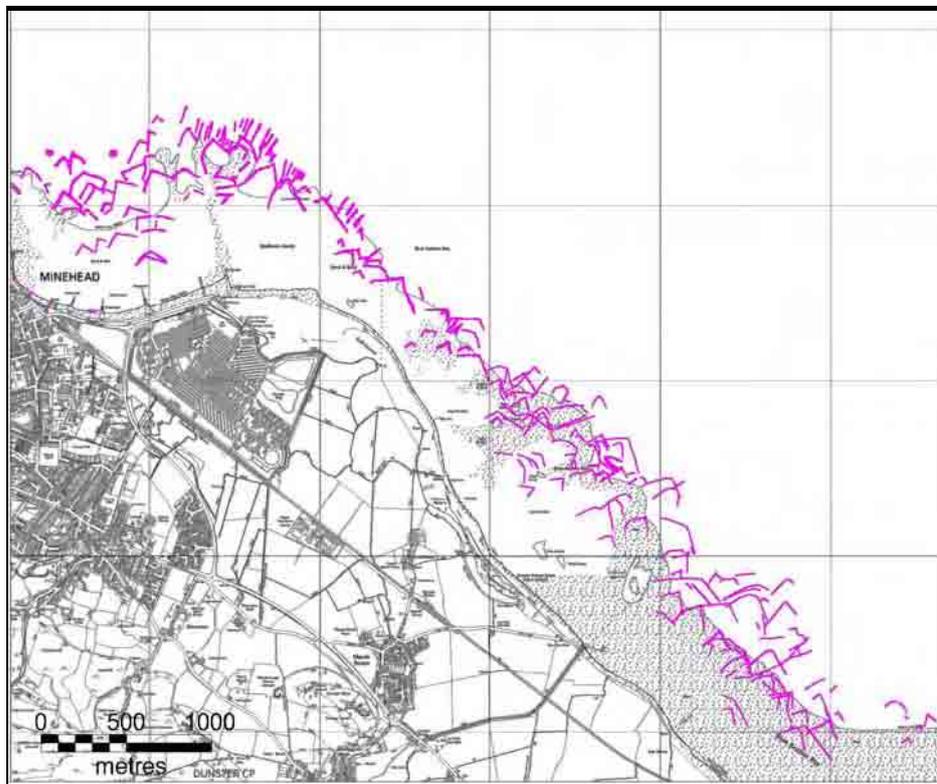


Figure 5-1 Numerous fish weirs identified in Blue Anchor Bay which abut and overlap one another and have been constructed in an intriguing variety of designs and materials.

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Background map acquired from the Ordnance Survey

The most significant archaeological features identified in the intertidal zone are the numerous coastal fish weirs and traps. The RCZAS aerial survey mapped and recorded the remains of 352 fishing structures from aerial photographs, adding substantially to those features already known. Most of the fish weirs and traps were located within Bridgwater Bay and Blue Anchor Bay in Somerset and constructed using an intriguing variety of designs and materials (Figure 5.1). The location of these structures in the intertidal environment has resulted in relatively little field survey undertaken or dating evidence collected until the 1990s. The recent upsurge of interest in the archaeology of the Severn Estuary is adding significant information on the exploitation of the estuary's intertidal zone. The numerous fish traps identified during the RCZAS aerial survey suggest that exploitation of intertidal resources was widespread in the RCZAS project area.

Absolute dating evidence of organic material from these intertidal structures reveals that fishing has taken place for at least a thousand years along the Severn Estuary's shores, with dates ranging from the 10th century to the post-medieval period. In localised areas of the Severn Estuary's intertidal zone such as off Minehead and Stolford in west Somerset, the tradition of intertidal fishing continues to the present day.

5.2 Fishing In The Severn Estuary From Gloucester To Avonmouth

5.2.1 Regulation Of Fisheries

In the inner Severn Estuary, a rising demand through the medieval and post-medieval periods led to fishing specialisation, with the catching of seasonally-migrating species such as cod and salmon. This led to over-exploitation and crashing stock levels, especially salmon, primarily caused by extensive fish weirs placed across spawning rivers and in the intertidal areas, illegal poaching activity and increases in pollution (Turner 2005: 82). Commissioners appointed in 1860 to investigate English and Welsh salmon fisheries heralded several Salmon Fisheries Acts in 1861 and 1865 that regulated and licensed fixed engines. Other than those fisheries which could prove immemorial rights of use, this tight legislative control by the state ensured that no expansion of coastal fisheries and fixed engines would take place after 1865 (Green 1992: 70).

5.2.2 Putts And Putchers

Fishing on the inner Severn Estuary took a number of different forms, many of which leave little or no trace, although the fisheries recorded as part of the RCZAS are all types known as putchers or putts. Allen (2004: 31) states that "the traps represent a long-lived industry that is now and for a variety of reasons essentially defunct". The basket fisheries recorded within the inner Severn Estuary's intertidal zone by the Severn Estuary RCZAS and Forest of Dean NMP surveys are shown in Figure 5.2.

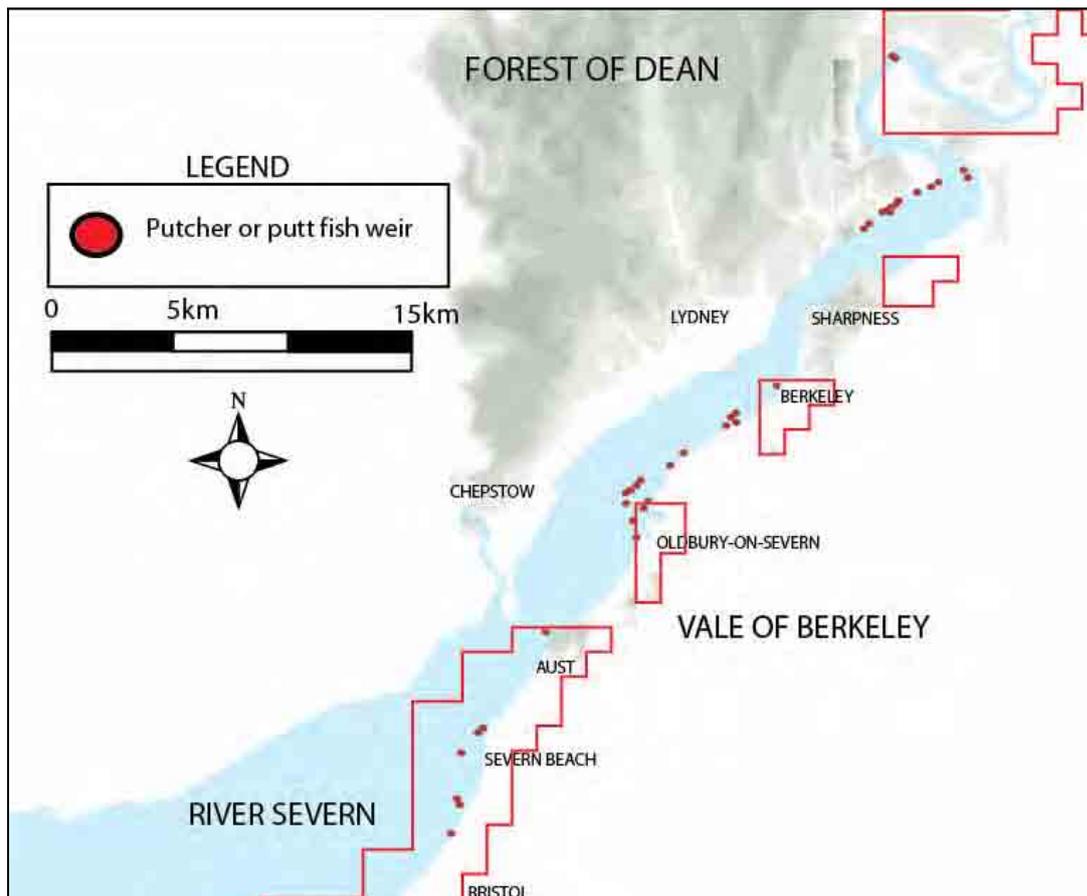


Figure 5-2 The distribution of putcher and putt fish weirs between Gloucester and Avonmouth identified by the Severn Estuary RCZAS and Gloucestershire NMP surveys

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Background map acquired from the Ordnance Survey

A putt is a large, three piece funnel-shaped wicker basketry fishing trap up to about 4 metres long and 2 metres wide at the open end. The putts are laid in single layered rows, with the baskets' mouths facing upstream only. They were individually staked with wooden posts to the riverbed and capable of trapping a wide variety of fish types. Left in place all year, the baskets' mouths were blocked during the closed season (Green 1992; Taylor 1974). The 1945 aerial photograph at Figure 5.3 shows an example of a putt fish weir located at Berkeley (ST 69 NE 41/HOB UID 1466960). The photograph clearly shows the large individual putt baskets in the channel between Bull Rock and the shoreline, visible as dark, V-shaped objects with their open mouths facing upstream to fish on the ebb tide. This fish weir was no longer visible in aerial photographs taken in 1960 following the construction of the Berkeley nuclear power station, which presumably destroyed them.

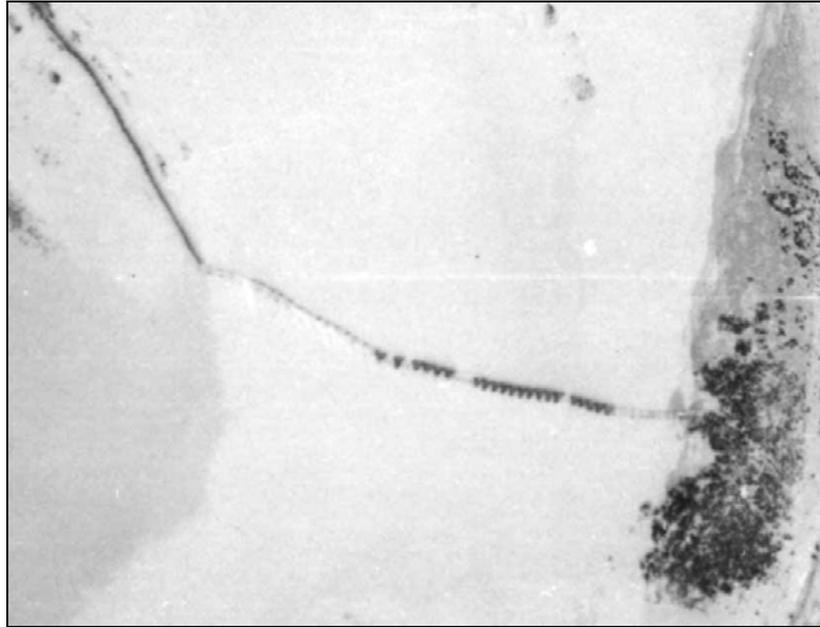


Figure 5-3 A vertical photograph of the Berkeley putt and putcher rank taken in 1945. The larger baskets represent the putts to the right and possibly putcher baskets to the left

RAF/I06G/UK/710 1043 25-AUG-1945 © English Heritage (NMR) RAF Photography



Figure 5-4 A putcher rank at Awre that is still in use, though steel has mostly replaced wood in basket construction.

Putcher rank, Awre (83B7D) reproduced with the kind permission of © John Tickner Photography.

Putchers are likely to have been introduced after putts (Green 1992: 69; Turner 2005: 84). The putcher weir at Purton, for instance, was first used in 1838 (Green 1992: 69; Taylor 1974: 13). As shown at Figure 5.4, a putcher is a roughly 1.5m long funnel-shaped basket fishing trap traditionally constructed from willow or hazel, whose diameter narrows from 60cms at the open end to 10cms at the closed end. Putchers are placed in tiered rows, with each weir consisting of up to several hundred individual putts arranged in tiers on a stout timber framework called a 'hedge', built at right angles to the tidal flow across the river. The putchers

traps' open mouths may face into or against the main tidal flow to catch a wide range of fish, including shrimp, flat fish, salmon and sturgeon on both ebb and flow tides, but most faced upstream in order to catch fish on the ebb tide (Taylor 1974).

The right to use these basket fisheries or fish weirs, legally known as 'fixed engines', including the season they could be used in, was heavily regulated from the 19th century. The location and number of putts and putchers that would have formed the post-medieval weirs was stipulated in the Certificate of Privilege granted in the 1860s. Many of these fish weirs, however, had earlier origins, having been granted originally by royal licence from the early medieval period onwards to manorial and monastic landowners (Taylor 1974, p.13).

A group of putcher and putt fixed engines located on rock platforms in the intertidal zone on the river's eastern bank have been the subject of recent analysis by Small and Stoertz (2005). The NMP surveys have also recorded the morphology and location of these structures, but also include all features identified both upstream and on the Severn's west bank. Many of those recorded in documentary evidence, especially on Oldbury Flats, have since been destroyed by the construction of the tidal reservoir for the nuclear power station (Small and Stoertz 2005).

No fish weirs were recorded in the Severn's tidal reaches around Gloucester by the RCZAS aerial survey although it was thought that they might have once existed. These would have been robustly constructed and small in size to cope with the harsh tidal flow conditions and so as not to hinder navigation by commercial river traffic. It is also possible that a weir could have been constructed at Minsterworth, where the river channel was naturally bifurcated by an island, known locally as a naight with the weir site across one channel, though neither naight nor any evidence of a weir exist today (Rowbotham 1993). The fisheries that have been recorded by the RCZAS aerial survey between Gloucester and Severn Beach on the Severn's east bank and Beachley on the west bank are invariably either putcher or putt ranks. During field surveys of the Severn Estuary's intertidal zone at Caldicot (Godbold & Turner 1994), Magor Pill (Nayling 1999) and Avonmouth (Riley 1998), however, numerous post and wattle weirs and structures have been identified, as well as small fish baskets. It is thus likely that field

investigations conducted as part of Phase 2 of the Severn Estuary RCZAS will identify similar ephemeral structures along the inner Severn Estuary's intertidal area.

On some fish weirs, woven hedges of hazel known as 'leaders' were constructed to guide salmon towards the putchers and putt ranks. Upon entering the putt or putcher funnel the fish are unable to turn and are caught in the narrow end, as shown in Figure 5.5. As the tide ebbs the fish weir rank becomes exposed and the fisherman is able to retrieve the fish before the tide turns and re-covers the weir. This method of fishing continues in the River Severn, although steel mesh has mostly replaced wood in construction.



Salmon in Putcher (83B88)
reproduced with the kind
permission of © Iohn Tickner

Figure 5-5 A Salmon caught in the end of a putcher.

A combination of factors will have dictated the original siting of a fish trap in the Severn Estuary: the desired type of catch, the nature of the riverbed and river flow. The putts and putchers seem to have been sited with regard to specific topographic contexts on the riverbed. They are often, but not exclusively, located on rock shelves because these are more stable than other parts of the river floor, and traps are often sited between rock outcrops that have a depression between them forming pools or channels. By necessity on a river with navigable channels, the location of fish traps is going to be fixed at those points in the intertidal area where they present the least hazard to navigation. Furthermore, parish boundaries are often set in navigable channels, which further restrict the options for moving and siting putts and putchers (Salisbury 1991). As described above, once licenced by

the 1865 legislation, the location of putchers and putts were thereafter tightly regulated and so re-siting or expansion halted (Green 1992: 70).

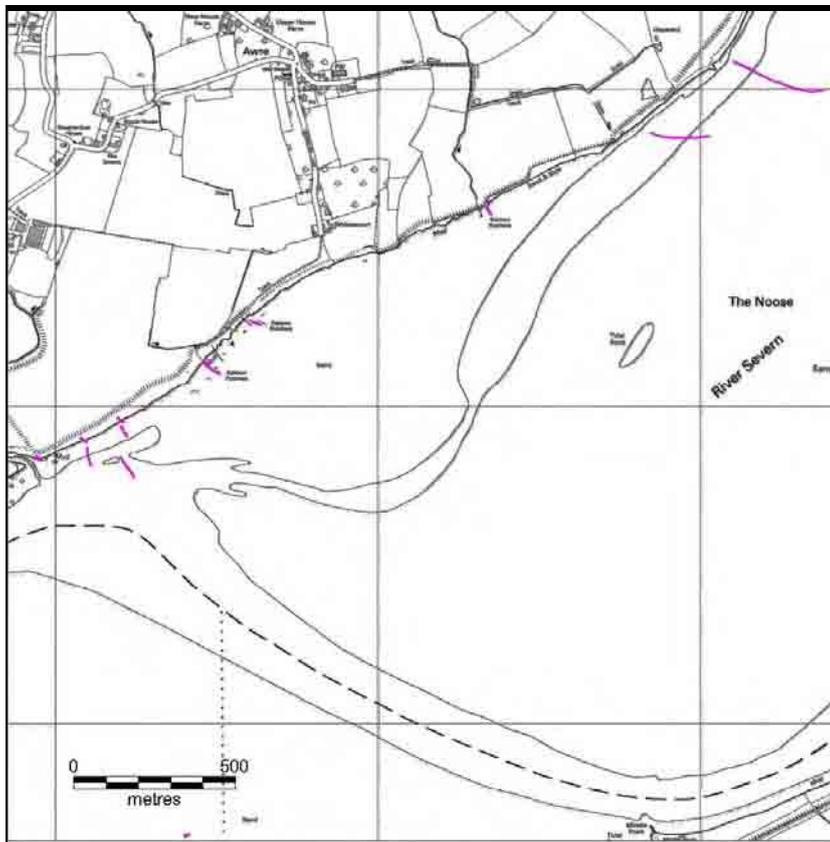


Figure 5-6 The putcher ranks recorded in the River Severn at Awre

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Background map acquired from the Ordnance Survey

The putt and putcher weirs recorded by the RCZAS aerial survey appear to have a varied morphology. More recent putcher ranks are usually linear (Allen 2004), such as on the river's west bank at Awre, north of Brim's Pill, where a succession of relatively small and simple linear putcher rows are sited, shown at Figure 5.6.

Further downstream on the river's east bank on Bull Rock at Berkeley, on Hayward Rock south-west of Berkeley power station and on Hill Flats and Oldbury Sands, the fish weirs are larger and more complex, with curvilinear elements and some with double arms. The more stable nature of the exposed bedrock and the larger intertidal area accessible at some of these locations probably allowed these more complex structures (Figure 5.7).



Figure 5-7 Linear fish traps identified by the Forest Of Dean NMP survey. These have now disappeared due to the construction of the tidal reservoir at Berkeley Power Station.

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Background map acquired from the Ordnance Survey

The RCZAS aerial survey identified only one putcher rank outside the boundary of the inner Severn Estuary, within the River Parrett in Somerset. The putcher fish weir (ST 24 SE 47/HOB UID1449419) is located on the River Parrett's intertidal mudflats south of Black Rock Clyce, Pawlett Level, about 3kms from the mouth of the river. This 'fixed engine' was still in operation until around the year 2000 (pers comm. David Lloyd, Environment Agency).

A decline in use of the putchers and putts on the River Severn has arisen from a combination of factors. The Severn Estuary has suffered from falling fish stocks, tight regulatory restrictions on fishing and potential modifications of the estuary's hydraulic regime that made the upkeep of fishing sites impractical. Further contributory factors were regional changes to the socio-economic focus, away from the Severn itself towards larger urban areas such as Bristol and Gloucester, as well as the industrialisation of the local landscape with the construction of nuclear facilities at Berkeley and Oldbury-on-Severn. There has also been a wider change of diet and culinary tastes.

Without regular maintenance, the supporting superstructure of hedges and stake rows soon decay or are damaged and then destroyed by the extremes of the Severn Estuary's tidal ebb and flow. Indeed, the fish weirs in the inner Severn Estuary appear in varying states of repair on the aerial photographs examined. It is known that some fish weirs were in use in the middle 1960s, such as near Berkeley (Taylor 1974). Some fish weirs remain in use today, with six putchers licensed for use in the Severn Estuary in 2001 (Turner 2005: 83).

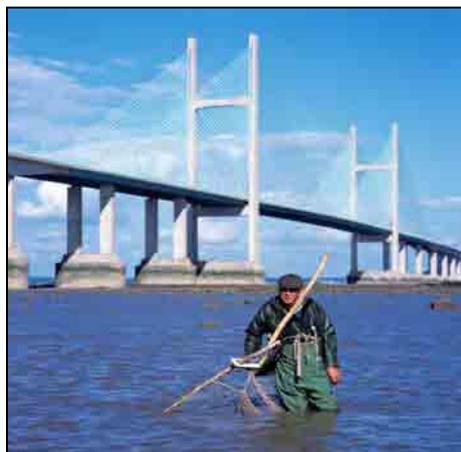
Little archaeologically focused aerial reconnaissance has taken place on the sites of these structures. To view intertidal features, aerial photography should be carried out over a number of years with optimal tidal and climatic conditions. However, restrictions placed on flying over the nuclear power plants at Berkeley and Oldbury on Severn, along with the potential hazard of flying over the bird sanctuary at Slimbridge, have resulted in few specialist oblique photographs of the inner Severn Estuary being available for either the Forest of Dean NMP survey or the Severn Estuary RCZAS (Small and Stoertz 2005). Further work including aerial reconnaissance and field survey is required to assess their current state of preservation. The closure of Berkeley nuclear power station and the forthcoming closure of Oldbury on Severn nuclear power station should remove some of the restrictions for aerial reconnaissance in this area. Some fish weirs have almost certainly been destroyed by the construction of the reservoir at Oldbury Sands and many of the less substantial weirs upstream have probably collapsed from lack of maintenance.

5.2.3 Other Fishing Practices

Many other fishing methods were used in the Severn Estuary, including drift and trammel nets, stop boats, long nets, lave nets, seine nets and elver netting, as well as eel and fish spearing (Jenkins 1974; Taylor 1974). Many of these practices used portable, organic equipment and therefore the archaeological evidence is sparse. Even where archaeological evidence of the more mobile fishing practices survives, it is unlikely to have been visible on aerial photographs and will therefore not be reflected in the RCZAS aerial survey. The consequent predominance of the large and more robust putcher and putt fish weirs does not therefore necessarily

accurately represent the historical or statistical significance of these features in the history of the fishing industry of the Severn Estuary.

Historical documents mention stop net boats on the inner Severn Estuary during the 17th century, so use of these probably pre-dates that period (Cooper 2008). Between 1866 and 1870 the Special Commissioners licensed twenty-four stop net boats for use on the inner Severn Estuary, a number which had dwindled to three by the 1960s (Taylor 1974: 13), and has now ceased entirely. As with putcher and putt fish weirs, certificated stop net boats were 'fixed engines', used only at stated fixed locations. Licences passed down through families from the previous holder. Stop net boats would attach to chains anchored to the river bottom or to wooden stakes driven into the riverbed to act as tethering posts (Green 1992: 70-71).



River Severn lave netsman (83B5D)



River Severn lave netsman (83B74)

Reproduced with the kind permission of © John Tickner Photography

Figure 5-8 Lave netsmen fishing for Salmon in the River Severn using traditional techniques.

Lave nets were also widely employed to catch salmon (Figure 5.8). The earliest recorded mention of lave nets is AD1639 (Jenkins 1974: 83) but during their peak at the beginning of the 19th century, about four hundred individuals were using lave nets on the inner Severn Estuary (Environment Agency 2008). This is a skilled and hazardous fishing method that operates in shallow channels and sand banks exposed by low tides (Green 1992). Effects on fish stocks are minimal, with just four salmon being caught between seven lave net fishermen at Black Rock in 2002.

In 2000, twenty lave net licences were issued for use at Lydney and Black Rock (Turner 2005: 83).

Long-nets were also used on the inner Severn Estuary into the 20th century (Elrington *et al.* 1972). For example, the long-net was known to have been used near Elmore at Weir Green, the name referring to an enclosed piece of land from which long-netting was conducted from wooden stages moored to the shore (Rowbotham 1993).



Arlingham Passage (P1010095) © Amanda Dickson.

Figure 5-9 Wooden remains exposed on the Severn's banks at Arlingham that may be associated with platforms used in longnetting.

The archaeological evidence for stop net boats, lave netting and long netting would be minimal (Godbold and Turner 1994: 49), and would be limited to wooden stake tethers or remnants of uninterpretable wooden platforms, such as those seen protruding from the layers of alluvium on the bank at Arlingham Passage in 2008 (Figure 5.9).

5.3 Avonmouth To Clevedon: Gaps In The Evidence

Little archaeological work has taken place along the coastal strip between Avonmouth and Clevedon (Mullin 2008, p.25). The results of the Severn Estuary

RCZAS aerial survey show that the intertidal area between Avonmouth and Clevedon is notable for the scarcity of archaeological features. This absence is in stark contrast to Bridgwater Bay and Blue Anchor Bay, with a dense cluster of fish weirs and traps in the former and almost contiguous fish weirs in the latter.



Figure 5-10 The scouring tidal forces sweeping along the Severn Estuary's coastline south of Portishead may have affected the survival of intertidal archaeological features.

OS/78083 065 11-JUN-1978 © Crown copyright. Ordnance Survey

La Trobe-Bateman and Russett (1999a: 25, 33) provide details of a long history of fishing at Portishead, especially by the Pill near the Empire Hotel. In the 18th century, documentary accounts tell of 32 fishing stages and nets, as well as 6 fish weirs, catching sprats and other fish on the beach. The fish weirs described in the 1740 documents appear to have been replaced by the early 19th century by two ranks of fishing stages, one of 26 and the other of 20 stages at least. The RCZAS aerial survey identified no evidence of this activity in the intertidal zone, however. Field surveys have recorded wooden stumps at the lowest tidal ebb that might represent the remains of these structures. The tidal force of the falling tide along the outer Severn Estuary's eastern shore is at its strongest between Avonmouth and Woodspring Bay (Figure 5.10) (Kirby and Shaw 2004: 33). The consequent scouring effect of the strong tidal currents is likely to mean that any fishing structures in the intertidal zone would have required constant maintenance (La Trobe-Bateman and Russett 1999a: 25).

Once these fish weirs and stages were no longer in regular use, the force of the estuary's tides would probably have destroyed them. Significant mud deposits such as those on Stert Flats in Bridgwater Bay, are more likely to provide protection to buried archaeological features from tidal forces. At Portishead, the relative absence of silt deposits resulting from tidal scouring is unlikely to have provided the same degree of protection to intertidal structures. The industrialisation of the adjacent dock area is also likely to have contributed to the destruction of these features. In Woodhill Bay, west of Portishead, a field survey recorded wooden posts visible in the intertidal area (La Trobe-Bateman and Russett 1999a). These features may not be associated with fishing, however, but may have been connected to wartime defences and require further investigation to assess their function. Field investigations of Portishead's beaches, as part of Phase 2 of the Severn Estuary RCZAS, might assess and record the state of preservation and nature of surviving features.

Portishead and Clevedon's topography are different from the coastal landscape further south in the Severn Estuary where Woodspring Bay, Sand Bay, Weston Bay and Bridgwater Bay are wide with extensive, flat, mud-filled intertidal areas. Between Portishead and Clevedon, sizeable cliffs, rocky foreshores and comparatively narrow intertidal areas are interspersed with a series of small bays that define the coastal character of the two towns. Large, flat rock platforms such as Blackstone Rocks west of Clevedon bear evidence of extreme folding, making it very difficult to identify man-made features from vertical aerial photographs alone. Available oblique archaeological photographs of Portishead and Clevedon's intertidal zone was limited, partly due to the area being restricted airspace in modern times and partly because the photography was not undertaken at tidally optimal periods. Similar rocky, folded shoreline topography is also evident west of Hinkley Point along the coastal foreshore of The Quantock Hills, causing the same problematic issues for aerial photographic interpretation (H. Winton, pers. comm.)

5.4 Woodspring Bay

South of Clevedon in the wide and flat Woodspring Bay, Hildich (1997) conducted an intertidal survey and recorded the presence of many stake clusters, as well as fish weirs. These features were visible on specialist oblique aerial photographs

taken by English Heritage in 2000, but not on the available historic vertical air photographs. In Woodspring Bay, the RCZAS aerial survey only identified and recorded ten fish weirs, spread along about 1.8km of the bay's lower intertidal reaches. These intertidal features comprise a row of six single fish weirs, as well as a cluster of four overlapping fish weirs (ST 36 NE 41/HOB UID 1462160). Four of the single fish weirs appear to be of a type not identified elsewhere in the RCZAS aerial survey, being W-shaped rather than V-shaped.

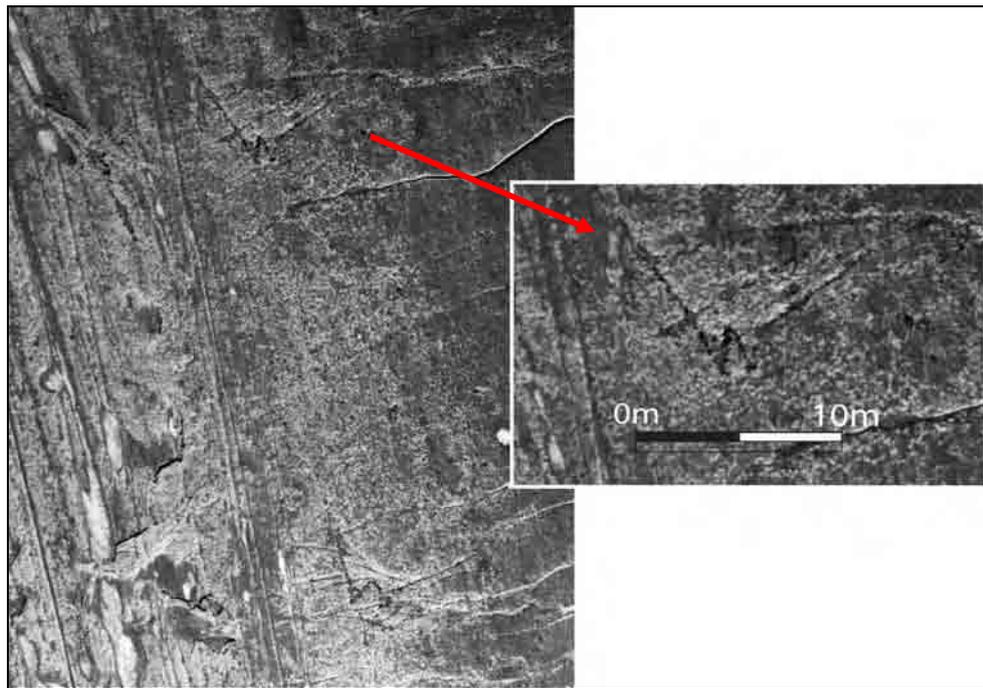


Figure 5-11 The remains of two W-shaped fish weirs recorded in Woodspring Bay

NMR 18714/07 19-FEB-2000 © English Heritage (NMR)

These four unusual fish weirs are constructed of linear or curvilinear wooden post alignments sunk into the mud in the shape of a 'W' (Figure 5.11) and are likely to be the remnants of wooden hurdles set out as two arms which measure between 15m and 23m across at their open ends. At the apex of each weir is an arrangement of wooden posts, probably where a wicker basket held fish trapped by the weir. Why the W-shaped fish weirs differ in morphology to any others recorded by the RCZAS aerial survey is unknown, but they may have been designed to counter local tidal forces. A cluster of beach pebbles or small boulders scattered at the apex of one weir (ST 36 NE 42/HOB UID 1462161), as shown in

Figure 5.12 may have been used to create a funnel or to weigh down and secure the wicker basketry in strong tidal currents.



Figure 5-12 A W-shaped fish weir with a cluster of small boulders at the apex

NMR 18714/07 19-FEB-2000 © English Heritage (NMR)

All of the fish weir structures in Woodspring Bay are parallel to the shore, with the weirs' apexes facing south-west down the estuary. This orientation is unlike almost all the other fish weirs recorded by the RCZAS aerial survey further down the Somerset coast, whose apices face seaward to trap fish on the receding tide. This design variation is possibly a response to the tidal rip in the bay. Linear striations visible in the intertidal area's surface (Figures 5.10 and 5.11) may be the result of these strong and scouring tides running down the Severn Estuary at this point.

5.5 Middlehope, Sand Point And Sand Bay

On Sand Point and Middlehope, the Somerset Historic Environment Record identifies the presence of many stake scatters or clusters, but none of these was visible in the RCZAS aerial survey's photographs. No further information on these sites was available, but they might not be visible on aerial photographs because these features are small widely dispersed remnants of wooden posts. As at Portishead and Clevedon, the coastal foreshore between Middlehope and Sand Point consists of flat, rock platforms, on which it is very difficult to identify archaeological features, especially if they are small.

Sand Bay has a beach approximately 3.6kms wide, with a large expanse of mudflats exposed at low tides. Aerial photographs suggest that the mud deposits in this bay are particularly thick, protected from tidal scouring by the headland of Middlehope and Sand Point. In Sand Bay, only one V-shaped fish weir was visible in the mudflats, a near absence that is difficult to explain given its protected topography. The wooden post V-shaped fish weir recorded by the survey (ST 36 NW 19/HOB UID 1460859) was visible in some years' aerial photographs as a shape formed by tidal erosion around embedded wooden post stumps (Figure 5.13), but apparently re-covered by mud in photographs taken in other years. It is possible that the depth of marine mud deposits in Sand Bay will have made fish weir construction and maintenance impractical, although it is also possible that mobile mud deposits accumulated since the fish traps were in use are covering hitherto unidentified features.

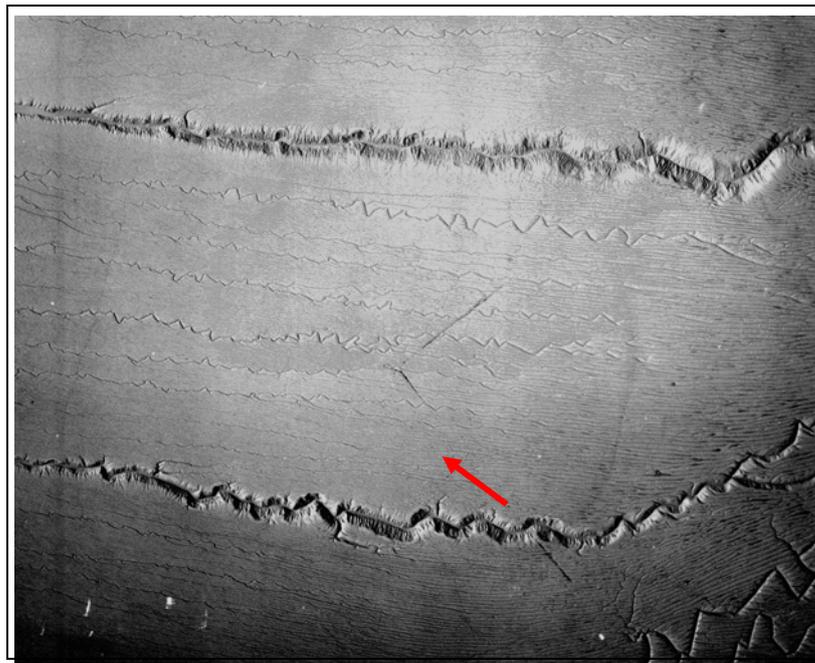


Figure 5-13 A V-shaped fish weir in Sand Bay (arrowed) within thick mud deposits as shown by the deep incision made by the channels running left to right

MAL/ 63067 017 30-JUN-1967 © Reserved.

If Sand Bay was unsuitable for fisheries for whatever reason, then the local population still apparently made use of the intertidal area. There is documentary evidence of wildfowling taking place in Sand Bay in the post-medieval period, with hunters sat on straw bales near channels in the mud, waiting for birds to move inshore on the incoming tide (Bailey 2007).

Further archeologically-focused oblique aerial photography in Sand Bay, combined with field surveys, may determine the extent of any archaeological features located there. For instance, Figure 5.14, taken by the authors on a field visit in 2008, identifies a linear post row at the edge of the *Spartina* grass covered area at the northern end of Sand Bay. This fish trap operated by hanging fishing nets between the posts, and is known locally as a 'stall'.



Figure 5-14 A possible fish stall photographed in Sand Bay. This post alignment was not visible on any available aerial photographs

Sand Bay 14-JAN-2008; Inset: 14-JAN-2008 © Paul Adams

The feature was not visible in the available aerial photographs of the area. This post row might have been constructed subsequent to the assessed aerial sorties, or was not detectable within the marsh area during the RCZAS aerial survey due to the nature of the vegetation. Changes have taken place within the bay. In the 1980s, part of the beach had sand pumped onto it from the Bristol Channel, raising it to create a 'perched' beach to help prevent flooding, giving the beach two levels: one at the original height near the sea, but the other adjacent to the road is at a higher level (Tour UK 2004; Kirby and Shaw 2004, p.35).

5.6 Weston Bay

In Weston Bay, the RCZAS aerial survey did not identify any intertidal features other than Second World War anti-invasion defences (ST 35 NW 108/HOB UID 1453677). As with Sand Bay, the alluvial mud deposits of Weston-super-Mare's intertidal zone are infamous, giving the town the unfortunate sobriquet 'Weston-super-Mud'. On a field visit to the bay in 2007, examination of the mudflats through binoculars from the end of the recently fire-gutted Weston pier revealed various upright posts or tidal debris across the visible intertidal area. It is possible that if archaeological features are located in Weston Bay's intertidal zone, they have been buried beneath accumulating alluvial mud deposits and were not visible on the aerial photographs assessed as part of the RCZAS aerial survey.

5.7 Discussion Of Boat Fishing In The Severn Estuary

The fishing industry of the outer Severn Estuary also saw the widespread use of fishing boats. Working boats evolved to deal with the conditions peculiar to the specific marine environment in Somerset. Known as 'Somerset flatners', these boats were double-ended (for use in either direction) and flat bottomed, being single planked or clinker built and having no keel but a centreboard so that it could be dragged over the mudflats or shallows. In Britain, this design was unique to the Severn Estuary. Local modifications in shape and size to the basic flatner design were developed and became known variously as Gore boats, Bay boats, Bridgwater flatners, Weston-super-Mare flatners and Clevedon flatners, all being widely used in the 19th and early 20th centuries. Fishermen along the Quantock Hills coastline used a variation of the flatner boat design known as 'Watchet Flatties' that were constructed with a reinforced keel to protect them from the rocky foreshores of the Quantock Hills. Fishermen would set out when the tide still covered the mudflats and try to find water channels running through the intertidal area to minimise the risk of being stranded by the ebbing tide. The Bay and Gore boats were fitted with sails and were used not only to fish, but also for transporting coal and sheep between South Wales and Bridgwater Bay. Still in use up to the Second World War, most were destroyed by the British government as part of wartime security considerations. The Weston-super-Mare flatners ferried day-tripping Victorian tourists around the Somerset coast (National Maritime Museum 2008; South West Maritime History Society 2008).

Many other variants were used in Somerset's inland watercourses such as the River Parrett: the turf boat for cutting and carrying peat, the withy boat for cutting and transporting withies for basket making and the riverboat for salmon fishing with dip nets. Although the Parrett riverboats continue to be used, the catching of salmon in the River Parrett and estuary has almost died out, with overfishing in the Atlantic drastically affecting returning salmon and almost killing off what was once an important local industry (National Maritime Museum 2008; South West Maritime History Society 2008).

5.8 Fish Weir And Trap Forms In The Outer Severn Estuary

5.8.1 Introduction

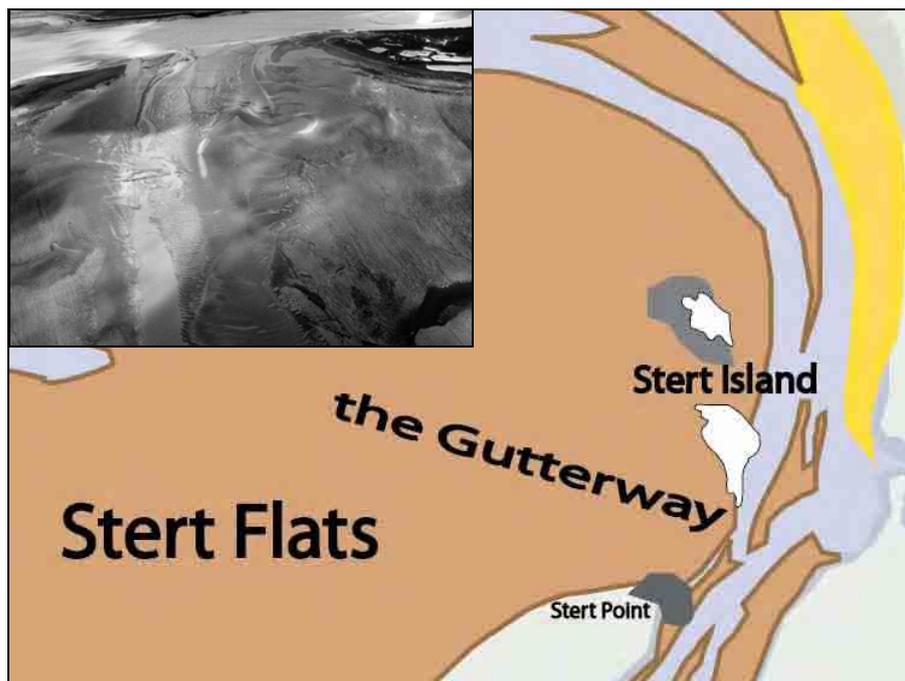


Figure 5-15 The Gutterway on Stert Flats, a channel between Stert Island (top left on aerial photo) and Stert Point (top right on aerial photo). Most of the coastal fish weirs and traps on Stert Flats are sited across this channel at its seaward end (bottom on aerial photo).

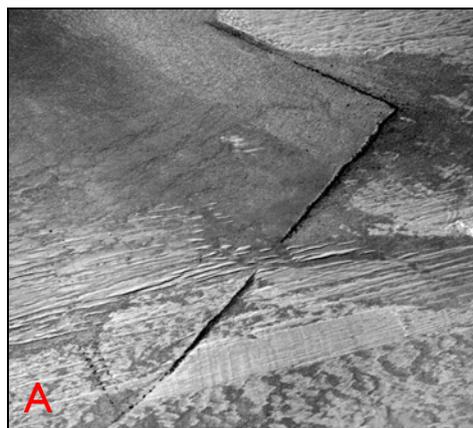
(Main image) © Crown Copyright. All rights reserved. Gloucestershire County Council 100019134 2008. Background map acquired from the Ordnance Survey.
(Inset) NMR 18674/30 19-FEB-2000 © English Heritage (NMR)

In Bridgwater Bay there are many coastal fish weirs focused on Stert Flats in the Gutterway, a wide, linear channel between Stert Island and the mainland at Stert

(O'Donnell 1995) (Figure 5.15) and at least five types of weir structures have been identified here during the aerial survey. Similar structures are also visible in Berrow Flats, Blue Anchor Bay, Porlock Bay, Minehead bay and on the Quantocks coast.

V-Shaped Fish Weirs

The most numerous fish weir type consists of the remains of two 'arms' of wooden post alignments, set out to form a V-shaped structure whose apex faces the sea (Figure 5.16). Many of these fish trap structures identified by the RCZAS aerial survey are clustered across the Gutterway at its seaward end. Constructed of wooden posts and wattle with holding basket butts or putchers at the apex, the area formed behind the wooden post and wattle arms of the fish weir creates a tidal pool, trapping fish on the ebbing tide.



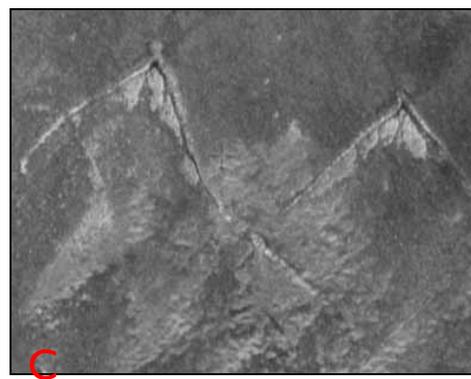
A
NMR 18675/01 19-FEB-2000 © English Heritage (NMR)



B
NMR 18675/21 19-FEB-2000 © English Heritage (NMR)



D
NMR 18300/10 19-MAR-1999 © English Heritage (NMR)



C
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Figure 5-16 Four examples of V-shaped fish weirs identified within the outer Severn Estuary

Some of these fish weirs appear as 'tick' shapes, rather than V-shapes, with one arm much shorter than the other (Figure 5.17). Whether these are merely truncated V-shaped weirs is unclear, although Allen (2004) also noted similar structures in his survey of the Severn Estuary. Similarly, the W-shaped structures mapped and recorded in Woodspring Bay (Figures 5.11 and 5.12) appear to be a variant of the V-shaped weir. Targeted collection of dating evidence from these structures may provide a better understanding of their chronological associations with other intertidal fish weirs.

Some structures are linear wood post alignments, giving the appearance of a 'forward slash' or 'backslash'. Some of these features seem to be taking advantage of natural features, such as shingle or peat ridges, against which the arm is sited; but other single arms or tick-shaped fish weirs are likely to be the incomplete remains of V-shaped examples. In both cases, this is likely to be due to erosion of part of the weirs or their concealment by mud, sand or stone.

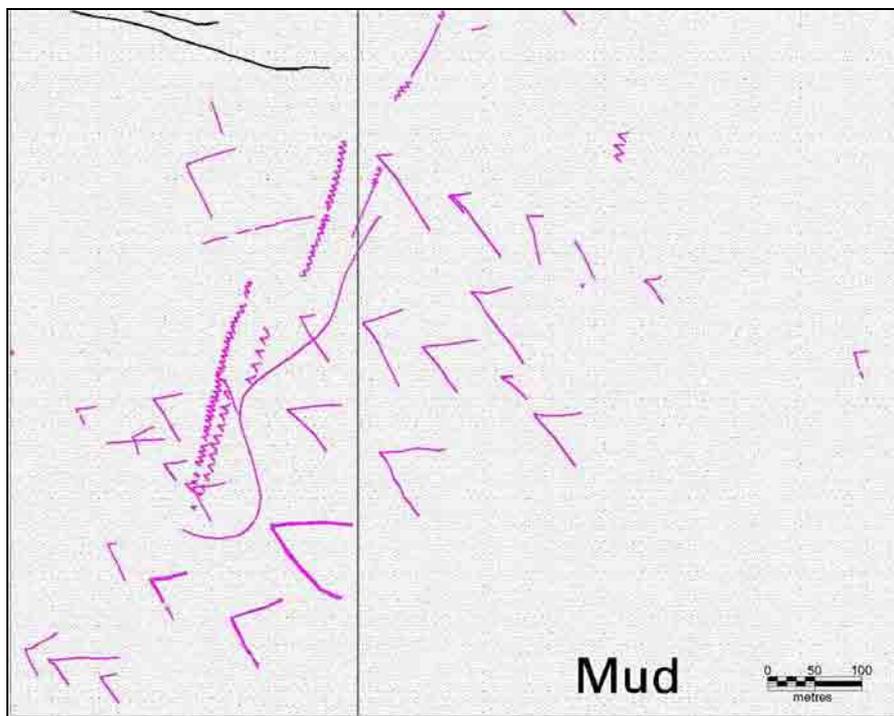


Figure 5-17 'Tick' shaped fish weirs in the Gutterway on Stert Flats, which may be truncated V-shaped weirs. 'Zigzag' and v-shaped fish weirs are also shown

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Background map acquired from the Ordnance Survey

In Bridgwater Bay there is also a V-shaped weir consisting of two long arms constructed of both wooden stakes and stones that converge at an apex of similar design to the wooden V-shaped fish weir mentioned above. The linear alignments of wooden stakes are closely packed together and there are other miscellaneous stakes at the interior of the apex. The density of stakes is such that large fish such as salmon may have been forced along the arms towards the apex without the need for horizontal wattle woven between the posts (Brunning 2008b).

In Minehead's bay, Blue Anchor Bay and Porlock Bay, different construction types were also identified, making use of stone, wood or a mix of both. Most of the coastal fish weirs identified in Minehead harbour were stone-built (Figure 5.18). These structures are similar in morphology to the wooden V-shaped fish weirs, except that they almost all appear to have been constructed of heaped stone walls instead of wooden posts. They comprise two linear walls of heaped stones that form a roughly V-shaped structure with the apex facing seaward. At the apex of the fish weir, some structures still have evidence of an opening or sluice, known also as a gut, which funnelled fish into nets set across it as the pool empties (McDonnell 2001: 21).



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Figure 5-18 Stone built fish weirs at Minehead which are still in use today.

A fish weir of this type located to the north of Minehead (Figure 5.18) (SS 94 NE 183/HOB UID 1455321) along with a few others is still in use today by two local families but the type may originally date to the medieval period when they were first specifically mentioned in a document dating from AD 1424-5. An earlier origin is possible as there are documentary references to fish weirs in this area from the

11th century and again in AD 1299-1300, when five were first recorded in Minehead Bay (information taken from Scheduled Ancient Monument notification 33730).

Zigzag-Shaped Fish Weir Ranks

The second type of fish weir identified is smaller than the single V-shaped post and wattle weirs. There are at least nine rows or ranks, or fragments of rows, of smaller contiguous V-shaped traps, constructed of wooden posts, visible in aerial photographs as a zigzag pattern (Figure 5.19). These may have been frames over which nets stretched and were known as 'hangs' or 'netstalls'. Documentary evidence records that there were three rows, or 'renes', of these by the mid 16th century (Dunning and Elrington 1992: 146-152). These small 'zigzag' ranks of V-shaped fish weirs have only been recorded within the area of Stert Flats during the Severn Estuary RCZAS aerial survey, but similar structures have also been identified at Magor Pill on the estuary's Welsh coast (Nayling 1999: 105). The zigzag fish weirs are situated mostly to the seaward side of the 'tick' and V-shaped single weirs and also overlying some of them, suggesting that they post-date at least some of the larger V-shaped fish weirs, perhaps reflecting a change in fishing strategy. Wood sampling carried out on one of these structures produced construction dates within the 15th to 17th centuries (Brunning 2008b).



Figure 5-19 The 'zigzag' fish weir on Stert Flats, Bridgwater Bay

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Double And Single Post Rows

The third type of fish trap consists of single post rows or double post rows, which are fragmentary in places (ST 24 NE 9/HOB UID 972260) and visible as rows of low wooden stumps in the Gutterway. Oblique aerial photographs taken on Stert Flats off Stolford village in 2000 (Figure 5.20) show that three similar double rows of posts were still in use, the aerial photograph capturing an individual attending the nets strung over the posts (ST 24 NW 36/HOB UID 1450108).



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Figure 5-20 Double post rows still in use as seen from the air (left) and another example in a ruinous state in the mud (right).

Visual examination of wooden posts located in the Gutterway suggests a post-medieval date (Brunning 2008b). These post rows, such as three fragmentary examples on Stert Flats (ST 24 NE 92/HOB UID 1450365), are unlike the other fish weir types which use leaders or arms to move fish to the structures apex. The double posts, some of which seem to be made of spruce/larch roundwood, may have supported basketry using a similar putcher or putt strategy as used in the River Parrett or the inner Severn Estuary. These more enigmatic structures were also recorded at Magor Pill (Nayling 1999: 107-109).

Fish weirs consisting of linear narrow banks of stone and wooden posts were also identified in Blue Anchor Bay. Posts at approximately 10m intervals visible along the entire length of these weirs may suggest that some sort of netting was used to supplement the height of the stone walls, or that the walls simply provided a firm base and packing for poles used as stake nets (Hale 2005).

Bow Or U-Shaped Fish Weirs

The RCZAS aerial survey recorded a fourth type of fish weir on Stert and Berrow Flats in Bridgwater Bay. These structures are visible as rows of wooden posts in inverted bow or U-shapes (Figure 5.21). In many cases the structures are built in rows. Off the village of Stolford, near Hinkley Point, the fish weirs lie parallel with the Mean Low Water line (such as ST 24 NW21/HOB UID 1450077, ST 24 NW32/HOB UID 1450091), with several weirs joined together at the end of their arms giving the appearance of an inverted swag. On Berrow Flats, these bow or U-shaped weirs (ST 25 NE70/HOB UID 1450640, ST 25 NE80/HOB UID 1450733) were mixed with the V-shaped types in a single row along the mudflat near and parallel with Mean High Water. An estimated construction date for these weirs has not been determined but documentary map evidence suggests that they may date from between the 16th century to the 19th century. One such weir is shown on an 1831 map by Lieutenant Denham (RN) of 'The Parret or Bridgwater River and the Bar' (Taunton Hydrographic Office H.485 shelf Qe) and a 16th century hydrographic chart depicts large U-shaped weirs in Porlock Bay and Minehead bay (Somerset Record Office D/RA/9/24).

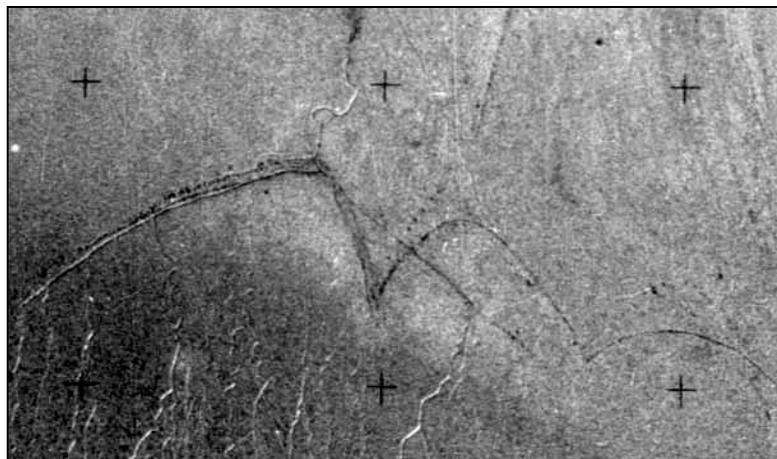


Figure 5-21 Large U-shaped fish weirs off Stolford, near Hinkley Point in Bridgwater Bay. These weirs were only visible on one set of available aerial photographs

OS/70064 060 03-MAY-1970 © Crown copyright. Ordnance Survey

Other Fish Trap Types

Conger eel traps were also recorded, located in the intertidal area northeast of Minehead harbour quay (SS 94 NE 178/HOB UID 1455313 and SS 94 NE 179/HOB UID 1455316). They are visible as concentric circular walls, constructed of heaped beach pebbles, surrounding a central subcircular pebble heap (Figure 5.22). The

conger eels inhabit holes and fissures created in the central stone pile and when disturbed, the eels are forced into the circular pools formed by the outer circular stone walls, from where they can be taken (Dennison 1985; McDonnell 2001: 26). Documentary evidence suggests that eel fishing was once a traditional Somerset occupation, particularly near Watchet where the eels hide under the natural rock formations in the mud. 'Glatting' is the local term for hunting the conger eels using basic equipment and a specially trained 'fish dog' which can sniff out the eels as they lie in water-filled crevices under the shelves of shale rocks exposed at low tide (Somerset County Council 2008).



Figure 5-22 A circular conger eel trap visible in Minehead bay

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Many linear pebble-built wall-like structures and cleared gullies were visible between Madbrain Sands at Minehead and Dunster Beach. A further five linear wall-like structures at Culver Cliff, west of Minehead, appear to be associated with the three coastal fish weirs recorded there by the Severn Estuary RCZAS aerial survey. These linear heaped stone walls and cleared lanes are sited perpendicular to the coast, immediately to the seaward side of the coastal fish weirs as shown in Figure 5.23. It has been suggested that these features are ground line gullies, a form of fish trap, the cleared lanes for the setting of long lines (McDonnell 2001: 23; Riley and Wilson-North 2001). However, they may also help limit longshore drift and/or provide some protection to the weirs from the effect of strong tidal forces. Those weirs that are still in use off Minehead harbour require constant maintenance. Recent aggregate extraction of the naturally protective shingle spit

on Madbrain Sands, opposite Butlins holiday camp, has altered the hydraulic regime, causing increased tidal damage to the fish weirs (pers. comm. Nick Russell).



Figure 5-23 Linear pebble-built structures on Madbrain Sands, Minehead that may limit longshore drift.

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Other possible fishing structures are more enigmatic. There are a number of linear and curvilinear post alignments in the mud whose function is not immediately obvious, such as the sinuous structure mapped on Stert Flats (ST 24 NE 112/HOB UID 1450411).



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Figure 5-24 Other intertidal structures that may be associated with the fishing industry. On the left is the triangular structure on Berrow Flats and on the right is the linear stone wall constructed across the Gutterway.

Other features have also been identified on Berrow Flats including an unusual triangular structure (Figure 5.24) (ST 25NE 83/HOB UID 1450737), that encloses an area that measures 86m by 33m. It is not obvious how this feature would

function as a fish trap, if that is indeed what it is, but it may also be that it consists of remnants of several weir structures not contemporaneous with each other.

Stone-built linear walls have also been identified stretching across the Gutterway, (Figure 5.24) (ST 24 NE 88/HOB UID 1450356 and ST 24 NE 91/HOB UID 1450364). It may be that they were fish traps, or perhaps they functioned as dams to regulate the ebbing tide and so better control fish movement to increase catches in fish weirs further down the Gutterway.

At Lilstock on the Quantock Hills coastline, an enigmatic and complex group of wooden structures may be the remains of a post-medieval fish trap (ST 14 NE 21/HOB UID 1365781). These features require further field investigation to determine their precise functions.

5.8.2 Discussion Of Morphological Form, Dating And Construction.

Morphology

In the outer Severn Estuary, the RCZAS aerial survey identified at least four distinct morphological types of fish weirs and trap. It is likely that this diversity reflects different fishing methods in order to exploit a variety of fish species, the nature of the estuarine environment, the availability of raw materials and design changes over time. Different types of weir construction were also identified: post and wattle weirs constructed of wood only, weirs constructed from stone or pebbles only and weirs constructed with both stone and wooden posts (Figures 5.25, 5.26 and 5.27).

Porlock Bay and Madbrain Sands are covered in beach pebbles and shingle ridges, whereas Stert Flats are covered in thick deposits of marine mud, necessitating weir construction from wood (Brunning 2000). The stone-built structures on Stert Flats are unusual in that stone is not abundant on the mudflats and was probably brought from the shore or Stert Island. In Figure 5.25, it is notable that there is a transition from mostly stone-built fish traps and weirs around Minehead and Madbrain Sands, to those mostly constructed of wood or of wood and stone around Blue Anchor Bay.

As shown in Figure 5.25, the structures constructed of stone (in red) appear to be mostly large, V-shaped fish weirs, many of which have a constriction at the apex producing a wishbone-shape (Figure 5.16c). The location of these features along the Mean Low Water line, along with their common morphology, might suggest that some were broadly contemporaneous, although this may only be resolved with further fieldwork investigations.

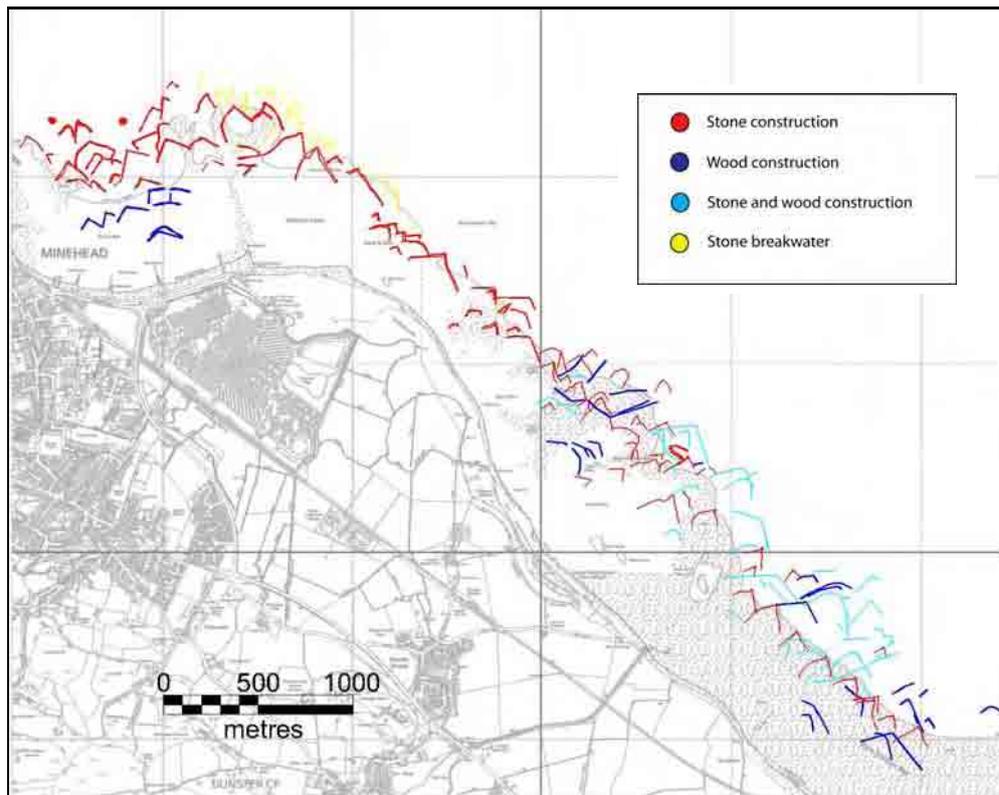


Figure 5-25 Wood, stone and a combination of wood and stone were used to construct fish traps in the intertidal zone of west Somerset.

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Background map acquired from the Ordnance Survey

Similarly, the structures constructed from both stone and wood (Figure 5.25 in cyan) appear to share a roughly common morphology, of linear and curvilinear stone walls, interspersed with wooden posts or depressions in the mud suggestive of wooden post remains beneath the mud. In plan, these features tend to be shallow V-shapes with flattened or rounded apices. These structures, distributed singly along Dunster Beach to Blue Anchor, are mostly sited to seaward of Mean Low Water and the stone-built fish weirs noted above.

Wood-built fish traps (Figure 5.25 in blue) are concentrated in three locations between Minehead and Blue Anchor Bay: on Minehead's The Strand, on Dunster Beach and off Ker Moor. The wooden fish weirs are also shallow V-shapes with both rounded and pointed apexes. These are very similar in form to the fish weirs constructed of both stone wall and wooden posts. The wood-built fish weirs are located mainly, though not exclusively, to the landward side of the stone-built fish weirs. The distribution of wooden fish weirs and those built of both stone and wood between Dunster Beach and Blue Anchor also overlap. The wood built fish weirs on The Strand are grouped together to the landward side of the stone-built weirs.

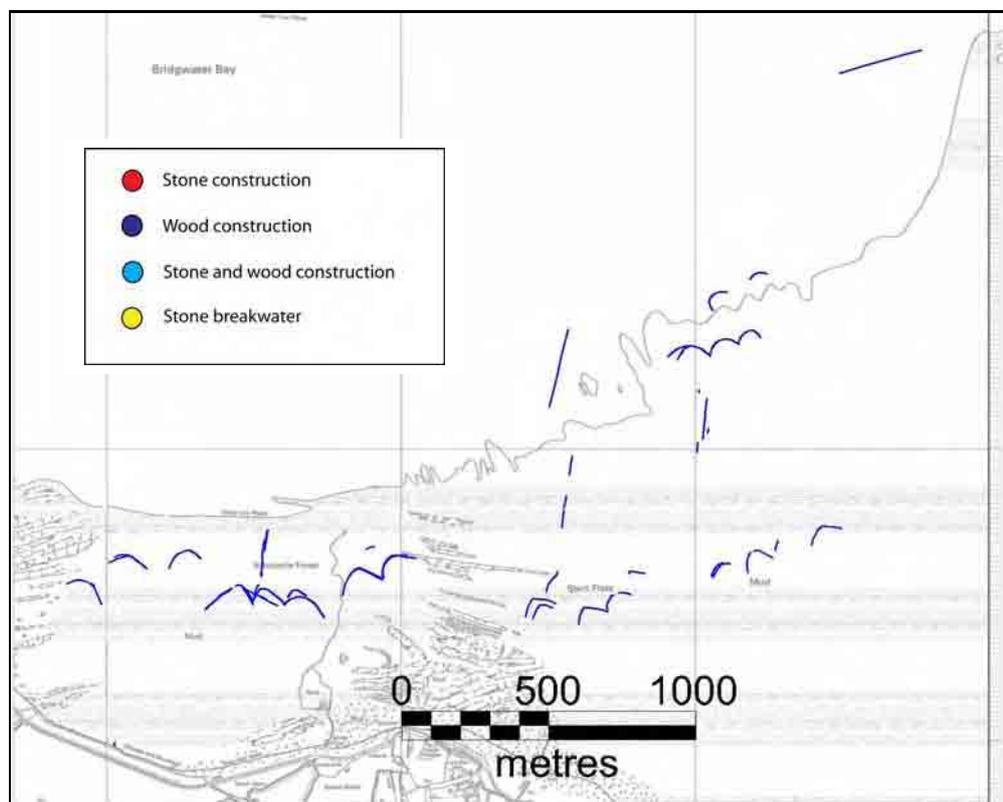


Figure 5-26 Wooden fish traps in the intertidal zone off Hinkley Point, Somerset.

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Background map acquired from the Ordnance Survey

As can be seen in Figures 5.26 of Hinkley Point and Figure 5.27 of Stert Flats, the material used for intertidal structures from Hinkley Point to Sand Bay is almost exclusively of wood, with the exception of two large structures in the Gutterway on Stert Flats. Only at Woodspring Bay do the W-shaped fish weirs again appear to be constructed of both wood and stone, with a cluster of rocks located at the weir's apex.

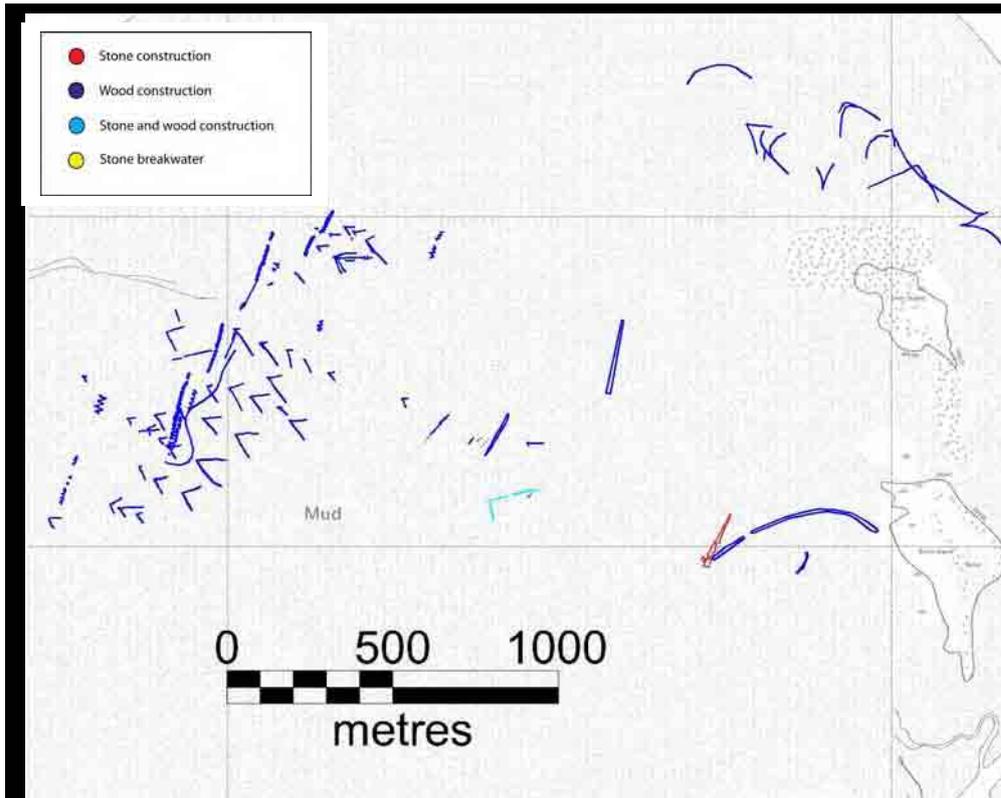


Figure 5-27 Wood, stone and wood and stone constructed fish traps in the Gutterway on Stert Flats, Somerset.

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Background map acquired from the Ordnance Survey

Dating Intertidal Structures

Attempts to classify the fish weirs at various locations on the Severn Estuary have produced different typologies (Allen 2004), allowing some comparisons with similar structures recorded elsewhere in the estuary. At Wootton-Quarr on the Isle of Wight, radiocarbon dating of intertidal wooden structures produced dates ranging from the early Neolithic to the post-medieval period (English Heritage 1997). With the hitherto virtual absence of absolute dating evidence of Somerset's intertidal fishing structures, constructing a chronology from morphological variety within the Severn Estuary RCZAS intertidal zone would be speculative.

The intertidal fish weirs appear as a palimpsest from the air. In Blue Anchor Bay, for example, many fish weirs overlap and there is evidence of re-use of stones for wall rebuilding. From the aerial evidence alone, it is difficult to draw conclusions regarding the dating or construction phases of these fish trap structures from their relative locations to each other within the intertidal zone.

In Bridgwater Bay, the 'tick' and predominant V-shaped fish weirs appear to be deliberately built in linear columns, spaced fairly evenly behind one another. On Stert Flats, at least eight coastal fish weir columns extend over one kilometre across and down the Gutterway. None of the mapped V-shaped weirs overlie one another, perhaps suggesting some contemporaneity. The gaps in some of the columns imply the destruction or burial of more fish weirs and that the area originally covered by the fish weirs was more extensive than the RCZAS aerial survey has recorded. If these fish weirs and traps were indeed contemporaneous, then the strategy demonstrates the intensive, even industrial, nature of the exploitation of the marine resources in this area, maximising the catch from each ebb tide.

The dynamic nature of the estuarine alluvium, episodic coastal erosion and changes to the shore, combined with a huge tidal range of up to 14m, suggest that the working lifespan of these structures was unpredictable and slight variations in conditions could render them unworkable and force a shift in location (Allen 2004).

Although some fish weir structures may be of considerable age, it should also be noted that the parallel post row alignments seen off Hinkley Point were still in use in aerial photographs taken in 2000 (Figure 5.31). This demonstrates a likely continuity of activity in Bridgwater Bay and therefore we might anticipate a wide date range for the use of these individual fish weirs, with possible reuse and repairs. Brunning (2008b) suggests that some of these linear weirs may have supported ranks of woven baskets, such as the putt weirs common in the inner Severn Estuary. The species range of the wood used in their construction was only examined in one location, where the presence of sycamore and larch or spruce suggested construction must post-date the mid-16th century.

Some limited tree-ring dating, radiocarbon dating and wood characterisation of the Severn Estuary's intertidal structures has been carried out. Radiocarbon dating and dendochronological dating of intertidal structures has taken place at Magor Pill, Gwent, on the Welsh side of the Severn Estuary. Wood samples from intertidal structures at Magor Pill (Nayling 1999: 101-102) dated V-shaped fish weirs to the 12th century. Nayling (1999) suggested that the medieval V-shaped fish weirs were furthest away from the current shoreline, with later post-medieval fish weirs

constructed to the landward side of these, a pattern resulting from coastal erosion and retreat. A similar chronological pattern might become evident along the Severn Estuary's Somerset shoreline as more absolute dates for these structures are established.

Sampling of intertidal features at Sudbrook Pill in Wales in advance of the Second Severn Crossing suggested that V-shaped fish weirs had early medieval origins (Godbold and Turner 1994). In 2003 and 2004 (Brunning 2008b; Groves *et al.* 2004), samples were taken from structures in Stert Flats. The large, individual V-shaped fish weirs constructed of alder, oak, hazel, willow or poplar were the earliest structures sampled, at least some of which dated to the late 10th century AD. This date range and the use of similar wood species for this V-shaped fish weir type are similar to Sudbrook Pill's intertidal sampling results, with radiocarbon dates of AD789-1008 (Godbold and Turner 1994: 36). The Norfolk (Albone *et al.* 2007) and Suffolk (Hegarty and Newsome 2005) coastal NMP as well as mapping from the Blackwater Estuary in Essex (Strachan 1997: 9-10) have all recorded large V-shaped fish weirs. Radiocarbon dating of wattle samples taken from V-shaped fish structures in the Blackwater Estuary produced calibrated dates from the 7th century to the 10th centuries AD (Strachan 1997: 9-10). These results suggest that the V-shaped structures were used over a wide geographical area, and that it is the earliest form of weir so far identified.

The unusually large wooden post and stone V-shaped fish weir in the Gutterway (ST 24 NE 7/HOB UID 972246) seen in Figure 5.16a was also recently examined and the wood sampled (Brunning 2008b). There was evidence that a basket would have been located at the weir's apex. The wooden post rows, many made from non-native larch and spruce species introduced to Britain in the post-medieval period, suggest that the structure was either post-medieval in origin, or was an earlier structure substantially repaired in the post-medieval period.

The much smaller V-shaped groups of wooden posts identifiable as zigzag shaped ranks on Stert Flats were dated between the 15th and early 17th centuries (Brunning 2008b). Two similar structures sampled at Magor Pill produced a tree-ring date after AD 1172 for one and a radiocarbon date of AD1470-1650 for another (Nayling 1999: 105-106). The medieval to post-medieval dates from the Stert Flats

zigzag structures confirm the evidence from the aerial survey mapping, whereby the zigzag fish traps appear to overlies the V-shaped fish weirs that may date to the early medieval period. With a date range of several hundred years at Magor Pill, a more comprehensive sampling of the Stert Flats zigzag fish weir structures could provide a more robust date range. The use of larch or spruce roundwood in some of the double rows of wooden posts on Stert Flats points to a post-medieval date. These more enigmatic structures were also recorded at Magor Pill, using larch or spruce posts, producing radiocarbon dates of AD1490-1680 and AD1740-1800 (Nayling 1999: 107-109).

The dates recorded by Brunning (2008b) and Groves *et al.* (2004) correspond well to the dating evidence from fishing weirs, traps and structures collected by Nayling (1999) and Godbold and Turner (1994) on the Welsh shores of the Severn Estuary. The limited sampling undertaken in Bridgwater Bay has revealed that structures remain on Stert Flats that represent around one thousand years of intertidal fishing and activity. The sample dates provide evidence of similar widespread exploitation of the intertidal zone along the Severn Estuary's shoreline. The sampling survey by Brunning is a good starting point towards a better chronology for fishing on Stert Flats in Bridgwater Bay, and a similar sampling exercise on Blue Anchor Bays' fish traps would prove useful. As more sampling of these structures is undertaken, a more comprehensive interpretation of the archaeology of the intertidal zone will be possible.

Limitations Of The Evidence - Problems With Visibility

The results of the RCZAS aerial survey indicate that dating intertidal structures from aerial photographs alone is problematic. Many features mapped and recorded from aerial photographs may not necessarily be visible on the intertidal zone today, either because they have been destroyed by erosion or buried under mud deposits. Similarly, the identification of construction materials from aerial photographs alone is similarly problematic. Many wooden posts are barely visible on aerial photographs. Time and tide have reduced many wooden remains to stumps protruding only slightly from the surface. Many other structures have been buried and are only visible from depressions in the intertidal muds caused by the tide washing around them. Only closer examination of these through fieldwork may

determine the nature of such structures. It is likely that the Severn Estuary RCZAS aerial survey has not mapped the full extent of intertidal features, especially in Blue Anchor Bay and Bridgwater Bays, and it is likely that more structures lie below Mean Low Water, not visible on the available aerial photographs.

5.9 Case Studies: Somerset Fisherman

5.9.1 Introduction

As a result of research for the RCZAS aerial survey, the following two case studies from Somerset are presented to illustrate the nature and level of human activity that has taken place in the past, to demonstrate the potential for substantial but hitherto unrecorded archaeological features. Both case studies also show how widely employed and long-lived fishing practices, which documentary evidence records was locally economically significant, leave ambiguous or ephemeral archaeological evidence. The aerial photographic evidence alone cannot fully reflect intertidal fishing's cultural richness, regional significance or idiosyncrasies.



Birnbeck Island and Pier 1890
Courtesy of Weston-super-Mare Library



Old Pier Weston-super-Mare 1938 (Olney 2008)

Figure 5-28 The Birnbeck fishery. Left: A row of wooden posts can be seen to the upper right of the photograph, on the shingle spit. Note the nets still attached. Right: A postcard depicting the same fishing stalls (bottom-right) but viewed from the island.

5.9.2 Birnbeck Island And The King Of Yellers

Birnbeck Island is located just off Weston-super-Mare's Spring Cove beach (Bailey, 2007), shown in Figure 5.28. As early as AD1492 there is documentary evidence relating to the Birnbeck fishery. The RCZAS aerial survey recorded a curvilinear fish weir (ST 36 SW 111/HOB UID 1460797) on Birnbeck island from wartime aerial photographs, although the structure was no longer visible in aerial photographs taken in the immediate post-war period.

Weston's fisheries were famous for catches of salmon, cod, conger eels, soles, plaice, herring, shrimp and sprats (Rutter 1829: 25). Sprats were not only sold locally in the streets of Weston-super-Mare in the 18th and early 19th centuries, which had a population of less than one thousand at the time (Rutter 1840), but were also transported to nearby towns by train. The sprat industry continued into the 20th century. Shown in Figure 5.29 are at least two fish traps, locally known as stalls, visible as post alignments on which would be hung nets. The main one (also shown in Figure 5.28) was sited along the man-made shingle ridge connecting the island to the shore when the tide ebbed. Between tides, however, the fishermen's catch would be exposed above the water and at the mercy of sea gulls. The first guide book of Weston by Ernest Baker in 1822 (Rutter 1840, p.53) describes the solution the local fisherman evolved to solve their problem:

To keep the gulls away, the local fishermen every fishing season employed two men to live on the island as 'gull yellers'. A little hut was erected for them and their job, when the tide was ebbing, was to scare the gulls away from the nets by yelling at them. There was one gull yeller named Bill Hurle, a man with terrific lungs and a huge cavernous mouth. No gull could be seen when he was near. In fact, the uninitiated stranger thought that his head was going to divide in two when he opened his mouth. His tongue was tremendous, large and long; people said that if he put it out and twisted it round he could touch the nape of his neck with it. If a good westerly breeze were blowing when he was yelling, his voice could be heard for miles inland. Such was the strength of this man's mighty voice. He was a very king of yellers.

Birnbeck island was permanently linked to the mainland with the construction of a pier in 1867 to connect to steamer ferries, as shown in Figure 5.29, taken at the turn of the 19th and 20th century. One of the island's fishing stalls is still visible in the upper right of the *circa* 1900 photograph and there is another double post row in the bottom left by the mainland's foreshore. Both structures appear in good repair and were presumably still in use. A postcard dating to 1938 (Figure 5.28) shows the fixed net stakes of the fishing stall on the island still extant.



Figure 5-29 A double row of wooden posts can also be seen bottom-left of the photograph on the foreshore. The pier top-right is the North Pier used to ferry passengers to and from Wales.

Birnbeck Island and Pier circa 1900. Courtesy of Weston-super-Mare library

The fishing industry in Weston-super-Mare declined in the early 20th century, probably due to increased pollution in the Severn Estuary, changes in public tastes and diet, the availability of other foodstuffs and goods with improved transport links, the expansion and focus of the town for tourism, a decline in catches from over-exploitation and the loss of manpower following the First World War.

During a field visit by the authors in 2007, Birnbeck pier was in a ruinous state, with no evidence of any fishing stalls on the island. The site of the fishing stall on the mainland foreshore seen in Figure 5.28 has been used as recently as the 1980s (La Trobe-Bateman and Russett 1999b), although the wooden stakes have now been replaced by metal scaffold poles (Figure 5.30).



Figure 5-30 The remains of the Birnbeck Fishery, the double row of wooden posts has now been replaced by metal poles

Birnbeck Fishery (028 NOV-2007) © Steve Crowther

The scale and economic importance of the early nineteenth century fishing industry led to a significant modification of the intertidal environment, with the construction of an artificial shingle causeway prior to 1822 between Birnbeck Island and the mainland (Rutter 1840). The causeway is still visible today, and would have required a significant investment of time, labour and organisation without the assistance of modern machinery. Work on this ridge could only have taken place when the tide was sufficiently low, and was presumably undertaken by the fishing families who would ultimately benefit from the project (Bailey 2007). The anticipated economic reward from these efforts illustrates the marine richness of the Severn Estuary's intertidal area at that time and highlights the changes that have taken place since. Salmon were notably numerous at Weston, whilst the seasonal glut of sprats in winter was occasionally so large that excess cartloads were taken to local fields for use as fertiliser (Bailey 2007).

The rather limited aerial archaeological evidence does not reflect the true scale or importance of post-medieval fishing in Weston Bay's intertidal zone, and the RCZAS survey identified few features. It may be that in other areas of the Severn Estuary's intertidal zone with few recorded archaeological features, the history of human activity may also be more complex.

5.9.3 Stert Flats And The Somerset Mud-Horse Fishermen

In the intertidal mudflats off Stolford village on Stert Flats in Bridgwater Bay, the Severn Estuary RCZAS aerial survey recorded the last known working example of a formerly thriving fishing practice, of which now only one practitioner remains. Fishing on the lowest reaches of the intertidal zone presents unique challenges, as some fish traps are over a mile offshore across Stert Flats' deep and mobile mud deposits. This potentially dangerous journey was solved with the invention of the 'mud-horse' and so created the occupation of 'mud-horse fisherman'. These hardy individuals worked on the intertidal mudflats throughout the year, exploiting a wide range of fish, shellfish and crustaceans. An NMR aerial sortie to obtain oblique images in 2000 fortuitously captured the last of the mud-horse men at work, shown circled in Figure 5.31.



Figure 5-31 A mud-horse fisherman (circled) captured tending his nets on Stert Flats.

NMR 18675/19 16-FEB-2000 © English Heritage (NMR)

The photographed fisherman was a member of the Sellick family of Stolford who are Somerset's only surviving intertidal mud-horse fishermen, following the tradition of at least four previous generations of his Stolford family. Figure 5.32 shows Adrian Sellick tending the same shrimp nets recorded on the oblique aerial

photograph above. Whether any of the Sellicks follow in the family footsteps is uncertain, so this may be the last generation of working mud-horse fishermen.



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© John Tickner Photography

Figure 5-32 Mr Adrian Sellick attending the shrimp nets as seen on the 2000 oblique aerial photography

During the 1800s, however, many families used mud-horses to get to nets in the mudflats. In the middle of the 20th century, there were still about fifty men employed in the craft (Tierney-Jones 2008), and Mr Brendan Sellick recalls that as a child accompanying his father to his nets, seven or eight mud-horses would be out on the mudflats at the same time.



(left) Reproduced with the kind permission of © John Tickner Photography
(right) Courtesy of Weston-super-Mare Library

Figure 5-33 Somerset intertidal fishermen in the 1930s (right) and present (left) attending fixed nets.

The techniques and equipment of intertidal fishing have probably remained basically unchanged for many centuries (Tierney-Jones 2008; Turner 2005), as illustrated in

Figure 5.33. The mud-horse fishermen used a combination of nets, employing fixed nets at the lowest tidal reaches to catch cod, plaice, whiting and sprats in winter; with skate, sea bass, dover sole, mullet, conger eels and ling are caught in summer. In the 1930s, sturgeons were also caught (Tierney-Jones 2008). Nets are used for shrimps in autumn. In the 20th century, the catch was sold to fishmongers as far as Weston-super-Mare, being transported by train, but also used taken by horse around the local villages. The Sellick family still sort, prepare and sell their catches from their own wet-fish shop in Stolford, a village on the Somerset coast near Hinkley Point.

Figure 5.34 shows the mud-horse fisherman in action. The mud-horse is a homemade, part driftwood wooden sledge propelled by the fisherman, who leans on it to distribute his weight (Tierney-Jones 2008). This was a skilled but physically demanding practice, enabling the fisherman to get to the fishing nets and return safely to shore with the catch. The fishing grounds were often up to a mile offshore across treacherous mudflats. When the tide rose, the mud-horses were secured with rocks under the waters in the intertidal area. The mud-horse design was simple, efficient and cheap and may have remained unaltered for hundreds of years (Lynch 2002). In the 1800s, Brendan Sellick's great-grandfather was the first of his family known to have been a mud-horse fisherman, but he was just one of dozens of mud-horsemen on the mudflats (Fort 2008).



Reproduced with the kind permission of © John Tickner Photography

Figure 5-34 Adrian Sellick pushing his mudhorse across the thick wet mud. The wooden sled and its runners spreads the weight of the fisherman and his catch, enabling him to travel across the mud.

Aerial photographs taken of Stolford reveal many intriguing and ephemeral curvilinear features in the Stert Flats mud, such as these in Figure 5.35, leading from the shoreline in 1969.



NMR OS/70064 060 03-MAY-1970 © Crown copyright. Ordnance Survey

Figure 5-35 Linear features on the mudflats near Stolford village that have been interpreted as trails made by mudhorsemen.

The ephemeral features probably resulted from mud-horse fishermen propelling mud-horses across the thick mud, leaving distinctive linear trails in their wake, but the tide would have eventually removed the sled tracks. The supporting structures for the fixed nets and shrimp nets are the only elements of this fishing practice likely to survive in the archaeological record.

5.9.4 Past, Present And Future

Large intertidal areas such as Bridgwater Bay are undoubtedly treacherous places to work, as demonstrated in recent years with such tragedies as the drowning of a young girl cut off by the tide in Burnham-on-Sea's muds in 2002 and the 18 cockle pickers drowned by the incoming tide in Morecombe Bay in 2004. These accidents resulted from ignorance of the nature of the intertidal zone, particularly its local topography and strength of the tidal flow. For the fishermen of Stolford and Birnbeck, however, their livelihoods and family traditions were inextricably linked with the intertidal zone. They had intimate local knowledge of Bridgwater Bay's

mudflats passed down through the generations concerning dangerous or impassable areas, fish behaviour and vagaries of tidal movement, as recounted by Brendan Sellick (Lynch 2002).

The examples of the Birnbeck island fisheries and Stolford mud-horse men demonstrate that intertidal fishing was not merely an industry, but a skill series of practices within an ever-changing dynamic landscape and entirely reliant on the marine muds of the Severn Estuary, but the archaeological of all this barely survive. Bridgwater Bay's intertidal area was far more industrious than today, and even in the recent past was utilised by a population whose connection with the tide and marine muds of the Severn Estuary is now almost severed. It is clear from accounts by Mr Sellick (Lynch 2002) that the intertidal mudflats of Bridgwater Bay were once regarded as a bountiful landscape and those families who inhabited it possessed a strong emotional bond and sense of ownership towards it. During the 20th century a combination of declining fish stocks and pollution in the Severn Estuary made coastal fishing economically unviable (Fort 2008; Turner 2005: 83). The image that has emerged of the Severn Estuary's intertidal area in the past, of a sustaining landscape filled with people and activity, is difficult to reconcile with more contemporary perceptions of it as dangerous and no place for people to venture. With few if any likely successors, the techniques and skills of the Severn Estuary's coastal fishermen will soon be lost and the relationship of modern people with the estuary's intertidal area will become increasingly distanced and detached.

5.10 Other Intertidal Structures

5.10.1 Wrecks

Numerous wrecks have been recorded in the Severn Estuary, which was difficult to navigate and many vessels foundered on rocks and sandbanks. Boats have to contend with fiercely tidal waters with currents moving at up to eight knots in spring (Hawkes 2008). North of Sharpness the estuary is extremely hazardous to navigate; hence the construction of the Gloucester and Sharpness Canal, which opened in 1827.

Within the inner Severn Estuary, the site of a possible shipwreck (SO 71 SE 27/HOB UID 1448141) was recorded protruding from mudflats at Longney Point

only on aerial photographs taken in 1979. Nearly 53m long, this vessel may have been a large trow, a type of craft unique to the Severn Estuary. The aerial photographs assessed in the survey that cover Longney Sands clearly document the movements of the channels, sandbanks and mudflats over four decades. It is feasible that the vessel was subsequently buried beneath deposits of alluvial mud and sand, and only a brief change in the mudflat environment exposed its structure, and coincided with the aerial photographic sortie.

In the outer Severn Estuary, only a few of the numerous known shipwrecks were visible on aerial photographs and recorded as part of the aerial survey, due to poor water clarity, erosion by the sea, deliberate destruction removed or burial beneath mud and sand deposits up to two metres deep (McDonnell 1995a). On Berrow Flats, however, two new shipwrecks protruding from the sand (ST 25 SE 57/HOB UID 1451211 and ST 25 SE 49/HOB UID 1451194) were recorded from aerial photographs. The first of these wrecks was visible in photographs taken in 1989 only, but with no evidence of its presence in photographs from preceding or subsequent years. The second vessel was only fully visible in photographs from 1946, and then partially visible in only one subsequent aerial sortie.

A third well-known post-medieval wreck of a ship called the 'Nornen', (ST 25 SE 42/HOB UID 1003025) was visible as timber remains on aerial photographs. The vessel foundered in 1897 after a storm drove it onto Berrow Flats. The surviving remains of the Norwegian barque consist of wooden ribs, with some planking and a substantial keelson (Figure 5.36). Examination of aerial photographs from the 1960s reveals that the wrecked vessel had moved position southwards approximately 60m and shifted its orientation from E-W to WSW-ENE in the intervening years (Figure 5.36 inset). The vessel was not visible at all in aerial photographs taken in 1941 or 1946, further illustrating the mobile nature of the sand and mud on Berrow Flats and the strength of tidal forces, able to move such a substantial wreck.

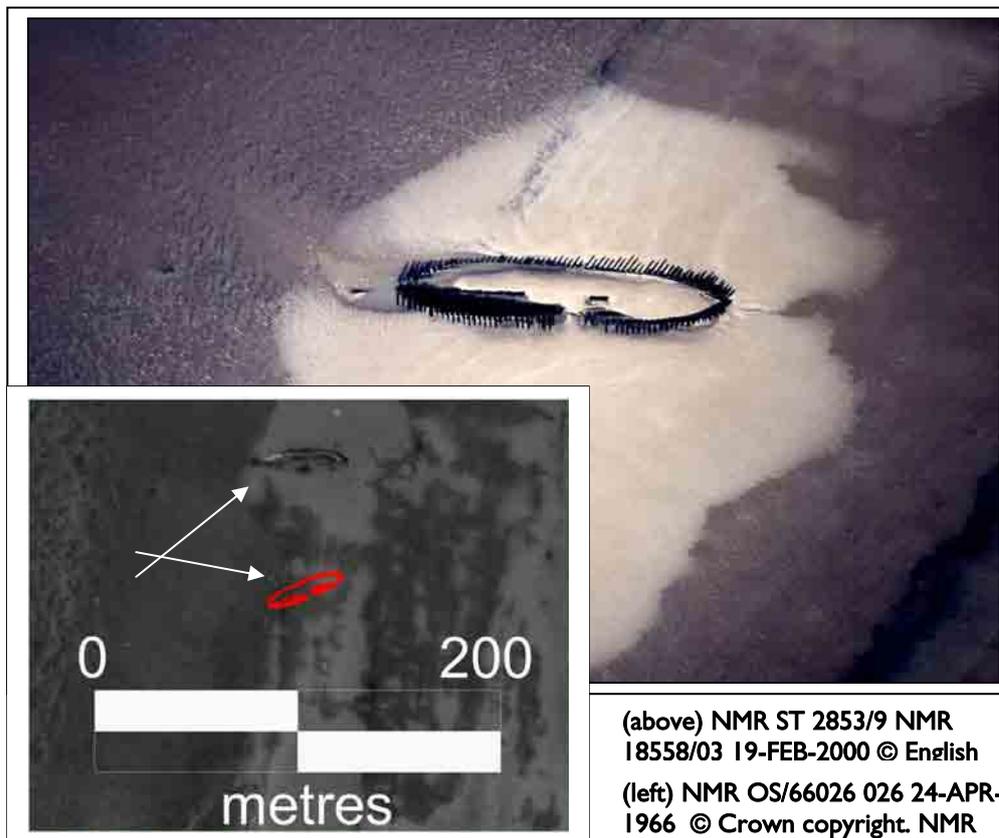


Figure 5-36 The wreck of the barque Nornen as it was in 2000 (main picture), partially submerged in the mud. (Inset) The Nornen's position has shifted in the mud since photographed in 1966 to its current position (in red).

Groups of abandoned or decommissioned boats have been recorded as part of the Forest of Dean NMP (Small and Stoertz 2006) at Lydney Harbour and Purton, and appear to be a mix of Severn trows and other vessels. Due to the decline of the Severn cargo route in the early 20th century, trows were no longer required and some were deliberately grounded along the shore to prevent erosion of the sea bank and the Gloucester and Sharpness Canal.

5.10.2 Piers And Quays

At several locations along the east bank of the Severn Estuary, there is evidence of ferry crossings to the Welsh side of the estuary. These ferry crossings were very important before the construction of the two Severn bridges in 1966 and 1996 (Severn River Crossing PLC 2005).

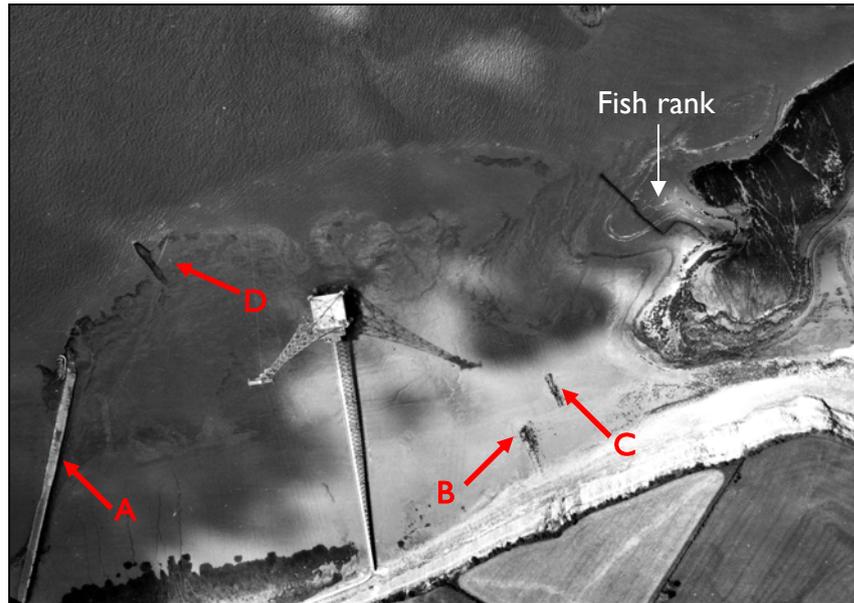


Figure 5-37 Aerial photograph of the four piers (arrowed A-D) identified at Old Passage, Aust. Also note the fish weir rank in the top right corner of the image

OS/60419 80022 10-JUN-1960 © Crown Copyright. Ordnance Survey.

At Old Passage, Aust, four piers, or quays are visible on aerial photographs, close to a modern pier leading to an electricity pylon (Figure 5.37). There is a narrow 2km wide stretch of water between Aust on the Severn's east bank and Beachley on the west bank. Allen (2002) completed an archaeological survey of these piers and discussed the surviving evidence in detail. The main Old Passage pier is a compound structure that relates to activities between 1825-1863 and again from 1926-1966, when the ferry ceased operations due to the completion of the first Severn Road Bridge. The pier (Figure 5.37 A) was 412m in length but was in a dilapidated state on photographs taken in 1989. The three remaining piers (Figure 5.37 B, C and D) are defined by linear spreads of stones and upright timber posts, and are likely to date to the post-medieval period. Pier D was first depicted on an 1845 map (Allen 2002: 59) and all are marked as 'Old Pier' on the 1st Edition Ordnance Survey Map (1881-1891). Allen's (2002) field survey of the piers suggests that the structures could have accommodated wheeled traffic as well as foot passengers, and an account of a ferry crossing at Old Passage in the 1780s related that the traveller intended to use his post chaise as a cabin during the voyage (Farr 1954: 18).

At Avonmouth Docks, small quays were mapped and recorded along the north bank near the mouth of the River Avon. These structures are associated with early

20th century industries such as the Avonmouth iron works and petroleum storage facilities clearly marked on the 3rd Edition Ordnance Survey map (1921).



NMR ST4071/12 NMR 23552/04
02-JUN-2004 © English Heritage
(NMR)

Figure 5-38 The restored Clevedon Pier

Some piers also acted as a focus for entertainment. This was especially true in the later 19th and early 20th centuries when thousands of tourists would flock to seaside resorts during the summer months. Birnbeck Pier, the Grand Pier at Weston-super-Mare and Clevedon Pier, the latter having recently been restored (Figure 5.38) are all examples. All provided various amusements along their lengths as well as connecting ferry passengers to South Wales. The construction of the Severn Railway Tunnel in 1886 and the Severn Railway Bridge in 1879 brought about the decline of the Severn paddle steamers as a transport method to Wales.

5.11 Discussion Of The Archaeological Evidence In The Intertidal Zone

There are a relatively large number of fish traps, both putchers and putts, in the narrower inner Severn Estuary, taking into account the breadth and nature of the intertidal area available on each bank of the Severn. The Severn Estuary RCZAS aerial survey's mapping of the estuary's intertidal zone clearly identified an apparent disparity, however, between the inner and the outer estuary in the distribution of archaeological features, specifically fish traps. The virtual absence of such intertidal features between Portishead and Brean Down is notable. Are the aerial survey

results in the Severn Estuary's intertidal zone a true representation of the distribution of archaeological features? The RCZAS survey has identified a number of factors which may contribute to this distribution pattern, with biases to Bridgwater Bay and the coast between Blue Anchor and Porlock Weir.

5.11.1 Limitations Of Existing Knowledge

Prehistoric and Roman archaeology

The anaerobic alluvial deposits along the Severn Estuary's intertidal zone have preserved significant evidence of prehistoric activity, although the main focus of research to date has been along the Welsh coastline (Bell and Neumann 1997a, 1997b; Bell et al. 2000; Locock 1997; Neumann and Bell 1996). Evidence recovered from the Welsh shoreline ranges from Mesolithic axes and other lithic finds, Mesolithic to Bronze Age human skulls found at Newport and Goldcliff, a probable Bronze Age trackway at Cold Harbour, as well as Mesolithic animal and human footprints sealed within sediments of the lower Wentlooge Formation. Late Bronze Age and Iron Age buildings have also been recorded in the peats at Redwick, Rumney, Chapel Tump and Goldcliff (Bell and Neumann 1997a: 100-102). A woven, basket-like structure excavated from Iron Age contexts at Cold Harbour Pill was interpreted as a fish trap (Neumann and Bell 1996: 14).

Archaeological evidence for prehistoric activity on the English shores of the outer Severn Estuary is well documented. Excavations at Brean Down, Somerset, identified occupation evidence from the Early to Late Bronze Age (Bell 1990). Submerged forests dating from the Mesolithic period onwards have been identified and recorded off both shores of the Severn Estuary. In the Severn Estuary RCZAS project area, Mesolithic, Neolithic and Bronze Age lithics have been recorded in association with a submerged forest in the intertidal area off Minehead Bay (Gathercole 2003b: 8). A submerged forest is also recorded at Porlock Bay, with associated Mesolithic and Neolithic worked flints (SS 84 NE 12/HOB UID 35864).

As will be discussed in Chapter 7, Roman-British occupation has been identified along the length of the Severn Estuary's coastal hinterland, but evidence of Roman period activity in the intertidal zone, however, is limited. At Brean Down, sherds

of Roman pottery were recovered from palaeochannels (Locock and Lawler 1995). With the presence of Iron Age fish traps and Bronze Age buildings on the Welsh side of the Severn estuary, it is very likely that some structures or material of Iron Age and Roman date probably survive within the intertidal zone of the English Severn Estuary. Only more detailed fieldwork, wood sampling and absolute dating may provide such evidence.

Medieval fisheries

The distribution of significant medieval estates and monastic sites bordering the Severn Estuary may be reflected in the location and quantity of intertidal archaeological features associated with fishing in the estuary identified by the RCZAS aerial survey.

In Gloucestershire, the numerous putcher and putt 'fixed engine' fish weirs recorded on aerial photographs are reflected in documentary sources that detail the granting of Royal licences to manorial and monastic landowners to site and operate fisheries in the inner Severn Estuary from the early medieval period onwards. The granting of the right to site a fish weir at Tidenham, for examples, dates to the 10th century (Taylor 1974: 13). In Awre parish, the licencing of fisheries for Box manor dates to AD1300 (Currie and Herbert 1996). In the 15th century, Tidenham and Awre parishes also contained licenced fisheries belonging to Gloucester's Llanthony Priory, whilst Arlingham hosted fisheries belonging to St. Augustine's Abbey, Bristol (Godbold and Turner 1994: 44).

The distribution of fishing sites along the Somerset shore of the outer Severn Estuary is also notable for the proximity of manorial and religious establishments. Woodspring Bay is near the medieval Augustinian priory at Woodspring. Although only 11 intertidal fish weirs were mapped and recorded by the RCZAS aerial survey in the priory's locality, a preliminary field survey of the intertidal zone between Clevedon and Sand Point identified numerous wooden stakes, some possibly associated with trammel net fishing, in addition to the fish weirs (Hildich 1997: 100). Moreover, a number of stake groups have been recorded by the North Somerset Historic Environment Record along the north shoreline of Middle Hope. The RCZAS aerial survey was unable to identify these small sites on the shore's rock platforms due to the size of the features and the complex geological

formations. This evidence suggests significant fishing activity taking place in the intertidal zone near Woodspring Priory (ST 36 NW18/HOB UID 1460857). Further field investigations are required to quantify the extent and nature of this intertidal activity and to provide a chronology.

Further southwards down the outer Severn Estuary, known medieval sites increase in number. Bordering Bridgwater Bay, Cannington was a royal manor in 1066, part of the land from which rose the Benedictine nunnery from the 12th century until the priory's dissolution in the middle of the 15th century (Dunning and Elrington 1992, p.76-85). A number of other medieval manors also lay within Cannington parish. Similarly, flanking the east bank of the River Parrett's estuary, Huntspill parish alone accommodated eight medieval manors (Dunning 2004, p.91-112). Documentary evidence records the existence of an eel fishery attached to Huntspill manor in the 13th and 14th centuries. Nearby Delahayes manor had a fishery known as Le Core in the early 15th century and Withy manor a fishery called La Grype in the early 16th century (Dunning 2004). It seems likely that the other medieval manors in Huntspill parish identified by Dunning (2004), such as Mareys manor, Verney manor, Bailey manor, Rectory manor and Alstone manor, all had access to similar fisheries either on the River Parrett or on Stert Flats. Stogursey castle dates from the 11th century and stood until the early 16th century, when it fell into disrepair and decay (Dunning and Elrington 1992, p.76-85). At Stolford on Stert Flats, Stogursey priory had fishing rights by AD1431. By the 17th century, the Stolford fisheries were shared equally by the manors of Wick, Newnham, and Stogursey Dodington, the latter manor letting out 12 of the Stolford butts and fishing rights (Dunning and Elrington 1992, p146-152). Construction of Bridgwater Castle began in AD1200 although was in ruins by the middle of the 16th century, part of its lifetime being in the hands of the Crown (Dunning and Elrington 1992, p.206-207). On the Quantock Hills coast are located the important power centres of Nether Stowey Castle, West and East Quantoxhead medieval manors, Kilve and Kilton medieval manors (Riley 2006; Gathercole 2003b). Between Minehead and Blue Anchor are sited Dunster Castle and the Benedictine Priory of Dunster and at Porlock is the site of medieval Doverhay manor. With the importance of fish to the medieval diet (Turner 2005), particularly the social elite and monastic orders, it is probable that these estate owners operated fisheries in their respective local intertidal areas, though further documentary research would be required to quantify the nature and size of exploitation in each area.

5.11.2 Preservation And Survival

One of the main issues regarding interpretation of the evidence regarding past fishing along the Severn Estuary is that of differential preservation. Areas of the intertidal zone apparently devoid of archaeology may have been nothing of the sort. The distribution of fish traps and weirs along the Somerset coast as mapped by the RCZAS aerial survey might suggest that, between Blue Anchor and Stogursey villages, exploitation of the intertidal area was limited. This would be an erroneous conclusion, as many medieval fish weirs and fishponds are documented along the sea front at Watchet during the 14th and 15th centuries, with at least one example of a semi-circular stone weir surviving west of the harbour (Gathercole 2003b), although the Quantock Hills NMP survey did not identify this site. Similarly, an absence of fishing traps and structures appears to exist between Clevedon and Avonmouth's intertidal zone and one might assume that the change in coastal geology in this area, with its cliff and rocky foreshore, might preclude medieval or post-medieval fishing activity. The location of a 17th or 18th century line of fish weirs on Portishead beach, however, was replaced by wooden fishing stages by the 19th century (La Trobe-Bateman and Russett 1999a). No evidence of such structures was identified by the RCZAS aerial survey.

The RCZAS aerial survey did record numerous structures in Bridgwater Bay's Stert and Berrow Flats, but none in Weston Bay or off Portishead. The tidal currents at Portishead are very strong. Documented post-medieval fishing stages and earlier fish weirs sited on Portishead beach would have required constant maintenance and repair and once disused, would soon be damaged and destroyed by the scouring tides. Conversely, in the highly mobile sediments of Bridgwater Bay, archaeological features such as fish traps, weirs and baskets would be soon buried in alluvium, although this would protect and preserve organic material such as wood from tidal forces until uncovered once again. Similarly, structures sited on rocky foreshores subject to strong currents such as along the Quantock Hills coastline would have less chance of long-term survival than those buried by alluvial deposits. Moreover, the rocky topography of the Quantock Hills shoreline would make large-scale, land-based fishing problematic.

The Severn Estuary's intertidal zone is composed of numerous different hydraulic regimes, and this may help explain the differential survival of archaeological

features. It only requires a small change in the local hydrology to have serious consequences for even the most substantial intertidal features.

At Minehead, for example, the recent removal of shingle from the spit on Madbrian Sands appears to have resulted in an increase of tidal damage to some of the historic stone fish weirs east of Minehead harbour, of which at least three are still in intermittent use. The fishermen have had to make constant repairs to the extensive stone fish weir system, using large beach boulders to rebuild the weir walls (Figure 5.39) (N. Russell, pers. comm.). Bridgwater Bay has hitherto provided a fairly benign environment for the survival of fish traps and other archaeological features. Even here, however, the process of erosion and destruction is ongoing and wooden posts and other organic structures are currently being displaced from their protective mud covering and eroded by a projected depth of 16mm per year (Kirby, pers. comm., cited in Brunning 2008b).



Figure 5-39 A stone weir at Minehead under much needed repair in 2007

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5.11.3 Limitations Of Aerial Photographic Analysis

As discussed in Chapter 3, there is a general lack of archaeologically focused oblique aerial photography of the Severn Estuary's intertidal area. The targeted aerial sorties by English Heritage in 1999 over Blue Anchor Bay and in 2000 over Bridgwater Bay and Woodspring Bay are notable exceptions, and took advantage of optimal conditions of low tide and good visibility. Similar aerial photographic

coverage of Weston Bay, Sand Bay, Middlehope, Berrow Flats and the Quantock Hills coast at their lowest tidal reaches may yet reveal hitherto unrecorded archaeological features. Aerial survey of the intertidal zone cannot identify small features such as fishing baskets or stake scatters that are partially buried in sediments and protrude only a few centimetres above the surface (Figure 5.40). Such features are known to exist in numbers on both coastal shores of the Severn Estuary within Bridgwater Bay, Woodspring Bay, Oldbury Flats, Magor Pill and Sudbrook Pill, all of which have undergone limited field survey (Hildich 1997; McDonnell 1995; Nayling 1999; Riley 1998b; Godbold and Turner 1994).



Figure 5-40 Small partially buried structures such as this fish basket are not discernible on aerial photographs

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The field survey of Woodspring Bay between Middlehope and Clevedon recorded numerous discrete wooden posts and other organic remains in the intertidal zone that may be related to fishing (Hildich 1997), but the RCZAS aerial survey was only able to identify the remains of the largest fish weirs at the lower tidal reaches. This potential underestimation of the archaeological resource relating to intertidal fishing is a strong argument for further field survey in these areas to locate and identify ephemeral features not visible on aerial photographs.

5.11.4 Fishing Practices

Another factor influencing the results of the RCZAS aerial survey is that much of the intertidal activity that took place along the Severn Estuary has left no tangible

archaeological evidence that might be identifiable from an aerial survey. There was a widespread tradition of using 'flatner' boats for both inland and inshore fishing. Stop net boats and long net boats were used in the upper Severn. Long net boats were used for catching salmon, one example still being used in this role at Bollow Pool until the 1980s. Fishing with lave nets, seine nets or even spears was widely practiced along the Severn Estuary since the medieval period at least, and no doubt long before that. Eels were also widely fished all along the Severn Estuary, a large proportion being caught using nets known as wing, coghill or fyke nets to funnel them into long, conical, hooped eel nets. All these methods would leave little or no tangible trace.

6. Prehistoric

6.1 Introduction

Archaeological evidence for periods before the Neolithic is rarely visible from the air. Pre-Neolithic evidence in the Severn Estuary RCZAS area comprises Mesolithic implements at Arlingham, Oldbury-on-Severn, the Portishead area, Sand Point, Uphill, Kilve, Old Cleeve, West Quantoxhead and Minehead; and is summarised elsewhere (Mullin 2008). Mesolithic flint has also been recovered from the submerged forests in the intertidal zone at Minehead and Porlock (Canti *et al.* 1995; Mullin 2008). On the west bank of the Severn Estuary in the Forest of Dean, several cave sites with middle Palaeolithic deposits are situated along the River Wye (Small and Stoertz 2006).

Only from the Neolithic onwards were there more monumental sites such as long barrows and causewayed enclosures that had a more lasting impact on the landscape and which may still be visible on aerial photographs, although there are problems in differentiation between Neolithic and Bronze Age, particularly monuments (Riley and Wilson-North 2001: 21). For the purposes of this report, however, the two periods are described separately.

This section will examine the contribution that the Severn Estuary RCZAS has made to existing knowledge of the Neolithic, Bronze Age and Iron Age periods within the Severn Estuary intertidal zone and its hinterlands.

6.2 Neolithic

No new Neolithic sites or any of earlier date were positively identified and described by the Severn Estuary RCZAS. Neolithic artefacts have been found in the intertidal zone at Oldbury-on-Severn (Allen 1990), Blackstone Rocks south of Clevedon (Sykes 1938), and Hill Flats, south Gloucestershire (Allen 1997b). Most of the evidence of human habitation within the Severn Estuary in the Neolithic period, comes from such chance finds (Riley 2006; Small and Stoertz 2006). The intertidal zone is associated with areas of early prehistoric submerged forest exposed along the shoreline, as for example at Porlock (Boyd Dawkins 1870) and Minehead.

Possible Neolithic stone settings survive on the high ground to the east and south east of the RCZAS project area in the Exmoor National Park; yet similar structures are not visible on nearby upland areas such as Selworthy Beacon, Bossington Hill. Nearly all survive on moorland to the west, outside the limits of medieval and later agricultural improvements that may have destroyed such evidence (Riley and Wilson-North 2001). Aerial photographs show that many upland areas are covered in woodland, plantations or dense moorland vegetation that can obscure the archaeological evidence, particularly small stone settings such as those on Exmoor.

Excavations on the Somerset Levels indicate that the wetlands were also exploited during the Neolithic period where there were large expanses of reed swamps containing some slightly 'islands' known locally as burtles (Costen 1992). Buried within the Levels are remains of wooden tracks or walkways that provided access and may have facilitated the exploitation of wetland resources (Brunning 1995). The Sweet Track dated to 3809-8 BC is the most notable of these features, and connected The Polden Hills with the 'island' of Westhay. Due to episodes of tidal inundation and peat formation on the Levels, evidence of prehistoric habitation is now buried to a depth of c.1.5m (Leech 1981) and it is thus unlikely that visible remains will be recorded on aerial photographs. Neolithic settlement sites and structures may yet be discovered (Costen 1992), though this is again more likely to be evaluation and excavation rather than aerial surveys. Many Neolithic features have probably been obliterated or masked by subsequent building, cultivation, and other human activities as well as by natural processes (Havinden 1981).

6.3 Bronze Age

Most of the Bronze Age sites visible on aerial photographs and recorded by the Severn Estuary RCZAS project were ritual monuments, with round barrows being the most widespread Bronze Age monument type within the survey area. These cannot be positively identified as Bronze Age by aerial survey alone, but antiquarian excavations (Ashbee 1960; Fenton 1811; Phillips 1931) suggest that the majority are Bronze Age in date rather than Neolithic.



Figure 6-1 Two possible round barrows identified as cropmarks and slight earthworks at Over, near Gloucester

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Two possible barrows (SO 81 NW 437/HOB UID 1448916 and SO 81 NW 436/HOB UID 1448915) are located near Over, Gloucestershire (Figure 6.1), and are situated 120m apart on a slight knoll 12m above the floodplain. They are both circular mounds surrounded by a ditch. The barrows are now only visible as cropmarks, though the western most example was still visible as a slight mound in 1940s aerial photographs. Some 350 or more extant round barrows of comparable form are known in Gloucestershire (Grinsell and Darvill 1989; O’Neil and Grinsell 1960).

Two further round barrows (ST 47 SW 6/HOB UID 195444) are situated on Walton Down (Figure 6.5) close to a later Iron Age banjo enclosure and were first recognised from a field survey carried out in 1931 (Phillips 1931). The barrow to the west is visible as a ring ditch in the centre of which is a circular pit, perhaps for a burial, approximately 3 metres in diameter. The barrow to the east is visible on aerial photographs taken in 1946 and may be the fragmentary remains of a suspected second circular disc or saucer barrow identified in 1931, but not visible when surveyed in 1962 and 1965 by the Ordnance Survey (NMR HOB UID 195444). This suggests that the barrow is now so badly damaged as to leave no trace or that encroaching woodland and scrub vegetation has obscured the monument.

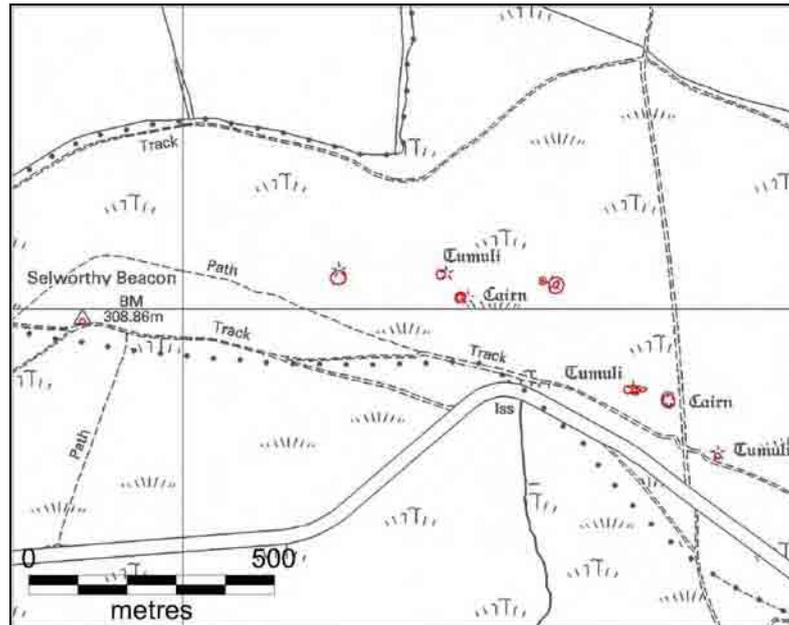


Figure 6-2 A Bronze Age barrow group recorded on Selworthy Beacon, Bossington Hill.

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Most of the Bronze Age burial monuments within the survey area are found on upland areas such as Bossington Hill, Porlock and Brean Down where groups of barrows form 'cemeteries'. The Bronze Age barrow cemetery on Bossington Hill (SS 94 NW 15/HOB UID 36806), comprises nine Bronze Age cairns or barrows and is centred on a ridge of high ground to the east of Selworthy Beacon (Figure 6.2). The cairns are still visible as earthworks on aerial photographs, although Second World War tank training appears to have caused some disturbance to them. Several mounds have visible depressions in their centres, probably from early excavations such as those carried out by Richard Fenton in the 19th century (Fenton 1811). A cairn towards the east side of the group (SS 94 NW 109/HOB UID 1123254) has a large central depression, the spoil from which is thought to have been piled up on the west and east sides of the cairn forming two adjacent mounds, once thought to be separate cairns (Riley and Wilson-North 1997).

Many barrows in the survey area were found through field survey but are not visible on aerial photographs due to vegetation cover on the upland areas. It is possible that further examples may be discovered underneath the dense gorse, heather, and woodland that cover much of the hillsides to the west of Bridgewater Bay.

There are some lowland examples of barrows, such as Pixies Mound (ST 24 NW 2/HOB UID 191177) adjacent to Hinkley Power Station, approximately 10m OD. Excavation revealed that this Early Bronze Age round barrow had at least two phases, with a later episode of digging disturbing burials within the central mound, as large quantities of fragmentary human remains were found throughout the backfill. Three crouched inhumations, each accompanied by a Beaker, were found within the central area at relatively shallow depths, but undisturbed by the later excavation (Ashbee 1960). The barrow is overgrown by vegetation and was not visible on aerial photographs, and hence was not mapped as part of the RCZAS project.

Barrows in lowland areas have generally been more adversely affected by land improvements and intensive agriculture from the medieval period onwards. Cropmark features such as ring ditches might therefore become more visible once the extensive ridge and furrow is plough levelled, such as the ring-ditch recorded north of East Quantoxhead (ST 14 SW 138/HOB UID 1366927).

Like Neolithic remains, Bronze Age settlements may also be hidden or destroyed beneath modern development. No settlement sites were identified from the aerial photographs. Localised excavations of Bronze Age occupation have taken place at Brean Down (Allen and Richie 2000; Bell 1990) and Oldbury Power Station (Allen 1998). Brean Down uncovered Early to Late Bronze Age occupation (ST 25 NE 5/HOB UID 191314), including roundhouses and evidence for cooking, weaving and small-scale salt extraction (Bell 1990).

At Avonmouth, Mesolithic saltmarsh was sealed by later alluvium, and a deposit above this contained Late Bronze Age pottery that was subsequently covered by over a metre of further alluvial clay (Allen *et al.* 2002). Although alluvial clay deposition varied on the Levels, in some places within the survey area Bronze Age monuments may not be visible on aerial photographs as they are buried too deeply under the present ground surface. Yet Bronze Age people apparently frequented low-lying areas just as they did in the Neolithic period. A continuing cycle of activity and inundation throughout the Bronze Age in the Somerset Levels led to the construction of further extensive trackways (Brunning 1995; Cunliffe 2006).

There is also evidence from the Welsh side of the Severn Estuary at Rumney Great Wharf hinting at seasonal or semi-permanent later Bronze Age coastal settlements (Allen 1995), and similar settlement sites might be located on the English side of the estuary.

6.4 Iron Age

There is clear evidence for Iron Age populations in the hinterland of the Severn Estuary, and the larger monuments include three hillforts (Brean Down, Worlebury Hill, and Wain's Hill in Clevedon), two hillslope enclosures (Furzebury Brake and Bury Castle, Porlock), whilst two hillforts at Cannington and Oldbury-on-Severn are located just outside the survey area. These structures are concentrated on the upland areas within the survey area south of the Severn Vale. One Iron Age settlement site discovered through excavation at Hallen, near Avonmouth on the low-lying Avon Levels (Gardiner *et al.* 2002) revealed that the early Iron Age settlement was originally on a stable salt-marsh edge, following which there was a period of sea-level rise or marsh development (Druce 1997; Gardiner *et al.* 2002). This may suggest that coastal sites on or near the Levels were abandoned as marine inundation increased. However, as the Welsh evidence for Iron Age buildings at Goldcliff and Greenmoor Arch suggests (Bell *et al.* 2000; Locock 1999), early Iron Age sites located within the Levels may still survive *in situ* buried under layers of silts and peat. Subsequent cultivation and settlement may also mask Iron Age features and structures, and on the Levels peat cutting may also have done much to destroy the evidence (Costen 1992)

In the Severn Vale, possible Iron Age sites are visible as cropmarks on the gravel terraces in Gloucestershire, as at Frampton-on-Severn. Gravel terraces are infrequent south of Gloucestershire and they tend to be sites of modern settlement or aggregates quarrying, which has possibly masked or destroyed archaeological sites from this period.

within the Inner Severn Estuary, the only Iron Age site recorded within the Severn Estuary RCZAS project area is an enclosure known as Long Brook Camp at Minsterworth (SO 71 NE 9/HOB UID 113299), though it has also been less convincingly ascribed a Bronze Age or early Roman date (Saville 1984). It is defined by a bank with narrow ditches on either side, enclosing a roughly oval area.

Further study of the available aerial photography did not yield any additional information. An exploratory geophysical survey was carried out in 2006, but the results were inconclusive (Riches 2007).

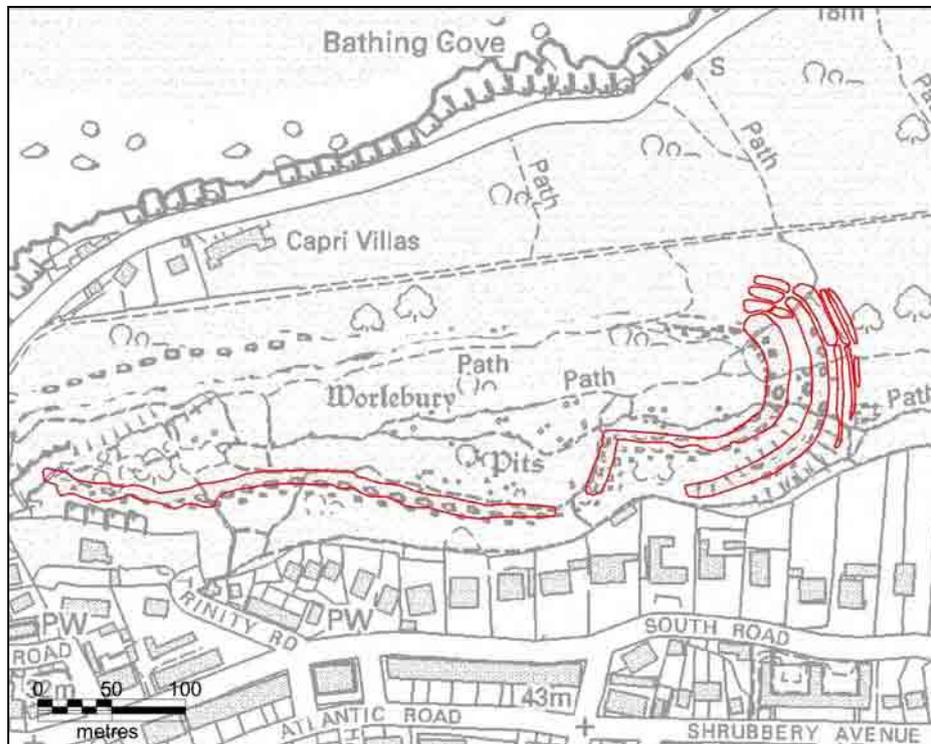


Figure 6-3 Worlebury Camp hillfort. Due to tree cover only some sections of the ramparts were visible on the available aerial photography.

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Worlebury Camp (ST 36 SW 1/HOB UID 192721) occupies the spur of Worlebury Hill and is the largest hillfort identified in the project (Figure 6.3). This is a multivallate hillfort with seven recorded ramparts to the east of the fort, though only six were visible on the aerial photographs due to tree cover over most of the hill. Neolithic flint arrowheads and flint axes recovered from the area suggest that the hilltop was occupied before the Iron Age, and it was used well into the Roman period (La Trobe-Bateman 1999c).

On the hills west of Minehead, Bury Castle (SS 94 NW 2/HOB UID 36765) and Furzebury Brake (SS 94 NW 14/HOB UID 36801) are two examples of possible Iron Age hill slope enclosures (Riley and Wilson-North 2001). Bury Castle is well-preserved and has an associated cross-ridge dyke, a feature of several broadly

contemporary monuments in the wider region. Furzebury Brake, an oval, single banked enclosure (Figure 6.4) is now badly affected by erosion and aerial photographs detail the extent to which it has been damaged over the last five decades.



Figure 6-4 *The hillslope enclosure of Furzebury Brake, which has become badly affected by erosion.*

NMR 23825/20 19-FEB-2005 © English Heritage. (NMR)

The purpose of Iron Age hillforts and the natures of the inhabitation within them is still subject to much debate within archaeology, but certainly by the middle and late Iron Age most of the population lived in small-scale, rural enclosed settlements, probably the farmsteads of extended families. The Walton Ridge between Portishead and Clevedon features many Iron Age sites probably linked to aspects of arable or pastoral agriculture. The possible Iron Age field system (ST 47 SW 4/HOB UID 195436) at the western end of Walton Down, north of Walton-in-Gordano village, was associated with nearby excavated Iron Age storage pits, one of which contained an inhumation. A further four subcircular earthworks (ST 47 SW 20/HOB UID 195496) are located 0.8km to the south west, which may be the remains of Iron Age dated features excavated by Colonel W. Long in 1856 (Dymond 1902). These may indicate the remains of unenclosed settlements associated with the nearby field system. A possibly associated ‘banjo’ enclosure (ST 47 SW1/HOB UID 195425) survives as an earthwork on Walton Down (Figure 6.5), and comprises a roughly circular enclosure with two parallel curvilinear banks

extending in a funnel entrance on the north east side (Scheduled Monument: AA 78694/1). Dating of other similar examples suggest a middle to late Iron Age date (Cunliffe 1995), and may have had a role as livestock corrals or seasonal pastoral settlements.

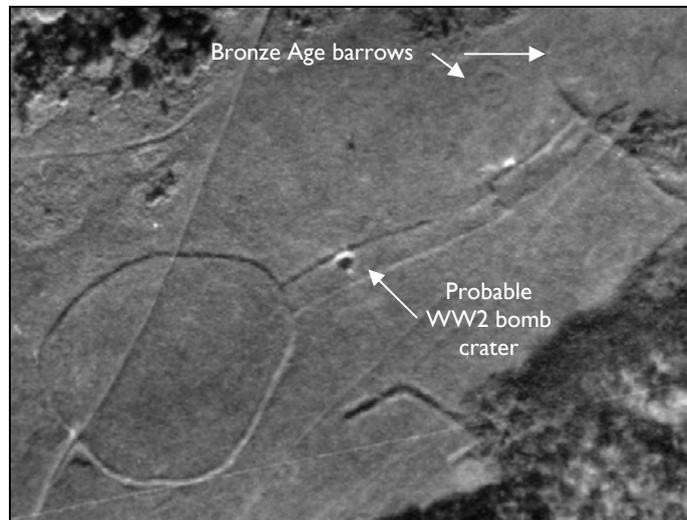
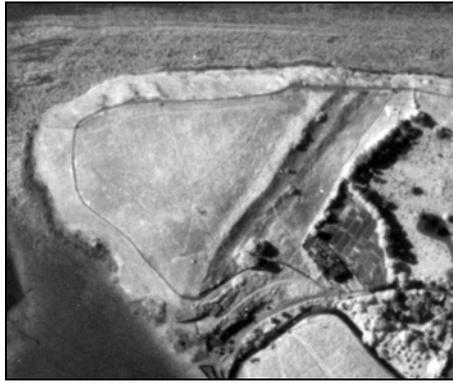


Figure 6-5 The 'banjo' enclosure on Walton Down with faint earthworks of two Bronze Age round barrows to the top-right. The circular pit in the centre of the photograph is a probable Second World War bomb crater

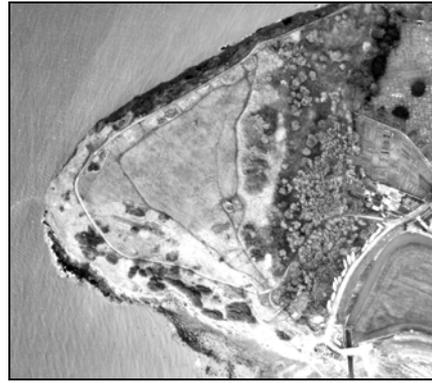
RAF/CPE/UK/1869 3059 04-DEC-1946 © English Heritage (NMR) RAF Photography

Five other areas of similar surviving field systems have been identified within the RCZAS project area, but these cannot be positively assigned Iron Age dates from aerial photographs. Dating, interpretation and analysis of these field systems are problematic (Collis *et al.* 1984; Ford *et al.* 1988; Riley and Wilson-North 2001) and they may date from the Bronze Age or earlier to the Roman period.

The NMP survey may not have added greatly to known sites of this period, but clarification of the known evidence has been important. For example, the hillfort at Wain's Hill, Clevedon (ST 37 SE 1/HOB UID 192815) is described as a promontory univallate hillfort, but aerial photographs taken in 1950 clearly indicates a second outer rampart, only visible as a slight earthwork by 1986 (Figure 6.6).



NMR RAF/541/553 3036 04-JUN-1950
© English Heritage (NMR) RAF Photography



NMR OS/86259 138 27-NOV-1986
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Figure 6-6 Wain's Hill at Clevedon. The two ramparts of the hillfort are clearly visible on the left hand photograph. In the aerial photograph taken in 1986 (right), little remains of the earthwork ramparts.

6.5 Summary of Prehistoric Evidence

Most surviving prehistoric monuments are concentrated on the upland regions of the RCZAS project area. There is plenty of evidence to suggest that the Levels were occupied from the Neolithic onwards, though much of the evidence remains buried under layers of silt and peat and are not visible through aerial survey. This bias towards upland monuments must therefore be taken into account when considering the distribution of prehistoric sites. The aerial survey has added to and updated the known archaeological evidence for this region, although a fuller understanding of the prehistoric landscape in the Severn Estuary's intertidal zone and its hinterland can only be achieved in combination with archaeological techniques such as field survey.

7. The Roman Period

7.1 Introduction

There is a virtual absence of monuments from the Roman period (AD 43-410) visible on aerial photographs in the Severn Estuary RCZAS project area. This is probably the result of a combination of factors, including the extensive earthworks from medieval and post-medieval agricultural regimes masking earlier archaeological features; alluvium build-up from repeated inundations, as well as coastal and sea-level changes. The effects of these contributory factors are discussed below.

Gloucestershire

In Gloucestershire, no new evidence of Roman activity was identified by the RCZAS project. Similarly, the Forest of Dean NMP survey did not identify any new Roman sites and some of the known and recorded Roman sites were only partially visible on aerial photographs (Small and Stoertz 2006). The Frampton on Severn ALSF/NMP survey (Dickson 2006) also did not identify any new archaeological remains from the Roman period, although it could be that Roman sites were located on the higher, free-draining gravels most suitable for settlement and have thus been destroyed by large-scale gravel extraction around Frampton on Severn.

The early occupation of Gloucester by Roman military forces dates to *c.* AD 49, and it became an urban settlement known as *Colonia Nervia Glevensium* in *c.* AD 96-8, although archaeological evidence from this period is scarce (Wilson 2002). Gloucestershire is renowned for the many Roman sites in the Cotswold Hills such as the town of *Corinium* (Cirencester) and high-status villas such as Chedworth (Wilson 2002). Other Romano-British sites existed along the Severn Vale, however, including the villas of Great Witcombe and Frocester below the Cotswolds escarpment and potential settlements at Oldbury-on-Severn and Shepperdine on the River Severn's east bank (Allen and Rippon 1997). On the west bank, a temple complex at Lydney and significant villas and industrial complexes at Tiddenham and Woolaston have been excavated. Archaeological evidence of these sites usually comes from field survey, small finds and excavations though rather than aerial photographs.

An 800m long section of Roman road (LINEAR 167/HOB UID 1161622) is visible as a cropmark south of Over, near Gloucester (Figure 7.1). This road provided a link between Gloucester and the Forest of Dean (Elrington et al. 1972). Roads were not the only means of transport, and it is likely that the Romans used the Severn Estuary to transport military and industrial supplies. Several ports such as Lydney and Caerwent are known to have been established along the river, with Gloucester acting as the main transshipment centre (Landscape Design Associates 2004). No archaeological evidence of a Roman port was identified from aerial photographs in the Severn Estuary RCZAS project area, although Aust in Gloucestershire is thought to have been an important Roman river crossing (Allen 2002).

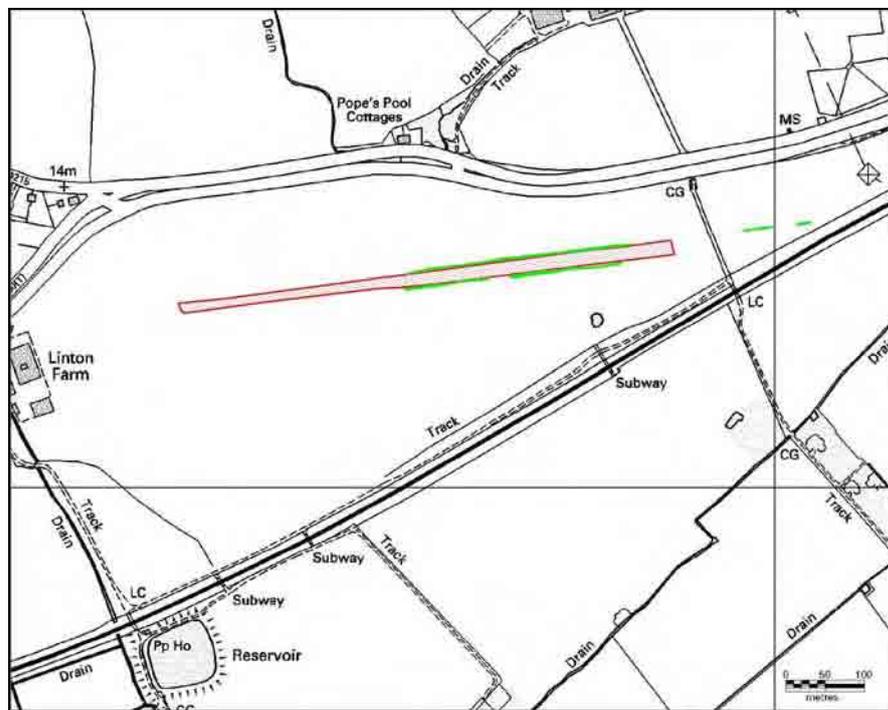


Figure 7-1 Mapping of the Roman Road at Over, visible as a cropmark west of Linton Farm.

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Background map acquired from the Ordnance Survey.

In the loop of the River Severn around Elmore is for the 'Great Wall of Elmore' (SO 71 NE 24/HOB UID 766021), a 490m long earthen bank with stone revetments (Figure 7.2). This linear earthwork has been proposed as a Roman flood defence to prevent flooding of reclaimed land east of the wall (Allen and Fulford 1990b). It has been suggested that this bank continued to the north but the available aerial photographs and the lidar data, as discussed in Appendix 4 (Truscoe

2007), did not confirm this. To the east of Elmore's 'Great Wall', Allen and Fulford (1990b) identified two possible Roman land reclamation episodes (SO 71 NE 22/HOB UID 765785), defined by surviving fragments of possible Roman-dated flood defence banks.

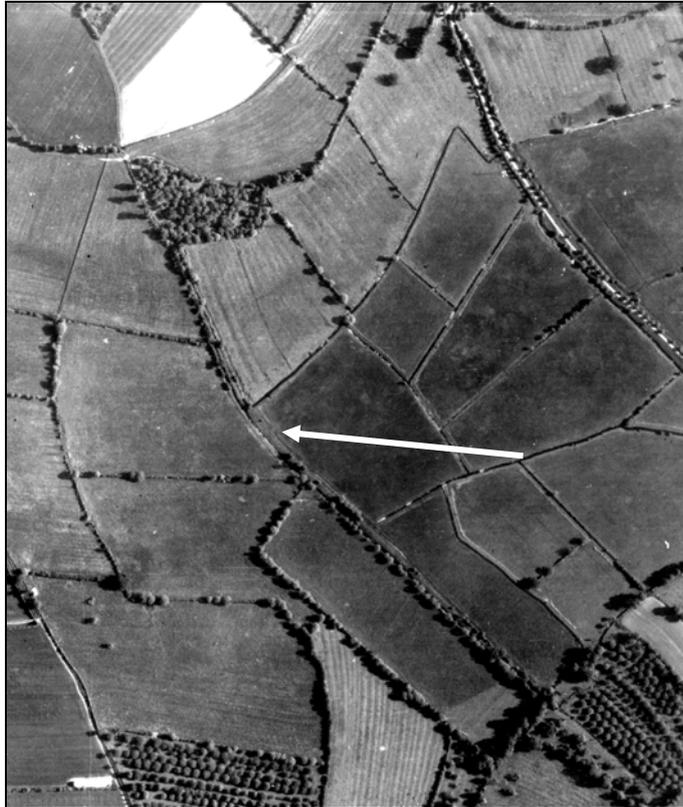


Figure 7-2 Aerial photograph of the possible Roman feature at Elmore, indicated by the white arrow

RAF/I06G/UK/I558 3001 02-APR-1946 @ English Heritage (NMR) RAF Photography

The NMP survey identified earthworks at Hempsted on the outskirts of Gloucester (SO 81 NW 37/HOB UID 115325), consisting of banks and shallow ditches identified on 19th century maps as a Roman camp. The site was part of the manor of Llanthony Priory from AD 1141 in which the prior had rights of warren (Herbert 1988) and the site is known as the Coneygar, the name traditionally given to managed rabbit warrens, supporting the interpretation that the earthworks actually represent medieval pillow mounds.

Somerset

In Somerset, the Severn Estuary RCZAS project identified only two sites of potentially Roman date, and neither the Mendip Hills AONB NMP survey of Brean Down or the Quantock Hills NMP survey recorded any Roman features along the coastline (H. Winton pers comm.). Significant numbers of Roman sites are known from excavation, field survey, and spot finds, within the project area, some due to developer-funded archaeological investigations prior to construction projects.

At Portishead and Clevedon, evidence for Roman occupation includes pottery, coins, industrial activity, burials, a villa site and other buildings and structures (La Trobe-Bateman 1999; La Trobe-Bateman and Russett 1999a). Clevedon's origins may have been as a naval post, with artefactual evidence comparable to a Roman naval post on the Welsh side of the estuary at Barryhead (La Trobe-Bateman 1999). Pottery assemblages suggest that numerous farmsteads were located in the area, with an increase in villa sites from the middle of the 3rd century onwards and a Romano-British settlement east of Clevedon. The Roman occupation in Weston-super-Mare has been identified through archaeological excavation and finds.

On the Quantock Hills, excavations, surveys and artefact finds indicate Romano-British settlements ranging from small enclosed farmsteads to villa estates such as Spaxton and Yardford. In Watchet and Minehead, however, there has been little evidence for Roman settlement. This emphasises the different character of Romano-British inhabitation in West Somerset's uplands (Gathercole 2003a, 2003b). Further west on Exmoor, the Roman military may have been responsible for an extensive iron mining and processing industry (Riley 2006).

There was also Romano-British activity in Iron Age hillforts, as for example at Worlebury Camp where coin hoards and pottery, dating from the 2nd to the 4th centuries AD has been found, in addition to possible ritual structures (La Trobe-Bateman and Russett 1999b). Just outside the RCZA project area on Brent Knoll, known to the Romans as *Mons Ranarum* (the Mount of Frogs), evidence of Roman occupation was identified on the Iron Age hillfort during the 19th century (Barrett 1789; Burrow 1981).

At Alstone south of Burnham-on-Sea, two earthwork ditches (ST 34 NW 101/HOB UID 1452315) were possibly associated with nearby occupation only 70m to the east, where there was an Iron Age and Romano-British settlement (ST 34 NW 8/HOB UID 192237/Scheduled Ancient Monument 10504) located at the interface between an island shore and the surrounding flooded landscape (from Record of Scheduled Ancient Monument description SAM 10504). It is equally possible, however, that the earthwork features represent the remains of a medieval or post-medieval moat ditch. The proximity of Alstone Court Farm and the layout of the village lanes suggest a focus of medieval settlement here

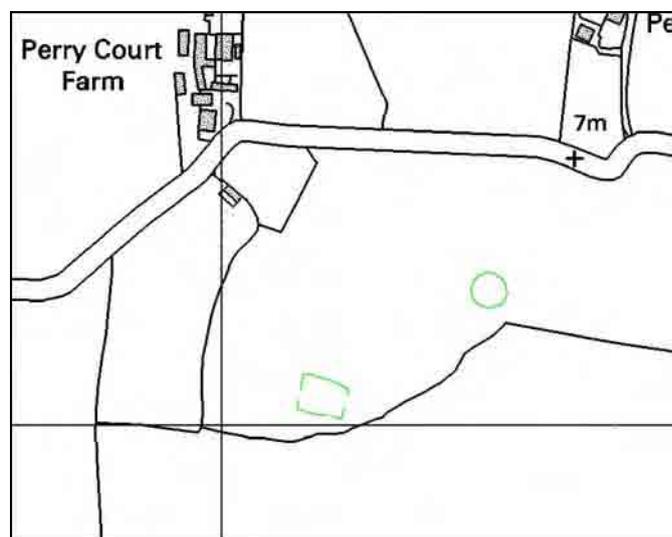


Figure 7-3 Cropmarks of a possible Roman settlement at Perry Court Farm

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Background map acquired from the Ordnance Survey.

Northwest of Bridgwater near the village of Perry Green, the NMP survey recorded a possible late prehistoric or Romano-British settlement site (ST 23 NE 57/HOB UID 616947) from cropmark evidence first identified in the 1970s. As shown at Figure 7.2, the site consists of a single ditched trapezoidal enclosure and ring-ditch. That some occupation here may have been of Roman date is suggested by nearby finds of 4th century AD pottery, although the cropmark features themselves are not diagnostic of Roman period features.

7.2 Discussion Of The Evidence

Gloucestershire

Archaeological fieldwork has uncovered extensive evidence of Romano-British occupation in the north of the Severn Estuary RCZA project area (Allen 1997c; Allen and Rippon 1997), such as immediately south of Arlingham peninsula where a Romano-British settlement near Shepperdine lies buried beneath the ridge and furrow (Allen 1992).

Somerset

In Somerset, extensive Roman industrial activity is concentrated in the Brue Valley around Highbridge, Huntspill and west of Burtle (Gathercole 2002; Grove and Brunning 1998). A few kilometres to the south on the banks of the River Parrett, a Roman town had existed at Combwich from the 1st to the 4th century AD, reached by a ford across the river.

There is a notable paucity of aerial photographic evidence for Romano-British occupation along the shores of the Severn Estuary in the RCZAS project area, but this is not representative of the Roman period in the wider Gloucestershire and Somerset landscape. Slightly inland, settlements and villas were much more widely distributed and the landscape probably more heavily populated. This is evident especially on the North Somerset Levels (Rippon 1992; 1994; 1995; 2000) and Bleadon Hills. With so much archaeological evidence for Roman activity along the Severn Estuary coastline, the apparent dearth of evidence on aerial photographs is likely to result from several constraining factors.

Sea level rises and tidal inundations may have buried Romano-British features such as structures or earthworks under alluvial deposits, rendering them invisible on aerial photographs. In the Burnham-on-Sea area, for example, Leech (1981) estimates a Roman land surface depth between 0.3m and 1.4m below the present height due to post-Roman alluviation.

In the North Somerset Levels, it is possible that flood defences protected some Romano-British settlement sites and the Roman period land surface is sealed by only 0.1m to 0.6m of estuarine clay (Gilbert 1996; Leech 1981). Even so, the combination of alluvial deposition and the results of medieval and post-medieval agriculture in the North Somerset Levels means that only three Roman settlements and associated field systems have been recorded at Kenn Moor, Banwell Moor and Puxton (Rippon, 1994; 1995; 1996; 1997b; 1998).

In the South Somerset Levels, however, the archaeological evidence is more complex. Leech suggested that there was little or no Roman cultivation in the area south of Brent Knoll, based on an absence of buried soil horizons and the likelihood that the area was the catchment for the former tidal River Siger. Lidar data (Bunning and Farr-Cox 2005) has confirmed the presence of a large, buried tidal channel likely to have been part of a larger saltmarsh river system suited to seasonal grazing that opened to the Severn Estuary north of Burnham-on-Sea in the Roman period, and whose course passed near the base of Brent Knoll. The River Siger was still extant in the 11th century before a sand dune system probably cut off its mouth to the sea. It is thus unlikely that widespread Roman agricultural settlement with field systems and farmsteads would have been established, and in only in two areas of estuarine clay is Roman settlement known (Leech 1981). A lack of settlement does not mean a lack of inhabitation, however. Significant evidence of Roman salt-making and peat cutting (Bunning and Farr-Cox 2005) has been found along the River Brue at Highbridge and around East Huntspill south of Highbridge, both sites just outside the Severn Estuary RCZA project area. The extent of the salt marsh probably determined the nature of Roman occupation, industrial and agricultural activities in this area (Bunning and Farr-Cox 2005: 11). Production of salt was likely to have been seasonal, limited to the summer months due to sunshine levels (and hence evaporation), air temperature and low waters (Leech 1981). These seasonal, dynamic activities would nevertheless leave few archaeological remains visible from the air.

Many Roman sites within the Severn Estuary RCZA project area have been discovered in urban areas such as Portishead, Clevedon and Weston-super-Mare through developer-funded excavation during urban improvement. It may be that the absence of evidence from aerial photography is also partly due to continuities

of occupation through to the present day on these topographically favourable coastal sites (Rippon 1997b). Significant expansion of these urban areas has probably masked much Romano-British settlement activity.

On the coastal hinterland between Gloucester and the River Parrett estuary, extensive and intensive medieval and post-medieval cultivation has blanketed the low-lying alluvial soils in ridge and furrow and land drainage features, thus masking earlier archaeology (Allen 1992).

Summary

The few Romano-British features identified from the NMP survey along the coastal rim of the project area are not representative of the wider regional Roman archaeological resource. Contributory factors that may account for the absence of archaeological evidence visible on aerial photographs include:

- the historic alluvial deposition and burial of Romano-British land surfaces;
- saltmarsh and coastal erosion and alluviation due to sea level rises or repeated tidal inundations;
- the nature of the ephemeral Roman period seasonal exploitation and settlement;
- the extensive later disturbance and surviving earthworks from medieval and post-medieval land drainage and farming practices.

Many potentially Romano-British features may thus still be buried beneath silts or masked by later archaeology and/or urban development.

8. The Early Medieval Period

The early medieval period (410-1066AD), is the most poorly represented of all the periods considered in this report, with only 62 known records from the RCZA survey area, many relating to church buildings and place names. The aerial survey did not identify any diagnostic archaeological evidence of the early medieval period from the aerial photographs. As the records for this period are so sparse, there are no identifiable concentrations within the RCZAS project area (Mullin 2008).

In the intertidal zone on Stert Flats a fish weir has been dated by dendrochronology to AD 932 (Groves et al. 2004), as discussed in more detail in Chapter 5, and similar or adjacent fish weirs may date to this period. There is no definitive way of dating fish weirs or traps by morphology alone and further research is required such as the work by Brunning (2008b) in order to establish the distribution of early medieval fish weirs.

The 5th century saw the collapse of the Roman administration in the British Isles and within that same century the arrival of the Anglo-Saxons, some initially employed as mercenaries who then settled in Britain. Most of what we know is derived largely from historical accounts, as there is a lack of archaeological evidence (Riley and Wilson-North 2001) especially in the west of the RCZAS survey area.

The evidence for Anglo-Saxon structures from excavated settlements, both nationally and regionally, suggests that most were constructed of timber, either as halls or as sunken-featured buildings (Wilson 2000: 127). Even substantial Anglo-Saxon structures thus leave remains that are often difficult to identify from aerial photographs (Hegarty and Newsome 2005: 70-71). Archaeological features may also be masked by present urban settlements or medieval and post-medieval ridge and furrow.

The Somerset Levels may have been affected by a period of later or post-Roman flooding that blanketed the earlier landscape with a layer of saltmarsh derived alluvium (Allen 1997c: 67-81; Rippon 1997b: 41-54). Rippon (1996) has proposed

that 'infield' sites (large sub-oval enclosures) throughout the Severn Estuary Levels may represent colonising settlement that followed this post-Roman flooding. Many of these possible 'infields' have field names like 'worth' and 'huish' that may be indicative of Late Saxon habitation (Gilbert 1996); and are associated with medieval churches or chapels and surface finds of Roman/medieval pottery. Examples can be found at Puxton, Banwell Moor and Kenn Moor, inland of the RCZAS survey area. Place names suggest extensive occupation along the Severn Levels by the late Saxon period, although the backfen areas appear to have been colonised much later.

The first large Anglo-Saxon estates may have been controlled centrally by the king (Cunliffe 2006: 58; Riley 2006: 77). One possible royal centre at Cannington in Somerset was associated with a substantial cemetery (ST 24 SE 5/HOB UID 191207). Although, affected by 150 years of quarrying, excavations suggested that there were originally over 2000 graves (Rahtz et al. 2000) with perhaps 1500-5500 people estimated to be buried there (Riley 2006: 79). The cemetery may have been used in the late Roman period, but was certainly still in use until AD 700. The cemetery and whole hilltop were quarried away and are now a lake.

9. Medieval And Post-Medieval

9.1 Introduction

Analysis of the Severn Estuary RCZAS aerial survey data suggests that there were five principal but not mutually exclusive landscape character zones in the project area during the medieval and post-medieval periods: Gloucestershire's alluvial ploughlands, the Somerset Levels, the Quantock Hills, Exmoor and the intertidal zone. The intertidal zone has been discussed separately in Chapter 5.

For the purposes of this report the medieval period is taken to date from AD 1066 to 1540 and the post-medieval period from AD 1540 to 1900. Although this is a wide date range, it is often difficult to identify and discuss in isolation the major elements of the medieval and the post-medieval landscapes: settlement, agricultural economies, land reclamation and sea defences. Many archaeological features and landscape management practices such as ridge and furrow and orcharding continued from one period into the next. Such features may be either of medieval or post-medieval origin, or both. Consequently, they are discussed within a single agricultural theme.

9.2 Agriculture And Settlement

9.2.1 Agriculture and Settlement In Gloucestershire

In the Severn Vale a shift predominately arable towards pastoral farming in the 14th and 15th centuries brought with it enclosure of the open field systems, which was probably achieved by the 17th century. This change in farming consequently protected the ridge and furrow of the earlier arable landscape, although post-war arable cultivation has reduced the extent of surviving earthworks.

Medieval and post-medieval agriculture once dominated the Severn Estuary's coastal hinterland in Gloucestershire and this is reflected in the archaeological evidence visible on aerial photographs. Extensive ridge and furrow cultivation has been mapped and recorded in the RCZAS project area, particularly in the Severn Vale of Gloucestershire. Much of the ridge and furrow was mapped as surviving earthworks from RAF aerial photographs taken in the 1940s and remains extant,

except where it has been ploughed out or destroyed to make way for residential expansion.

Ridge and furrow is created by annually ploughing furlong block strips in the same direction (Rippon 1997a: 224) and creating fields of undulating corrugations. The form of surviving blocks of ridge and furrow may be directly related to the date they were last ploughed (Hall 1998). By the 19th century, much arable land along the shores of the inner Severn Estuary had been returned to grassland and meadow, with dairy farming and stock rearing most commonly practised. Consequently, until the latter stages of the 20th century when arable farming was reintroduced in some areas, earthworks such as ridge and furrow have survived (Allen 1992). There are two broad types of ridge and furrow cultivation:

Pre-enclosure medieval strip ploughing resulted in a characteristic or 'classic' elongated, shallow reverse-S shape caused by the horse or oxen plough team pulling left prior to turning. The ploughboard throws soil to the right to form convex ridges, the plough team starting in the middle of a field, and working outwards in a clockwise spiral. Upon turning, the plough would cast up a small amount of soil at the end of each ridge, forming a 'head'. A 'headland' is the ridge that formed where two furlongs met at right angles, and the resulting 'heads' from each furlong would be incorporated into a ridge. A 'joint' resulted where two adjacent furlongs lay end to end with ridges in the same direction, the two rows of end 'heads' forming an uneven boundary (Hall 1982, 1998).

A second form of ridge and furrow regarded as post-dating the reversed-S ridge and furrow was more geometric, with smoothly curving or straight furlong strips having a narrow, uniform width. Steam ploughed ridge and furrow from the 19th century is also included in this type, with uniform, straight ridges (Allen 1992; Aston 1988).

The Inner Severn Estuary's West Bank

The Forest of Dean NMP survey report (Small and Stoertz 2006) provides a full landscape description of the estuarine margins between Beachley and Awre on the

west bank of the River Severn and an interpretation of its archaeological features set within the context of the wider Royal Forest. An archaeological reassessment of the Severn's west bank has been carried out following the completion of the Severn Estuary RCZA NMP survey, however, as its results provide an opportunity for comparative analysis not previously available.

The estuarine margins on the west bank generally consist of low-lying alluvial land that rises up to the southern Forest of Dean Plateau. The main medieval and post-medieval settlements were focused around the Chepstow to Gloucester (now A48) trunk road, which formed their main streets. During the medieval period, despite a regional decline of farms and settlements this does not seem to have been repeated along the estuarine margins, and settlement remained stable up to the 19th century. In the village of Awre, however, there is evidence for former housing plots whose size and alignment suggest both continuity in the village's development in some parts and a retraction of earlier settlement in another. The reason for partial abandonment is unclear, though it could be connected to a change of agricultural regimes starting around the 19th century from mixed farming to stock rearing (Small and Stoertz 2006).

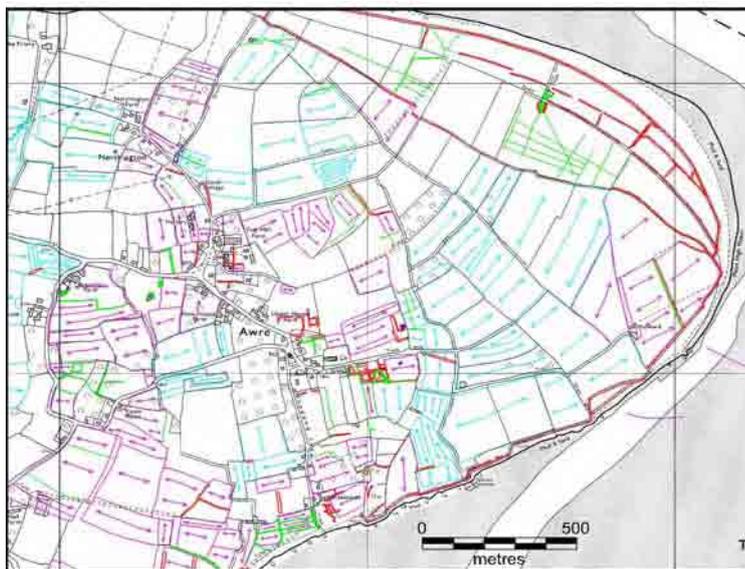


Figure 9-1 The Medieval landscape of Awre, with contiguous ridge and furrow, meadows and linear sea defences

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Background map acquired from the Ordnance Survey.

The medieval and post-medieval settlement pattern on the River Severn's west bank was generally characterised by dispersed farms and villages in an open

landscape, with a mixture of pasture, meadow, open arable fields with blocks of ridge and furrow and, by the 19th century, orchards (Figure 9.1).

The conversion from arable cultivation to pasture in the form of meadow and grass for dairy herds from the 18th century onwards preserved the ridge and furrow systems, although a return to intensive arable cultivation from the middle of the 20th century has resulted in the destruction by ploughing of many of these earthworks. Unenclosed woodland and common land was mainly confined to the estuarine hillslopes, but these lands were gradually enclosed. Meadow land was focused on reclaimed grounds bordering the river that were drained and bounded by earthwork sea banks (Small and Stoertz 2006).

The areas between Rodley and Chaxhill along the Severn's west bank and around Longney on its east bank are renowned for orchards, particularly for the production of apples. Many orchards have been recorded by the NMP survey, mapped using the ridge and furrow symbols and can be identified where relevant in the narrative entries in the NMR database. Orcharding in the 19th century represents the climax of a long history of cottage cider-making. The planting of orchards in west Gloucestershire commenced in the 13th century, following the wane of viticulture. By the 17th and 18th centuries, the region was a nationally important area for cider production, with most parishes in the area having between 2% to 5% of land under orchard (Newman 1983: 205). Numerous orchards were also established during the 19th century and many farms are recorded as having cider mills. The Longney area on the east bank was known for growing an excellent cider apple, the Longney russet (Elrington et al. 1972). Planting orchards on ridges was considered to be important as this not only allowed drainage, but the trees could be planted deeper in areas where soils were poor. The remains of these orchards generally appear as areas of narrow, straight ridges and furrows, usually clearly defined within enclosures or 19th century boundaries (Newman 1983). The ridge and furrow under some orchards, however, such as those around Rodley and Epney, seem to have been S-shaped, suggesting either an earlier date for them or the planting of later orchards on pre-existing ridge and furrow earthworks. Many orchards were planted within former vineyards and hopyards, and planting orchards on previously arable land was considered beneficial due to the quality of the soil (Newman 1983). It was not always possible to determine from the aerial photographs which orchards had utilised pre-existing ridge and furrow from earlier

arable cultivation, or whether the ridge and furrow had been created for that purpose. In general, however, curving ridge and furrow forming 'S-bends' is likely to be earlier in date whilst narrow, straight ridges adjacent to farms are likely to be later and therefore probably orchard (Figure 9.2).



Figure 9-2 The cider apple orchards of Rodley showing a ridge and furrow pattern where trees have been grubbed out.

RAF/CPE/UK1913 042 30-DEC-1946 © English Heritage (NMR) RAF Photography

The tree canopy of the long-standing orchards also limited visibility of some fields which may have contained ridge and furrow, leaving fields blank in the mapping. The scale of ridge and furrow may thus have been slightly under-represented in the final mapping.

The Inner Severn Estuary's East Bank

Along the inner Severn Estuary's east bank from Gloucester to Avonmouth there are extensive tracts of ridge and furrow between small and dispersed settlements. Large areas were also retained for pasture, however (Rippon 2000). These low-lying grassland areas were usually located on heavy alluvial soils and are visible today as smooth pasture devoid of ridge and furrow but with drains or rhyes in its place (Allen 1992). The aerial photograph taken west of Berkeley in 1946 in Figure

9.3 illustrates the combination of 'classic' and geometric ridge and furrow types, along with grassland blocks.



Figure 9-3 A combination of 'classic' and geometric ridge and furrow types visible in fields west of Berkeley

RAF/106G/UK/1295 3026 26-MAR-1946 © English Heritage (NMR) RAF Photography

The medieval open-field tenurial system is well represented in the RCZAS survey area between Gloucester and Avonmouth by 'classic', reverse-S ridge and furrow cultivation. In some places, more recent straight ridge and furrow has been superimposed on more classic ridge and furrow, as at Arlingham (Allen 1992) (Figure 9.4). The later geometric ridge and furrow respects the enclosure boundaries. Allen (1992) identifies four field enclosure types that are visible in field patterns at Hill, near Oldbury-on-Severn (Figure 9.5):

- Enclosed fields which respect the curving boundaries of pre-existing 'classic' ridge and furrow;
- Enclosed fields which zigzag from one ridge or furrow to one adjacent;
- Enclosed fields which divide furlongs unequally, straightening curved furlong boundaries;
- Enclosed fields that enclose more than one furlong within a single field.

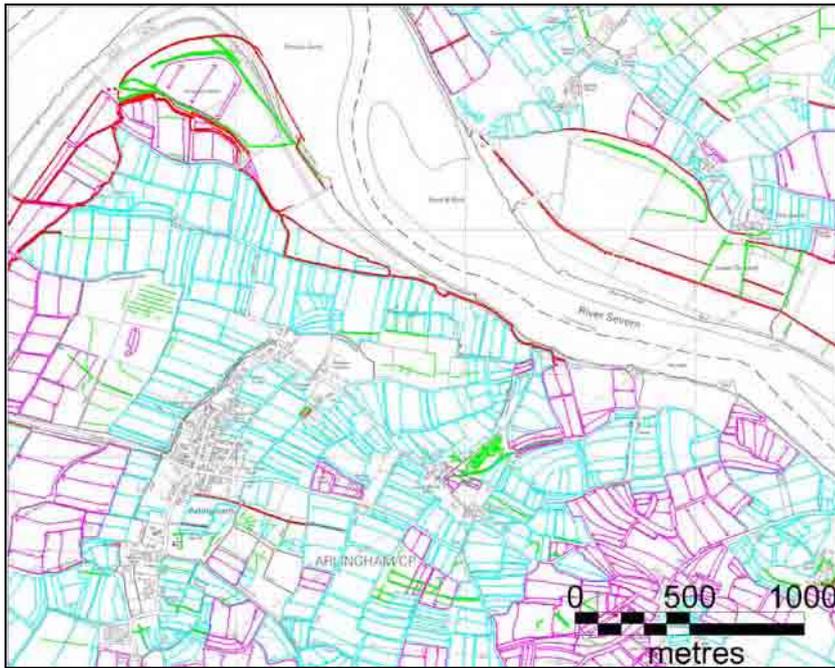


Figure 9-4 Extensive ridge and furrow earthworks recorded around Arlingham showing two ridge and furrow types and enclosure forms

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Background map acquired from the Ordnance Survey

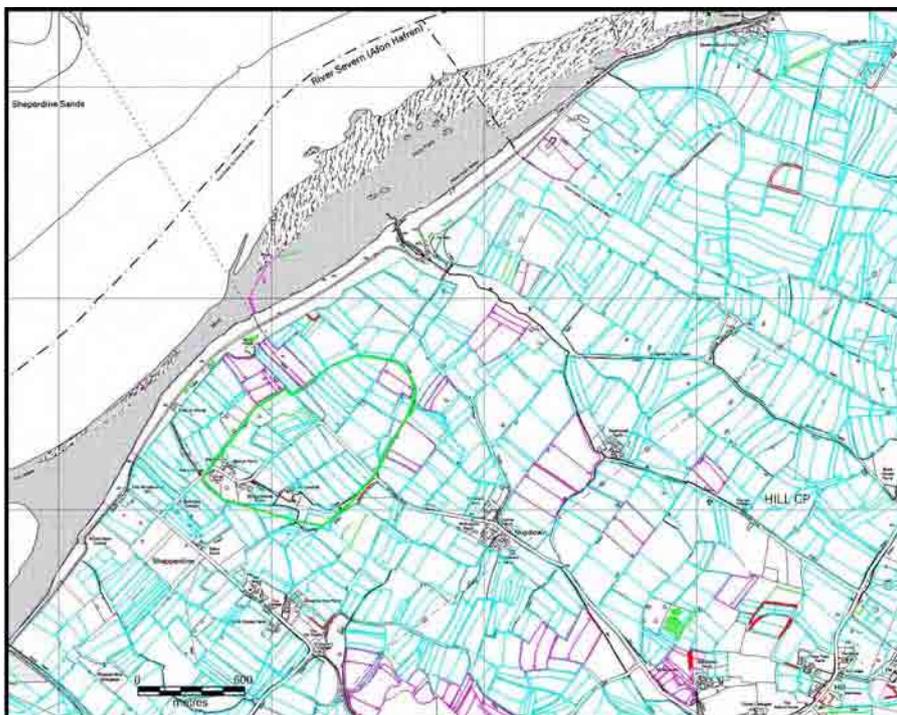


Figure 9-5 Various field enclosure types and ridge and furrow near Oldbury-on-Severn.

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Background map acquired from the Ordnance Survey

Between Berkeley and Aust, the geometric form of ridge and furrow was mostly not cut through by hedge enclosure, and is likely to be contemporaneous with or even date after enclosure (Allen 1992).

9.2.2. Settlement On The Inner Severn Estuary Margins

The earthwork remains of a previously unidentified deserted medieval settlement north of Oakey Farm in the parish of Moreton Valence (SO 71 SE 36/HOB UID 1448159) was mapped from aerial photographs taken in 1946. The earthworks consist of four subrectangular building platforms and enclosure boundary ditches, along with three small circular earthwork mounds of unknown function (Figure 9.6), now much degraded by ploughing. Abutting these features is ridge and furrow cultivation, along with a complex of drainage ditches which appear to have been truncated by the construction of the Gloucester and Sharpness canal just to the east.



Figure 9-6 The earthworks of the possible medieval deserted farmstead at Oakey Farm can be seen in the top centre of the photograph

RAF/CPE/UK/1913 4047 30-DEC-1946 © English Heritage (NMR) RAF Photography

At Hock Cliff, Fretherne, a medieval waterside settlement was recorded by the Forest of Dean NMP survey (SO 70 NW38/HOB UID 1391083) and the evidence suggests that the Severn Estuary played an important part in its economic life, both from fishing and riverine trade (Allen 2001).

A notable settlement form in the Severn Vale was the moated enclosure, several of which have been recorded by the RCZAS aerial survey. The moat at Wick Court near Framilode (SO 71 SW 8/HOB UID 113345) still holds water, whilst other known moats such as The Vineyard at Over (SO 81 NW 41/HOB UID 115331), Woolstrop Manor House at Quedgeley (SO 81 SW 5/HOB UID 115593), Arlingham Court in Arlingham (SO 71 SW 6/HOB UID 113339), Bury Court at Rodley (SO 71 SW 9/HOB UID 113348) and the unnamed moat south of the church at Westbury-on-Severn (SO 71 SW 7/HOB UID 113342) only survive as earthworks.

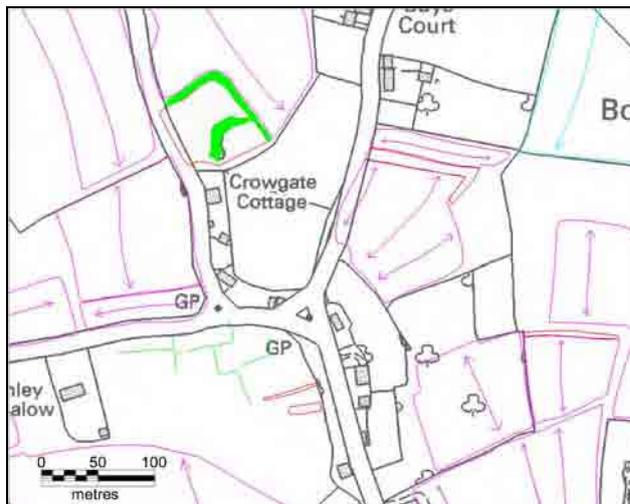


Figure 9-7 Part of the outer ditch of a moated site at Crowgate Cottage, Westbury-on-Severn

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Background map acquired from the Ordnance Survey

The Severn Estuary RCZAS survey has identified several potential moated sites. At Boxbush, Westbury-on-Severn, the remains of a possible moat (SO 71 SW 56/HOB UID 1445677) is visible as an L-shaped water-filled ditch (Figure 9.7). Similarly, adjacent to Bays Court in Bollow, a two-sided earthwork ditch (SO 72 SW 64/HOB UID 1445766) encloses a rectangular platform that may represent the remains of a moated site. Other sites were recorded at Bagley Farm (SO 71 NE 43/HOB UID 1448146) and Lower Ley Farm (SO 71 NE 44/HOB UID 1448149), in the north-east of Westbury-on-Severn parish (Figure 9.8).

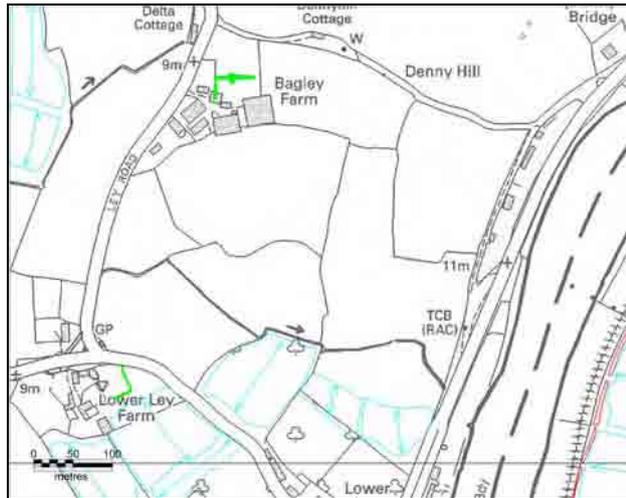


Figure 9-8 Earthworks of the moated sites at Bagley Farm and Lower Ley Farm.

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Background map acquired from the Ordnance Survey

Similar moated sites were also identified in the NMP surveys of the Forest of Dean, Malvern Hills AONB (Winton 2005) and Leadon Valley (Priest, Crowther and Dickson 2007) which border the northern parts of the Severn Estuary RCZAS project area. Breckness Court moat was recorded in the Forest of Dean NMP survey and in the Leadon Valley NMP survey, where moats were located on agricultural land in the valley bottoms. Conversely, in the Malverns, smaller moated sites were located on heavier soils in more peripheral locations (Bowden 2005: 40). Many moated sites represent the site of former medieval manors, halls and granges, but some also functioned as garden features and fishponds. These functions were not mutually exclusive, and the form was not necessarily related to the occupants' status (Bond 1978: 77). Rather than enclosing large, high-status buildings, many moated sites may have been colonising farmsteads in marginal wetland or low lying areas, with the moats providing drainage rather than defence or status (Reynolds and Platt 2007). On both river banks within the RCZAS survey area, however, the distribution of moated sites appear to be restricted to the area north of Frampton on Severn.

9.2.3 A Comparison of the Severn's East and West Banks in Gloucestershire

An examination of the Severn Estuary RCZAS and Forest of Dean NMP mapping of Gloucestershire's estuarine margins at Figures 9.4, 9.5 and 9.9 reveals that the

medieval and post-medieval archaeological remains of the River Severn's east and west banks appear different in character, with extensive ridge and furrow earthworks on the east bank contrasting with a more fragmented, dispersed pattern on the west bank.

As previously described, the dispersed settlement pattern, the trend away from medieval arable cultivation to post-medieval pastoralism and the introduction of enclosure and orcharding, as well as episodes of land reclamation, is evident on both sides of the river. On both riverbanks, the ongoing destruction of ridge and furrow earthworks from the middle of the 20th century resulted from a partial return to arable cultivation and modern ploughing techniques.

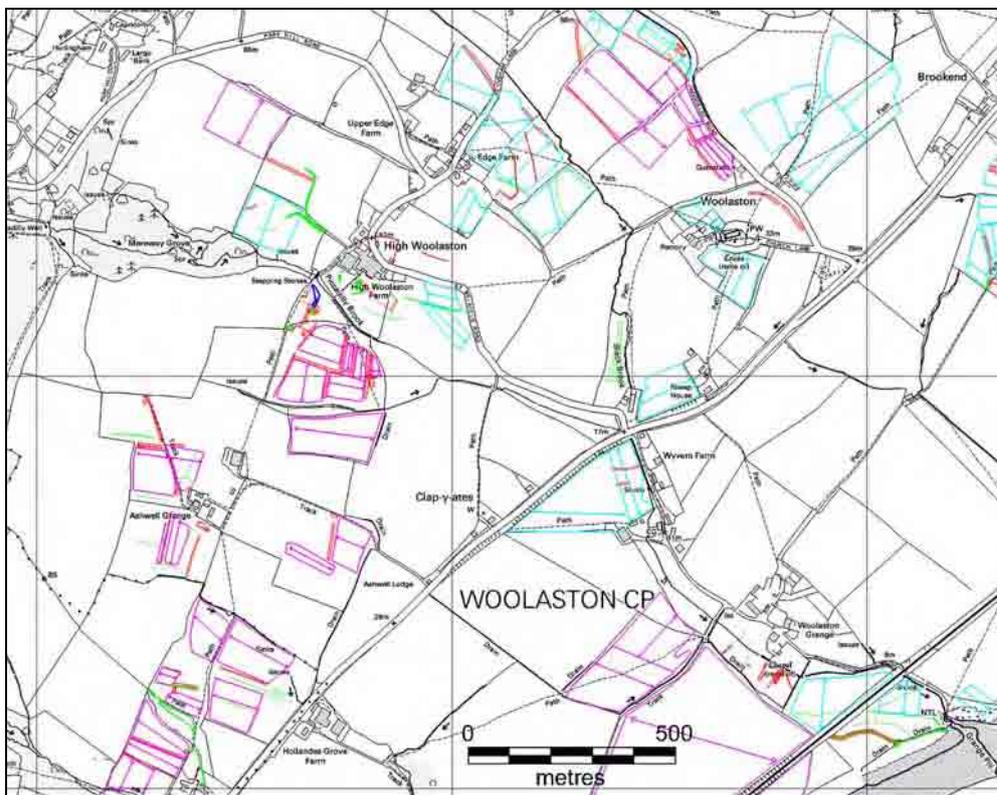


Figure 9-9 Scattered ridge and furrow blocks on the River Severn's western shore south of Woolaston

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Background map acquired from the Ordnance Survey

Settlement patterns and agricultural character along the two riverbanks were different, however. Aerial photographs of nucleated medieval settlement often show earthwork remains of buildings within yards (or tofts) facing onto a central

sunken streets (Riley and Wilson-North 2001: 95), as visible at Awre on the west bank (Figure 9.1). Other west bank settlements grew up along the main Chepstow to Gloucester road, a pattern that continues to the present with large villages and towns such as Minsterworth, Westbury-on-Severn Newnham, Lydney, Blakeney and Chepstow (Small et al 2006: 57). Conversely, on the river's east bank the evidence from the aerial surveys suggests that the medieval landscape was more thinly populated than across the river, with a dispersed settlement pattern that continues today. With the threat of inundations along much of the inner Severn Estuary, medieval settlement along the east bank of the River Severn was limited to higher ground such as Berkeley, Longney and Arlingham. The same flooding that restricted medieval settlement, however, also brought the alluvium that made the land so economically viable to cultivate. A study combining the documentary evidence with the NMP interpreted mapping could begin to address more the detailed research questions which are beyond the remit of this report.



Figure 9-10 The cliffs at Newnham on the west bank of the inner Severn Estuary

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On the inner Severn Estuary's estuarine margins on the west bank, the topography is influenced by the elevated bulk of the southern Forest of Dean Plateau. Between Beachley and Gloucester, the land mostly rises rapidly westwards from the river's

edge, with woodland only a few fields' distance from the River Severn. At Newnham and at Garden Cliff near Westbury, steep rising cliffs flank the river, protecting the adjacent land from flooding (Figure 9.10).

On the inner Severn Estuary's west bank between Gloucester and Westbury-on-Severn, the wooded slopes of the Forest of Dean give way to discrete areas of relatively flat, low-lying ground such as the river margins at Chaxhill and Minsterworth, where earthwork flood banks defend the fields and settlements. Further south at Lydney and Awre, reclaimed parcels of heavily drained grazing land are also protected by earthwork banks, behind which are blocks of medieval ridge and furrow, orchards, arable cultivation and meadow pasture for livestock (Small and Stoertz 2006: 62)



Figure 9-11 Minsterworth Ham and Corn Ham, notable for the absence of medieval and/or post-medieval ridge and furrow cultivation.

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Background map acquired from the Ordnance Survey.

On Corn Ham and Minsterworth Ham, the RCZAS aerial survey noted the relative absence of medieval or post-medieval ridge and furrow cultivation on the available aerial photographs, except where orchards formerly stood (Figure 9.11). In this

respect, the hams' characters differ somewhat to the western estuarine margins at Awre and Lydney as described by Small and Stoertz (2006, p.60-62). Both Hams are below 10m OD and the flood defence banks along the riverbank appear extant on the the first County Series I: 2500 and I: 10560 scale Ordnance Survey maps of Gloucestershire dated 1893. In the first half of the 19th century, 157 of Minsterworth's 1827 acres were common or waste land. On Corn Ham and Minsterworth Ham, south of Gloucester on the inner Severn Estuary's west bank, the soil was described as rich, mostly in pasture and meadow, with some arable cultivation and cider apple orchards (Lewis 1848: 321-325). Today, the two Hams are agriculturally improved grassland with some arable cultivation, mainly cereals and maize. Little of the orchards remain, although some cider apple trees were observed just behind the sea banks on Corn Ham, opposite Weir Green, during a field visit in 2007.

The Environment Agency (2005: 10) describes Minsterworth Ham and Corn Ham as being a typical washland (a floodplain where water is stored in time of flood), which is subject to frequent fluvial and tidal inundation, especially in winter. The loop of the River Severn surrounds the Hams on three sides, which suggests that flooding from breaches of the sea banks could be more severe than at other points on the inner estuary. The flat, low-lying topography exacerbates the effect of the flooding (see Figure 9.32).

Unlike the estuarine margins only a few kilometres downstream of Minsterworth at Longney, Rodley, Arlingham, Awre and Slimbridge, there is no evidence visible on the available aerial photographs of episodic land reclamation on Minsterworth and Corn Ham. These reclamation events are identifiable as irregular parcels of heavily drained pasture, protected by earthwork banks (see Figures 9.1, 9.4, 9.35 and 9.36). Several factors may account for this.

The character of the inner Severn Estuary appears to change in the 10kms of its course between Minsterworth and Corn Hams and Longney Sands. At Minsterworth Ham and Corn Ham, the land bordering the inner Severn Estuary does not seem to suffer from the instability from tidal forces as recorded further down the inner estuary at Awre and Slimbridge for example. On successive aerial photographs taken during the decades following the Second World War, the

effects of considerable erosion at points along the western shoreline of the inner Severn Estuary can be seen. This was especially marked around Longney Sands at Upper Dunball, Rodley, where Longney Crib constricts the River Severn's width to just 130m or so. Conversely, the Severn's course and banks at Minsterworth and Corn Hams appear almost unchanged from that illustrated on the 1st Edition OS map from the late 19th century. At Minsterworth, the River Severn is a single, narrow (60m to 80m wide) channel, and the shallow bifurcated channels and broad shifting mud and sandbanks visible from Longney southwards down the estuary are absent. The strong and complex hydrological forces acting upon the estuarine margins south of and around Longney appear to be lessened somewhat above that point by the Severn's physical character, reducing erosion up the inner Severn Estuary to Gloucester.

With the greater stability of Minsterworth and Corn Hams, erosion and flooding were less of an issue and the sequence of reclamation parcels and protective banks were not required. The earthwork defences continue to be maintained, rebuilt and realigned at Minsterworth and Corn Hams, however, as was witnessed during a field visit in 2007. Flooding and/or erosion are therefore active, but the effects are less marked at this point in the inner Severn Estuary than below Longney.

On the inner Severn Estuary's east bank in the Vale of Berkeley, between the roughly 15m high Hock Cliff at Fretherne and the cliffs at Aust which reach over 42m, and for nearly 26km down-river, much of the estuarine margin does not rise above 10m OD. Once reclaimed from salt marsh, this flat, low-lying alluvial land was suitable for arable cultivation despite the vagaries of sea-level changes and flooding, as evidenced by the depth of fertile alluvial deposits. One notable example was the so-called Great Flood of January 1607, which is recorded having breached coastal sea defences from Devon to South Wales, and up the Seven Estuary to Gloucester, whether this flood was caused by a tsunami or another natural phenomenon is still a matter of debate (Bryant and Haslett 2002; Haslett and Bryant 2004, 2008). The flood is estimated to have covered over 500 square kilometres of land and may have killed hundreds or thousands of people in coastal settlements. Coring reveals that sand was widely deposited across the flooded area and, at Oldbury-on-Severn and Gravel Banks, it has been argued that areas of cultivated coastal land were washed away (Allen and Fulford 1992).

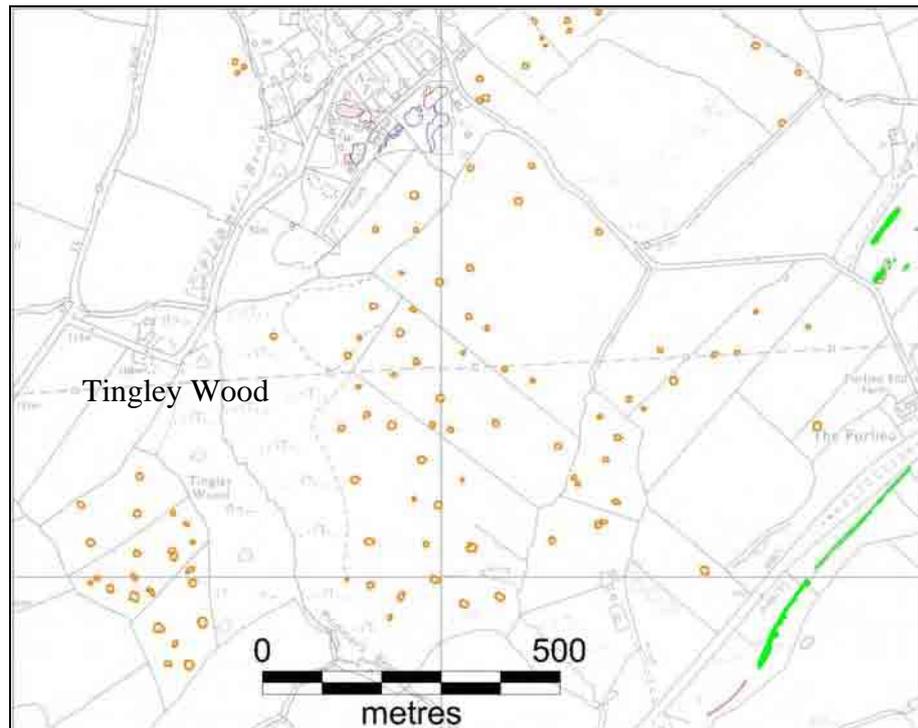


Figure 9-12 A large number of dark soil or cropmarks (shown in orange) reveal the locations of charcoal burning hearths or platforms (taken from Forest of Dean NMP survey mapping (Small and Stoertz 2006))

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Background map acquired from the Ordnance Survey

The industries of the Forest of Dean also influenced the character of the Severn's west bank in the NMP survey area. Cropmarks of a large group of medieval and/or post-medieval charcoal burning mounds are located on the slopes of Tingley Wood (Figure 9.12), Haytuft Wood, Horage Wood and The Purlieu north-east of Lydney, very near the estuarine margins (Small and Stoertz 2006). The group of charcoal burning platforms in the vicinity of Tingley Wood (e.g. SO 60 NE 133/HOB UID 1390393, SO 60 SW 142/HOB UID 1390389 and SO 60 SW 143/HOB UID 1390390) are either visible as cropmarks or as soilmarks, spreads of burnt material showing through the stubble of harvested fields. The locale is situated on a slope, with a nearby spring as a possible water supply (Small and Stoertz 2006). These industrial sites are situated within 2km of the inner Severn Estuary's western shore, on the periphery of the Forest of Dean. The proximity of this activity to the inner Severn Estuary's western shoreline contrasts with the eastern shoreline, where agriculture dominates from the medieval period to the 20th century. The field patterns in these areas suggest that these features were originally located within

woodland and/or common areas that have gradually become denuded through assarted fields.

In addition to farming, other historically attested industries related to fishing and river traffic on both sides of the river, with harbours and ports at Gloucester, Newnham, Lydney, Berkeley, Purton and Bristol (Avonmouth). The Forest of Dean's medieval industries of wood-cutting, charcoal burning, iron ore, coal and other mineral extraction would also have produced a more diverse economic focus and series of local identities.

9.3 Agriculture And Settlement In The Somerset Levels

9.3.1 Land Reclamation

Land reclamation has been a key factor in landscape development all along the inner and outer Severn Estuary's estuarine margins, but especially in the formation of the Somerset Levels. Between the end of the Roman period and the early medieval period (6th and 10th centuries AD), the sea defences along the outer Severn Estuary were breached and there was extensive marine transgression with the exception of the North Somerset Levels, which seem to have been less affected (Rippon 1993: 31). Following the 10th century AD the wetlands were gradually reclaimed between settlements, possibly to support an increasing population. In the Brue Valley, early piecemeal reclamation for meadowland occurred on the alluvial soils of the upland boundary, as they were free-draining and fertile (Musgrove 1997). By the 14th and 15th centuries there was coastal erosion and flooding, however, with a consequent change from arable to pasture (Rippon 1993: 32). There was little land reclamation into the wet, low-lying peat moors abutting the Polden Hills during the medieval period, and these were exploited for seasonal grazing, fishing and reed production (Musgrove 1997). Along the coastal salt marsh of the Somerset Levels, as well as on the peat moors inland, reclamation recommenced in the 17th century, with large-scale enclosure and draining occurring during the 18th and 19th centuries (Rippon 1993: 32).

Within the NMP survey area, Somerset's modern agricultural coastal landscape is an extensive area of low-lying flat arable farmland, enclosed and intersected by a complex network of large drains known as rhynes. This landscape has resulted

from intensive land management and the medieval to post-medieval periods are critical to the formation and appearance of the alluvial claylands which survive to the modern period, although the history of medieval settlement on the Levels is poorly understood (Rippon 1993). Rippon (1997a: 227) identified three main field system types in the Somerset Levels:

1. Between two and four large fields, in which were a series of unfenced strips in 'furlong' blocks enclosed all or most of a settlement's land in a regular, open field system of the classic Midland style and were generally located in areas of nucleated settlement such as Gordano;
2. The second field system was more irregular and open and appears on the coastal fringe of the Somerset Levels. The furlong blocks were located in numerous smaller fields that, in winter, would be open for grazing;
3. The final field system type was enclosed land in sole or independent private ownership, known as severalty.

Rippon (1997a) located some classic ridge and furrow cultivation similar to that in Gloucestershire on higher coastal areas such as the Gordano Valley and at Avonmouth, but it was otherwise largely absent in the Somerset Levels. Instead, plough-formed, linear, flat-topped ridging known as 'ridge and vurrow' was created to improve pasture and meadowland drainage. These large areas of 'ridge and vurrow' blocks were usually overlaid with a lattice system of narrow, linear hand-dug drainage trenches known in Somerset as 'gripes', as seen on the banks of the River Parrett in Figure 9.13 (Rippon 1997a: 224). Water drained from the narrow ridge and vurrow into gripes and thence into boundary ditches, themselves connected to the larger network of rhyes (Rippon 1997a: 224).

Earthworks of these features dominate the Somerset Levels' landscape aerial photographs from the 1940s. The ridging of the land aids surface drainage, particularly in meadow land. Probably dating to the post-medieval period, in aerial photographs ridge and vurrow can be distinguished from arable ridge and furrow as the latter tends to give a bolder relief due to prolonged ploughing, and is typically curved or reverse-S in shape. Ridge and vurrow has less relief with straighter and narrower ridging.



Figure 9-13 Contiguous blocks of improved and drained land from much of the low-lying agricultural land between Portishead and Minehead in the RCZAS survey area. The fields are bounded by ditches or rhyes, and show medieval and/or post-medieval ridge and furrow underlying the grid of linear drainage gripes

RAF/CPE/UK/1924 2006 16-JAN-1947 © English Heritage (NMR) RAF Photography

Extensive blocks of ridge and vurnow have been recorded along the low-lying land between Avonmouth and the River Parrett's estuary, and it is an important aspect of the history of the land management of the Levels. Similar methods of surface drainage may have been used since the medieval period and possibly earlier (Rippon 1997a). The cutting of artificial river channels such as the diversion of the River Brue that discharges into Bridgwater Bay south of Burnham-on-Sea, also formed part of the drainage of the wetlands. The cutting of ridge and vurnow and gripes suggests a post-medieval intensification of land reclamation, possibly to meet an increase in demand for land in response to population increases and social changes.

The success of medieval and post-medieval land improvement and drainage in the low-lying parts of the Somerset survey area resulted in the stabilisation of the land and allowed conversion in the late 20th century from pasture to arable agriculture.

As modern techniques of under drainage and mechanical pumping have been developed and adopted, however, the ridge and vurrow, gripes and rhyes are not as important as they once were. Evidence on aerial photographs from the 1970s onwards is testament to this, showing that much of the ridge and vurrow and gripes have been plough-levelled, although the larger rhyes remain in use.

9.3.2 Settlements

The Somerset Levels are not completely flat, as the recurrent inundation events deposit sediment which results in areas closest to the coast and tidal waterways becoming more elevated than those further inland. These elevated coastal fringes have clear advantages as settlement sites. There are a number of significant modern settlements in the South Somerset Levels area, the largest being Burnham-on-Sea and Highbridge, north of which are the villages of Berrow and Brean where residential development has covered much of this coastal strip to cater for tourism.

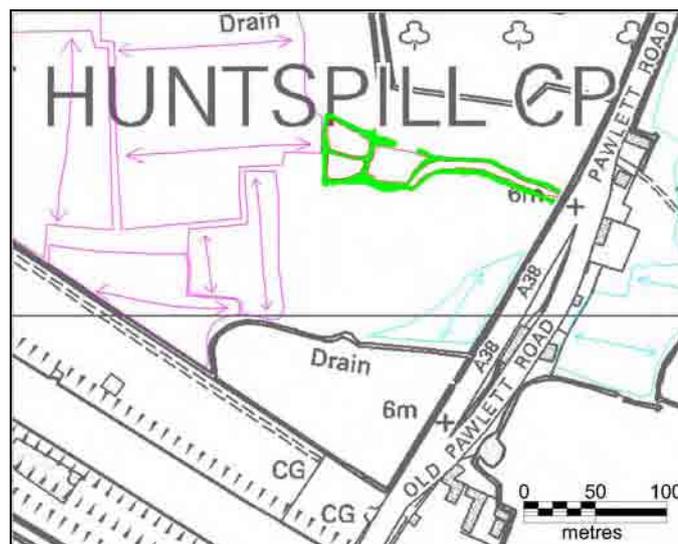


Figure 9-14 The earthwork remains of the deserted medieval/post-medieval farmstead at Huntspill.

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Background map acquired from the Ordnance Survey.

South of the River Brue, settlement has been less affected by such expansion. South of Huntspill village, the earthwork remains of a medieval or post-medieval deserted farmstead (ST 34 NW 34/HOB UID 617571) (Figure 9.14) were identified, consisting of a trackway leading directly from the course of the modern A38 road to three building platforms or enclosures and boundary ditches.

Within the area of the River Parrett the large village of Comwich is the main settlement focus. Other settlements around the Parrett's estuary were more dispersed, consisting mainly of small hamlets and farmsteads. This dispersed settlement pattern resulted in much land being held in severalty, rather than as communal open field systems, except in a few cases where settlement was more nucleated (Rippon 1997a: 227).

In Steart village the Severn Estuary RCZAS survey did not identify a supposed deserted medieval village (DMV) (ST 24 NE 3/HOB UID 617146) (Aston 1978), but did locate a raised platform (ST 24 NE 62/HOB UID 1450214) indicative of an artificially created earthwork. This feature, known locally as 'The Pound', continues to be used as a refuge for cattle (Figure 9.15) during flooding or waterlogging of the low lying pasture. Indeed, some aerial photographs of this site revealed cattle clustered on the raised earthwork.

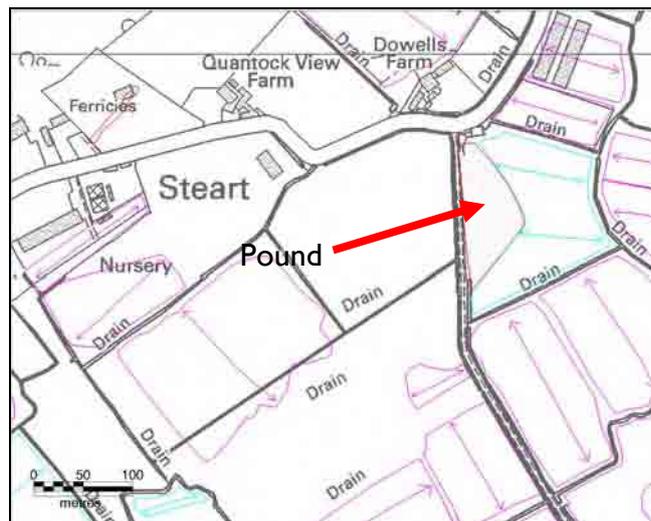


Figure 9-15 The cattle pound immediately south of Dowells Farm, Steart, visible as a roughly triangular earthwork shown by the arrow.

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Background map acquired from the Ordnance Survey.



Figure 9-16 An aerial photograph of a mill mound enclosure (arrowed) at Wall Common, Steart.

RAF CPE/UK/1944 1176 23-JAN-1947 © English Heritage (NMR) RAF Photography

The RCZAS aerial survey mapped and recorded other medieval or post-medieval features. Windmill mounds were recorded at various sites in Somerset and Gloucestershire, including one opposite Wall Common, near Steart (ST 24 SE4/HOB UID 191202), one of two between Stolford and Steart villages. Possibly known as Theat windmill, it is only one of many documented windmill and watermill sites that attest to medieval agricultural activity on the coastal margins west of the River Parrett's estuary (Dunning and Elrington 1992: 146-152) (Figure 9.16).

Similarly, the NMP survey identified and recorded the earthwork remains of stack stands around Bleadon Level and Uphill on which winter fodder or harvested hay and corn was stored to dry. Defined by either individual subrectangular or circular earthwork mounds and often enclosed by drainage ditches (Figure 9.17), they may be of medieval or post-medieval date. However, it is notable that some examples appear to post-date the gripes, although it may be that the gripes had been dug around them.



Figure 9-17 Eight stack stands are visible on this aerial photograph, of which three are still in use. The land by the River Axe is low-lying and prone to flooding hence the need for some drier, elevated areas

RAF/CPE/UK/1869 3317 04-DEC-1946 © English Heritage (NMR) RAF Photography

9.4 West Somerset - The Quantock Hills And Exmoor

9.4.1 The Quantock Hills

The Quantock Hills NMP survey recorded evidence of medieval and post-medieval agricultural regimes west of the Parrett estuary, although the change to a more upland topography is reflected in the field system forms.

The Quantock Hills coastal strip appears to have had a mix of medieval agricultural regimes including villages cultivating common fields, and scattered settlements cultivating enclosed land (Aston 1988; Riley 2006: 108). The RCZAS aerial survey of the Quantocks Hills coastline recorded both regimes. On the Quantock Hills, many medieval settlements began with an infield/outfield agricultural regime, heavily manuring improved land closest to farmsteads or hamlets for arable cropping (Riley 2006: 108). The Outfields were further away from settlements, usually of poorer quality and used for grazing, heather and gorse collection and occasional cultivation (Rippon 2002: 54). There is also evidence that some manors operated common fields, also known as open field agriculture, along the coast. Farmers cultivated unenclosed strips of land located in several large fields near the villages (Riley 2006: 108).

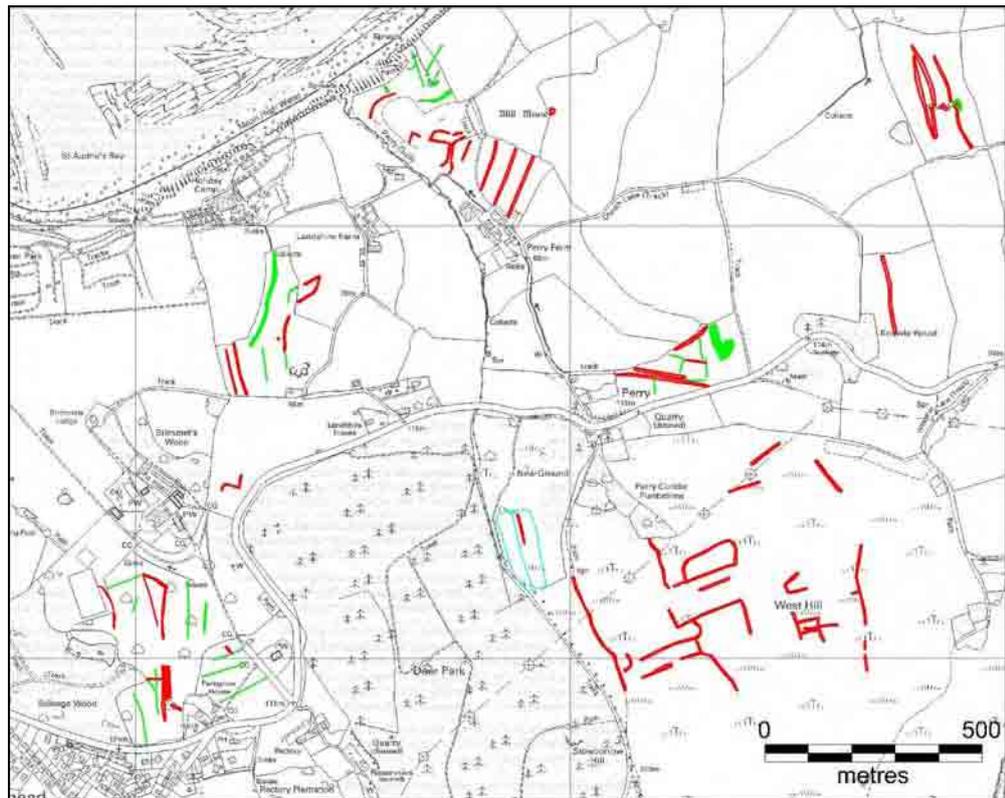


Figure 9-18 The earthwork remains of an extensive medieval and/or post-medieval field system between West and East Quantoxhead

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The earthwork remains of extensive medieval and/or post-medieval field systems (HOB UID 981397/ ST 14 SW49) cover much of West Hill between the villages of East and West Quantoxhead, as shown in Figure 9.18. Defined by low narrow banks, the fields were laid out in a regular pattern and some contain low, narrow ridge and furrow, but variations suggest that the features probably represent several phases of enclosure of the common land. Such relict field systems probably represent the remains of outfield cultivation (Riley 2006: 131).

A similar medieval and/or post-medieval field system is located north of Knighton (HOB UID 1365799/ST 14 NE 24), much closer to the coast (Figure 9.19). The system is visible as a combination of low earthwork banks and cropmarks, although it is unclear whether the banks defining the strips were plough headlands, or if they were field boundaries constructed along the line of ridge and furrow cultivation that is no longer visible.

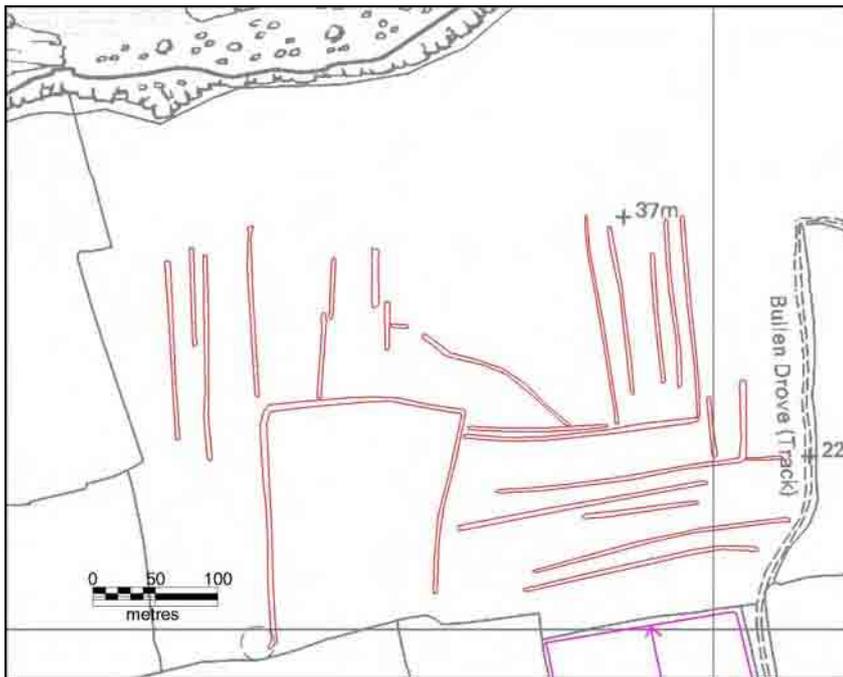


Figure 9-19 The earthwork remains of an extensive medieval and/or post-medieval field system on the Quantock Hills coast, north of Knighton village.

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Background map acquired from the Ordnance Survey

In contrast, the coastal villages of Lilstock and Kilton appear to represent the medieval common field agriculture prior to enclosure (Riley 2006: 108) (Figure 9.30). At Kilton, documentary evidence from the 14th century details the production of mostly wheat and lesser amounts of peas and beans, along with occasional barley crops (ibid.: 109).

Post-medieval agricultural activity on the Quantock Hills coastal strip was focused around land enclosure whose boundaries were often influenced by extant parish boundaries and trackways. It is thought that some enclosure began as early as the 13th century and that the small-scale cultivation of common lands continued into the post-medieval period until Parliamentary Enclosure. There was also the creation of some 'polite' landscapes, with the creation of formal and ornamental gardens such as those at East Quantoxhead (Riley 2006).

On the low lying wetland east of Minehead, now occupied by Butlins holiday camp, a significant area of post-medieval land improvement drainage in the form of ridge

and vurrow, gripes and rhynes was also recorded by the Severn Estuary RCZAS aerial survey, as shown in Figure 9.20. The fact that Butlins was able to develop this former marshland of countless meandering tidal channels and salt marsh is testament to the effectiveness of the earlier drainage.



Figure 9-20 Vertical image of the land now occupied by Butlins holiday camp at Minehead. The site is dominated by gripes and rhynes dug in an attempt to drain the former salt marsh.

RAF/CPE/UK/1980 3009 11-APR-1947 © English Heritage (NMR) RAF Photography

Settlement

The main settlements along the Quantock Hills coastline and Quantocks Fringes were Shurton, Burton, Knighton, Lilstock, Kilve, Kilton, West and East Quantoxhead, Doniford and Watchet. Population increase and economic prosperity up to the 13th century was followed by population decline as a result of climate change and the 'Black Death', possibly leading to a change from arable cultivation to pastoralism (Riley 2006). Medieval settlement along the Quantock Hills coastline appears to have been a mixture of farmsteads and hamlets, most of which have been subsequently destroyed, and also some manorial estates.

Around the village of Kilton, the NMP survey identified indistinct earthworks (Figure 9.21), representing possible medieval or post-medieval building platforms and a number of parallel ditches, northwest of which may be the remains of a drainage or irrigation system.

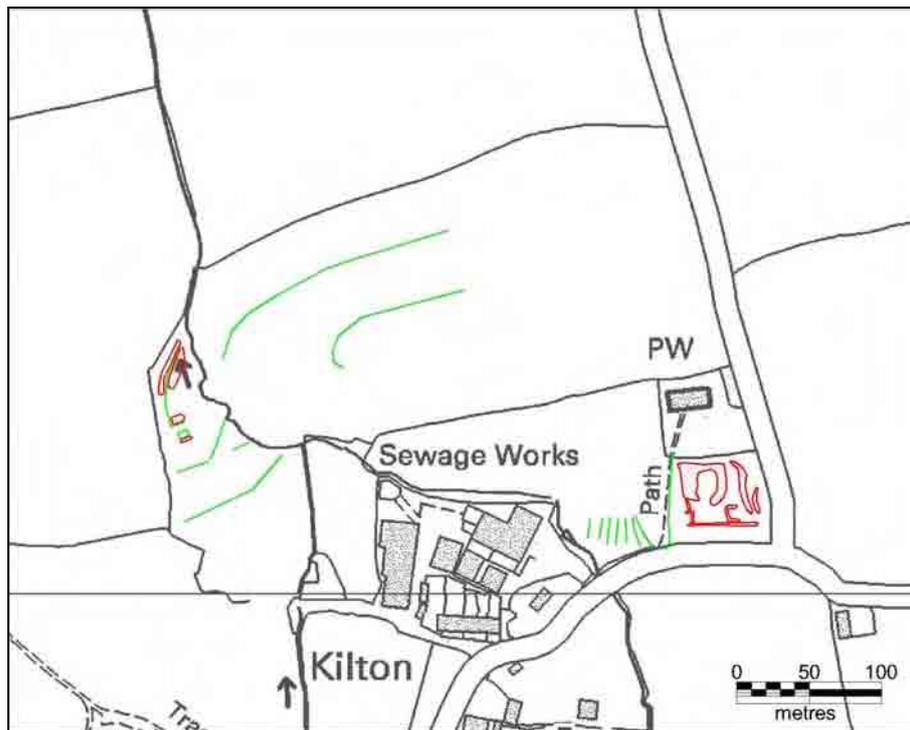


Figure 9-21. Earthwork remains of a possible settlement at Kilton

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Background map acquired from the Ordnance Survey

A medieval settlement at Lilstock is well documented (Dunning 1985), and the RCZAS aerial survey also recorded medieval and/or post-medieval earthworks including toft and croft boundaries, building platforms and a possible water meadow (Figure 9.22). Most of the earthworks appear plough levelled in more recent aerial photographs but it is possible that some remain upstanding.

West and East Quantoxhead, Kilve and Kilton were medieval manorial estates around which deer parks were created, the remnants of which are still visible in the modern landscape. In fact, the Quantock Hills coast is notable for its number of medieval deer parks and Riley (2006) suggests that the example at East Quantoxhead, one of many owned by the Luttrell family, enclosed three sides of

the village and extended to the coastal edge. This was a managed landscape of woods and pasturelands and the economy included coppiced woods, cattle and pig grazing, rabbit warrens, fishponds and deer management. The deer parks diminished in size and importance from the 15th century onwards, however, and most were converted to arable cultivation (Riley 2006).

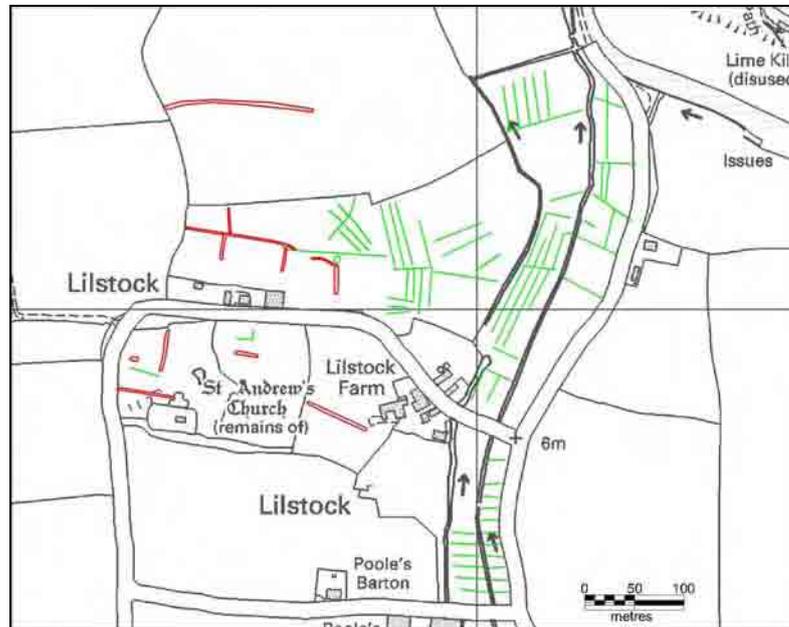


Figure 9-22. Earthwork remains of a possible settlement at Lilstock

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9.4.2 Exmoor

On Exmoor, relict medieval and post-medieval field systems extend across upland areas between Minehead and Porlock Bay, defined by field walls of earth and stone. Some field systems survive as linear earthwork banks in places such as Bossington Hill and North Hill. These field patterns continued in use during the post-medieval period. Estimates suggest that by the 16th century around 40000 sheep grazed on the moors in springtime, as well as cattle and ponies (Riley and Wilson-North 2001: 97). The unimproved character of Exmoor's upland grazing areas has prevented the destruction of such field systems by later arable cultivation.

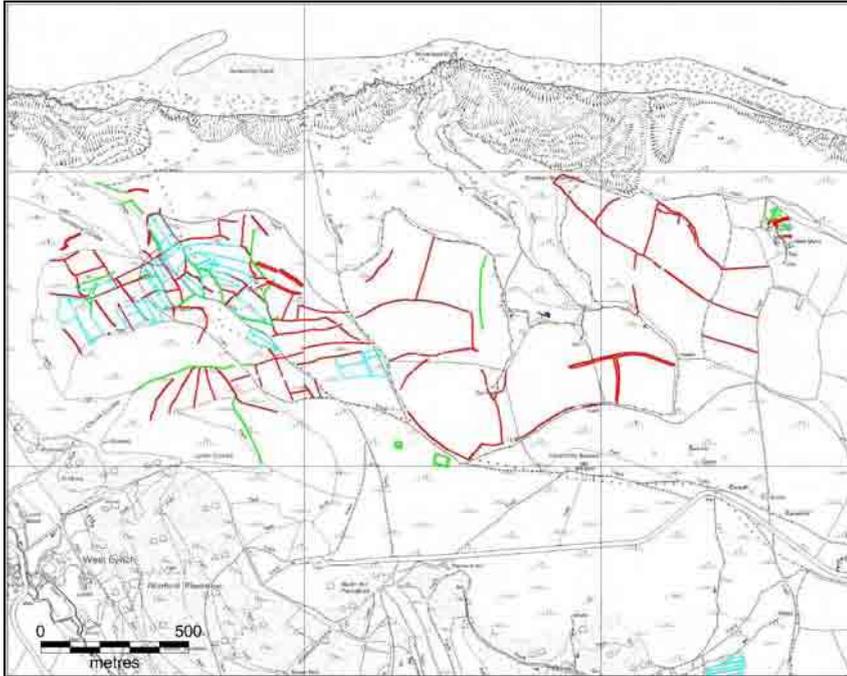


Figure 9-23 An extensive medieval and/or post-medieval field system on Bossington Hill, some fields show evidence of ridge and furrow

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Background map acquired from the Ordnance Survey.

The most extensive medieval and/or post-medieval field system is on Bossington Hill (SS 94 NW 52/HOB UID 1119198) (Figure 9.23). The well-preserved earthworks cover an area about 1km², defined by field banks of earth and stone forming sub-rectangular plots. The field system also continues eastwards where it survives as slight earthworks in improved pasture. On the slopes above East Combe are substantial lynchets up to 1m high, with associated clearance cairns mainly evident on the northern edge of the field system. The central portion of the field system is obscured by thick gorse in places hindering visibility, but aerial photographs do indicate some field banks as earthworks in this area. Many fields also show evidence of ploughing, with narrow ridge and furrow visible as slight earthworks. Documentary evidence records wheat cultivation on such discrete upland ridge and furrow blocks in the 16th century (Cunliffe 2006: 65). A number of small quarries scattered around these field systems may have supplied stone for the field banks (Riley and Wilson-North 1997). It is likely that other small quarries on upland areas also provided stone for field walls and buildings.

Settlement

The topography of Exmoor's landscape has long favoured dispersed settlement, a pattern that continues to the present day (Riley and Wilson-North 2001: 81).

Hamlets and isolated farms are the predominant modern settlement forms on the north-east coastline of Exmoor, and many medieval hamlets and farmsteads were abandoned, a result of changing environmental conditions, farm amalgamations, marginal locations, changing farming practices and agricultural improvements (Ibid.: 125). Many farmsteads were abandoned in the 19th century, but this process has continued into the 20th century and present day.

Exmoor's medieval farmsteads share many characteristics with deserted upland settlement sites on Dartmoor. These settlements are rather haphazard, with buildings placed apparently *ad hoc* and representing the remains of several holdings together, and few discernible road patterns or property boundaries (Riley and Wilson-North 2001: 95). Sometimes several clustered farmsteads formed hamlets. Many farmsteads were sited at the head of combes, which afforded some shelter and access to running water. Few traces of the rectangular houses, cattle byres (known as shippons) and grain barns remain, mostly as earthworks or stony banks, terraced building platforms and some stone wall footings (Ibid.).

The deserted hamlets at Bramble Combe (SS 94 NW 27/HOB UID 36840) and Grexy Combe (SS 94 NW 26/HOB UID 36839) (Figure 9.24), both believed to be medieval in origin, are still visible on recent aerial photographs. Grexy Combe consisted of a cluster of four haphazardly sited, rectangular buildings (Riley and Wilson-North 2001: 94).

There were also larger medieval settlements on the Exmoor coastline. The medieval town of Dunster dates from the 12th century, and was associated with the woollen industry. It developed around the 11th century Dunster Castle (SS 94 SE 6/HOB UID 36863), Dunster Priory, and a now vanished harbour on the River Avill (Riley and Wilson-North 2001: 120-121). Dunster Castle also had a large adjacent medieval deer park (SS 94 SE 35/HOB UID 36936), 100 acres of pasture and wood recorded in AD 1428 as 'the Hanger Park' (Figure 9.25). The castle's estates also included other parks at Minehead and Marshwood (Dodd 1981: 37).



Figure 9-24 An example of a deserted medieval settlement located at the head of Grexy Combe.

NMR 1459/197 01-MAR-1979 © Crown copyright. NMR



Figure 9-25 The medieval village of Dunster adjacent to Dunster Castle, with its ornamental parkland and remnants of former deer park

RAF/CPE/UK/1980 4216 11-APR-1947 © English Heritage (NMR) RAF Photography

On the coast, medieval Porlock developed because Porlock Bay was one of the few easily accessible points to the Severn Estuary west of Minehead, with rocky and wooded high cliffs elsewhere along the coast making the shoreline inaccessible (Riley and Wilson-North 2001: 143).

Farms dating from the post-medieval period now dominate the Exmoor landscape. During the post-medieval period, courtyard farms replaced medieval farmstead hamlets, in some instances evolving from the latter. The courtyard farm is characterised by a single farmhouse and associated outbuildings focused around a central yard area. Other courtyard farms were built as part of post-medieval agricultural expansion, as model farms, or they developed around older hill farms (Riley and Wilson-North 2001: 121-122). Some courtyard farms were subsequently abandoned, such as at Combe Meadow (SS 84 NE 37/ HOB UID 1127383) south of West Porlock which remains visible only as indistinct stone walls and an enclosure ditch.



Figure 9-26 The abandoned post-medieval West Myne Farm, with earthworks of possibly medieval date

NMR 21073/21 9-FEB-2001© English Heritage. NMR

The farms of West Myne (SS 94 NW 28/HOB UID 36841) and East Myne (SS 94 NW 29/HOB UID 36842) were in use during the 19th century, but were both requisitioned for tank training during the Second World War. At West Myne farm (Figure 9.26), earthworks north-west of the site may indicate an earlier phase of the farmstead, and might be the deserted site of Myne mentioned in the Domesday Book (Thorn and Thorn 1980).

Post-medieval estates also played a significant role in the development of Exmoor's coastal settlement pattern, particularly during the 19th century (Riley and Wilson-

North 2001: 132). These estates were often assemblages of various manors and farmsteads and included a variety of landscape features, from formal parkland and deer parks to the duck decoy at Porlock Marsh (Ibid.: 133). At Dunster Castle, a substantial landscape and deer park (SS 94 SE 35/HOB UID 36936) was laid out during the mid to late 18th century on the site of the medieval park (see Figure 9.25). The castle grounds also included 6 hectares of 18th century and 19th century formal terraced gardens (SS 94 SE 87/HOB UID 621258) (Dodd 1981: 36-37).



Figure 9-27 The post-medieval estate of Ashley Combe at Porlock Weir, with remains of Italianate terraced gardens and tunnels (upper left).

NMR 18529/30 12-OCT-1999 © English Heritage. NMR

In Porlock Bay, the house and estate of Ashley Combe (SS 84 NE 31/HOB UID 1127301) was built in the mid-19th century. Terraced Italianate gardens and tunnels were cut out of the coastal cliffs, and are visible in the top left of Figure 9.27, taken in 1999, although the main Italianate house itself was destroyed in the early 1960s. The numerous Corsican pines on the coastal slopes were planted by the estate as cover for deer (Riley and Wilson-North 2001: 136).

9.4.3 Water Meadows

In the Severn Estuary RCZA project area, the aerial survey identified a number of artificially flooded meadows dating to the post-medieval period along West Somerset's coastal hinterland, and on the west bank of the inner Severn Estuary. Flooded meadows are regarded as "... one of the most important agricultural

innovations of the post-medieval period” (Brown 2005: 84). By flooding the meadow between November and February with water that was several degrees above air temperature, the ground temperature remains above five degrees Celsius. The ground is prevented from freezing and grass growth is thus promoted for lambs and sheep in early spring. The meadows can be flooded again in May to maintain moist conditions conducive to grass growth and ensure a summer hay crop (Brown 2005: 85; Cook and Williamson 2007). There were two principal types of artificially irrigated meadow: the ‘bedworks’ and the ‘catchwork’ system, the latter also known as a ‘catchmeadow’ or catchwater leat (Brown 2005: 84). In West Somerset, both water meadow types have been identified by the RCZAS aerial surveys.

Bedwork water meadows used rivers, streams or rhyes as water sources. Damming the watercourse produced a depth of water about one metre above its natural level, at which height a sluice led the water along channels which had been dug along the top of convex ridges known as carriers, carriages or panes. The water then flowed over the ridges and collected in linear furrows known as side drains, between the panes (Brown 2005: 88; Cook and Williamson 2007). This can sometimes give water meadows the superficial appearance of ridge and furrow cultivation. The side drains led the excess water to a tail drain that returned the water to its original source. Bedwork systems were expensive to construct and required the employment of skilled ‘drowners’, whose job it was to regulate the flow of water and manage the water meadow (Cook and Williamson 2007).

Possible bedwork water meadows were identified by the Forest of Dean NMP survey, east of Tidennham village, close to the western shore of the inner Severn Estuary (ST 59 NE 48/HOB UID 1389482 and ST 59 NE 53/HOB UID 1389511). Alongside ridge and furrow cultivation blocks, a complex series of linear ditches may simply be the remains of a land improvement drainage system, but it is possible that they once functioned as a water meadow (Figure 9.28) (H. Winton pers. comm.).

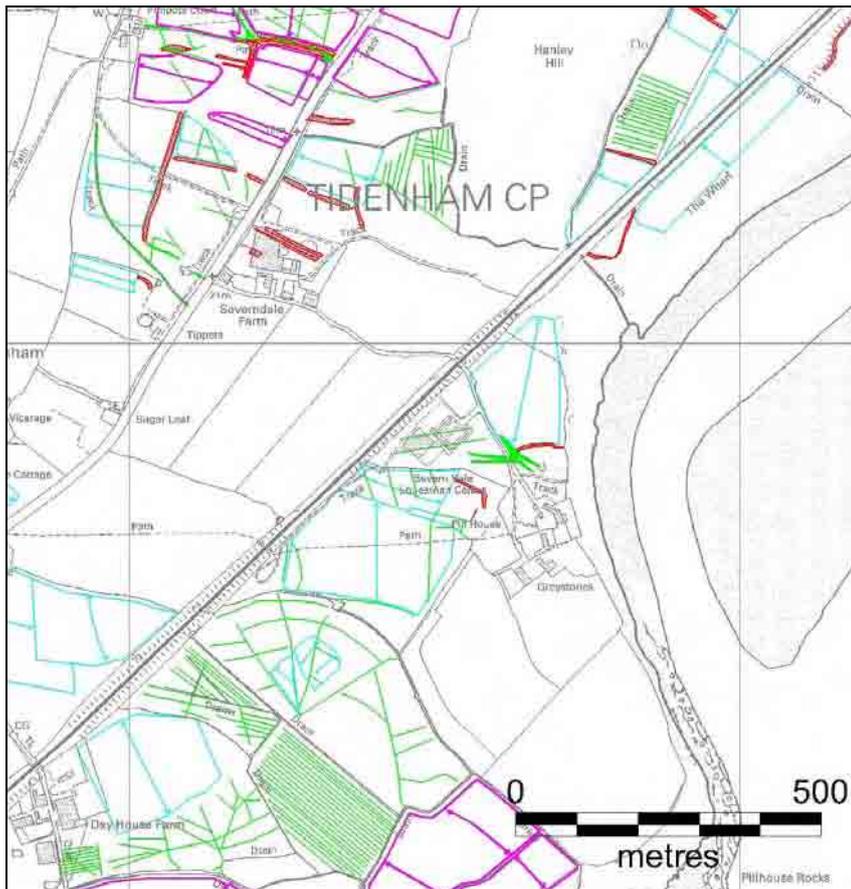


Figure 9-28 Possible post-medieval water meadows east of Tidenham village, on the west bank of the inner Severn Estuary

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Background map acquired from the Ordnance Survey

Several possible bedwork water meadows have also been recorded as part of the NMP survey of the Quantock Hills, with complex drainage ditch systems located along the low-lying coastal strip.

In Figure 9.29, possible bedwork water meadows are located between Knighton village and the Severn Estuary coastline. Two sections of ditch systems (bottom left and right) are adjacent to Bum Brook. However, two other systems (middle and upper right) appear to be located adjacent to 'issues' or springs, with drains leading the water eastwards. The use of water meadows dating to the medieval period has also been documented at Perry by association with field names (Riley 2006: 135), although no water meadow features were identified at that particular site by the Quantock Hills NMP survey.

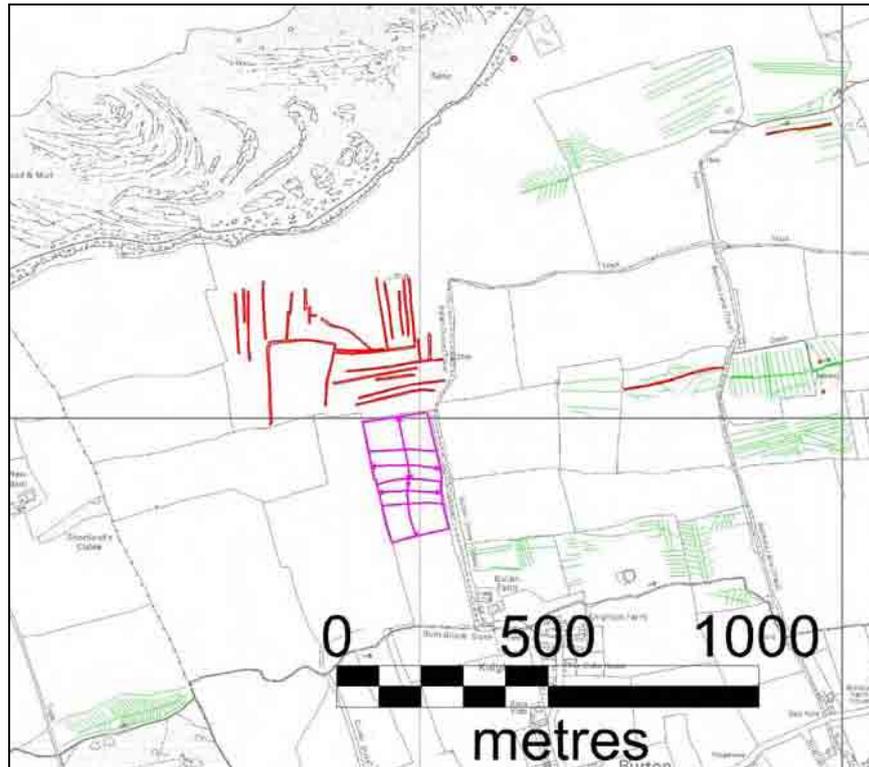


Figure 9-29. Possible bedwork water meadows recorded by the Quantocks Hills NMP around Knighton.

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Background map acquired from the Ordnance Survey

Figure 9.30 shows possible bedwork water meadows around Kilton and Lilstock villages, along with the topographic contours. As can be seen, these ditch systems are within a small basin approximately 2km (east-west) by 0.5km (north-south) across, that drains into the outer Severn Estuary via a small north-south running valley east of Lilstock. The drainage ditches have been constructed between 0-20m OD, in each case adjacent to 'issues' or a larger drainage ditch. It is also possible, however, that these drainage complexes are the remains of post-medieval land improvement as recorded around the River Parrett a few kilometres to the east (H. Winton pers. comm.). These features should be investigated further to determine their function, as part of the Phase 2 fieldwork of the Severn Estuary RCZAS.

On the uplands of Exmoor and the Quantock Hills, catchmeadows are notable features and not generally found on other uplands (Cook and Williamson 2007). The upland farmsteads with catchmeadows were generally sited below or on an equal height with water sources, such as springs or streams, but above the

Somerset was still in use up to the 1960s (Cook and Williamson 2007:). The NMP survey identified nine catchmeadow systems on Exmoor between Culbone Hill and North Hill. All the post-medieval upland farmsteads that have been identified on Exmoor and on the Brendan Hills have catchworks nearby, most located between 200m and 400m OD.

An example of a catchmeadow, although a few metres outside the RCZAS survey area, is Wydon Farm near Minehead. A spring above the farm ran through the farmyard, collecting cattle dung and pooling in a large pond that was emptied by the farmer by means of a plug into a head drain, and onto the meadow below (Cook and Williamson 2007). As can be seen in Figure 9.31, a catchmeadow system north-west of Westcott Farm, Pitt Combe (SS 84 NE 36/HOB UID 1127380) is also typical. Water was transported from springs above the farm and carried by curvilinear field gutters cut parallel to the contours, allowing water flow down the slopes and back into the watercourse.

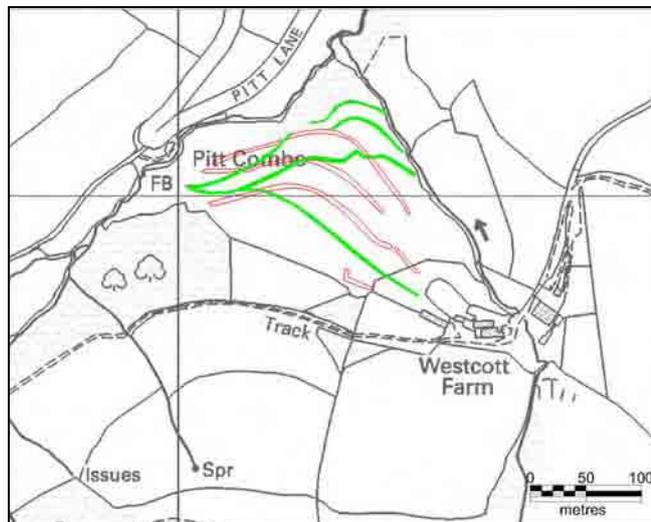


Figure 9-31 The earthwork remains of a catchmeadow system at Westcott Farm on Exmoor, West Somerset.

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9.5 Flood Defences And Land Reclamation

9.5.1 Introduction

In the formation of the Severn Estuary landscape, reclamation was an important process (Rippon 2000). The Severn's tide and flooding are powerful influences.

On Bossington Beach on Porlock Bay, the 5km long shingle ridge breached severely as recently as the winter of 1996, with flooding of the land behind the barrier and the subsequent development of saltmarsh (Orford 2007). At Gloucester, breaching of the flood defences have been a historic fact, as shown in the aerial photograph taken west of the city in 1950 (Figure 9.32). Flood defences are still regularly breached, most recently in the summer of 2007 when farmlands at Minsterworth Ham, Sud Meadows, Oxlease and Port Ham were inundated. This flood event very nearly caused the evacuation of around 500000 people living in and around Gloucester, when floodwaters nearly overwhelmed a vital electricity station at Oxlease.



Figure 9-32 The flooding at Port Ham at Over and Maisemore west of Gloucester in 1950.

RAF F14/540/292 0063 16-FEB-1950 © English Heritage (NMR) RAF Photography

Sea banks are usually recorded on historic maps but where relict sea banks or coastal changes have not been depicted, they can sometimes be mapped from aerial photographs. Earthwork sea or flood defences have probably been constructed along the Severn Estuary since the Roman period to protect and stabilise reclaimed coastal wetland, and to protect agricultural land from tidal inundations (Allen and Fulford 1987). Sea defences are expensive to construct and maintain and there is

plenty of documentary and physical evidence to illustrate that they have often been breached, incurring further reconstruction costs. However, the reason for such expenditure is the economic return provided by the nutrient rich, productive reclaimed land. The trade-off for this productivity is the loss of the diverse natural resources afforded by the natural salt marsh estuarine margin (Rippon 2000).

Dating of flood defences from aerial photographs alone can be difficult because their basic form changed little from medieval to modern times. There is documentary evidence to suggest that at least some of the flood defences recorded in the survey area may have medieval origins. For example, defences alongside the River Axe in Bleadon are first mentioned in documents from AD 1129 (Havinden 1981). Some authors even propose Roman origins for some sea walls on the Severn Estuary, as at Elmore in Gloucestershire (Allen and Fulford 1990b) and on the banks of the River Banwell in Woodspring Bay (Allen 1997a). The earthwork flood defences cannot be accurately dated from the aerial photographic record alone and therefore have been recorded as both medieval and/or post-medieval features.

9.5.2. Sea And Flood Defences In Gloucestershire

In Gloucestershire flood defences were constructed to prevent winter flooding and to protect the reclaimed fields on both banks of the River Severn. Flooding of the Severn floodplain can be extensive, with some farmsteads reduced to small 'islands' within the flood waters (Figure 9.33).



Figure 9-33 The Severn floodplain at Minsterworth Ham in 2000, showing the extent of the flooding of the inner Severn Estuary at Gloucester

NMR 21083/17 14-DEC-2000 © English Heritage. NMR

Flood defences at Elmore may originally have had Roman origins (Allen and Fulford 1990b), although dating these features is problematic and most of the flood defences visible today are relatively modern repairs and upgrades. Sections of medieval and post-medieval banks, however, are still likely to be in use. To the east of Longney, as seen in Figure 9.34 and 9.36, three linear parallel medieval or post-medieval earthwork banks (SO 71 SE 35/HOB UID 1448157) may have been flood defences to protect Longney village and its agricultural land from the landward side. It is thought that the course of the River Severn once ran to the east of the village (Elrington et al. 1972) and land there remained poorly drained and was still liable to flooding in 1946. To the west of Longney, a series of former sea walls record at least two phases of land reclamation, with apparent ridge and furrow earthworks within reclaimed fields more likely related to land improvement drainage and orcharding than medieval arable cultivation.



Figure 9-34 Flooded areas to the east of Longney ('long island') indicate a possible former channel of the River Severn. The drained fields are protected by three linear earthwork banks. To the west of the village, a series of sea banks record successive land reclamations.

RAF/CPE/UK/1913 3045 30-DEC-1946 © English Heritage (NMR) RAF Photography

The Severn Estuary RCZAS aerial survey noted attempts to drain and improve low-lying, wetter fields by the construction of linear complexes of shallow drainage ditches that emptied into larger and deeper rhynes at the field boundaries. Examples of this are recorded west of Rodley (SO 71 SW 53/HOB UID 1445648), east and south of Longney (SO 71 SE 31/HOB UID 1448150 and SO71 SE 42/HOB UID 1448213) (Figure 9.34), at Elmore (SO 71 NE 22/HOB UID 765785), Port Ham (SO 81 NW 439/HOB UID 1448922) and at Hempsted (SO 81 NW 440/HOB UID 1448925 and SO 81 NW 441/HOB UID 1448926).

Similar sea banks and episodes of land reclamation were recorded by the RCZAS survey at Rodley, Arlingham, Awre, Slimbridge, Lydney and Berkeley. Possible medieval sea defences at Awre and at Slimbridge, for example, survive behind the current shore defences (Allen 1986) (Figures 9.1 and 9.35).



Figure 9-35 A complex sequence of drainage and reclamation at Slimbridge and Awre (mapping taken from Forest of Dean NMP survey)

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Background map acquired from the Ordnance Survey.

Medieval and post-medieval meadows were concentrated on reclaimed land protected by phases of earthwork sea banks (Allen 1992). Linear drainage features and in some cases more substantial rhynes are visible within the enclosed land. Examples of this are visible at Lower Dumball, Rodley (SO 71 SW 55/HOB UID 1445663) and Arlingham Warth (SO 71 SW 46/HOB UID 1445579) (Figure 9.4) and west of Longney (SO 72 SE 40/HOB UID 1448184). Located within these parcels of land reclamation are often blocks of ridge and furrow, much of which is straight and narrow: for example, between Longney village and the river (Figure 9.36). Rather than being created as part of an arable agricultural regime, these are probably aids to land drainage. The large reclaimed area at Lower Dumball (SO 71 SW 55/HOB UID 1445663) (Figure 9.4) has no evidence of ridge and furrow land improvement, suggesting it was reclaimed for use as meadow pasture, not arable,

or for orchards which were not planted following the decline of the cider industry in the 19th century (Newman 1983).



Figure 9-36 Land reclamation between Wicks Green and Longney

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Background map acquired from the Ordnance Survey.

It is likely that riverbank erosion has removed earlier phases of sea bank defences. On Upper Dumball at Longney Crib, the shoreline has receded nearly 50m, as recorded on aerial photographs taken between 1946 and 1970 (see lower centre of Figure 9.36). Drainage ditches (SO 71 SW 41/HOB UID 1445354) on the eroding, incising side of the river will thus only represent later phases of flood defences. At Berkeley Pill, Gloucestershire, there is evidence of significant sea defence banks constructed along both banks of the Pill all the way to the village of Berkeley (Figure 9.37). The sea defences also extend along the inner Severn Estuary's east bank, both north and south of Berkeley Pill's mouth.

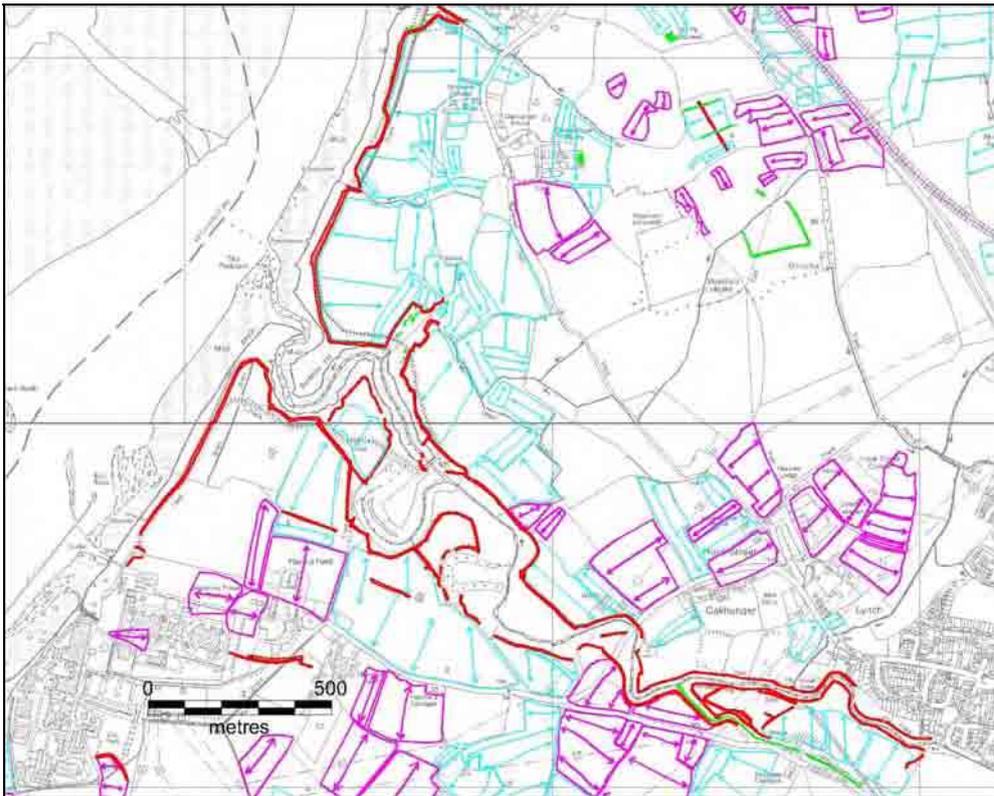


Figure 9-37 The sea defences around Berkeley Pill have been rebuilt and rerouted in response to the changes to the Pill's movement.

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Background map acquired from the Ordnance Survey.

In the lower centre of Figure 9.37, gaps in the defensive banks adjacent to two former loops of Berkeley Pill suggest that some of the defences were in a state of disrepair when aerial photographs were taken in 1946. In the bottom right of Figure 9.37, the earthwork defences continue along Berkeley Pill to the village, but also extend along the canalised leat of the Little Avon River that ran through the former mill known as Sea Mills (see Figure 9.50).

Sea banks recorded at Lydney (Figure 9.38) from 1940s aerial photographs were not recorded on 19th and 20th century maps. Documentary records indicate that by the 13th century, the land on the riverside of Lydney and Aylburton was being farmed and the sea banks may have been constructed during this time to prevent tidal inundations. From the 16th century, changes in the Severn Estuary's tidal currents caused silt deposition, creating new land subject to both flooding and later erosion. The Forest of Dean NMP project recorded a number of phases of sea wall built in the 19th century to protect the area known as 'New Grounds', and noted several possible phases of the bank (Small and Stoertz 2006).

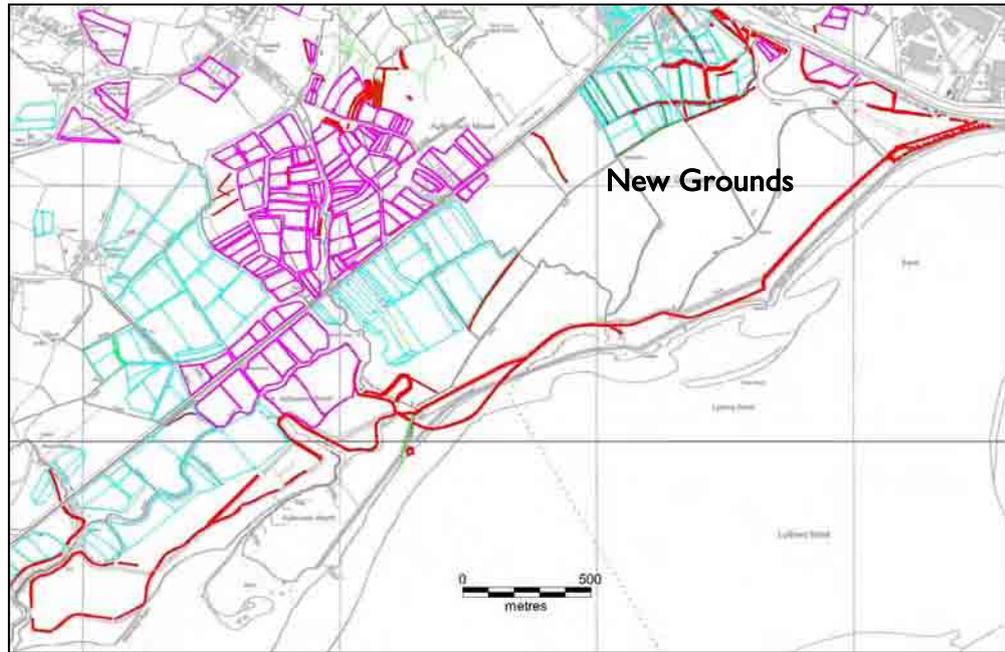


Figure 9-38 The sea defences on Aylburton Warth, south of Lydney harbour (mapping taken from Forest of Dean NMP survey).

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Background map acquired from the Ordnance Survey.

The use of sea walls can cause ‘tide lock’, which occurs when exceptionally high rainfall raises the level of flowing freshwater and this meets the incoming tide (Miles 1993). This phenomenon causes water levels to rise above the defences and spill over onto the surrounding land. The water is prevented from draining back into the river by the very embankments built to keep flooding at bay. Although more sophisticated flood management plans are now in place around Gloucester to protect adjacent urban areas from widespread inundation, the Gloucestershire flooding events of 2007 illustrate the ongoing struggle to manage the Severn Estuary.

9.5.3 Sea And Flood Defences In Somerset

The RCZAS aerial survey recorded several areas of sea and flood defences in Somerset, often on bays of wide, relatively low-lying land, and where large rhyines, waterways and rivers flow into the outer Severn Estuary. The topography of the Somerset coastline is variable, however, and natural barriers against marine inundation occur along much of the coastal hinterland. These include limestone outcrops, sand dune systems, high shingle ridges and undulating coastal cliffs.

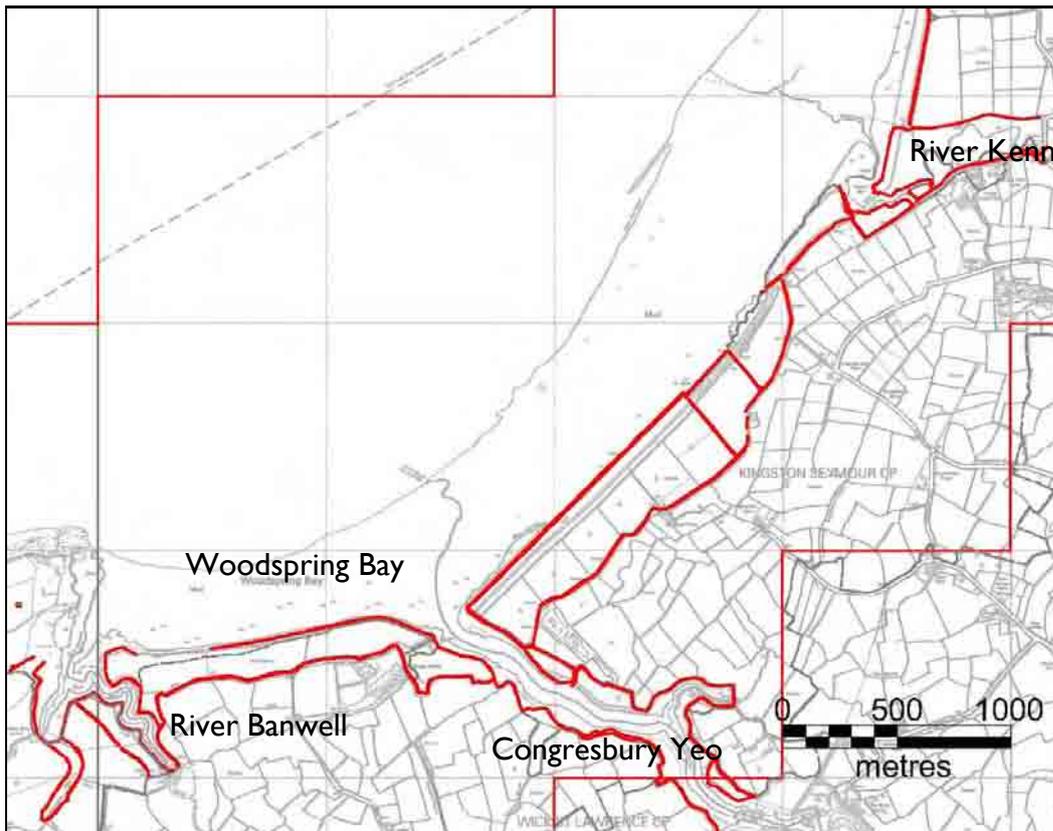


Figure 9-39 The sea defences on Wick Warth in Woodspring Bay, stretching inland to border the mouth of the River Banwell, Congresbury Yeo and River Kenn.

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Background map acquired from the Ordnance Survey.

In the medieval period, the construction of sea defences was a means of creating new agricultural land on the Somerset Levels. Earthwork sea banks known as ‘wharfs’ were constructed to reclaim tidal salt marsh, as at Wick Warth on the coast of Woodspring Bay and along riverbanks such as the River Banwell, Congresbury Yeo and the River Kenn (Figure 9.39). Large swathes of Somerset’s unprotected wetland, however, were still regularly inundated (Rippon 1997a: 226). An extensive system of flood defences or sea walls has been recorded along both banks of the meandering River Parrett on Pawlett Hams (Figure 9.40), where the estuary has a long history of accretion and erosion (McDonnell 1995b). The main flood defence sea wall is situated on the banks of the river, but there appear to be successive sea and flood banks further inland. Many of these appear to be redundant, having been plough levelled on the latest available aerial photographs viewed by the RCZAS aerial survey.

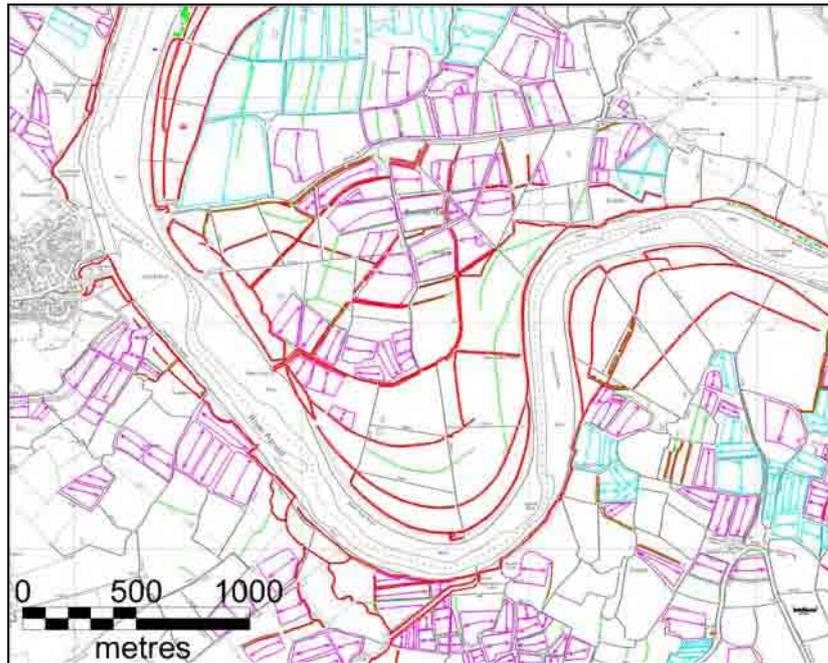


Figure 9-40 The flood defences recorded along the River Parrett at Pawlett Hams

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Background map acquired from the Ordnance Survey.

On Pawlett Hams (ST 24 SE 59/HOB UID 1449438) and at Dunball, near Bridgwater (ST 34 SW 61/HOB UID 1451527) (Figure 9.41), a similar history is recorded in a series of linear flood and sea defence walls, attesting to the mobility of the River Parrett.



RAF/CPE/UK/1924 4012 16-JAN-1947
© English Heritage (NMR) RAF Photography



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Figure 9-41 Successive flood banks at Dunball on the River Parrett

The dynamic landscape of the River Parrett and its estuary can be observed on aerial photographs over a 30 year period. Medieval and/or post-medieval flood defences mapped from aerial photographs taken in 1946 have been subsequently eroded or destroyed by the river. Further evidence of the rapid changes around the Parrett is visible at Pawlett Hams (Figure 9.40), where three successive flood walls are visible, reflecting the movement of the River Parrett and new land becoming available for reclamation (Havindon 1981). The flood defences closest to the river are still functioning and aerial photographs show attempts to repair and strengthen them and construct new ones where they have been breached or damaged.

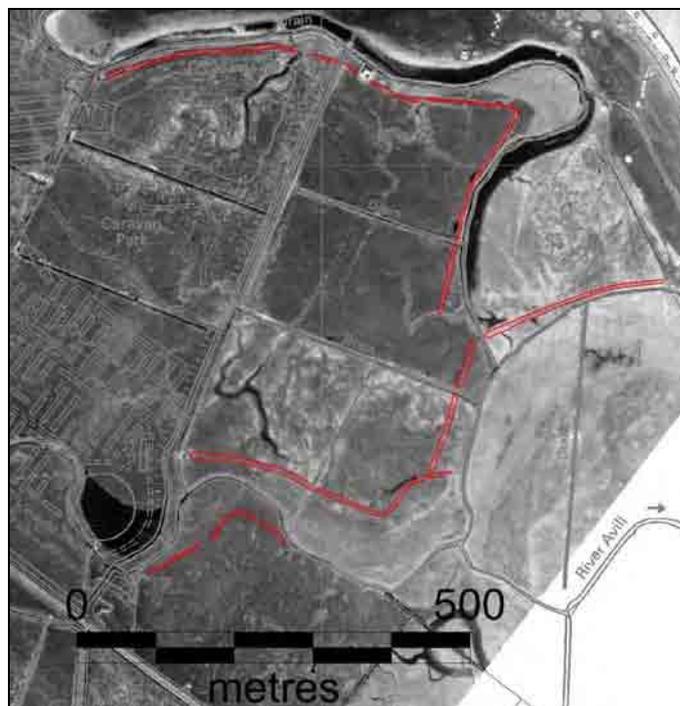


Figure 9-42 Former sea banks on the land now occupied by Butlins holiday camp at Minehead. The gripes and rhyves were an attempt to drain the former salt marsh.

RAF/CPE/UK/1980 3009 11-APR-1947 © English Heritage (NMR) RAF Photography
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 Background map acquired from the Ordnance Survey

Between the River Parrett's estuary and Blue Anchor village, cliffs or shingle ridges offer natural protection to agricultural lands behind the shoreline. West of Blue Anchor on the Quantock Fringes, however, the coastline flattens and broadens out into an expanse of former wetland east of Minehead with no natural sea defences. This low-lying area below 10m OD is the only other part of west Somerset within

the Severn Estuary RCZAS project area where earthwork sea and flood defences were recorded (Figure 9.42).

9.6 Post-Medieval Transport, Industry And Military Sites

Evidence of post-medieval industrialisation was recorded along the length of the Severn Estuary RCZAS project area. Post-medieval improvements to the transport infrastructure are visible in the number of railway branch lines recorded on pre-1950s air photos, many of which subsequently closed from the mid-20th century onwards.

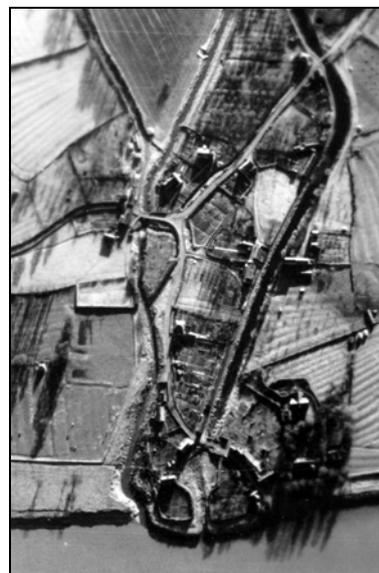
Canals

The construction of the canal system in the 18th and 19th century was a response to the Industrial Revolution in Britain. Most of the canal systems were constructed in the industrial heartland of the Midlands and north of England, extending and connecting the navigable rivers, and were a means of economically and (relatively) quickly, shipping large quantities of raw materials from coastal ports to the potteries, foundries, mills and factories of the great manufacturing centres, returning from there with finished goods. Canals were also constructed to provide industrial goods to agricultural communities and to avoid dangerous voyages around Britain's coast (Hadfield 1942: 59). Relatively few canals were built in southern England, though five connected directly to the Severn Estuary or with rivers feeding into the estuary within the RCZAS project area: the Herefordshire and Gloucestershire Canal, the Stroudwater Navigation Canal, the Gloucester and Sharpness Canal, the Kennet and Avon Canal and the Bridgwater and Taunton Canal.

The Herefordshire and Gloucestershire Canal (also known as the Hereford and Gloucester Canal) (SO 64 SE 44/HOB UID 112342) was opened from Gloucester to Ledbury in 1798. The canal provided a means to supply coal, timber, stone and bricks to the Ledbury region, but closed following the construction of the Hereford to Worcester Railway with which it could not compete (Figure 54). At Over west of Gloucester, the canal ran north and east of The Vineyard and joined the River Severn above Over Bridge. The canal was closed in 1881, and the canal bed for part of its course converted for use as the Gloucester and Ledbury Branch Railway

(LINEAR 1764 /HOB UID 113567) that opened in 1885 (Bailey 2007; Elrington et al. 1972). Although it was possible to see more of the canal's course in many other aerial photographs, the tree cover prevented accurate mapping. Subsequent aerial photographs record part of this feature after it was levelled.

The construction of the 13km (8 mile) long Stroudwater Navigation Canal in 1789 from Framilode to Stroud linked to the mills of the Stroud valleys and the west coast ports to London, via the connecting Thames and Severn Canal and the River Thames. At Upper Framilode, the extent of the canal basin, lock gates, locks and swing-bridge for the Stroudwater Navigation Canal (SO 71 SE 22/HOB UID 1448132) was mapped from aerial photographs taken when it had just ceased to be a working canal. The entrance from the River Severn at Unla Water was subsequently filled in completely and these features destroyed. In addition to providing a method of transporting large quantities of coal to and finished goods from Stroud valley mills, the canal also provided a water link for traffic between the River Thames and the River Severn. Vertical and oblique aerial images held by the NMRC and ULM provide a valuable pictorial record of this important part of the area's industrial history (Figure 9.43).



(left) CAP 8133/67 05-JUL-1953. © Original photography held by Cambridge University Collection of Air Photographs, Unit for Landscape Modelling
(right) RAF/CPE/UK/1913 4042 30-DEC-1946 © English Heritage (NMR) RAF photography

Figure 9-43 The entrance from the River Severn at Upper Framilode to the Stroudwater Navigation canal taken in 1953, the canal having just ceased to be operational. These photographs record the canal basin, dock, locks and lock gates that have been subsequently destroyed

Whilst the Severn Estuary was navigable along a considerable part of its course, there were restrictions to maritime trade on the river by the 18th century. Larger boats could not sail higher than Bewdley in Worcestershire and the sandbanks and shoals in the inner Severn Estuary were constantly shifting, affecting riverine traffic. For the river to remain economically viable, it was decided to construct a canal from Berkeley Pill to Gloucester. Work began on Gloucester Docks in 1794, and over the next few years 5.5 miles of canal were cut. Financial shortages then halted work until 1817 when Thomas Telford was commissioned by the government to report on the feasibility of the canal, with particular reference to the maintenance of navigation on the Severn. He was in favour of continuing and completing the canal, but recommended that it should run to Sharpness instead of Berkeley. The government then provided the money for the canal, mainly to relieve acute problems of unemployment, and after considerable delays the Gloucester and Sharpness Canal (LINEAR 728/HOB UID 1340634) was opened in 1827. It was of sufficient size to allow passage for sea-going shipping, which ensured the longevity of the canal and Gloucester and Sharpness as commercial ports (Perrott 1983: 151-152). The opening of the canal to Gloucester port to larger sea-going vessels negated the need to undertake the hazardous navigation of the River Severn around the Arlingham peninsula.

Although just outside the Severn Estuary RCZAS project area, two further canals linked directly to navigable rivers that merged with the Severn Estuary: the River Parrett and the River Avon. The Kennet and Avon Canal provided an east-west water transport link, which meant that shipping could unload their cargoes at Bristol and so avoid the hazardous sea voyage around England's southern coastline to London and the eastern counties (Hadfield 1942: 59). The canal opened in 1810, providing a link between the Severn Estuary and London via the River Avon at Bristol and the River Kennet (and River Thames) at Newbury. The subsequent construction of a railway link to the West Country in the mid-19th century caused a significant reduction in canal traffic and freight (Perrott 1983).

The Bridgwater and Taunton Canal was opened in 1827 and had an entrance lock to the River Parrett (Hadfield 1942: 59). The canal brought coal, iron and other goods from South Welsh ports to Somerset's inland communities. The Bridgwater and Taunton Canal was also partly conceived as a means of creating a water route

from the Severn Estuary and the south coast of Devon, avoiding the hazardous sea route around Land's End. The other connecting canal projects to the south coast were short-lived, however, for technical reasons (Hadfield 1942: 63-64). With the coming of the railways to the west and south-west of Britain, the canal's profits collapsed.

Railways

In Gloucestershire, the Severn Estuary RCZAS aerial survey recorded a disused section of the Gloucester and Ledbury Branch Railway (LINEAR 1764 /HOB UID 113567), a cutting for which ran west of the site of The Vineyard to join the main South Wales Railway line at Over (Elrington et al. 1972). This cutting has now been completely filled in and is only visible in later aerial photographs as a curvilinear field boundary and scrub area (Figure 9.44).

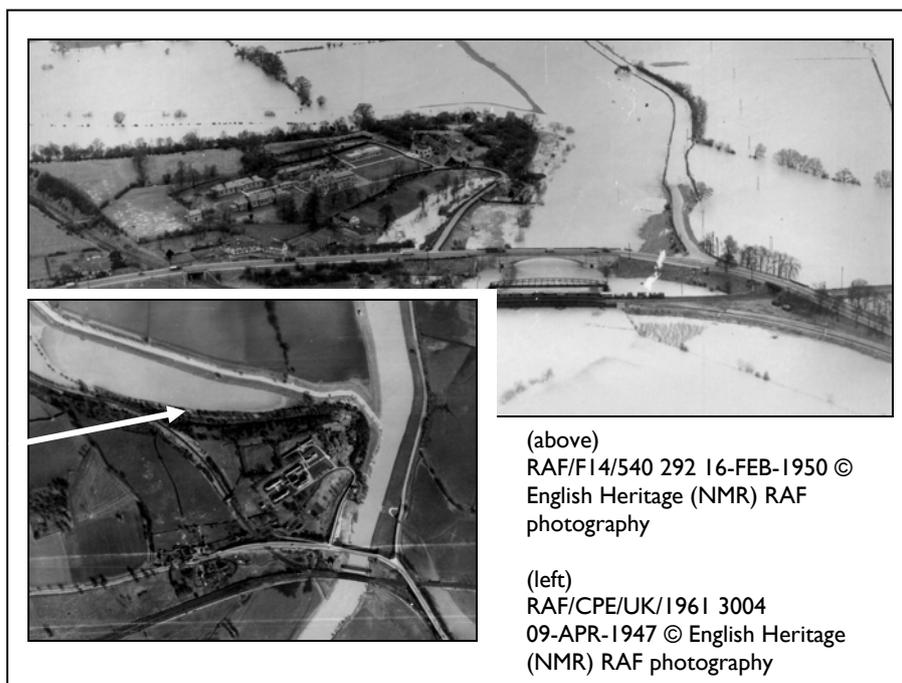


Figure 9-44 The Gloucester and Ledbury Branch Railway merges with the South Wales Railway at Over, west of Gloucester. The bed of the Herefordshire and Gloucestershire Canal, which was closed in 1881 was converted into the branch railway line for much of its course, and opened in 1885. The railway cutting (arrowed) was subsequently filled in following the branch railway's closure.

The Gloucester and Ledbury Branch Railway developed out of two schemes. The first was a plan to provide Ross with a route to Ledbury, but this was only built as far as Dymock before being abandoned. The second scheme was a route from

Gloucester to Dymock - the Newent Railway. Both lines opened in 1885, joining at Dymock and giving the Great Western Railway its shortest goods route between Birmingham and Gloucester until the opening of the Birmingham and North Warwickshire Railway. The Dymock to Ledbury section closed in 1959, and the remainder in 1964 (Elrington et al. 1972).

The intensification of the Forest of Dean's coal and iron industries led first to the development of a tramways network and then to railways throughout the Forest of Dean, forming a large interconnecting transport network to the rivers and Britain's wider railway network (Small and Stoertz 2006: 106). The Severn Estuary RCZA and Forest of Dean NMP surveys recorded parts of this network of cuttings and embankments within the Severn Estuary RCZAS project area as many elements were still in use when the immediate post-war aerial photographs were taken, although many were subsequently dismantled.

In 1801 the engineer Benjamin Outram, an advocate of rail transport, recommended that a system of tramroads be built throughout the Forest of Dean to the Severn and Wye rivers to serve the coal industry, and also the region's ironworks. The Severn and Wye Railway (LINEAR 1668/HOB UID 111615) opened in 1809, and was a horse-drawn tramroad laid on stone blocks between Lydbrook and Lydney, connecting with the Lydney Canal and Lydney docks. It converted to a broad gauge railway in 1869 (Small and Stoertz 2006: 108). In 1872, the Severn Bridge Railway Company was formed to build a 4 mile line from Lydney to Sharpness, joining a spur of the Midland's Birmingham and Bristol Line via the construction of a new bridge over the River Severn. It became the Great Western and Midland and Severn and Wye Joint Railway in 1894, but in 1960 the bridge was badly damaged and the link line was closed (Small and Stoertz 2006).

The Forest of Dean NMP survey also identified the earthwork traces of cuttings and embankments of unfinished railway lines. South of Blakeney, north-west of Purton, the remains of the uncompleted 1830 Purton Steam Carriage Road (SO 60 NE 40/HOB UID 1385023) are visible as cuttings and embankments. Originally intended to link with Purton Pill, the line was halted due to opposition from the Severn and Wye Railway and the Forest of Dean Railway (Small and Stoertz 2006: 109). In 1856 the construction of the Forest of Dean Central Railway was intended

to link with the River Severn at Brims Pill (SO 60 NE 55/HOB UID 1385119), but instead formed a junction with the GWR South Wales line at Awre (Small and Stoertz 2006: 110). The unused earthworks of the railway embankment can be seen in Figure 9.45.



Figure 9-45 The junction of the Forest of Dean Railway with the GWR South Wales Line and the unused line to Brims Pill (taken from Forest of Dean RCZAS survey).

NMR RAF CPE/UK/2098 4276 28-MAY-1947 © English Heritage (NMR) RAF Photography

River Severn ports like Bullo Pill lost trade as a result of the expanding railway network such as the GWR South Wales line and the link via the Severn Railway Bridge. As the coal and iron mines and ironworks of the Forest of Dean closed, however, the railway infrastructure, whose main purpose was to serve these industries, also rapidly declined during the latter part of the 19th century (Small and Stoertz 2006: 110).

On the inner Severn Estuary's east bank within the RCZAS project area, 19th century branch railways were also mapped, as shown in Figure 9.46. The Portishead and Bedminster Branch Railway (LINEAR 951/HOB UID 1361435) was opened in April 1867, and this broad gauge service between Bristol (Ashton) and Portishead Pier was run by the Bristol and Portishead Pier and Railway Company. The railway provided a connection at the pier with steamers from Cardiff, Newport and Ilfracombe from 1868 onwards, and, following the opening of Portishead docks in 1879, to I.K.Brunel's steamships sailing to America (Portishead

Railway Group 2007). Converted to standard gauge in 1880, the line was operated by Great Western Railways from 1884.

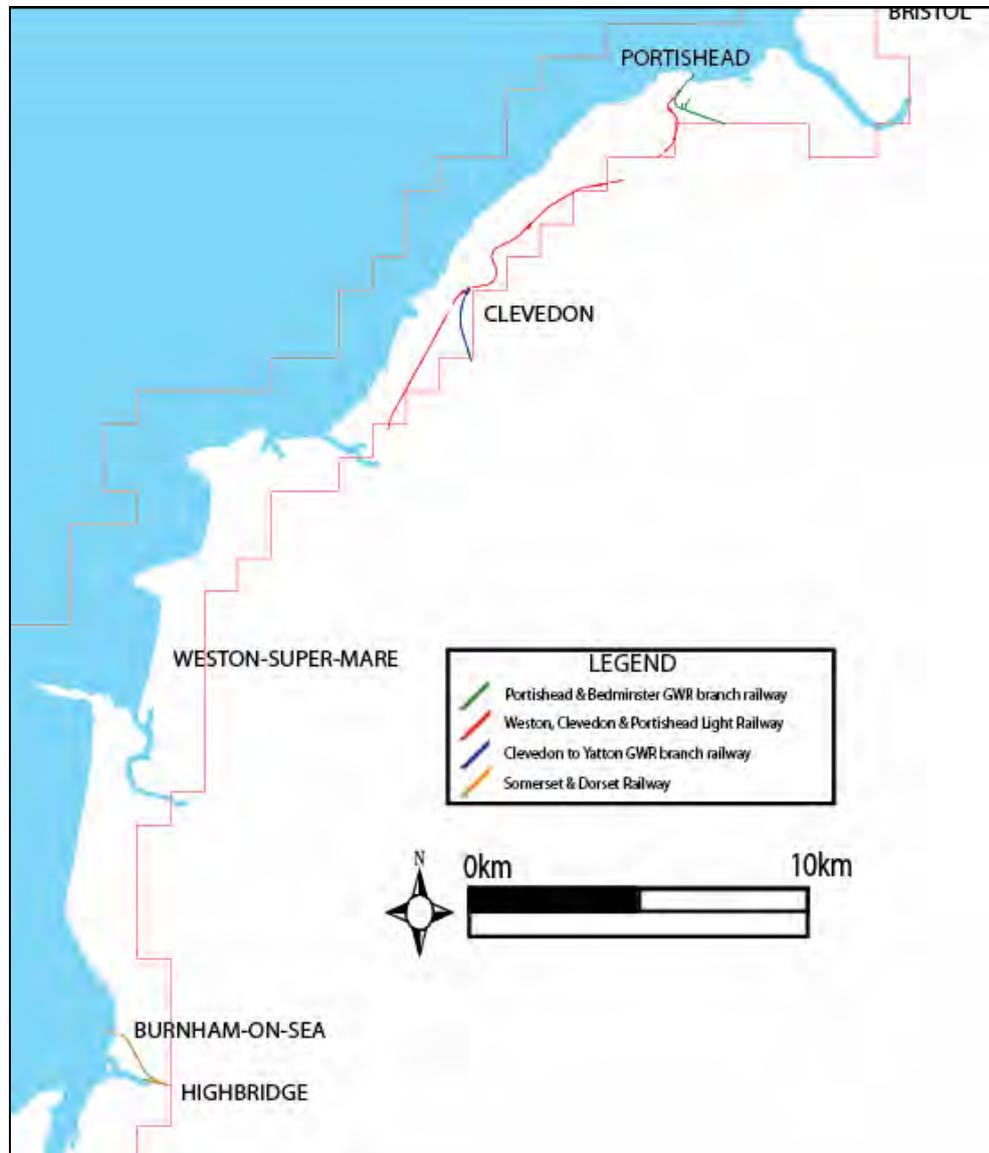


Figure 9-46 The 19th century branch railways within the Severn Estuary RCZA project area in Somerset.

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Background map acquired from the Ordnance Survey

At Portishead Dock two railway junctions lead to substantial shipyard sidings. In addition to the GWR line's two railway stations at Portishead (ST 47 NE 135/HOB UID 1468112 and ST 47 NE 136/HOB UID 1468117), there was also a railway line connection to the Weston, Clevedon and Portishead Railway (LINEAR 1800/HOB UID 195623) (Portishead Railway Group 2007). The GWR line closed to passengers in September 1964 as part of the Beeching cuts, though it continued

to remain open for freight traffic for some after (Gregory 2004-2008). Aerial photographs taken in 1989 show that industrial and retail development around the docks has destroyed the railway line's course. East of Portishead Dock to Sheepway, however, the railway line remains intact but disused.

Clevedon was the headquarters of the Weston, Clevedon and Portishead Railway (LINEAR 1800/HOB UID 195623) which opened from Weston-super-Mare to Clevedon in 1872 and was extended to Portishead in 1907, becoming a light railway in 1899. It operated until 1940 when it was sold to the Great Western Railway, who dismantled it (Gregory 2004-2008). The RCZAS survey mapped the railway and its halts between Portishead town centre and Weston-in-Gordano, the Gordano Valley and Swiss Valley, and between Clevedon and Wick St Lawrence. The track, sidings and the halts were all dismantled in 1942, and so were not extant on the available aerial photographs from the late 1940s. The railway's former course was still visible as sections of earthwork embankment and cuttings. In more recent aerial photographs, some of the railway's course was still visible as earthworks, but many other sections were either only visible as cropmarks or had been destroyed by urban expansion.

Part of the dismantled Clevedon to Yatton GWR Branch line (LINEAR 1794/HOB UID 195071) was also recorded by the RCZAS survey. Opened on 28th July 1847 by the Bristol and Exeter Railway, the 5.6km (3½ miles) long branch line ran from the junction at Yatton to Clevedon. The 1963 'Beeching Plan' resulted in line closure in 1966, though the last of the track was not lifted until the 1980s (Gregory 2004-2008). The course of the track in Clevedon has been destroyed underneath residential housing and car parks. From the south bank of Blind Yeo, however, about 1km of the track's course is still visible as an earthwork bank.

In Somerset, the RCZAS survey recorded the Somerset & Dorset Railway's (LINEAR 155/HOB UID 867808) extension from Highbridge to Burnham-on-Sea (ST 34 NW 106/HOB UID 1460071). This line was opened in May 1858 and closed in 1963, and served the passenger and goods traffic using the Burnham-on-Sea to South Wales ferry. The 2.5km (1½ mile) long extension ran from Highbridge to Burnham-on-Sea, and was part of a wider Victorian scheme to link the south coast of Britain with Bristol, South Wales and the Midlands (Nevard

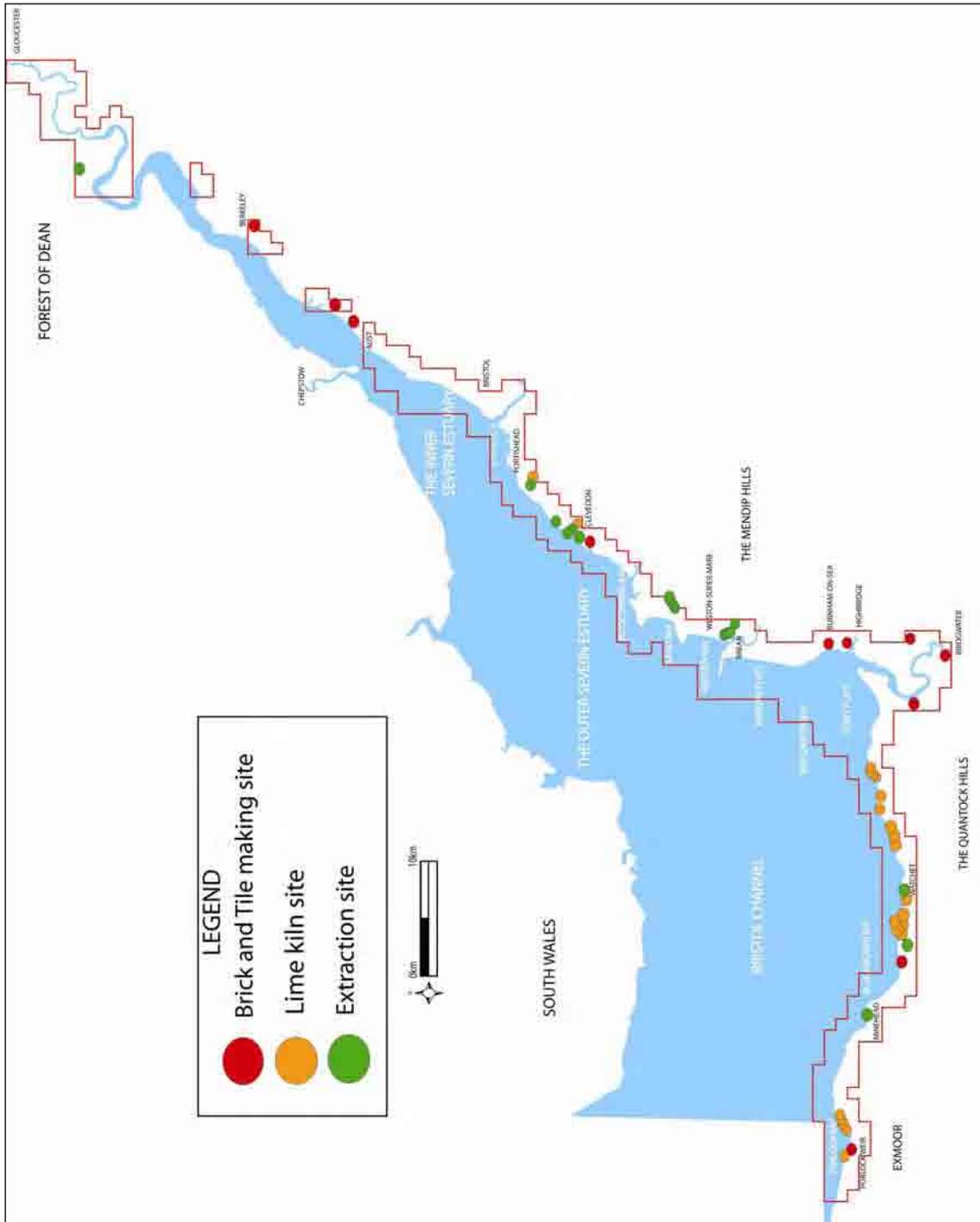
2002). Private railway sidings were used by Colthurst and Symons & Co Ltd north of Highbridge Wharf, south of their Apex brick and tile making site (Clapcott 2007). The course of the railway has been built over with residential housing and access roads.

The remains of a stone-built jetty (ST 34 NW 35/HOB UID 617573) at the Somerset & Dorset Railway terminus at Burnham-on-Sea projects from the seafront onto the beach. The jetty was opened in May 1858 to connect the railway-owned paddle-steamer ferry service to Cardiff in South Wales, which ran from 1858 to 1888, carrying passengers, livestock and other goods. From Burnham railway station, the railway ran across The Esplanade and along the length of the jetty. The jetty's steep down gradient of 1 in 23 required rolling stock to be lowered by wire ropes from the top of the jetty (Smith 2007).

Brick And Tile Making

The main industrial activities identified within the survey area are from the post-medieval period, although many sites were no longer in use by the early 20th century. Brick and tile making became a major industry from the 17th century onwards (Figure 9.47). Many of these sites remain visible as earthworks on aerial photographs.

Somerset's alluvial clays provided the material for the bricks and tiles which Bridgwater was producing by the mid 17th century. Brickworks continued to develop around the town in the latter half of the 18th century and early 19th century (Dunning and Elrington 1992: 213-223). By the 1850s, 16 brick and tile making works were sited within 3.2km (2 miles) of Bridgwater Bridge. Mud extracted from the River Parrett's banks produced so-called 'Bath brick', resembling the stone used for the city of Bath's buildings. In the 19th century, brick and tile making also took place in Glastonbury and Wellington (Evans 2008). Although providing employment for a large workforce, brick and tile production was not a well-paid occupation, which resulted in poverty and growing industrial unrest at the end of the 19th century (Evans 2008).



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Background map acquired from the Ordnance Survey

Figure 9-47 The distribution of post-medieval industry visible on aerial photographs, showing brick and tile making sites, lime kilns and extraction sites, including calamine quarries.

At the end of the 19th century, the brick and tile making industry reached its peak, many works being recorded on 2nd edition Ordnance Survey maps. Although used

in the construction of many of Bridgwater's 19th century buildings, such was the popularity of the town's roof tiles and red bricks led to them being exported to America, the Far East and Australia (Evans 2008). As demand increased, five brickworks opened around Burnham-on-Sea and Highbridge (Gathercole 2002). The brick and tile making industry's focus remained Bridgwater, however. It started to decline following the First World War, with Bath brick production ending altogether around the time of the Second World War. In the post-war period, Bridgwater's expansion created an increased demand for bricks and tiles, but this waned by the 1960s as a result of high cost and the availability of the raw material, the superior clays having been exhausted (Dunning and Elrington 1992: 213-223). Bridgwater's only remaining tile kiln, now part of a museum, used to be one of six at the former Barham Brothers' Yard at East Quay, closing in 1965 when the kiln was last fired (Somerset County Council 2007). All of these brick and tile making sites have now been filled in, built upon or adapted for other purposes and all their associated buildings, kilns, sheds and tramways destroyed. The Severn Estuary RCZAS aerial survey has therefore recorded the final decades of a regionally important industry. Gathercole (2002: 15) noted that where industrial-scale brick and tile making took place, the extensive brickearth and clay pits will have destroyed any earlier archaeological deposits.

As shown in the distribution map (Figure 9.47), 11 brick and tile making sites were mapped and recorded by the RCZAS aerial survey between Gloucester and Porlock, with several of the larger sites still operational on the 1940s and 1950s air photos. From documentary evidence for the Bridgwater area brick and tile industry (Evans 2008), the five sites mapped between Burnham-on-Sea and Combech appear to accurately reflect the distribution of brick and tile making sites along the Somerset coast.

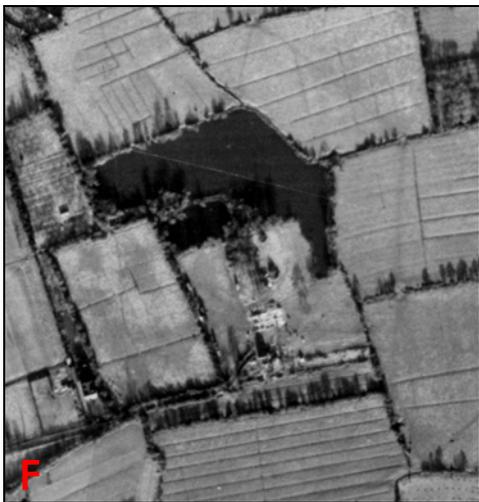
Of the many brick or tile works located near Bridgwater, only one site (ST 36 NE 73/HOB UID 617038) was recorded by the RCZAS aerial survey, J.B. Hammill's works near Chilton Trinity (Figure 9.48E) (Evans 2008). Given the documentary evidence, this may be under representative of this formerly thriving industry around Bridgwater. As the boundary of the Severn Estuary RCZAS project does not include the town of Bridgwater itself, most of the brick and tile making sites would have been outside the survey area.



NMR RAF CPE/UK/1924 1010 16-JAN-1947
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NMR SS 8648/1 MSO31206/019 27-JUN-1941
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NMR RAF CPE/UK/1924 3041 16-JAN-1947
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NMR RAF CPE/UK/1825 3072 04-NOV-1946
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NMR RAF 3G/TUD/UK/1519 5245 13-JAN-1946
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NMR RAF CPE/UK/1869 3092 04-DEC-1946
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Figure 9-48 Examples of post-medieval brick and tile making sites at (clockwise from top left) Highbridge (A), Porlock Weir (B), Clevedon (C), Berkeley (D), Bridgwater (E) and Burnham-on-Sea (F). Note the difference in scale between the diminutive works at Porlock Weir and the industrial-scale sites at Clevedon, Highbridge and Bridgwater.

Many former brick and tile making sites were only identifiable as water-filled clay pits. At Highbridge, however, two large brickearth pits supplied the Victorian Apex Works (ST 34 NW 104/HOB UID 1452413) (Figure 9.48A) owned by Colthurst and Symons & Co Ltd into the post-war period (Evans 2008). The clay pits, ancillary buildings, kiln, brick drying shed and narrow gauge railway were destroyed by the 1960s and the site turned into a leisure and wildlife park. Another clay pit north of Burnham-on-Sea (ST 34 NW 104/HOB UID 1452413) survives as Hunts Pond in a caravan park (Figure 9.48F). All evidence of the brickworks buildings, kiln and drying sheds has been destroyed. Other clay pits associated with brickworks were recorded at Combwich and north of Puriton (ST 34 SW 15/HOB UID 192348), both owned by Colthurst and Symons & Co Ltd (Evans 2008).

Mining

Numerous small quarries and mineral extraction sites were recorded by the RCZAS aerial survey, ranging in scale from small subcircular marl pits, calamine mines and quarries to large stone quarries. The remains of post-medieval calamine mining visible as earthworks was also recorded from aerial photographs (ST 36 SW 109/HOB UID 1460789) (Figure 9.49). Calamine is a zinc ore, used in the production of brass, an alloy of copper and zinc. Numerous sub-circular extractive pits are located on the south side of Worle Hill north of Weston-super-Mare, which documentary evidence suggests is the site of the first discovery of calamine in Britain, where mining began about 1568 (Access to Mineral Heritage 2004-2006). The mines were probably abandoned by the early 19th century, though some remain as earthworks. A larger adjacent quarry (ST 36 SW 122/HOB UID 1460802) may be an extraction pit related to calamine mining or a limestone quarry for local building.

Located on the south side of Hangstone Hill, Clevedon, Hangstone quarry (ST 47 SW 120/HOB UID 1464584) was a 'common' quarry for many years; whereby any resident of Clevedon could use the stone to a house, although that house could not be sold (Clevedon Civic Society 2008). Smaller-scale post-medieval limestone quarries are located on Dial Hill, Clevedon (ST 47 SW 134/HOB UID 1465055), the largest accommodating a lime kiln (ST 47 SW 84/HOB UID 195646) for lime production. Other subcircular quarries are also recorded on the top of Dial Hill,

three of which were marked as earthworks on the 1st Edition Ordnance Survey map of 1885.

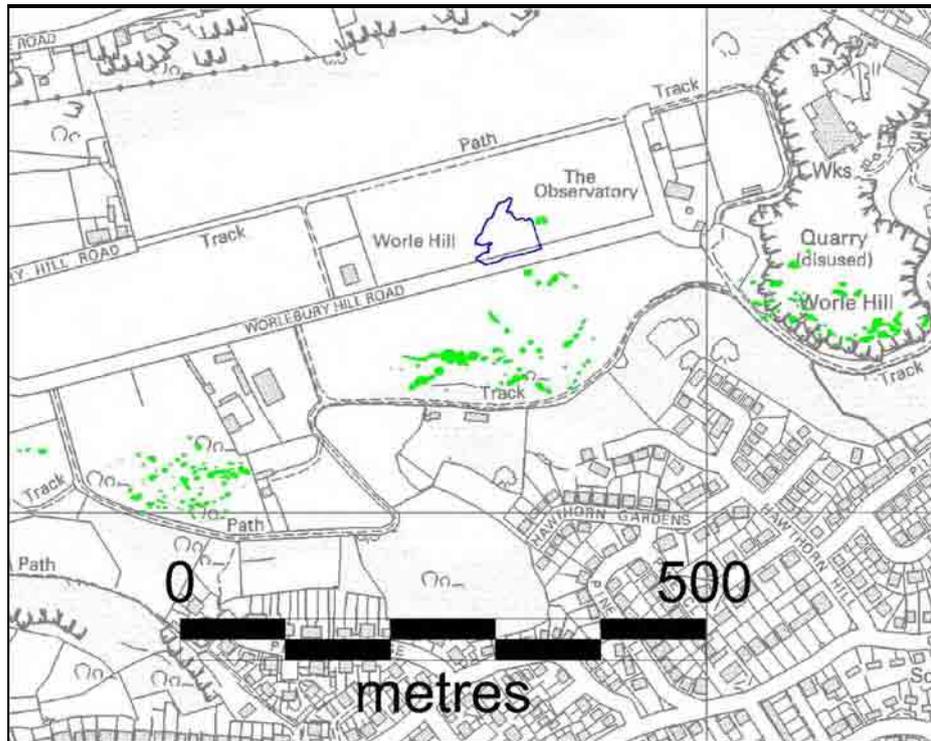


Figure 9-49 Post-medieval calamine extraction sites and other quarries at Worlebury, Weston-super-Mare.

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Background map acquired from the Ordnance Survey

In Gloucestershire, small subcircular post-medieval marl pits on Jordan Hill, north of Westbury-on-Severn (SO 71 SW 63/HOB UID 1445750) and on Wintle's Hill and Hunt Hill, east of Westbury-on-Severn (SO 71 SW 58/HOB UID 1445689), were recorded as cropmarks.

Mills

The Severn Estuary RCZAS aerial survey identified the sites of some former watermills and wind mills as standing buildings, slight earthworks or cropmarks. The survey identified a medieval or post-medieval windmill (SO 71 SE 24/HOB UID 1448137) known to have existed somewhere east of Longney village, but which was visible in one only photograph as a semi-circular ditch cropmark (Wilson, 2000: 108).

There were more mills constructed along the River Frome than any other river in Gloucestershire (Tann 1965). At Framilode, a mill site was mapped (SO 71 SE 34/HOB UID 1448154) comprising a single leat leading from and rejoining the River Frome to provide power for a number of post-medieval mills located on an island formed by the creation of the leat (Elrington et al. 1972). There was no visible evidence of these mill buildings on aerial photographs, however, as the island on which they were located was covered in dense vegetation.

Sea Mills, a tide mill south of Berkeley Pill (ST 69 NE 42/HOB UID 1466966) is a surviving building located west of Berkeley castle and village, thought to have been constructed in the post-medieval period, and continuing in use into the 20th century. Shown as Sea Mills (corn mill) on the 1:2500 scale 1st Edition Ordnance Survey map of Gloucestershire of 1880, Berkeley estate papers from 1605 mention two mills located under one roof. In 1754 the earlier mill was rebuilt, having been purchased by merchants including Bristol apothecaries to produce oil from linseed, flax and/or hemp (M. Horton pers. comm.). The steam boiler and chimney were built between 1884 and 1902 and the mill was partly rebuilt in 1904 following an explosion and fire. The mill was fed by the canalised Little Avon River flowing from the south-east, the leat passing through the middle range of the mill and then emptying into Berkeley Pill beyond (Figure 9.50A). Although the leat has been filled in, the mill building still stands (Figure 9.50B).

Other windmill mounds were recorded in Somerset, visible on aerial photographs as slight earthworks. The county's Historic Environment Record, however, had invariably already identified these features. For example, a possible post-medieval windmill mound (ST 24 SE 4/HOB UID 191202) was visible as earthworks adjacent to Wall Common. The site comprises several earthwork mounds, the largest thought to be the mill mound, within a ditched enclosure. Excavations in the early 20th century recovered medieval pottery. Although recorded as a mill mound, the available photographs show badly damaged earthworks, not identifiable as a mill mound from the aerial evidence alone.



Figure 9-50 Sea Mills at Berkeley, Gloucestershire. The aerial photographs capture the changes to the mills in the 47 years between the two photos above. Note the filling in of the mill pool, leats and flood banks, as well as the canalising and re-routing of the Little Avon River to bypass the mill.

Lime kilns

Limestone is the raw material for lime production, and lime burning was an important industry in the 18th century, continuing until the early 20th century (Murphy 2008). Lime burning produced slaked lime, widely used as an agricultural dressing to improve soil quality, and as an ingredient in building materials such as

lime render and mortar. Limestone outcrops were exploited inland in the Quantock Hills but the many limekilns located along the coastal foreshore (e.g. ST 14 SW 139/HOB UID 1366929, ST 14 NE 3/HOB UID 982087, ST 14 NE 26/HOB UID 1365811, ST 04 SE 112/HOB UID 1365645) were supplied from the shore reefs of lias (Murphy 2008). Raw limestone was also imported from South Wales. Watchet lime was a component of natural cement stone, whose quick-setting properties even in seawater were suited for use in the construction of maritime piers and walls, as well as lighthouses such as Eddystone (Murphy 2008).

Post-medieval lime kilns identified by the Severn Estuary RCZAS survey in Somerset are particularly concentrated along the Quantock Hills coastline and in Porlock Bay, as shown in Figure 9.51. In the 18th century and 19th century, lime burning was widely practiced along Somerset's coastline (Murphy 2008), but the distribution of lime kilns shown by the RCZAS aerial survey (Figure 9.51) does not represent the full distribution of lime kilns in west Somerset as many documented lime kilns no longer survive. For example, in Minehead documented 18th and early 19th century limekilns at Alcombe were later destroyed and there were also 19th century limekilns situated on the quay and in the town (Gathercole 2003b: .22, 30). In Watchet, lime kilns were established during the 19th century (Gathercole 2003a: .6).

On the Quantock Hills coastline, Kilve Pill was once a tiny port used for the importation of an inferior type of coal from South Wales known as culm, used in the production of slaked lime (Heal 1993: 63-64; Riley 2006). Culm was also imported through Minehead, Porlock and Watchet harbours and boats coming across the Severn Estuary would also land directly on the beaches adjacent to the kilns to unload their cargoes of raw limestone and coal for fuel (Purvis 2004). The empty boats would then reload at Porlock Weir, Watchet and other ports along the estuary, either returning to Wales with sheep and cattle or via Bristol with bricks and timber. Other boats, once empty of limestone, would refill their boats with oak bark and bricks from Porlock Weir harbour to take to Penzance and then return to South Wales from there with cargoes of tin (Heal 1993: 63-64; Riley, 2006). The concentration of lime kilns around Watchet and Kilve Pill, seen in Figure 9.51, reflects this trade around available landing places.

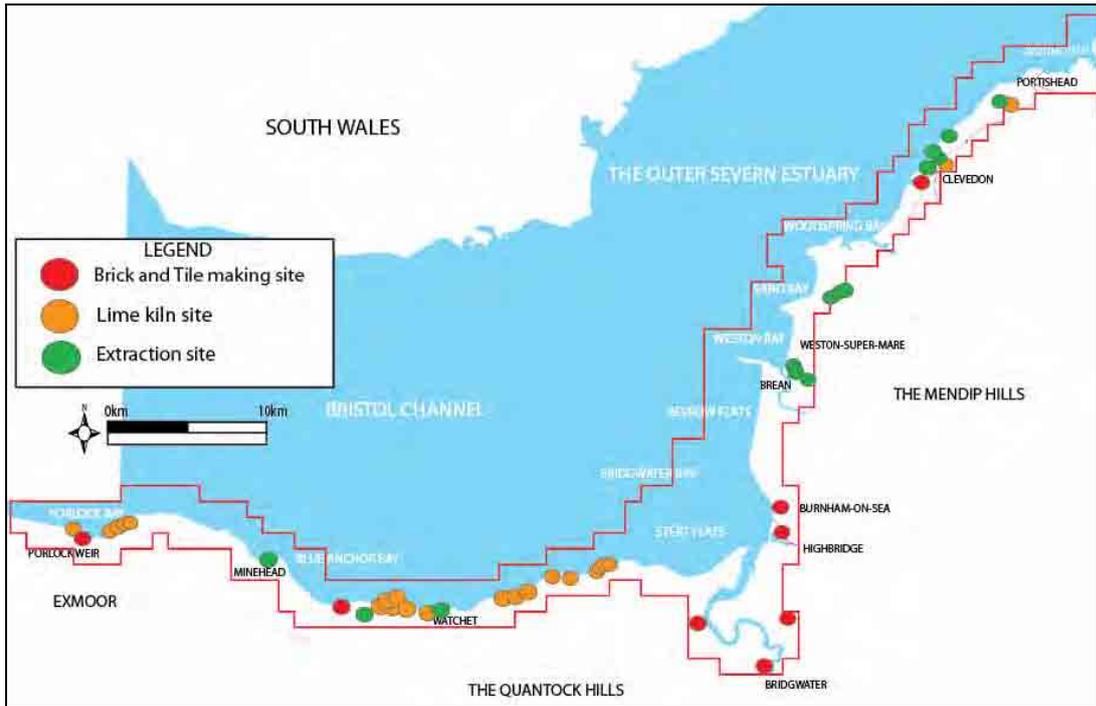


Figure 9-51 The distribution of post-medieval lime kilns, extraction sites and brick and tile making works in Somerset.

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Background map acquired from the Ordnance Survey



NMR SS 8948/10 NMR 18299/10 19-MAR-1999
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NMR SS 8948/6 MSO31206 005 21-JUN-1941
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Figure 9-52 The remains of post-medieval lime kilns on Bossington Beach, Porlock Bay.

On the Exmoor coastline at the top of Bossington Beach's shingle ridge in Porlock Bay, five post-medieval lime kilns (SS 84 NE 38/HOB UID 881336, SS 84 NE 50/HOB UID 957639, SS 84 NE 51/HOB UID 957648, SS 84 NE 53/HOB UID 957659, SS 84 NE 26/HOB UID 881113) were recorded in the 19th century, but only the remains of four structures were visible and recorded by the RCZAS survey (Figure 9.52). Four kilns are shown on a Bossington estate map of 1809 and on the 1842 tithe map.

The largest surviving lime kiln on Bossington Beach (SS 84 NE 38/HOB UID 881336) is a rectangular draw kiln constructed of roughly coursed stone blocks and large beach pebbles, built into the shingle bank with three external buttressed walls. It is labelled on the 1st edition Ordnance Survey map of 1889 as an 'old limekiln', implying it was no longer in use by that time. Two lime kilns behind the harbour at Porlock Weir (Figure 9.53) were originally built as brick kilns, but later turned to produce lime, the raw materials coming from Barry in South Wales (Purvis, 2004).



MSO31206/019 27-JUN-1941 © English Heritage (NMR) RAF Photography

Figure 9-53 The surviving lime kilns (arrowed) adjacent to the former tile and brick works at Porlock Weir.

A post-medieval roofless rectangular lime kiln (SS 84 NE 26/HOB UID 881113) with an entrance in the south wall was located behind Bossington Beach off the path from Sparkhayes Lane. An old limekiln is noted at that location on the Ordnance Survey map of 1889, although the structure had been demolished on aerial photographs taken in 1976 and, when visited by English Heritage in 1994 there was no evidence of such a feature.

Post-Medieval Military Sites

The fortification of The Vineyard (SO 81 NW 41/HOB UID 115331/SAM339) at Over, near Gloucester (Figure 9.54) was constructed on the site of a moated

medieval Bishop's residence. Breastworks and bastions associated with the site dated to the English Civil War defence of the city by Parliamentary forces.

In Somerset, the Palmerstonian fort on the western end of Brean Down (ST 25 NE 11/ HOB UID 191330) was completed in 1870 and formed part of the Bristol Channel defences to guard against the perceived threat of French invasion. The fort comprises a barrack block, officers' quarters, a latrine block, the remains of three gun positions and a powder magazine. An explosion in July 1900 destroyed half the battery and many of the fort's features were obscured by Second World War re-fortifications.

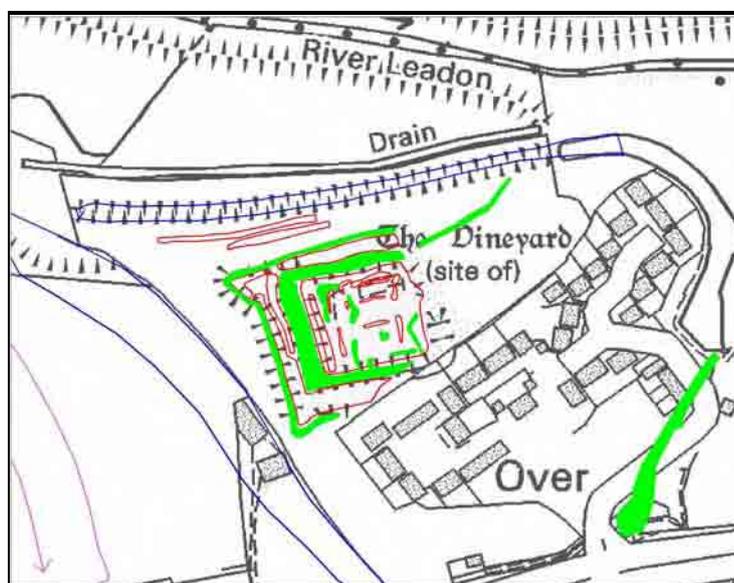


Figure 9-54 A post-medieval military site known as The Vineyards. It was originally a moated medieval bishop's residence but was fortified during the English Civil War.

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Background map acquired from the Ordnance Survey

10. 20th Century

10.1 Introduction

In keeping with NMP methodology, 20th century sites recorded mainly relate to military structures from the First and Second World Wars. The military archaeology and coastal wartime defences of the Second World War proved to be one of the main themes of the Severn Estuary RCZAS project, providing hitherto unrecorded details of the defensive landscape of the Severn Estuary coast. Other unusual 20th century archaeological sites were recorded at Minehead and at Over near Gloucester. The historic aerial photography provides a valuable record of these modern but short-lived features.



Figure 10-1 The remains of a pier at Minehead demolished to make way for a Second World War coastal battery.

RAF/S262/8703 36 27-JUN-1941 © English Heritage (NMR) RAF Photography

For example, the remains of a pier at Minehead quay (SS 94 NE 436/HOB UID 1455490) (Figure 10.1) were visible as sections of iron beam framework with a substantial iron base at the seaward end. It was constructed in 1901 by the Campbell Steamboat Company for ferries from South Wales, but was dismantled in 1940 to provide the two naval guns of the gun emplacement on the harbour quay with a clear field of fire along the Bristol Channel (Gathercole 1998; McDonnell 2001: 40). The surviving landward section of the pier and the iron support framework were no longer visible on aerial photographs taken in 1947, although a small section of the pier's end section was still visible in the sea in 1993.



RAF/CPE/UK/1961 3004 09-APR-1947 © English Heritage (NMR) RAF Photography



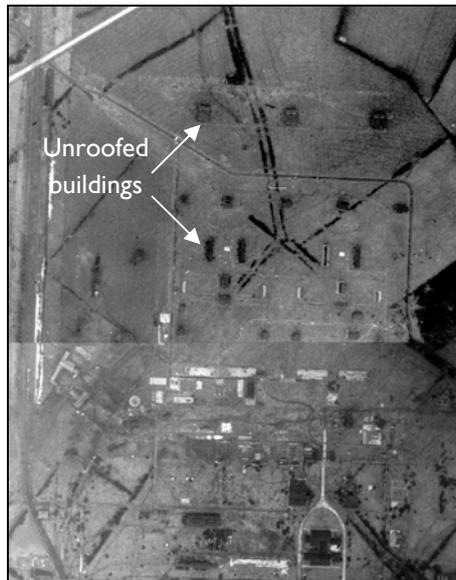
RAF/540/1564 (F21) 0214 18-MAR-1955 © English Heritage (NMR) RAF Photography

Figure 10-2 Aerial photograph of Over depicting the Telford road bridge (top), gas pipeline (middle) and Brunel's railway bridge (bottom) over the River Severn. Note the realignment of the railway bridge in the 1955 photograph.

An examination of 1947 and later aerial photographs of the Over area, to the northwest of Gloucester reveal the changes to the railway bridge over the River Severn (SO 81 NW 434/HOB UID 1448908). The bridge carrying The South Wales line over the River Severn, designed by I. K. Brunel and built by the Gloucester and Dean Forest Company, was opened in 1851. It was replaced by a new girder bridge in 1953 when the courses of the railway, the railway junctions and the embankments on either side of the bridge were realigned to meet the new bridge further south. The aerial photographs are a valuable and unusual pictorial record of the Brunel bridge and its supporting infrastructure (Figure 10.2).

10.2 First World War

Three First World War sites are visible on aerial photographs, all related to the manufacture or storage of high explosives. Two of these sites were located north of Avonmouth docks on flat land adjacent to the coast, and were situated away from an urban centre in case any accidents occurred.



Composite of two pre-WW2 photographs
Top: CCC 11756/6225 (1920s)
Bottom: CCC 11756/6226 (1920s)
© English Heritage. NMR Crawford Collection

Figure 10-3 The possible location for H.M. Henbury, a First World War explosives factory that was only partly constructed and abandoned in 1917. To the bottom of the photographs is the northern part of His Majesty's Avonmouth.

Following the success of Nobel's Explosives Company at Ardeer, Scotland, the company was invited by the Ministry of Munitions to design and run a factory to manufacture propellant nitrocellulose powders in December 1916. Work began at His Majesty's Henbury (ST 58 SW 9/HOB UID 1078468) but was abandoned in May 1917 with only part of the site constructed (Cocroft 2000; Great Britain. Ministry of Munitions 1921). The precise location of the site from documentary evidence is vague, but the study of pre-Second World War aerial photographs and historic Ordnance Survey Maps strongly suggests that the likely site is adjacent to His Majesty's Avonmouth (ST 58 NE 125/HOB UID 1078413) (Figure 10.3). The site appears to have been derelict before the Second World War with some buildings demolished; only their footings remained and other buildings were unroofed, with no clear access roads. This suggests abandonment prior to completion, but the layout of the buildings and earthworks indicate that it would have become an explosives factory similar to Ardeer. The site is now completely levelled and a modern industrial trading estate occupies part of the site.

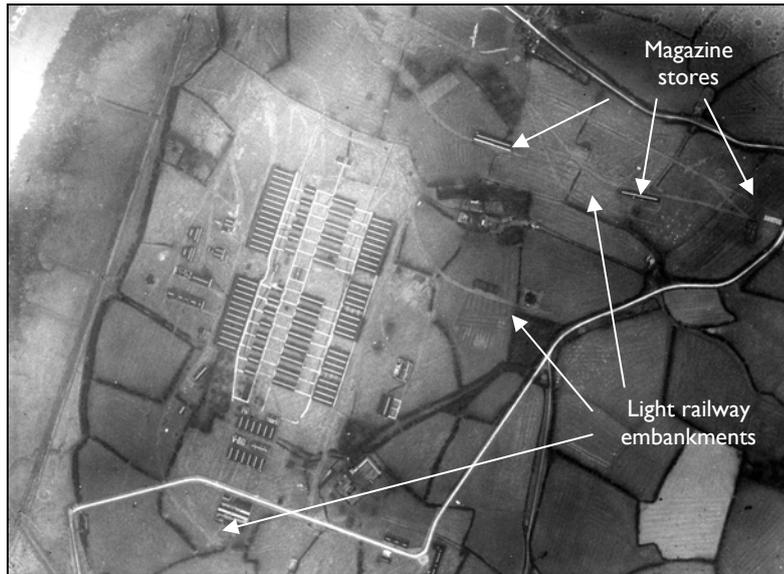


Figure 10-4 The National Shell Filling Factory (No. 23) at Chittening, north of Avonmouth. The original layout can clearly be seen with the light railway embankments. Only two buildings remain unchanged today part of what is now a modern industrial estate.

CCC I1756/6238 (1920s) English Heritage. NMR Crawford Collection

About 1km north of H.M. Henbury at Chittening, another explosives factory was constructed for the manufacture of H.S., a variety of Mustard Gas, though it seems the factory was converted into National Shell Filling Factory No. 23 (ST 58 SE 21/HOB UID 1078472) at some point during the war (Bristol HER No. 21403 and 21389). The factory layout is clearly visible on pre-Second World War photography (Figure 10.4) and included the embankments of the light narrow gauge railway that surrounded the site. What appears to be a railway loading platform or a goods station is visible to the northwest of the site where there was a junction with the Avonmouth and Pilning Railway.

The factory was re-used in the Second World War, with the roofs of the main buildings painted in camouflage. Many of the outlying magazine storage buildings can be seen without roofs on aerial photographs taken in 1946. An aerial photograph taken in 1944 shows groups of decommissioned planes to the south of the site (Figure 10.5), suggesting its use as an extension to the Bristol Aeroplane Company, nearby at Filton. Many of the buildings appear to have been still in use after the Second World War, though the majority have been demolished over the years and the most recent photography taken in 1993 shows the site covered by

Chitting Industrial Estate, but two buildings appear to be from the original factory.



Figure 10-5 Second World War photograph of the National Shell Filling Factory (No. 23) at Chitting showing what appears to be decommissioned planes which may be associated with the Bristol Aeroplane Company, located nearby at Filton. Top left is a barrage balloon site.

RAF/106G/LA/145 5130 30-OCT-1944 © English Heritage (NMR) RAF Photography

Although the two explosive factories previously described, along with H.M Avonmouth just outside the area surveyed, appear to have been contemporary, it is difficult to define the extents, location and function of each site from documentary evidence alone. The 1920s aerial photography has been important in resolving some of these issues and providing strong evidence to establish accurate location and extent. Further work would be useful in understanding how the First World War factories relate to one another and how they were used to produce explosive material to aid the war effort. Unfortunately, little survives of these two factory sites, which are now both occupied by modern industrial estates.

The armament depot located at Slimbridge (SO 70 SW 39/HOB UID 1466748), also known as His Majesty's Magazine No 23, was used for the storage of cordite propellant from 1916 to 1921. The depot held sixteen wooden storage buildings which were removed in 1924 (Edwards 1995). The munitions buildings were connected by railway embankments to the main Midland Railway line and the Gloucester & Sharpness Canal, allowing easy transportation of a very volatile product.

The Forest of Dean NMP survey mapped and described the extensive First World War shipyards at Chepstow and Beachley. These include the remains of six slipways, a dry dock, associated buildings, with connecting railway branch line and sidings (HOB UID 1383682/ HOB UID ST 59 SW 94; HOB UID 1383732/ ST 59 SW 95) (Small and Stoertz 2005). In a response to heavy British naval losses in the Atlantic, a number of National Shipyards were established. National Shipyard No.1 established at Chepstow by extending the site of the existing shipyard and No. 2 was a new shipyard established at Beachley. The local population was moved and the shipyard constructed by Royal Engineers with the help of German prisoners of war. The railway linked the shipyard to the main line at Chepstow and had numerous sidings linking the various slipways and parts of the yard. The shipyard never completed a ship, and by 1927 the site had been taken over by the Army Apprentices College, and the railway ceased to be of use.

10.3 Second World War

10.3.1 Introduction

The character of the Second World War coastal defences varies throughout the length of the Severn Estuary RCZA area due to changes in topography and strategic importance. This archaeological evidence will be described and discussed according to defensive structure type. The NMP survey, created a total of 237 (excluding Forest of Dean and Quantocks NMP surveys) records of previously unrecorded Second World War sites or structures, with 181 records updated or amended.

Many of the Second World War sites were recorded by the Defence of Britain Project, which was fieldwork based and carried out by about 600 volunteers with the aim of recording surviving military structures (Defence of Britain Project 2002). The NMR historic aerial photographic collection has been an important resource for identifying former and destroyed military sites, as the aerial photographs are a key pictorial record of their location, morphology and function. Due to the NMP survey, it has been possible to reconstruct a much fuller picture of the Second World War military landscape than has been previously possible.

10.3.2 Pillbox Defence

As a navigable river and a major route into England, the Severn was protected against German invasion with coastal crust defences and other anti-invasion structures. A major part of the defences was the numerous pillboxes and gun emplacements constructed in defensive lines and placed strategically at intervals to compartmentalise the country. Known as Stop Lines, they were essentially designed to prevent enemy armoured fighting vehicles breaking through beach defences and in the event of major landings, creating 'fields of fire' (Lowry 1999). Along the Severn Estuary, pillboxes formed part of the Green, Taunton and GHQ Stop Lines (Foot 2006). The Green Stop Line, also known as the Bristol Outer Line, ran from Burnham-on-Sea to near Melksham, Wiltshire and then north to the River Severn at Newnham. The Taunton Stop Line began at Pawlett Hill and extended south along the banks of the River Parrett and on towards Taunton. The GHQ line ran eastwards from Highbridge near the Taunton Stop Line and eventually to Yorkshire (Wills 1985).



MSO 31206 PO-067 27-JUN-1941 © English Heritage (NMR) RAF Photography

Figure 10-6 Second World War military structures on Minehead promenade. Centre of the photograph is a concrete infantry section post. Top centre is a pillbox disguised as a kiosk outside the railway station.

As well as providing protection to individual sites, such as the Barrage Balloon hangar and the wartime radio receiving station on Brue Pill, pillboxes were also located to deny the enemy access to waterways (Wills 1985), and have been recorded on the River Severn at Arlingham and Slimbridge Warths and the wharves at Highbridge and Dunball on the River Parrett.

Many of the pillboxes recorded by the NMP survey made use of camouflage. Some were disguised as local buildings such as fishing tackle stores, railway workers' huts, small cottages, beachfront kiosks, and cafés (Figure 10.6). Pillboxes located along the coast were also concealed within the landscape by cementing beach pebbles to their exterior. There are also instances where the two camouflage forms were used together on the same pillbox, as at Porlock Weir (Figure 10.7).

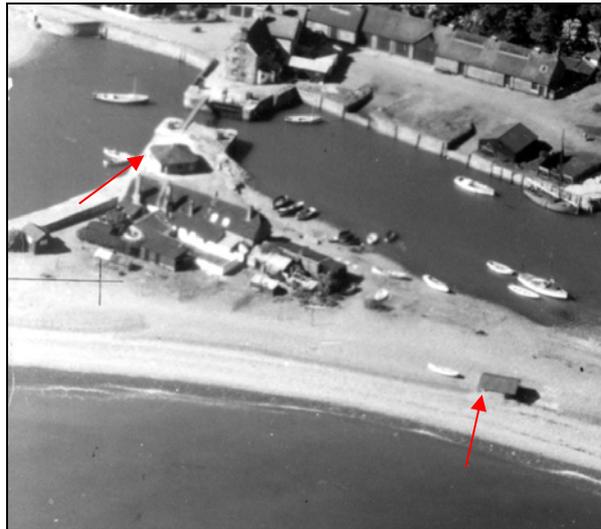


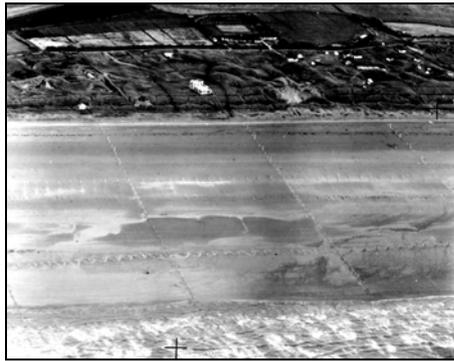
Figure 10-7 Two pillboxes are disguised (arrowed) with pitched roofs in Porlock Weir. The beachfront pillbox was also covered in beach pebbles.

MSO31206-019 27-JUN-1941 © English Heritage (NMR) RAF Photography

10.3.3 Coastal Crust Defences

The survey identified numerous anti-invasion coastal beach obstacles on the coast between Burnham-on-Sea and Berrow, in Sand Bay and Blue Anchor Bay.

A military command circular sent during the war prioritised beaches for defence based on proximity to ports that might be a target for seizure (Lowry 1999). Prioritised beaches identified close to Bristol and Avonmouth received full defensive structures, such as the continuous grid of post alignments constructed from the top of the beach into the intertidal area in each of these locations (Figures 10.8, 10.9 and 10.10).



RAF/1416/S407H50 PO-102 16-AUG-1941
© English Heritage (NMR) RAF Photography



RAF/1416/S512184 PO-102 19-SEP-1941
© English Heritage (NMR) RAF Photography

Figure 10-8 Second World War anti-invasion obstructions placed in a grid pattern on Berrow Flats (left) and Sand Bay (right).

These beach obstacles were designed to prevent both enemy gliders and marine craft from landing on the large tidal beaches. Most individual posts had been removed by the late 1950s, although some posts were still visible *in situ* at low tide during a field visit in April 2008. Although aerial photographs show that the anti-invasion obstruction alignments were continuous from Blue Anchor Bay to Minehead Bay, some of the wartime aerial photographs were not of sufficient quality to enable accurate mapping, but these features have been sketch plotted elsewhere (McDonnell 2001: 41).

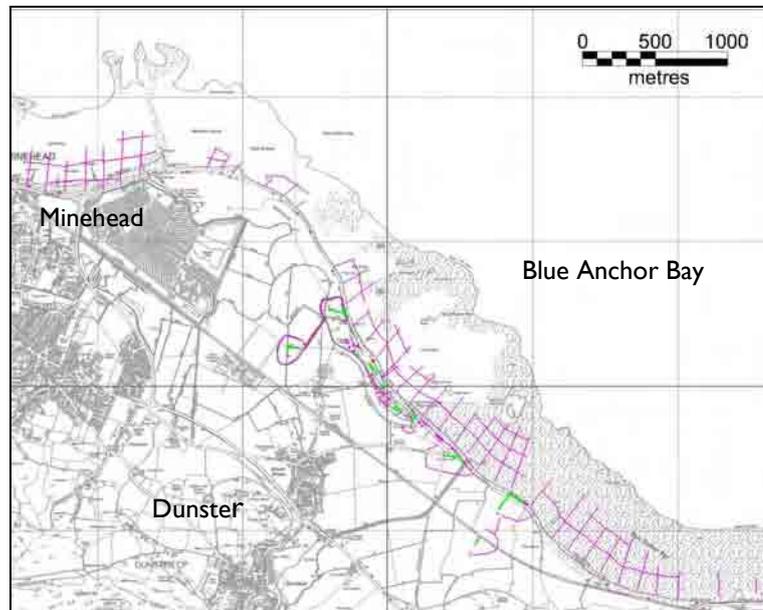


Figure 10-9 Anti-invasion post alignments constructed along Blue Anchor Bay, Somerset during the Second World War

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Background map acquired from the Ordnance Survey.

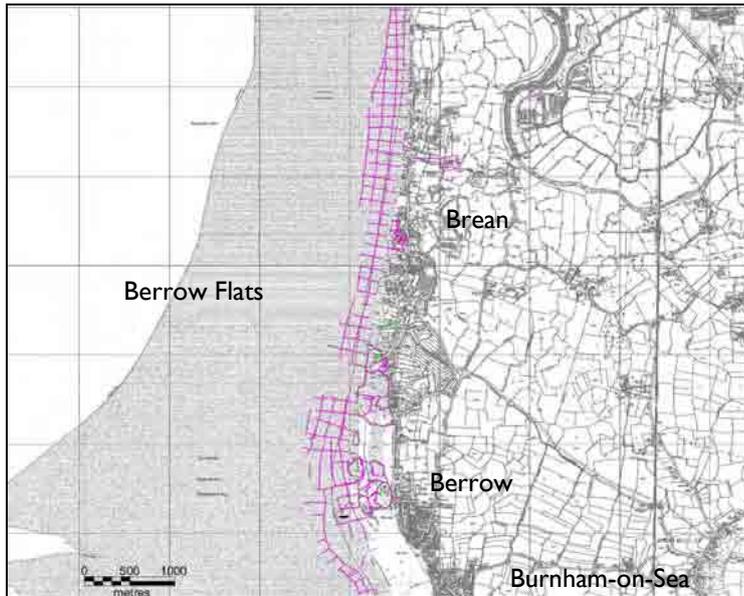


Figure 10-10 Anti-invasion post alignments constructed along Berrow Flats, Somerset during the Second World War.

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Background map acquired from the Ordnance Survey.

The large tidal bay at Weston-super-Mare, however, did not receive the same beach defences. On the beach there the obstacles comprised little more than irregular piles of stones arranged in rows, with barbed wire entanglements on the dunes adjacent to the beach (Figure 10.11).



RAF/1416/S512184 PO-102 19-SEP-1941 © English Heritage (NMR) RAF Photography

Figure 10-11 Beach obstacles comprising of piled stones on Weston-super-Mare beach. Note the circular group of soldiers training, bottom left.

It is unclear why the defences here were different, but perhaps it was considered that an invasion force would not choose Weston-super-Mare as a strategic landing

place. It is a dense urban area with a large military presence, which was adjacent to a RAF base, and the bay had protection from the coastal battery on Brean Down and a heavy anti-aircraft battery on the beach south of the town. An invasion of Weston Bay offered a much higher resistance than the beaches further south at Burnham-on-Sea which was essentially a rural area.



Figure 10-12 Second World War beach defence site at Berrow. The beaches are defended by anti-aircraft obstructions. Barbed wire entanglements enclose areas within the sand dunes comprising slit trenches and pillboxes.

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Background map acquired from the Ordnance Survey

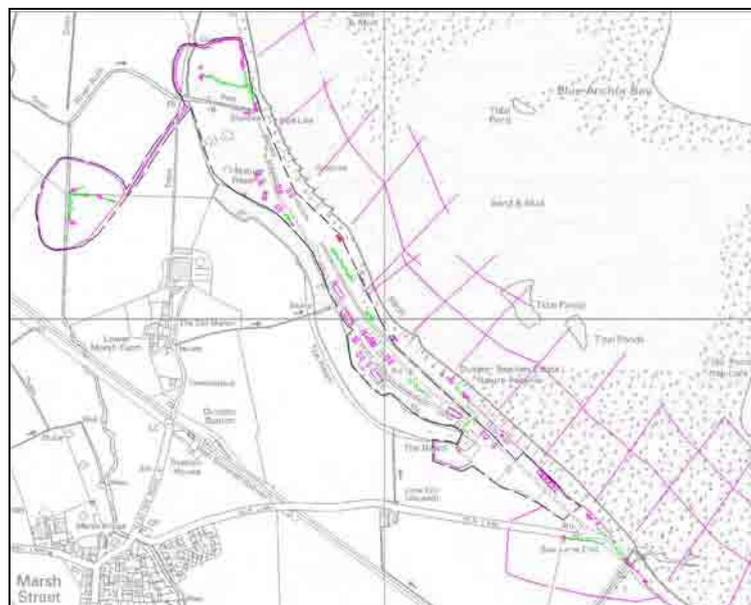


Figure 10-13 Second World War beach defence site at Dunster Camp. The military camp and beachfront is defended by anti-aircraft obstructions. Barbed wire entanglements enclose areas comprising slit trenches and pillboxes.

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Background map acquired from the Ordnance Survey

Other coastal crust defences were associated with the beach obstacles. The highest concentrations were focused between Berrow and Brean and between Minehead and Dunster. Sub-circular barbed wire entanglements were recorded enclosing large anti-invasion sites amongst the sand dunes. These defended areas contained slit trenches, Nissen huts, pillboxes, and gun emplacements (Figure 10.12 and 10.13). Concrete pillboxes were also sited along the inland approaches to coastal defence sites, such as along field boundaries, roads, and railway lines.



A
MSO31206-014 21-JUN-1941 © English Heritage
(NMR) RAF Photography



B
MSO31206-018 27-JUN-1941 © English Heritage
(NMR) RAF Photography



C
MSO31206-056 27-JUN-1941 © English Heritage
(NMR) RAF Photography



D
MSO31206-013 21-JUN-1941 © English Heritage
(NMR) RAF Photography

Figure 10-14 Four examples of the infantry section posts positioned along the coast between Blue Anchor and Porlock. These are an uncommon design and a unique part of the coastal crust defences, all but one of which have been destroyed in west Somerset.

Numerous pillboxes were positioned along the coast between Porlock Weir and Blue Anchor, of which 28 were identified as a non-standard design known as an infantry section post (Figure 10.14). Section posts of this type are a unique part of the coastal crust defences in the Severn Estuary RCZAS survey. These structures were constructed of concrete in a shallow V-shape, with its apex facing the sea. Embasures were located along each wing and at the centre rear of the structure;

an open square area may have contained a light anti-aircraft gun (Tacchi 2003). Infantry section posts are known in North Yorkshire, Teeside and Norfolk (pers comm. Roger Thomas), but only one surviving example of this type remains in Somerset, located on the western end of the esplanade at Blue Anchor (ST 04 SW 95/HOB UID 1417665). This illustrates the importance of early wartime aerial photographs for documenting Second World War defences that have since been destroyed.

10.3.4 Batteries And Bombing Decoys

According to Dobinson (2000a: 213), the performance of decoy sites throughout Great Britain was inconsistent, but the 5% of the total German bombs wasted on British decoys potentially spared many lives and property. Decoys were co-ordinated nationally but maintained by different bodies - the War Office was responsible for army targets and the Admiralty for naval installations (Dobinson 2000a). Various types and designs of decoys were constructed to suit different primary targets and these are reflected in the decoy sites identified along the Severn Estuary coastline.



Figure 10-15 The Second World War starfish bombing decoy site located near Gloucester.

US/7PH/GP/LOC234 5034/2 15-MAR-1944 © English Heritage (NMR) RAF Photography

In Gloucestershire a bombing decoy was (SO 71 SE 23/HOB UID 1448135) visible on only one United States Army Air Force (USAAF) vertical aerial photograph taken in 1944. The site consisted of Starfish or Special Fires (SF), which were

controlled fires set by military personnel from a control shelter at night to deceive Luftwaffe aircrew (Dobinson 2000a) (Figure 10.15). A bombing decoy's role was to deceive enemy aircrew into dropping their bombs by posing as failed or inadequate 'Blackouts'. In this case, the site functioned as a decoy for the city of Gloucester and the nearby airbase RAF Quedgeley and possibly RAF Moreton Valence, although many airfields had their own 'dummy' airfields. Another bombing decoy was located at nearby Standish (Dobinson 2000a).

A night time bombing decoy (also known as a 'Q-type' and 'QF') (ST 35 NW 46/HOB UID 1452024) located at Bleadon was only visible on two aerial photographs taken in 1941. Its primary purpose was to divert enemy bombing from RAF Weston-super-Mare airfield, but was also part of the civil decoys ('C-series') for the town of Weston-super-Mare. Sited along Middlehope (ST 36 NW 25/HOB UID 1460927) was another 'Q' site. This used the same illusory devices and is visible as a series of eight linear rows of flarepots or lights on aerial photographs (Figure 10.16). This night time decoy attempted to emulate the runway lighting at RAF Weston-super-Mare. Dobinson's gazetteer (2000a: 276) records a bombing decoy further east along the coast at Woodspring Bay. It is unclear whether this is the same site inaccurately recorded, or a different bombing decoy altogether.



Figure 10-16. Middlehope 'Q' bombing decoy site, the flare pots were used to emulate the runway lights at nearby RAF Weston-Super-Mare.

NMR RAF/GHQ/105 3 14-MAY-1941 © English Heritage (NMR) RAF Photography

Another two bombing decoy sites, located north and south of Avonmouth docks, were associated specifically with oil storage depots. Further details on these decoy sites can be found in the Bristol Defences Case Study below (Section 10.3).

The heavy anti-aircraft and coastal batteries located along the Severn Estuary coastline were the most aggressive form of defence structure. Four anti-aircraft batteries identified within the RCZAS survey were located at Pilning, Avonmouth (Hallen Marsh), Portbury (Sheepway) and Portishead, and adhere to a standard design. They comprised four octagonal gunpits or emplacements positioned in a semi-circular arc around a centrally placed reinforced concrete command post, with adjacent magazine buildings (Figure 10.17).



RAF/CPE/UK/2095 5468 28-MAY-1947
© English Heritage (NMR) RAF Photography



RAF/CPE/UK/2026 5028 26-APR-1947
© English Heritage (NMR) RAF Photography

Figure 10-17 The heavy anti-aircraft batteries at Hallen Marsh, Avonmouth (left) and at Sheepway, Portbury (right). Both have small camps and barracks attached to the gun emplacements. They were used to defend Avonmouth docks, Portishead docks and Bristol from aerial attack.

The battery located at Hallen Marsh (ST 58 SW 15/HOB UID 1395 032), Avonmouth was also equipped with a GL Mark II radar by June 1942, to allow for the detection of approaching aircraft at a distance of around 48kms (30 miles), and thus formed part of the Bristol Gun-Defended Area (GDA) (Bristol HER No. 5972).

A larger heavy anti-aircraft battery positioned at Weston-super-Mare (ST 35 NW 109/HOB UID 1453681) was also visible on aerial photographs, adjacent to the beach. This battery comprised four square gun pits as well as a gun laying radar

platform, and it underwent quite a few changes during the war. The layout of the ancillary buildings was different when the site was first constructed, and possibly their location was deemed to be too close to the battery as they were relocated a further 100m away. These wartime modifications are all visible on the early RAF aerial photographs.

Both the coastal batteries at Brean Down and at the aptly named Battery Point were re-used during the Second World War, but their original use as defensive positions, was much earlier. Brean Down Fort (ST 25 NE 33/HOB UID 1065684) like Steep Holm, Flat Holm and Lavernock started life as one of four Victorian Palmerstonian forts. During the Second World War, it became part of a chain of coast defence batteries designed to protect ports along the Severn Estuary.

The harbour quay at Minehead was also the site of a coastal battery (SS 94 NE 143/HOB UID 1426854). The battery consisted of two 4-inch naval guns belonging to the 400 Battery Coastal Artillery Royal Artillery, which were camouflaged within two false sub-rectangular buildings on the outer harbour quay wall, along with other military structures. However, the guns were only ever test-fired once nearly destroying the harbour wall, and as a result were removed (Hewett 2006; Somerset HER 1994).

The position and distribution of the anti-aircraft batteries suggests that enemy bombers were likely to use the Severn Estuary as a pathway into South-West England. Avonmouth and Bristol docks were clearly prime targets, with four of the anti-aircraft batteries clustered around the mouth of the Avon.

10.3.5 Military Camps And Training

Many of the defences in the RCZA survey area relate to the potential invasion by German forces in the early years of the war. In West Somerset coastal defences are certainly evident, but another important series of installations were artillery training ranges, and camps for the concentrations of American troops and equipment prior to D-Day in 1944 (Riley 2006). For example between North Hill, west of Minehead and along the coast to Lilstock, there were two tank training

circuits, two bombing ranges, a large artillery range and five military camps constructed for use by British, American and Canadian forces.

On North Hill the military made extensive use of the moorland to train tank crews, visible as numerous tank tracks criss-crossing the landscape in post-war photographs (SS 94 NW 64/HOB UID 1102198).



Figure 10-18 Second World War tank-training activities on Bossington and North Hill. A triangular tank training circuit can be seen in the bottom left and two linear railway targets are visible in the centre of the photograph.

RAF/106G/UK/1655 4010 11-JUL-1946 © English Heritage (NMR) RAF Photography

The most prominent features were three triangular tank circuits and their associated target railways (Figure 10.18). About 24 scattered observation posts and bunkers, visible as sub-circular mounds of earth, are also visible on aerial photographs. The supporting infrastructure associated with this facility also included military roads, a tank marshalling area and two temporary army camps. The American military ran a PX (Postal Exchange) canteen on North Hill and it is possible that it was located at one of these camps. Many of the structures and roads are still visible as earthworks on aerial photographs taken in 1979.

A similar tank training facility was identified in the Quantock Hills NMP survey at West Kilton Farm (Figure 10.19) (ST 14 SE 66/HOB UID 1366235). American forces used the tank range, built in 1942, until D-Day (Riley 2006).

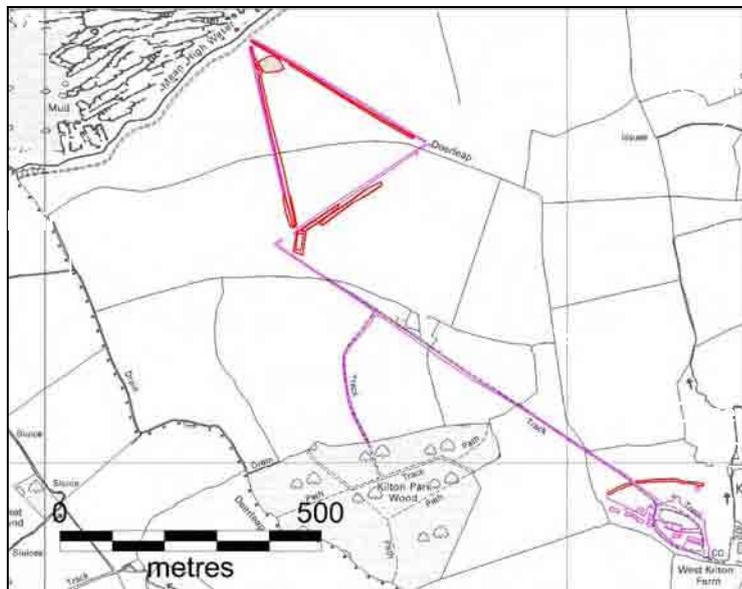


Figure 10-19 The Second World War tank training facility identified in the Quantock Hills NMP survey north of Kilton that comprised a triangular tank circuit and linear firing range.

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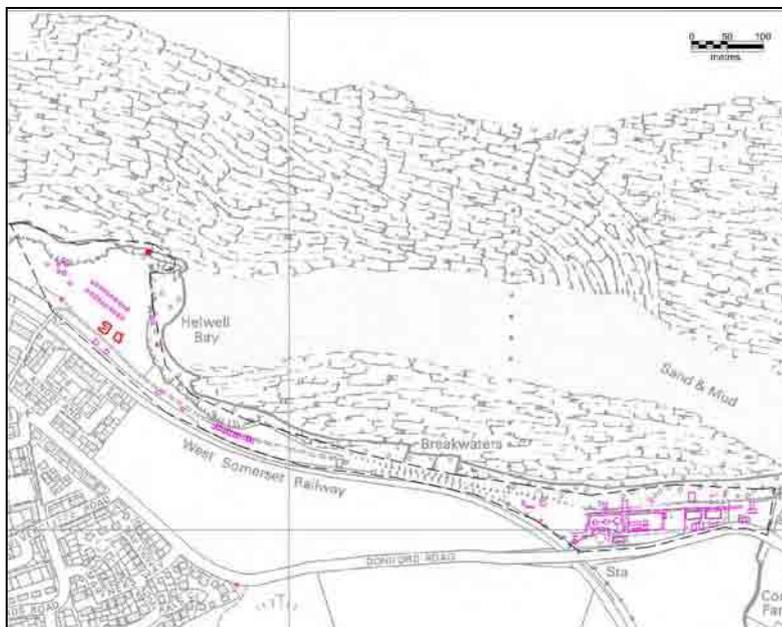


Figure 10-20 The Second World War air gunnery and bombing range identified in the Quantock Hills NMP survey, near Watchet.

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To the east of Watchet was an air gunnery and bombing range (Figure 10.20). Both North Hill and the Quantocks were ideal for training purposes, being located in rural upland areas that were sparsely populated. The bombing ranges also benefited from coastal positions allowing bombs to be directed out to sea away from the land and people.

There are four other bombing ranges within the RCZAS survey area at Stert Flats, Brean Down, Middlehope and Aust Cliff, and these are identifiable by the large directional arrows or bombing range markers (Figure 10.21). The Stert Flats bombing and air gunnery range (ST 24 NE 38/HOB UID 975093) had two arrows (Figure 10.21): a large white arrow indicating smoke-bombing and a smaller red arrow to signify live bombing practice. At the base of the arrows were two structures that told aircrews which direction arrow was in use. The arrows pointed north out onto Stert Flats, where bomb craters are visible on aerial photographs, 1.8km out in the intertidal muds.



RAF/CPE/UK/1944 1176 23-JAN-1947
© English Heritage (NMR) RAF Photography



RAF/CPE/UK/2489 5098 11-MAR-1948
© English Heritage (NMR) RAF Photography

Figure 10-21 Air gunnery and bombing range at Wall Common, Stert Flats (left) and Brean Down (right). The arrows indicate the direction of the bomber targets.

On St Thomas' Head on Middlehope, the Second World War air gunnery and bombing range (ST 36 NW 14/HOB UID 1468035) continues as a military site to the present day. The site is now operated by QinetiQ and is an Explosives and Shock Test Facility. In adjacent Woodspring Bay, a cluster of bomb craters (ST 36 NE 36/HOB UID 1462056) recorded from specialist oblique archaeological photography taken in 2000 attest to this continued activity. The two most obvious

features associated with this air gunnery and bombing range are the remnants of two wartime ships, HMS Staghound (ST 36 NE 12/ HOB UID 1001810) and SS Ferndown (ST 36 NE 11/ HOB UID 1001809), used for bombing targets, which have been virtually demolished by over 60 years of bombing activity.

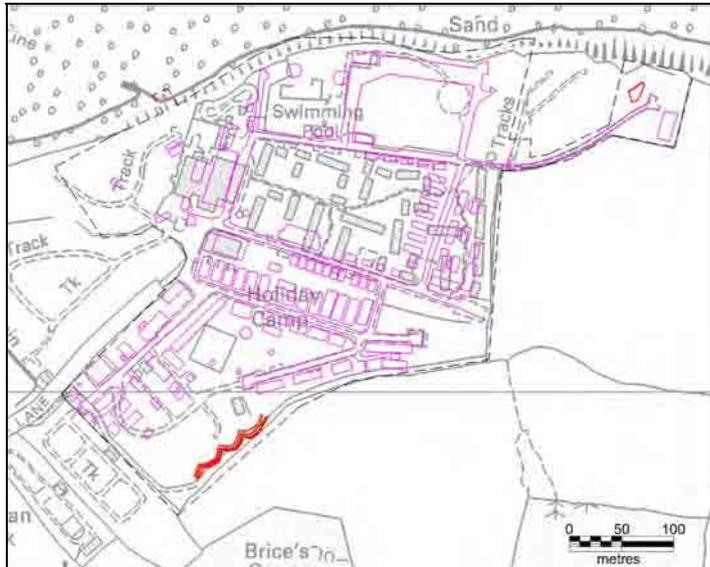


Figure 10-22. A Second World War military camp on the Quantock Hills. Doniford Camp is now the site of a Holiday Park.

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Background map acquired from the Ordnance Survey

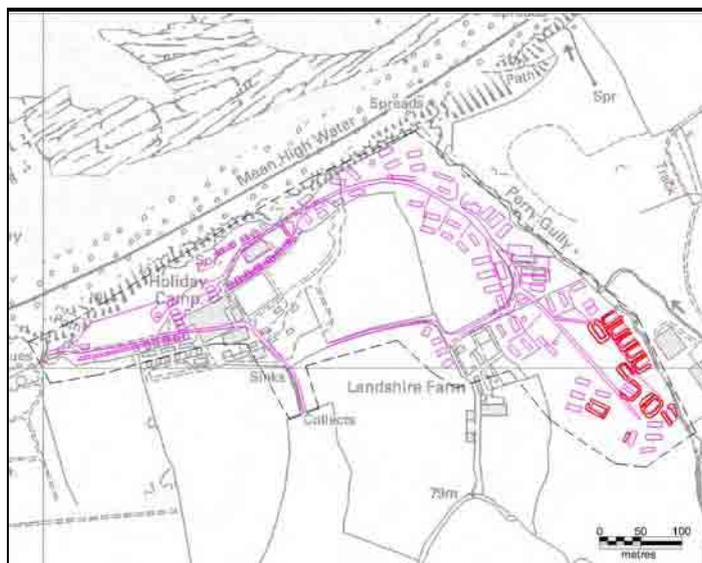


Figure 10-23 A Second World War military camp at Landshire Farm on the Quantock Hills; now the site of a Holiday Park.

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Background map acquired from the Ordnance Survey

Firing ranges were also an important part of military training, especially for the Home Guard who used many of the rifle ranges on the coast and were considered the last phase of the nation's defence (Riley 2006, p.157). Most of the ranges were in use before the Second World War, such as the originally Victorian range in use at Gullhouse Point, south of Clevedon (ST 37 SE 38/HOB UID 1465826). Firing ranges were also located at Uphill, Severn Beach and Pilning.

Military camps were also associated with the training areas, accommodating the numerous military personnel. Many of these such as at Donniford and Landshire Farm in the Quantock Hills are now the sites of holiday parks. At Landshire Farm (ST 14 SW 128/HOB UID 1366900), the present plan of the holiday camp partially follows that of the earlier military camp (Figure 10.22 and 10.23). Some military camps made use of existing holiday parks, such as those at Dunster (SS 94 NE 149/HOB UID 1454490) and Brean Sands (ST 25 NE 79/HOB UID 1450754), which were requisitioned wholesale. With wooden holiday chalets already in place, there was no need to construct new accommodation buildings for servicemen.

The remains of a military camp situated at the docks at Sharpness (SO 60 SW 64/HOB UID 1389558) are visible as a series of marks on grass indicating a group of 25 tents. These tents were square and measured approximately 5m by 5m. This tented encampment may suggest a temporary site not requiring hut accommodation.

Prisoner of War camps seem to be more common in the north of the RCZAS area as identified during the Forest of Dean NMP survey, for example at Naas House, Lydney (Figure 10.24). The Naas House Camp has an unusual plan with the accommodation huts appearing in lines around the edges of two fields. Small *et al.* (2006) suggests that the arrangement of the buildings is more typical of an Army camp or storage depot and that the site was originally intended to be for storage or housing for troops or factory workers.

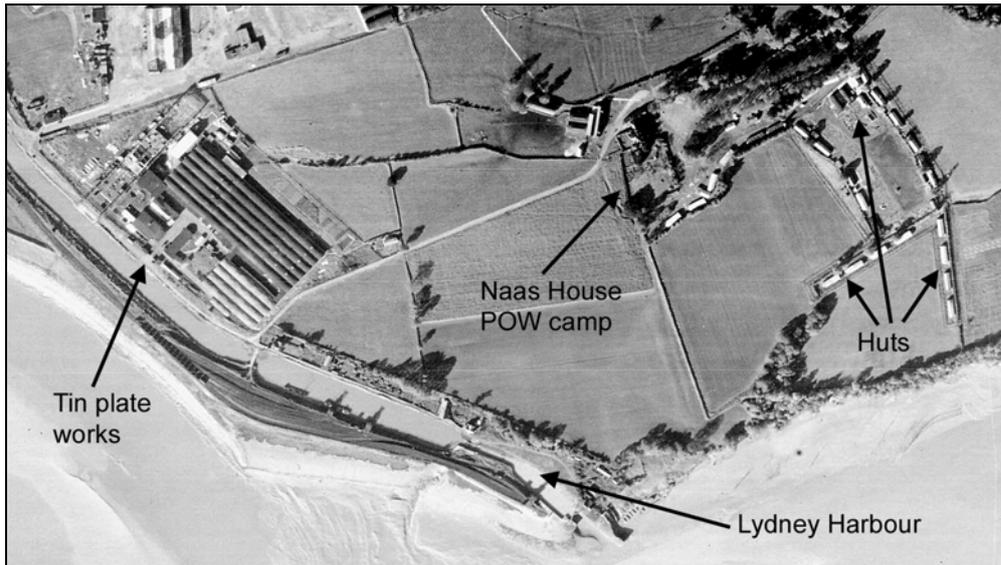
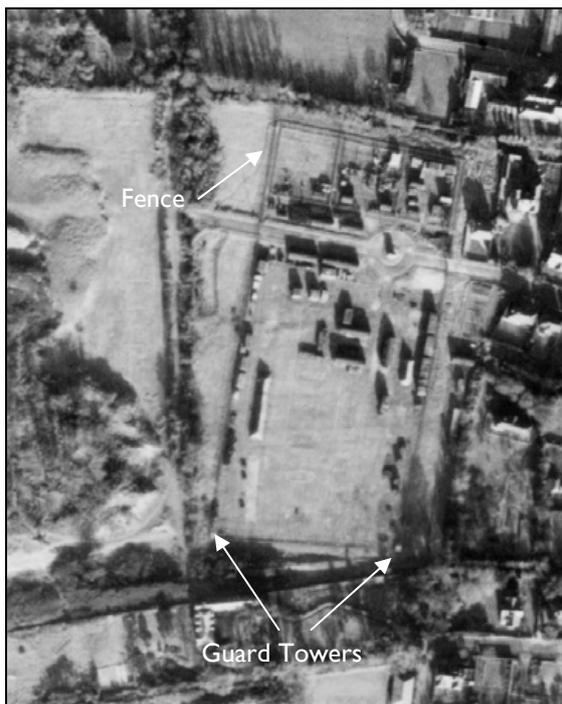


Figure 10-24 Naas House Prisoner of War Camp and adjacent tin plate works to the south of Lydney, where the prisoners are believed to have worked.

RAF/106G/LA121 3013 09-FEB-1945 © English Heritage (NMR) RAF Photography



RAF/3G/TUD/UK/1519 5246 13-JAN-1946 © English Heritage (NMR) RAF Photography

Figure 10-25 The military camp and/or prisoner of war camp at Burnham-on-Sea.

Another Second World War military camp and/or prisoner of war camp at Burnham-on-Sea (ST 35 SW 21/HOB UID 1451458), is visible as a rectangular fenced enclosure on aerial photographs taken in 1946. Not extant in 1941, the site of this military camp is now occupied by residential housing. A first hand account suggests that Italians were the main prisoners of war accommodated here

(Thewingdone 2003). Nissen huts and other military buildings are visible in Figure 10.26 and in the southwest and southeast corner of the enclosure; small square structures may have been guard towers.

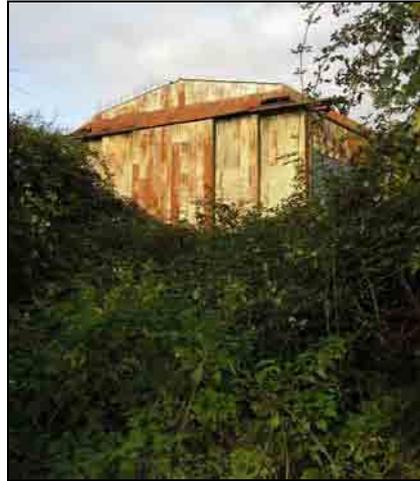
10.3.6 Experimentation And Communication

There are three military sites in the Severn RCZAS area that show evidence of military experiments. Perhaps the most important to the war effort was the secret weapons testing carried out at Birnbeck Island (ST 36 SW 30/HOB UID 192800). Between 1941 and 1946, the island and pier were taken over as a naval base known as HMS Birnbeck, whose role during the war is well documented (Pawle 1956). The military facility used existing buildings and dismantled all the fairground and amusement rides. Part of the secret weapons programme was the testing of new types of depth charge fuses, which were attached to dummy mines made of a metal casing filled with reinforced concrete (Friends of the Old Pier Society 2006). The 'bouncing bomb' was also tested here and at Brean Down (Pinsent 1983).

Also of particular interest is the site of balloon cable-cutting experiments by the Royal Aircraft Establishment (ST 24 SE 43/HOB UID 1449406) at Pawlett Hill and Pawlett Hams. The barrage balloon was housed in its own specially constructed camouflaged hangar on Pawlett Hill, and this meant there was no need to regularly deflate or inflate it (Balloon Barrage Reunion Club 2008). Aerial photographs taken during the war show the construction of the hangar with the balloon temporarily moored to the east of the site (Figure 10.26). Most of the ancillary buildings of the research establishment and the hangar are now either demolished or in a state of disrepair, the site being in use as a scrap yard during a field visit by RCZA staff in 2006 (Figure 10.26). The hangar is a rare Second World War feature comparable only to the surviving barrage balloon hangars at Cardington, Bedfordshire.



NMR RAF/CPE/UK/1944 4102 23-JAN-1947
© English Heritage (NMR) RAF Photography



Pawlett Hanger 2006 © Amanda Dickson

Figure 10-26 The Balloon Hangar at Pawlett Hill used for balloon wire cutting experiments. Note the camouflaged roof and the small white directional arrow just to the south of the hangar, used to guide the planes (left). The experiments were carried out to the west of this site on Pawlett Hams. The right hand image shows the Hangar in 2006.

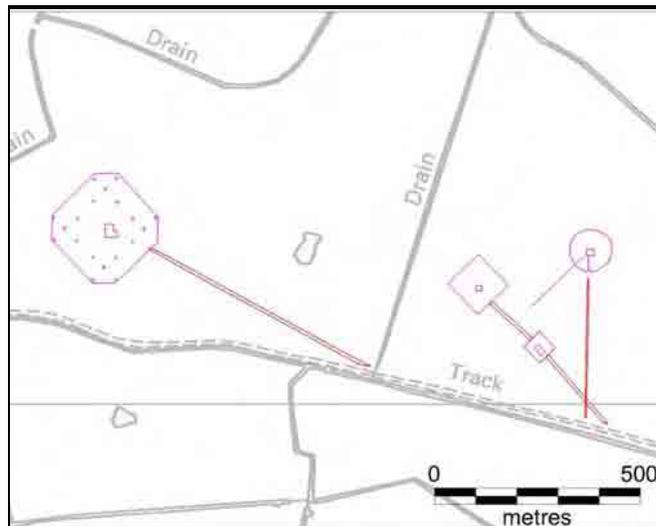


Figure 10-27 The Second World War maritime radio receiving station near Burnham-on-Sea. The antennas are shown enclosed by fences (purple). Trackways have also been recorded extending from the individual sites.

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Background map acquired from the Ordnance Survey

Communications were extremely important during the war and coastal defence radars allowed for an early warning of the approach of enemy ships or incoming aircraft as well as general surveillance of all marine activity within the area (Pearson 1991; Dobinson 1996). These were known as Chain Home stations and were

located around all Britain's coast. They played a key role in the Battle of Britain (Dobinson 1996: 64). Nearly all of those in the Severn Estuary RCZA survey area are now only visible on the historical air photography. The Coastal Defence/Chain Home Low (CD/CHL) radar station (SS 94 NE 171/HOB UID 1454868) sited on North Hill, which was associated with the coastal battery at Minehead, is no longer operational.

Radar stations were not the only forms of communications employed by the military. A wartime maritime radio receiving station was also identified and recorded in the fields south of Brue Pill, at Burnham-on-Sea, (ST 34 NW 96/HOB UID 1452298, ST 34 NW 97/HOB UID 1452301). It comprised three fenced enclosures containing large antenna array masts and military buildings (Figure 10.27), but had been dismantled by the late 1960s. It is likely that the radio receiving station was one of several sites linked to the Portishead Radio system. It is documented that a special aircraft section was set up by the Royal Navy in 1943 to maintain communications with patrol aircraft in the North Atlantic (British Telecom 2001), which is likely to have included the three sites shown in Figure 10.28. The main communications site was located at Highbridge and was known as Portishead Radio GKA (ST 34 NW 95/HOB UID 1453621). It was originally opened in 1925, but used by the military during the Second World War to communicate with allied shipping and maritime patrol aircraft (Bennet 2005). A third transmitting site located on Portishead Down was also part of this radio communication network, and continued in use into the late 20th century, though has subsequently been dismantled.

10.4 Case Study: Bristol Defences And Battery Point

10.4.1 Bristol Defences

Bristol, its docks and the surrounding industrial area was strategically vital for Britain during the Second World War. Pinsent (1983) refers to an official German wartime communiqué boasting that the Luftwaffe was heavily bombing Avonmouth's industrial harbours and installations. The main targets surrounding Bristol were the railway system, port docks, aircraft factories, chemical factories and oil depots, all of which were picked out by Luftwaffe photographs (Clarke

1995, p.11). Bristol and Avonmouth therefore warranted a large-scale defence strategy (Pinsent 1983) (Figure 10.28).

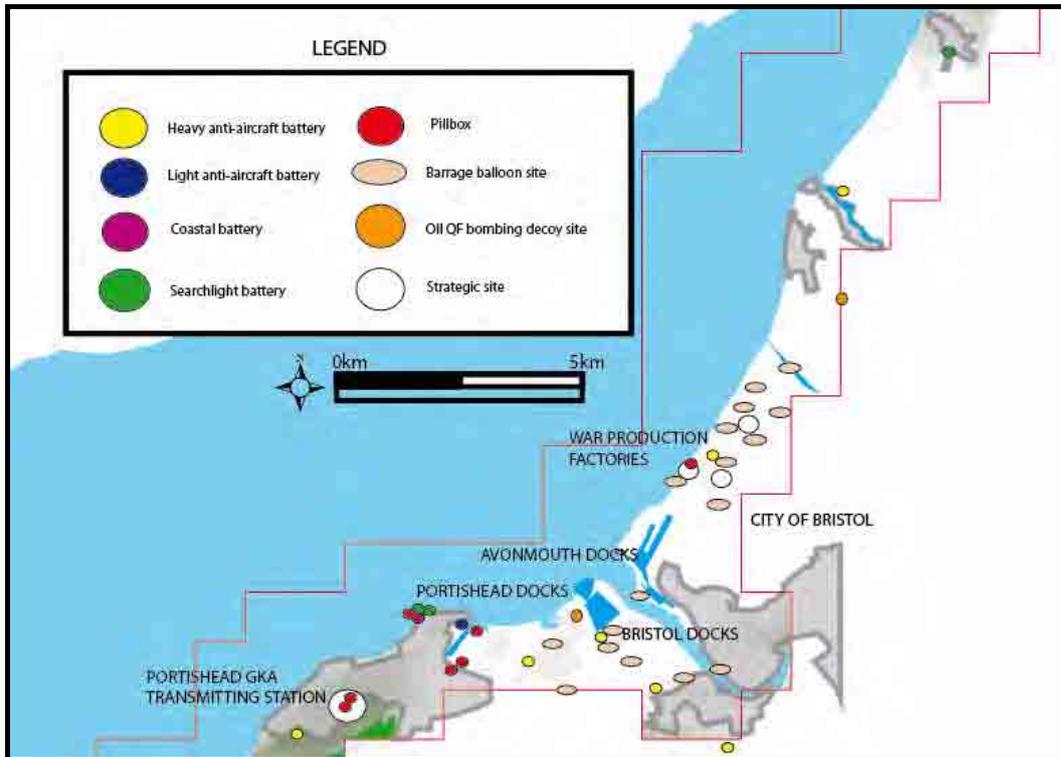


Figure 10-28 Distribution of Second World military defences in and around Bristol and Avonmouth.

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Background map acquired from the Ordnance Survey



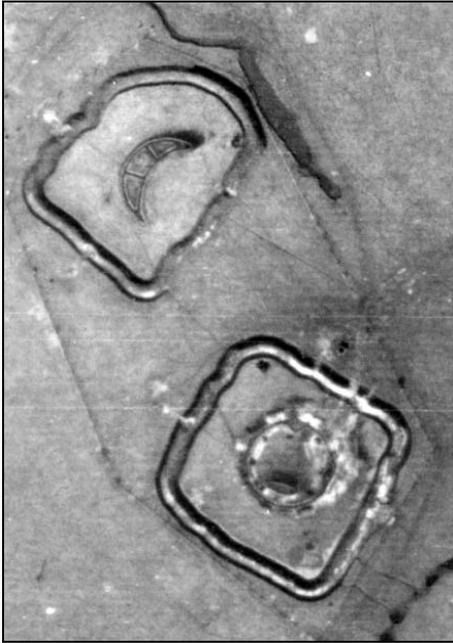
RAF/106G/UK/1288 5002 25-MAR-1946

© English Heritage (NMR) RAF
Photography

Figure 10-29 The site of a barrage balloon defending an adjacent camouflaged factory and a fuel depot at Avonmouth.

Shortly after 1939 mobile heavy anti-aircraft sites were set up, but these became static sites by 1941. Within the Severn Estuary RCZAS area these were located at Portbury, Hallen Marsh (Figure 10.17), Walton Down (Portishead) and Pilning. Barrage balloons were also set up to prevent enemy aircraft from flying low and therefore make it harder for them to hit their targets. Eight Second World War barrage balloon sites were identified in and around Avonmouth, but many more were visible on the aerial photographs outside the RCZA project area. The barrage balloon site in Figure 10.29 comprised a circular balloon mooring area approximately 23 metres in diameter, from which the balloon would have been winched into the air prior to an air raid and tethered to regularly spaced concrete blocks. Associated rectangular buildings would have acted as the balloon crew's accommodation.

Decoy sites included the Second World War oil QF (P series) bombing decoy sites visible on aerial photographs taken in 1946. The bombing decoys were located on the saltings of St George's Wharf, east of Portishead (also known as Sheepway) (ST 47 NE 127/HOB UID 1467868) and inland of Severn Beach (HOB UID 1036400/ST 58 SW 18). Both were created for the defence of Bristol docks and Avonmouth, to protect oil and fuel storage tanks of great strategic importance (Dobinson 2000a). The oil QF decoys acted as bomb damaged storage tanks to divert bombing away from real oil supplies. They were both located away from the main Avonmouth facilities, but close enough to confuse Luftwaffe bomber aircrew. Dobinson (2000a: 148-149) provides a useful historical account of British Second World War bombing decoys, including this one at St Georges Wharf, Portbury (Figure 10.30).



RAF/106G/UK/1288 5240 25-MAR-1946

© English Heritage (NMR) RAF
Photography

Figure 10-30 An oil QF decoy site located in the muds at Portbury. The decoy adheres to the standard layout.

The standard oil QF decoy site had three clay-lined fuel tanks supplied with oil by buried pipes: a circular oil ring with two 'Starfish' (SF- Special Fires) boiling oil fires attached, an oil crescent, and an irregular oil pool. The oil levels in each of the fire decoys were balanced by interconnecting pipes and the decoy was ignited electrically from a remote shelter (Dobinson 2000a). The bombing decoy at St Georges Wharf also consisted of two subrectangular enclosures, bounded by an earthwork bank with ditches on either side to act as sea defences against high tides or flooding.

10.4.2 The Coastal Battery At Battery Point, Portishead

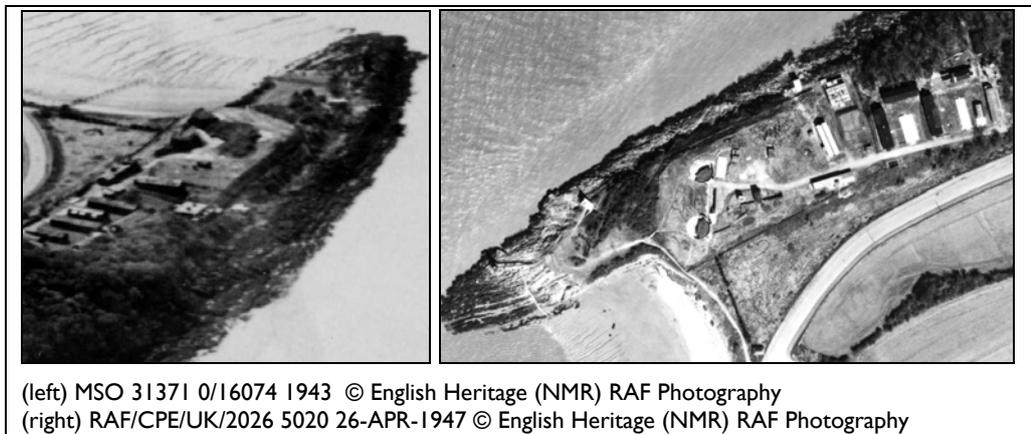
Battery Point is a multi-phase site and had at least four phases of fortification before its final use during the Second World War. The first fort planned in the 1790s remained a defensive position until 1899. In 1901, a conventional open battery was operated without supporting fire simply to cover Avonmouth and the dock approaches, but this was short lived as it was considered too remote from any attacking forces at that time to be justifiable (Dobinson 2000b).



Figure 10-31 The Second World War coastal battery on Battery Point, Portishead, shortly after the war.

NMR RAF/541/166 0207 13-SEP-1948 © English Heritage (NMR) RAF Photography

At the outbreak of the First World War the point protected the docks from submarines, but the battery was gone by the end of the war. The Second World War saw its final incarnation as a coastal battery when it was again armed to protect Avonmouth Docks and Portishead power station and was operated by the Home Guard (Figures 10.31 and 10.32).



(left) MSO 31371 0/16074 1943 © English Heritage (NMR) RAF Photography

(right) RAF/CPE/UK/2026 5020 26-APR-1947 © English Heritage (NMR) RAF Photography

Figure 10-32 Battery Point as it was during (right) and after the Second World War (left). The two coastal guns, magazine and control centre are heavily camouflaged in 1943.

Battery Point's strategic significance lies in the deep water shipping channel flowing between the headland and Newcome Buoy about 900 metres off-shore, which means that ocean-going vessels must pass closer to land at Battery Point than to any other part of the UK's coastline (Dobinson 2000b). Aerial photographs taken in 1978 show that the coastal battery, the military barracks, and the buildings are all

now demolished, although the remains of pillboxes and searchlight structures survive.

10.5 Summary Of Second World War defences

Second World War military coastal crust defences were prominent features in the Severn Estuary, and provide an interesting comparison with other military defences around Britain's coastline, such as those in East Anglia (Albone et al. 2007; Hegarty and Newsome 2007).

Most of the military structures appear not to have been constructed for heavy artillery use. The distribution of the anti-aircraft and coastal batteries reflects the fact that Bristol and the surrounding area was the main target for enemy bombing (Figure 10.28). Many coastal defences such as section posts, slit trenches and pillboxes were designed to be manned by a minimal number of military personnel (Tacchi 2003). These apparently lightly armed structures were part of the early wartime strategy of creating 'coastal crust' defences, designed to merely slow the advancing invasion forces rather than stop them, giving time for a larger mobile reaction force to respond (Hegarty and Newsome 2007; Wills 1985).

The RCZA survey highlights the strategic importance of camouflage used to disguise heavy and light coastal military defences (Osborne 2004), but many sites are still obvious even on wartime photography. The historical air photographs are valuable as few surviving examples retain their original camouflage, but the NMP survey has illustrated the different ways in which the military structures were disguised.

Many of the sites were identified by the Defence of Britain Project (2002), but study of the aerial photographs has revealed a much larger number of defensive structures around the Severn Estuary than previously known. The Second World War aerial photographs were extremely important in identifying the actual position of sites and the extent of the defences, as they existed during wartime, many of which have subsequently been destroyed, removed, or decommissioned (Foot 2006).

10.6 Cold War Military Sites

West Myne Farm at North Hill was the location of a Chain Home Extra Low (CHEL) radar station (SS 94 NW 122/HOB UID 1124654), visible as a group of buildings on only two oblique aerial photographs taken in 1958 (Catford 2006) (Figure 10.33).

CHEL stations functioned to provide radar cover against low flying aircraft carrying out low and surface level attacks against Britain from the Atlantic. The Cold War site was in operation between 1956 and 1958, but subsequently closed and demolished (Catford 2006). This site was fully recorded to resolve the confusion over the descriptions in the NMR AMIE database with this site and an adjacent Second World War tank-training site.



Figure 10-33 RAF West Myne CHEL station, its Stage 1 radar detecting and tracking low flying aircraft.

RAF/58/2555 (PT1) 0118 01-SEP-1958 © English Heritage (NMR) RAF Photography

Another similar possible Cold War site is located south of Severn Beach (ST 58 SW 30/HOB UID 1465100). It comprised a large squared-fenced enclosure that contained five large antenna masts; four in the corners of the square enclosure and one in the centre (Figure 10.34). The site may be associated with the Portishead maritime radio coast station at Highbridge (Bennett 2005). The antenna masts

were no longer visible on aerial photographs taken in 1969, though the station building remains extant on the most recent aerial photography from 1990.

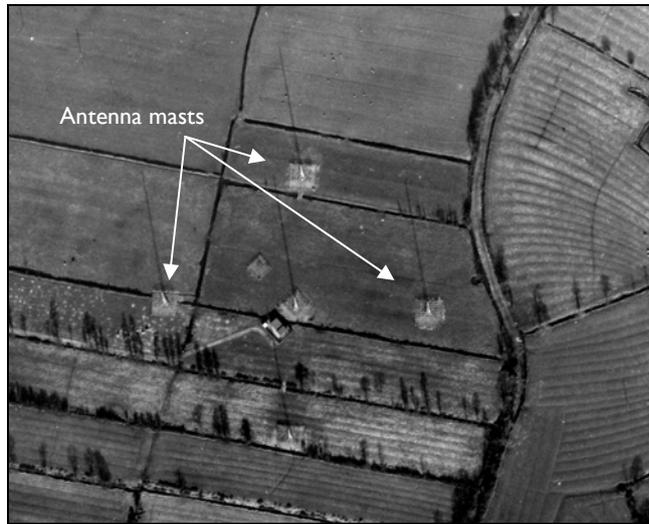


Figure 10-34 The possible Cold War telecommunications site located south of Severn Beach. The antenna masts had all disappeared by 1969.

RAF/540/1530 (F22) 0057 11-FEB-1955 © English Heritage (NMR) RAF Photography

11. Steep Holm Assesment

The island of Steep Holm lies 9km off Weston-super-Mare and 5km from the tip of Brean Down, sitting almost equidistant between Wales and England in the Severn Estuary (Figure 11.1). It has a shoreline of 2km and is 72m in elevation at its highest point. The island is composed of carboniferous limestone, part of the same geology that forms Brean Down, and has steep sided cliffs on all sides with a central plateau, about 665m long and up to 160m wide.

Steep Holm falls within the administrative area of the City of Bristol, and is therefore included within the Severn Estuary RCZAS project area. English Heritage requested a statement of assessment of the archaeology of Steep Holm, and all available aerial photography from the NMRC was examined. It became evident that identifying, mapping and recording the island's main archaeological features from the air would not be possible due to heavy vegetation cover on the central plateau. Even the excavated walls of the Augustinian priory were not visible on the assessed aerial photographs, most being obscured beneath scrub vegetation, and aerial mapping of Steep Holm would not add to the known archaeology recorded by field surveys.



NMR 18721/23 19-FEB-2000
English Heritage (NMR)



Steep Holm, 2008 Reproduced with the
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Figure 11-1 Two photographs of Steep Holm within the Severn Estuary.

Local amateur archaeologists Mr Stan Rendell and Mrs Joan Rendell have undertaken archaeological research and fieldwork on the island since 1978. Only a brief summary is given in this report, as a more detailed account of the archaeology and history of Steep Holm has been published (Rendell and Rendell 1993a; Somerset Archaeological and Natural History Society 1981).

The earliest archaeological evidence from the island consists of several possible Mesolithic flints discovered during archaeological work between 1979 and 1981. Roman pottery has also been found across the island, and in association with a circular earthwork at the west end of the island interpreted as a possible Roman signal station, although this has also been described as a Bronze Age barrow or Viking defensive work (Rendell and Rendell 1993a). Other surveyed linear earthwork banks have been interpreted as lynchets and field boundaries of Roman or medieval origin (ST 26 SW2/HOB UID 191345). Some earthworks are also associated with medieval rabbit warrens (Somerset Archaeological and Natural History Society 1981).



Figure 11-2 The eastern end of Steep Holm Island, showing part of the excavated Augustinian priory in the centre of the photograph, Second World War gun emplacements to the bottom left and a ruined post-medieval farmhouse top centre.

NMR 18558/16 19-FEB-2000 © English Heritage (NMR)

The remains of a 13th century Augustinian priory (Figure 11.2) (ST 26 SW1/HOB UID 191342) and its associated cemetery were excavated in 1978-79. The priory was probably founded before AD1260 on the site of an earlier Roman building but was dissolved by AD1300. In 1935 the south wall of the priory was still standing 1m above the outside ground level and was visible for about 14.5m of its length. Victorian infill of the priory site contained at least one La Tène III brooch and a 'Celtic' carved stone (Green 1993).

Documentary evidence suggests that similar fishing methods were employed in the waters surrounding the island as those used at Birnbeck Pier, with 'gull watchers' resident on the island. The Berkeley family, who owned the island in the medieval period, gave rights of fishing on the "rockes and illands" in the upper part of the Estuary and at Weston-super-Mare's own "little yland", known as Ankers Head (now Birnbeck), for the profits of both fowling and fishing for hundreds of years (Rendell and Rendell 1993: 74). Fish nets and basket salmon traps were erected on the shingle spit that projects out into the sea from East Beach (Figure 11.3). Little remains of these structures, and the Steep Holm fishery fell into disuse in the 1930s. From the available aerial photographs, the only surviving evidence appears to be three rows of circular features embedded in the shingle spit, likely to be the remains of the wooden 'stalls' of the fishery (ST 26 SW81/HOB UID 1456049), a term used to describe a row of wooden stakes between which fish nets were hung.



Figure 11-3 The shingle spit which projects from East Beach, Steep Holm. Three linear rows of circular marks that may be the remains of the wooden post rows known as fish 'stalls' are visible on the spit.

NMR 18713/11 19-FEB-2000 © English Heritage (NMR)

The main surviving structures visible on the aerial photographs are the military defences constructed in the Victorian period and during the Second World War. The War Department requisitioned land on Steep Holm in 1865 for fortifications, one of a series of forts constructed at this time across the Bristol Channel and Severn Estuary. Completed in 1871, this consisted of six heavy gun batteries (ST

26 SW94/HOB UID 1456118, ST 26 SW95/HOB UID 1456124, ST 26 SW96/HOB UID 1456168, ST 26 SW98/HOB UID 1456198, ST 26 SW99/HOB UID 1456215) and a barracks building (ST 26 SW67/HOB UID 1448521).

During the Second World War saw the battery was refortified with six-inch gun emplacements (ST 26 SW93/HOB UID 1456114, ST 26 SW96/HOB UID 1456168) forming part of the Fixed Defences, Severn (Figure 11.2), constructed from reinforced concrete, steel, brick and stone. Due to the difficult terrain, many of the battery guns and other defensive structures were left on the island at the war's end (Rendell and Rendell 1993: 129). The defensive complex may have destroyed earlier features. Aerial photographs taken in 1996 recorded the barracks, nissen huts, 6 inch naval gun emplacements, searchlights, a battery observation post, railways and jetties.

For Steep Holm Island, there are no RAF photographic sorties of Second World War or immediate post-war date in the NMRC archive, in contrast with the extensive RAF aerial photographic coverage available for much of the rest of the Severn Estuary RCZAS project. Aerial photography that was viewed as part of this archaeological assessment for Steep Holm dates between 1967 and 2000, only a little of which is vertical coverage.

Most of Steep Holm's known archaeological features are a result of documentary research, excavations and field surveys. As discussed above, the available aerial photographs assessed by the Severn Estuary RCZAS aerial survey show much of the island's central plateau to be covered in fairly dense scrub, revealing little in the way of earthworks, although wartime structures were partially visible. Further targeted archaeological aerial photography is unlikely to produce additional archaeological evidence on Steep Holm, unless the dense vegetative cover is cleared.

It is possible, however, that a lidar survey might reveal surviving earthworks on the island's central plateau. Previous lidar surveys in other locations have recorded earthworks considerably less than 1m high that were not detected through more traditional archaeological survey techniques (Crutchley 2006).

12. Assessment Of Survival Of The Archaeological Resource As Determined From Aerial Photographs

12.1 Introduction

This chapter presents an assessment of the likely survival of the archaeological resource identified from the available aerial photographs during the Severn Estuary RCZAS survey. Aerial photographs taken from the mid-1940s, mostly by the Royal Air Force, have proved most useful in charting more than half a century of changes to the agricultural, urban and industrial landscapes of the Severn Estuary following the Second World War. A comparison of these historic photographs with more recent aerial photography taken by the Ordnance Survey, English Heritage and other organisations and individuals has revealed just how significantly some areas within the Severn Estuary RCZAS survey area have altered due to urban expansion and industrial development. Within the intertidal zone, the aerial photography has documented the natural processes of erosion and alluvial deposition, with anthropogenic interventions such as aggregate extraction also affecting the coastline and archaeological monuments of the Severn Estuary. The historic aerial photographs may, in some instances, be the only evidence to date that has recorded significant archaeological features in the estuary's intertidal zone.

The Futurecoast study was commissioned in 2000 by the UK government's Department for the Environment Food and Rural Affairs (DEFRA) to provide predictions of coastal change over the next one hundred years. The results will be incorporated into Shoreline Management Plans (SMP) and other coastal defence policies of English and Welsh open coastlines. The study's results show that most of the Severn Estuary's coastline is under threat, the net coastal change advancing inland (Burgess et al. 2004). These areas are so extensive that "it is easier to identify those areas of the coast which are not affected..." (Mullin 2008: 64). It is likely that these changes in shoreline will have a significant impact on the archaeology of the intertidal zone and coastal hinterland within the Severn Estuary RCZAS project area.

12.2 Extraction Industry

During the aerial survey it was identified that some archaeological sites were located on slightly higher, free draining soils more suitable for permanent settlement, but that these areas may also be favoured for large-scale sand and gravel extraction. This is particularly noticeable around Frampton on Severn, Gloucestershire, where current quarrying continues to destroy remains of past occupation. A substantial Roman to Anglo-Saxon hilltop cemetery at Cannington, Somerset, is now a small lake due to extensive quarrying, though limited archaeological excavations were carried out in 1962-63 (Rahtz, Hirst and Wright 2000), allowing c.25% of the inhumations to be recorded before the site was destroyed.

In the intertidal area off Minehead, the Severn Estuary RCZAS aerial survey identified numerous large stone fish weirs which were recorded by oblique aerial photographs taken by English Heritage in 2000. The fish weir structures appeared to be well constructed, but recent removal of material for the aggregates industry from the protective shingle ridge on Madbrian Sands has led to a notable increase in damage to the fish weir structures.

12.3 Urban Development And Expansion

The area around Avonmouth Docks has seen a large increase in industrial activity since the Second World War, although some of the heavy industries have disappeared. Many factories and warehouses that formerly occupied the area have been demolished in recent decades to make way for modern warehouses and concrete covered holding areas for imported vehicles and other goods. Most of this expansion has occurred in the last 20 years, and can be documented on the aerial photography. Much of the ridge and furrow cultivation in the coastal hinterland north of Avonmouth mapped by the Severn Estuary RCZAS survey from aerial photographs taken in the 1940s has been destroyed by modern industrial estates. It is possible however, that earlier archaeological evidence may survive underneath these complexes, providing that it is buried at a sufficient depth.

12.4 Second World War Structures

Many Second World War sites within the Severn Estuary RCZAS survey area survive *in situ* as revealed by the Defence of Britain project, but using historic aerial photographs, the aerial survey was able to record substantially more sites and structures than previously known. Many sites were deliberately destroyed shortly after the war as they were no longer required, such as the 28 infantry section posts dotted along the coast between Blue Anchor and Porlock. These were clearly visible on wartime photographs but many had been demolished by the time the RAF took new photographs in 1946. In contrast, type FW3/24 pillboxes often sited adjacent to the section posts were left largely untouched, and most remain intact though in varying states of disrepair. Structures have also been demolished to make way for urban expansion, such as the Portishead GKA maritime radio station and adjacent type FW3/24 pillboxes on Portishead Down. On Bossington and North Hill west of Minehead, Second World War tank training activities have potentially destroyed earlier archaeological features, but many structures associated with the tank training have themselves subsequently been destroyed. Observation posts and firing range railway tracks were plough-levelled when the land returned to agricultural use. Some evidence of these activities remains, however.

12.5 Intertidal Sites

The archaeology of the intertidal zone is suffering significant erosion. Archaeological remains such as wooden fish traps may be preserved by burial beneath silt deposits, but once exposed to strong tidal actions, they quickly erode. Brunning (2008b) comments on the shallow depth of some of the surviving wooden posts from fish traps on Stert Flats, noting the erosive effects of the tide. It is this tidal scouring of the silt from around the features that makes them visible on aerial photographs, but the strength of the estuary's tidal forces is such that exposed features such as wooden stakes can easily be removed by a single tide. Brunning notes that parts of intertidal structures sampled during fieldwork in 2003 have already disappeared. Stone structures are also gradually being eroded by the waves where they are exposed above the sediments. At Minehead, removal of material from the protective shingle spit on Madbrain Sands has further exposed the fish weirs and attempts to maintain these weirs in the bay have become more difficult (N. Russell pers. comm.). The sea has broken down many of the stone walls of

disused fish weirs, spreading the stone structures across the mudflats and effectively destroying them.

Whilst field survey can identify erosion of archaeological features, quantifying the destruction of intertidal features from the available aerial photographs is more problematic. Few photographic sorties flown since the Second World War show the exposed intertidal area and hardly any capture the very lowest intertidal reaches. Only since 1999 has targeted oblique aerial photography provided images of intertidal archaeology taken at a sufficiently low flying height to identify individual posts forming many of the intertidal fish traps. These photographic sorties provide only limited coverage of the Severn Estuary's lower intertidal reaches such as Blue Anchor Bay, Stert Flats and Woodspring Bay and this coverage has not been repeated in successive years, which is necessary for an assessment of erosion of archaeological features. Field survey is therefore necessary to determine how processes of erosion are affecting these exposed structures.



Figure 12-1. A Second World War pillbox, fallen from the banks of the inner Severn Estuary at Arlingham, now mostly submerged in the soft mud.

Arlingham Pillbox © Amanda Dickson

Structures located on the banks of the inner Severn Estuary are also in some places slipping into the water as natural erosion takes place. This is evident around Arlingham, where several Second World War pillboxes have been undermined and have fallen into the soft mud deposits of the River Severn (Figure 12.1). Most of the archaeological features within the intertidal zone that have been mapped and recorded by the Severn Estuary RCZAS aerial survey, however, were focused on

Porlock Bay and Blue Anchor Bay, and on Stert Flats and Berrow Flats in Bridgwater Bay. The Futurecoast study revealed that the areas of high potential shoreline change in the next century includes these bays (Mullin 2008: 64), and it is likely that such changes to the hydraulic regime will have detrimental effects in the preservation of surviving archaeological features in these bays.

As described, identification of the surviving archaeological resource along the Severn Estuary from the available aerial photographs is variable. The Second World War coastal crust defences were best recorded from RAF vertical aerial photographs taken immediately after that war, but were not visible in later aerial photographs as many of the structures had been destroyed. The same 1940s dated photographs document the extensive medieval and post-medieval land drainage. Conversely, many of the structures in the intertidal zone were not visible in the 1940s aerial photographs, but were best recorded from oblique photographs taken by English Heritage since the late 1990s as few aerial sorties recorded the intertidal area prior to that. These photographs indicate that there are numerous features surviving especially in west Somerset's intertidal zone, but recent research has shown that ongoing erosion is likely to affect these structures adversely. Targeted fieldwork as part of Phase 2 of the Severn Estuary RCZAS will investigate some of these structures.

13. Recommendations For Further Work

The intertidal zone has revealed a large number of previously unrecorded coastal fish weirs of different morphology and construction. The results of this RCZAS aerial survey suggest that these structures require more study to recover absolute dating evidence in order to verify and enhance the existing typology. Limited dating has been obtained from some fish weirs in Bridgwater Bay with tree felling dates as early as AD 932 and AD 966 (Groves et al. 2004) recorded, but a recent survey by Brunning (2008b) has revealed a range of dates from the 10th century to the 19th century. This is supported by other Severn Estuary fieldwork, which suggests that fish weirs and traps were used throughout the medieval and post-medieval periods (Allen 2004; Godbold and Turner 1994; Nayling 1999). Some fish weirs are still being used in the 21st century, but other disused examples are being destroyed by the continual action of the sea. Given the rate of erosion, studies need to be carried out sooner rather than later if we are to understand the historically important fishing industry of the Severn Estuary.

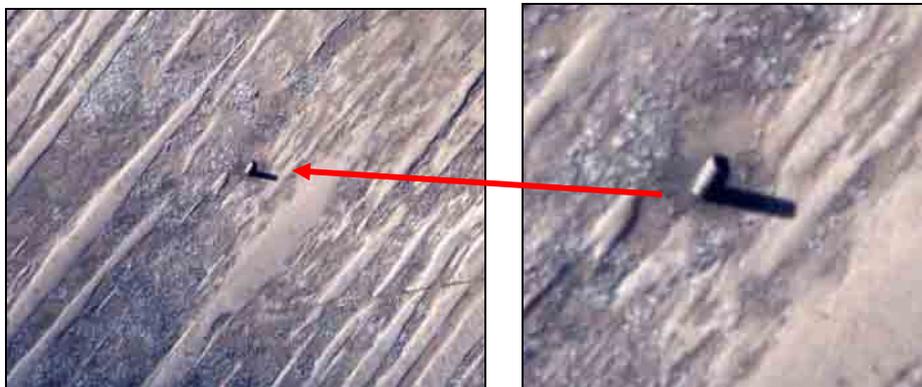


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Figure 13-1 The large plume caused by the detonation of a 700kg Second World War mine. Inset: Fisherman finds bomb partially sticking out of the mud.

On the 17th of April 2008 a large 700kg Second World War German parachute mine was successfully exploded on Stert Island (Figure 13.1). As shown in Figure

13.2, the bomb was recorded as part of the RCZAS aerial survey from oblique aerial photographs taken by English Heritage in 2000, located at the northwest end of the Gutterway on Stert Flats.



NMR 18555/30 19-FEB-2000 © English Heritage. NMR

Figure 13-2 The Second World War bomb partially buried in the Gutterway, Stert Flats.

Due to the mobile nature of Bridgwater Bay's mud flat and strong tidal forces, however, the mine had apparently shifted position closer to Burnham-on-Sea, where it was then deemed a potential danger to life (Newman 2008). The detonation was carried out on Stert Island, adjacent to many coastal fish weirs recorded by the RCZAS aerial survey. It is not known what impact, if any, this explosion will have had on the intertidal archaeology but judging by the mine's size there may have been incidental damage to adjacent archaeological features. It is suggested that the area around Stert Island be considered for further investigation to quantify the nature of the intertidal archaeological features recorded there as part of the RCZAS aerial survey, but also to assess the effects of this explosion.

Further targeted aerial reconnaissance of the intertidal zones obtained at the lowest available tides would also be beneficial in providing a clearer picture of the extent of coastal fish weirs and other buried structures such as wrecks. It would also allow the condition of features recorded during earlier flights to be assessed and to clarify the character of known structures of uncertain function, such as the possible fish weirs on Berrow Flats. The mobility of the estuarine mud is such that in some years archaeological features may be obscured, whilst in others they will be exposed. It is suggested, however, that further flights over selected areas would

produce additional valuable information. Potential target areas include the intertidal zone of the small coastal bays between Portishead and Clevedon. In Woodhill Bay, Portishead, medieval and/or post-medieval fisheries have been documented (La Trobe-Bateman 1999a), but nothing was visible on the available aerial photographs. Further field survey could clarify the apparent gaps in the RCZAS aerial mapping or provide an explanation for any 'blank' areas. All aerial photographs obtained will also enhance the current NMR collection, and reduce the time and risk spent in a notoriously hazardous estuarine environment. The Norfolk and Suffolk RCZA surveys (Albone et al. 2007; Hegarty and Newsome 2007) found that the aerial archaeological survey and the subsequent targeted field work were largely complementary. It is likely, therefore, that the Rapid Coastal Zone Assessment Survey of the Severn Estuary will be similar in this respect.

Further aerial reconnaissance will also prove beneficial in terrestrial areas where oblique aerial photography has hitherto been limited, and where the continued monitoring of sites is important. This is especially pertinent to Gloucestershire, where extensive blocks of medieval and post-medieval ridge and furrow potentially mask underlying earlier archaeological features. The most recent available vertical aerial photography dating from the 1970s showed increasing areas under the plough at that time, and it seems certain that further areas will have been levelled in the intervening 30 years. It is therefore recommended that areas of levelled ridge and furrow be reassessed should more recent aerial photography become available, with a view to identifying sub-surface archaeological evidence from earlier periods that may now be visible as cropmarks or soilmarks.

With the acquisition by English Heritage of the Aerofilms aerial photographic archive, it is also suggested that any relevant aerial photographic coverage of the Severn Estuary RCZAS project area be examined to reassess the potential archaeological resource.

Due to time constraints and the industrial nature of Avonmouth Docks, only the intertidal areas were mapped and recorded. However, it was useful at this stage to examine the available aerial photographs of the docklands area. This assessment of the docklands revealed a complex sequence of industrial archaeology and Second World War defences. As much of this region has changed considerably since the

end of the Second World War, Avonmouth Docks would merit further research as a separate detailed project encompassing not just aerial survey but also desk-based assessment using documentary and historical map resources, followed by detailed field survey and standing building recording. Large-scale port expansion is planned at Avonmouth, and the work suggested here will almost certainly be undertaken as part of the EIA for this development.

It has also been proposed by Damian Grady of English Heritage's Aerial Survey and Investigation Department that as part of the Severn Estuary RCZAS project's Phase 2 fieldwork programme, the field team participate in a co-ordinated exercise to provide updated aerial photography of Bridgwater Bay's intertidal zone. Grady proposes the setting out of a grid of GPS-located markers in the intertidal zone that can be seen from the air to provide accurately georeferenced control points for subsequent aerial photographic survey transcription (D. Grady, pers. comm.). This GPS mapping method has been successfully used previously in Suffolk's River Stour estuary, Holbrook Bay, on a single fish weir located far out in the intertidal zone (Hegarty and Newsome 2005: 62).

14. Conclusions

The Severn Estuary RCZAS NMP project has been successful in increasing understanding of the archaeology within the Severn Estuary, as well as the factors that affect the discovery and survival of the archaeological evidence. A total of 928 new monument records have been identified and created in the National Monument Record (NMR) database and 373 existing records have been revised. The project has recorded new sites and provided additional detail to others potentially ranging in date from the Neolithic to the 20th century. Thirty five percent of the new sites identified relate to the fishing industry in the intertidal zone, clearly demonstrating the importance of aerial photography in understanding past activities along the Severn Estuary coastline. Other themes to emerge during the project were the importance of coastal land reclamation and drainage, particularly from the medieval period onwards, as well as military remains from the Second World War.

The coastal survey has highlighted the potential of aerial survey, particularly within the intertidal zone where field survey can be difficult. Future targeted aerial survey projects will not only increase the value of the coastal survey data but also further enhance our understanding of the importance and extent of archaeological resources.

15. List of References

Access to mineral heritage. (2004-2006). *Mapping UK mining heritage – Calamine mining in the SouthWest*. [online] Available from: <http://mininghistory.thehumanjourney.net/swreg/calamineSW01.shtml> [Accessed 30 JUL 2008]

Ahern, K., Wilson, J., Henderson, M., and Ogden, E. (2005). *North Somerset Landscape Character Assessment*. Weston-super-Mare: North Somerset Council

Ainsworth, S., Bowden, M., McOmish, D. and Pearson, T. (2007). *Understanding the archaeology of landscapes: a guide to good recording practice*. Swindon: English Heritage. [online] Available from: http://www.english-heritage.org.uk/upload/pdf/Understanding_the_Archaeology_of_Landscapes_Part_2_pp_10-18.pdf [Accessed 30 JUL 2008]

Albone, J., Massey, S., and Tremlett, S. (2007). *The Archaeology of Norfolk's Coastal Zone. Results of the National Mapping Programme* (English Heritage and Norfolk County Council, unpublished).

Allen, J.R.L. (1986). A short history of salt-marsh reclamation at Slimbridge Warth and neighbouring areas, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* 104, 139-155.

Allen, J.R.L. (1990). Three Neolithic Axes from the Severn Estuary. *Transactions of the Bristol and Gloucestershire Archaeological Society* 108, 171-174

Allen, J.R.L. (1991). Salt-marsh accretion and sea-level movement in the inner Severn Estuary, southwest Britain: the archaeological and historical contribution. *Journal of the Geological Society*, 148 (3), 485-494.

Allen, J.R.L. (1992). A Reconnaissance Map of Medieval Alluvial Ploughlands in the Vale of Berkeley, Gloucestershire and Avon. *Transactions of the Bristol and Gloucestershire Archaeological Society*, 110, 87-97.

Allen, J.R.L. (1995). Three later Bronze Age occupations at Rumney Great Wharf on the Wentlooge Level, Gwent. *Archaeology in the Severn Estuary*, 6, 9-12.

Allen, J.R.L. (1997a). Geological Impacts on Coastal Wetland Landscapes: Sea-level rise, with illustrations from the River Banwell. *Proceedings of the Somerset Archaeology and Natural History Society*, 141, 17-34.

Allen, J.R.L. (1997b). A Scatter of Neolithic-Bronze Age Flintwork from the Intertidal Zone at Hill Flats, South Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* CXV, 265-76.

Allen, J.R.L. (1997c). Romano-British and Early Medieval pottery scatters on the alluvium at Hill and Oldbury, Severn Estuary Levels. *Archaeology in the Severn Estuary*, 8, 67-81.

- Allen, J.R.L. (1998). A Prehistoric (Neolithic-Bronze Age) Complex on the Severn Estuary Levels, Oldbury-on-Severn, South Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society*, 116, 93-115.
- Allen, J.R.L. (2001). A Medieval waterside settlement overlooking Severn-Estuary alluvium, Hock Cliff, Fretherne and Saul, Gloucestershire. *Archaeology in the Severn Estuary*, 12, 79-98.
- Allen, J.R.L. (2002). Intertidal archaeology at Old Passage, Aust, Gloucestershire: a sketch of the surviving evidence. *Archaeology in the Severn Estuary*, 13, 53-64.
- Allen, J.R.L. (2004). Fishtraps in the middle Severn Estuary: air-photographic evidence from the mid-twentieth century. *Archaeology in the Severn Estuary*, 15, 31-48.
- Allen, J.R.L., and Fulford, M.G. (1987). Romano-British Settlement and Industry on the Wetlands of the Severn Estuary. *Antiquaries Journal*, 67, 237-289.
- Allen, J.R.L., and Fulford, M.G. (1990a). Romano-British wetland reclamations at Longney, Gloucestershire, and evidence for the early settlement of the inner Severn Estuary. *Antiquaries Journal*, 70 (2), 288-326.
- Allen, J.R.L., and Fulford, M.G. (1990b). Romano-British and later reclamations on the Severn salt marshes in the Elmore area, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society*, 108, 17-32.
- Allen, J.R.L., and Fulford, M.G. (1992). Romano-British and Later Geoarchaeology at Oldbury Flats: Reclamation and Settlement on the Changeable Coast of the Severn Estuary. *Archaeological Journal*, 149, 82-123.
- Allen, J.R.L., and Rae, J.E. (1987). Late Flandrian Shoreline Oscillations in the Severn Estuary: a geomorphological and stratigraphical reconnaissance. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 315, 185-230.
- Allen J. R. L., and Rippon S. J. (1997). A Romano-British Shaft of Dressed Stone and the Settlement at Oldbury-on-Severn, South Gloucestershire, *Transactions of the Bristol and Gloucestershire Archaeological Society*, 115, 19-27.
- Allen, M.J., Crockett, A., Rawlings, M.N., and Ritchie, K. (1996). Archaeological Fieldwork along the Line of the Brean Down Sea Defences; new evidence of landscape change and human activity. *Archaeology in the Severn Estuary*, 7, 31-38.
- Allen, M.J., and Ritchie, K. (2000). The Stratigraphy and Archaeology of Bronze Age and Romano-British Deposits Below the Beach Level at Brean Down, Somerset. *Proceedings of the University of Bristol Speleological Society*, 22 (1), 5-52.

- Ashbee, P. (1960). *The Bronze Age Round Barrow in Britain*. London: Phoenix House.
- Aston, M. (1978). Fieldwork, Somerset. *The Deserted Medieval Village Research Group Annual Report*, 26, 12
- Aston, M. (Ed.). (1988). *The Medieval Landscape of Somerset*. Somerset: Somerset County Council
- Bailey, J. (ed.). (2007). *When the gull yeller boomed on Birnbeck*. [online] Available from:
<http://www.thewestonmercury.co.uk/content/twm/RoundAbout/story.aspx?brand=westonmercury&category=RoundAbout&tBrand=westonmercury&tCategory=zRoundAbout&itemid=WeED14%20May%202007%2010%3A18%3A11%3A610> [Accessed 19 May 2008].
- Bailey, N. (2007). *Herefordshire and Gloucestershire Canal Trust*. [online] Available from:<http://www.h-g-canal.org.uk/index.html> [Accessed 06-NOV-2006].
- Balloon Barrage Reunion Club. (2008). *Pawlett Barrage Balloon Hangar- An Interview with Tom Flack* [online] Available from: <http://www.bbrclub.org/Tom%20Flack.htm> [Accessed 14-JUL-2008]
- Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C., and Buck, A.L. (eds.) (1996). *Coasts and seas of the United Kingdom, Region 11 The Western Approaches: Falmouth Bay to Kenfig*. Peterborough: Joint Nature Conservation Committee.
- Barrett W.S. (1789). *The History and Antiquities of Bristol*. Bristol: William Pine.
- Bell, M. (1992). *Archaeology of the second Severn crossing: assessment and recommendations for the English approaches*. Swansea: Glamorgan-Gwent Archaeological Trust.
- Bell, M. (1990). *Brean Down: Excavations 1983-1987*. English Heritage Archaeological Report No15. London: English Heritage.
- Bell, M. and Neumann, H. (1997a). Prehistoric intertidal archaeology and environments in the Severn Estuary, Wales, in *World Archaeology* 29(1), 95-113.
- Bell, M. and Neumann, H. (1997b). Intertidal survey in the Welsh Severn Estuary, in *Archaeology in the Severn Estuary*, 8, 13-28.
- Bell, M., Caseldine, A, and Neumann, H. (2000). Prehistoric intertidal archaeology in the Welsh Severn Estuary, *CBA research report 120*. York: Council for British Archaeology.

Bennett, L. (2005). *Portishead Radio – GKA* [online] Available from: <http://www.gka.btinternet.co.uk/history.htm> [Accessed 14 FEB 2007].

Bond, C.J. (1978). Moated sites in Worcestershire. In Aberg, A. (ed). *Medieval moated sites. CBA Research Report 17*.

Bowden, M. (2005). *The Malvern Hills; An ancient landscape*. Swindon: English Heritage.

British Telecommunications (BT). (2001). *The Story of Portishead Radio. Long range maritime radio communications: 1920 – 1995* [online] Available from: <http://jproc.ca/radiostor/portis1.html> [Accessed 26 OCT 2007]

Brown, G. (2005). Irrigation of water meadows in England, in Klapste, J. (Ed.). *Water Management in Medieval Rural Economy, Rurality V. Prague. Institute of Archaeology, Academy of sciences of the Czech Republic, 84-92*

Brown, A.D., Bell, M., Timpany, S., and Nayling, N. (2005). Mesolithic to Neolithic and Medieval coastal environmental change: intertidal survey at Woolaston, Gloucestershire. *Archaeology in the Severn Estuary, 16*, 67-83.

Brunning, R. (1995). Sweet track assessment: An interim report. *Archaeology in the Severn Estuary, 6*, 3-8.

Brunning, R. (2000). Wood as an archaeological resource: the Severn Estuary evidence. *Archaeology in the Severn Estuary, 11*, 175-185.

Brunning, R. (2008a). Coastal change on the English side of the Severn Estuary from the Palaeolithic to the present day, in Mullin, D. *Severn Estuary Rapid Coastal Zone Assessment, Phase 1 Report for English heritage (HEEP Project no. 3885). Unpublished draft*.

Brunning, R. (2008b) A millennium of fishing structures in Stert Flats, Bridgwater Bay. *Archaeology in the Severn Estuary, 18*, 67-83.

Brunning, R., and Farr-Cox, F. (2005). The River Siger rediscovered: lidar survey and relict landscape on the Somerset claylands. *Archaeology in the Severn Estuary, 16*, 7-15.

Bryant, E.A., and Haslett, S.K. (2002). Was the AD 1607 coastal flooding event in the Severn Estuary and Bristol Channel (UK) due to a tsunami? *Archaeology in the Severn Estuary, 13*, 163-167.

Buck, A.L. (1993). *An inventory of UK estuaries, Volume 2: South-west Britain*. Peterborough: Joint Nature Conservation Committee.

Burgess, K., Jay, H., and Hosking, A. (2004). Futurecoast: Predicting the future coastal evolution of England and Wales, *Journal of Coastal Conservation* 10 (1/2), 65-72.

Burrow, I. (1981). Hillfort and hill-top settlement in Somerset in the first to eighth centuries A.D. *British Archaeological Reports (British series)* 91.

Burrow, I.C.G. (1976). Brean Down Hillfort, 1974. *Proceedings of the University of Bristol Spelaeological Society*, 14 (2), 151-154.

Burton, E., Clark, A., and Jamieson, D. (2007). *The Severn estuary; assessment of survey and research sources and appraisal of marine aggregate extraction*. London: MOLAS.

Butlins Memories (2007). *Pontins Camps past and present*. [online] Available from: <http://www.butlinsmemories.com/pontins/camps/index.htm>. [Accessed 24 JUL 2008].

Canti, M., Heal, V., McDonnell, R., Straker, V., and Jennings, S. (1995). Archaeological and palaeoenvironmental evaluation of Porlock Bay and Marsh. *Archaeology in the Severn Estuary*, 6, 49-70.

Carr, A.P. (1971). Coastal Changes at Bridgwater Bay: 1956-64. *Proceedings of the Bristol Naturalists' Society* XXXI, 91-100.

Catford, N. (2006). *RAF West Myne ('ZEM') CHEL R I I ROTOR Radar Station* [online] Available from: http://www.subbrit.org.uk/rsg/sites/wl/west_myne/index.html [Accessed 05 JUN 2007].

Caulfield, S. (1978). Neolithic fields - the Irish evidence. In: H.C. Bowen and P.J. Fowler (eds.) *Early Land Allotment*, 137-43. *British Archaeological Reports (British Series)* 48.

Clapcott, K. (2007). *The Somerset and Dorset Joint Railway*. [online] Available from: <http://www.sdjr.net/> [Accessed 22 FEB 2007].

Clarke, N.J. (1995). *Adolf Hitler's Holiday Snaps*. Lyme Regis: Nigel J. Clarke Publications.

Clevedon Civic Society (2008). *Images of Clevedon*. [online] Available from: <http://www.clevedon-civic-society.org.uk/imagesofclevedon/index.htm> [Accessed 27 MAY 2008].

Cocroft, W.D. (2000) *Dangerous Energy: the archaeology of gunpowder and military explosives manufacture*. Swindon: English Heritage.

Collis, J.R., Gilbertson, D.D., Hayes, P.P., Samson, C.S. (1984). The Prehistoric and Medieval Field Archaeology of Crownhill Down, Dartmoor, England. *Journal of Field Archaeology* 11. 1-12.

Cook, H., and Williamson, T. (eds.) (2007). *Water Meadows: History, Ecology and Conservation*. Macclesfield: Windgather Press.

Cooper, A. (2008). *Severn salmon boats of the River Severn in Gloucestershire*. [online] Available from: <http://www.salmonboats.co.uk/1206.html> [Accessed 16 JUL 2008].

Costen, M. (1992). *The origins of Somerset*. Manchester: Manchester University Press.

Countryside Agency. (2006a). *Joint Character Area Somerset Levels and Moors/Mid Somerset Hills 142/143* [online] Available from: http://www.countryside.gov.uk/Images/JCA142+143%20-%20Somerset%20Levels%20and%20Moors%20+%20Mid%20Somerset%20Hills_tcm2-21220.pdf [Accessed 30 OCT 2007]

Countryside Agency. (2006b). *Joint Character Area Severn and Avon Vales 106* [online] Available from: http://www.countryside.gov.uk/Images/JCA106%20-%20Severn%20and%20Avon%20Vales_tcm2-21199.pdf [Accessed 11 JUN 2008]

Countryside Agency. (2006c). *Joint Character Area Vale of Taunton 146* [online] Available from: http://www.countryside.gov.uk/Images/JCA146%20-%20Vale%20of%20Taunton%20and%20Quantock%20Fringes_tcm2-21223.pdf [Accessed 11 JUN 2008]

Countryside Agency. (2006d). *Joint Character Area Vale of Bristol, Avon Valleys and Ridges 118* [online] Available from: http://www.countryside.gov.uk/Images/JCA118%20-%20Bristol,%20Avon%20Valleys%20and%20Ridges_tcm2-21208.pdf [Accessed 11 JUN 2008]

Countryside Agency. (2006e) *Joint Character Area Quantock Hills 144* [online] Available from: http://www.countryside.gov.uk/Images/JCA144%20-%20Quantock%20Hills_tcm2-21221.pdf [Accessed 11 JUN 2008]

Countryside Agency. (2006f) *Joint Character Area Exmoor 145* [online] Available from: http://www.countryside.gov.uk/Images/JCA145%20-%20Exmoor_tcm2-21222.pdf [Accessed 11 JUN 2008]

Crutchley, S. (2006). Light Detection and Ranging (lidar) in the Witham Valley, Lincolnshire: an Assessment of New Remote Sensing Techniques. *Archaeological Prospection*, 13, 251-257.

Cunliffe, B. (1995) *English Heritage book of Iron Age Britain*. London: Batsford,

Cunliffe, B. (ed). (2006). *England's Landscape: The West*. London. Collins.

Currie, C.R.J., and Herbert, N.M. (Eds.) (1996). 'Awre', *A History of the County of Gloucester: Volume 5: Bledisloe Hundred, St. Briavels Hundred, The Forest of Dean*. [online] Available from: <http://www.british-history.ac.uk/report.aspx?compid=23250>. [Accessed 13 MAY 2008].

Defence of Britain. (2002). *The Defence of Britain Project*. [online] Available from: <http://www.britarch.ac.uk/projects/dob/index.html> [Accessed 26 OCT 2007].

DEFRA. (2008). *Environmentally Sensitive Areas (ESAs)*. [online] Available from: <http://www.defra.gov.uk/erdp/schemes/esas/default.htm> [Accessed 24 JUL 2008]

Dennison, E. (1985). Somerset Archaeology 1984-5, Minehead Fishweirs ST9647. *Proceedings of the Somerset Archaeology and Natural History Society*, 129, 20-22.

Dickson, A. (2006). *Frampton on Severn: Aggregate Levy Sustainability Fund: Archaeological Aerial Survey National Mapping Programme Report*. Swindon: County Council Archaeological Service and English Heritage.

Dickson, A., and Crowther, S. (2007). *Rapid Coastal Zone Assessment for the Severn Estuary. Archaeological aerial survey: National Mapping Programme interim report*. Swindon: Gloucestershire County Council and English Heritage.

Dobinson, C. (1996). Anti-aircraft artillery: England's air defence gunsites, 1914-46. *Twentieth century fortifications in England, 1.1*. York: Council for British Archaeology.

Dobinson, C. (2000a). *Fields of Deception: Britain's bombing decoys of Second World War*. London: Methuen.

Dobinson, C. (2000b). Coast artillery, 1900-56. *Twentieth century fortifications in England, 6.1*. 198-200. York: Council for British Archaeology.

Dodd, D. (1981). *Dunster Castle, Somerset*. London: National Trust.

Dreghorn, W. (1968). *Geology Explained in the Forest of Dean and the Wye Valley*. Newton Abbot: David & Charles.

Dunning, R. (1985). *A History of the County of Somerset: Volume 5*. Oxford: Oxford University Press.

Dunning, R. (Ed.). (2004). *A History of the County of Somerset: Volume 8: The Poldens and the Levels*. [online] Available from: <http://www.british-history.ac.uk/source.asp?pubid=62> [Accessed 15 JUN 2007].

Dunning, R.W., and Elrington, C.R. (Eds.). (1992). *A History of the County of Somerset: Volume 6: Andersfield, Cannington, and North Petherton Hundreds (Bridgwater and neighbouring parishes)*. [online] Available from: <http://www.british-history.ac.uk/report.aspx?compid=18555> [Accessed 17 APR 2008].

Dymond, C.W. (1902). *Worlebury: An ancient stronghold in the county of Somerset*. Bristol: Crofton Hemmons.

Edwards, B. (1995). Slimbridge magazine. *The quarterly journal for British industrial and transport history*, 45, 52-63.

Elrington, C.R., Herbert, N.M., and Pugh, R.B. (Eds.). (1972). *A History of the County of Gloucester: Volume 10: Westbury and Whitstone Hundreds*. [online] Available from: <http://www.british-history.ac.uk/source.aspx?pubid=51> [Accessed 06 NOV 2006]

English Heritage. (1997). *Archaeology Review 1996-97 - 4.20.10 The Wootton-Quarr, the Isle of Wight survey*. [online] Available from: http://www.eng-h.gov.uk/archrev/rev96_7/wquar.htm [Accessed 20 MAY 2008].

English Heritage. (2008). *National Mapping Programme (NMP)*. [online] Available from: <http://www.english-heritage.org.uk/server/show/nav.1186> [Accessed 14 APR 2008].

English Nature. (1997a). *Avon and Severn Vales (NA 56)*. [online] Available from: http://www.english-nature.org.uk/science/natural/NA_Details.asp?NA_ID=56&S=&R=0 [Accessed 30 OCT 2007].

English Nature. (1997b). *Somerset Levels and Moors Natural Area (NA 85)*. [online] Available from: http://www.english-nature.org.uk/SCIENCE/NATURAL/NA_DETAILS.ASP?NA_ID=85&S=&R=7 [Accessed 30 OCT 2007].

English Nature. (1997c). *Exmoor and The Quantock Hills Natural Areas Profile (NA 87)*. [online] Available from: <http://www.english-nature.org.uk/science/natural/profiles/naprofile87.pdf> [Accessed 11 APR 2008].

English Nature. (1998). *Vale of Taunton and Quantock Fringes Natural Areas Profile (NA 88)*. [online] Available from: <http://www.english-nature.org.uk/science/natural/profiles/naprofile88.pdf> [Accessed 11 APR 2008].

Environment Agency. (2005). *River Severn at Gloucester: Flood Risk Management Study*. [online] Available from: http://www.environment-agency.gov.uk/commondata/acrobat/gloucester3_1_1250294.pdf [Accessed 08 AUG 2008].

Environment Agency. (2007). *Severn Tidal Tributaries CFMP – Draft Plan*. [online] Available from: http://www.environment-agency.gov.uk/commondata/acrobat/draft_cfmp_part_5_1684809.pdf [Accessed 15 JUL 2008].

Environment Agency. (2008). *A dip into history: Lave nets in the Severn Estuary*. [online] Available from: http://www.environment-agency.gov.uk/comdata/acrobat/lavenets_846251.pdf [Accessed 13 MAY 2008].

Evans, R. (2008). *Brick and tile making in Bridgwater*. [online] Available from: <http://boards.ancestry.co.uk/localities.britisles.england.som.general/4180.5/mb.ashx> [Accessed 5 AUG 2008].

Exmoor National Park Authority. (2008). *Exmoor National Park*. [online] Available from: <http://www.exmoor-nationalpark.gov.uk/> [Accessed 24 JUL 2008].

Farr, G.E. (1954) *Chepstow Ships*. Chepstow: The Chepstow Society.

Fenton, R. (1811). *A Tour in Quest of Genealogy Through Several Parts of Wales, Somersetshire and Wiltshire in a Series of Letters to a Friend in Dublin Interspersed with a Description of Stourhead and Stonehenge*. London: Sherwood Neeley and Jones.

Finberg, H.P.R. (1975). *The Gloucestershire Landscape*. London: Hodder and Stoughton.

Foot, W. (2006). Beaches, fields, streets, and hills: the anti-invasion landscapes of England, 1940. *CBA research Report 144*. York: Council for British Archeology.

Ford, S., Bowden, M., Mees, G., Gaffney, V. (1988). The date of the 'Celtic' Field-Systems on the Berkshire Downs. *Britannia 19*, 401-404.

Fort, M. (2008). *The Guardian around Britain with a fork; Matthew Fort meets the last mudhorse fishermen left on Bridgwater Bay, Somerset*. [online] Available from: http://lifeandhealth.guardian.co.uk/food/story/0,,2282582,00.html#article_continue [Accessed 21 JUL 2008].

Friends of the Old Pier Society (2006). *Birnbeck Pier: A short history*. [online] Available from: http://www.birnbeckpier.org/birnbeck_pier_history.php?s=1213872094936. [Accessed 09 MAY 2008].

Carter, S., Jenkinson, L., Fine, R., and Houlston, I. (2006). *Gloucestershire landscape character assessment*. Gloucester: Gloucestershire County Council

Gathercole, M. (1998). *The Somerset Urban Archaeological Survey Minehead*. [online] Available from: <http://www.somerset.gov.uk/somerset/cultureheritage/heritage/projects/eus/minehead/> [Accessed 26 OCT 2007].

Gardiner, J., Allen, M.J., Hamilton-Dyer, S., Laidlaw, S., and Scaife, R. (2002). Making the Most of it: Late Prehistoric Pastoralism in the Avon Levels, Severn Estuary. *Proceedings of the Prehistoric Society 68*, 1-39.

- Gathercole, C. (2002). *Somerset Extensive Urban Survey: Burnham on Sea and Highbridge archaeological assessment*. Taunton: Somerset County Council.
- Gathercole, C. (2003a). *Somerset Extensive Urban Survey: Watchet archaeological assessment*. Taunton: Somerset County Council.
- Gathercole, C. (2003b). *An archaeological assessment of Minehead*. Taunton: Somerset County Council.
- Gilbert, P. (1996). The pre-Conquest landscape at Kingston Seymour on the North Somerset levels: report on survey 1996. *Archaeology in the Severn Estuary 1996*, (7), 53-57.
- Gilbertson, D.D., Hawkins, A.B., Mills, C.M., Harkness, D.D., and Hunt, C.O. (1990). The Late Devensian and Holocene of Industrial Severnside and the Vale of Gordano: stratigraphy, radiocarbon dating and palaeoecology. *Proceedings of the Ussher Society*, 7(3), 281-286.
- Godbold, S., and Turner, R.C. (1992). Second Severn crossing 1991 Welsh intertidal zone. *Archaeology in the Severn Estuary*, 3, 45-55.
- Godbold, S., and Turner, R.C. (1994). Medieval fishtraps in the Severn Estuary. *Medieval Archaeology*, 38, 19-54.
- Great Britain. Ministry of Munitions. (1921). *History of the Ministry of Munitions, vol. 10: The supply of munitions*. London: HMSO
- Green, C. (1992). The Severn fisheries. *Archaeology in the Severn Estuary*, 3, 369-73.
- Green, M. (1993). A Carved Stone Head from Steep Holm. *Britannia* 24, 241-2.
- Gregory, P. (2004-2008). *Weston, Clevedon and Portishead Railway*. [online] Available from: <http://www.portishead.f2s.com/wcpr/index.html> [Accessed 23-May-2008]
- Grinsell, L.V. (1971). Somerset Barrows. Part II: North and East. *Proceedings of the Somersetshire Archaeological and Natural History Society*, 115, 43-137.
- Grinsell, L.V., and Darvill, T.C. (1989). Gloucestershire Barrows: Supplement 1961-1988. *Transactions of the Bristol and Gloucestershire Archaeological Society*, 107, 39-105.
- Grove, J., and Brunning, R. (1998). The Romano-British salt industry in Somerset. *Archaeology in the Severn Estuary*, 9, 61-68.

Groves, C., Locatelli, C., and Nayling, N. (2004). Tree-Ring Analysis of Oak Samples from Stert Flats Fish Weirs, Bridgwater Bay, Somerset. *Centre for Archaeology Report 43/2004*. Portsmouth: English Heritage.

Hadfield, E.C.R. (1942). Canals between the English and the Bristol Channels. *The Economic History Review*, 12 (No. 1/2), 59-67.

Hale, A.G.C. (2005). Fish traps in Scotland: construction, supply, demand and destruction, in Klapste, J. (Ed.). *Water Management in Medieval Rural Economy, Ruralia V*. Prague. Institute of Archaeology, Academy of sciences of the Czech Republic.

Hall, D. (1982). *Medieval Fields*. Princes Risborough: Shire Publications.

Hall, D. (1998). *Medieval fields in their many forms. British Archaeology Issue no 33, April 1998*. [online] Available from: <http://www.britarch.ac.uk/BA/ba33/ba33feat.html> [Accessed 23 APR 2008]

Haslett, S.K., and Bryant, E.A. (2004). The AD1067 coastal flood in the Bristol Channel and Severn Estuary: historical records from Devon and Cornwall (UK). *Archaeology in the Severn Estuary*, 15, 81-89.

Haslett, S.K., and Bryant, E.A. (2008). Historic tsunami in Britain since AD 1000: a review. [online] Available from: <http://www3.newport.ac.uk/docstore/h/shasle01/Haslett&Bryant2008low%20res.pdf> [Accessed 2 OCT 2008], and *Natural Hazards and Earth System Sciences*, 8, 587-601.

Havinden, M. (1981). *The Making of the English Landscape – The Somerset Landscape*. London: Hodder and Stoughton.

Hawkes, D. (2008). *Severn boats and boating page: Severn Estuary*. [online] Available from: <http://www.btinternet.com/~motorboat/estuary.htm> [Accessed 16-May-2008].

Heal, V. (1993). A perspective from Porlock: the maritime potential of the Exmoor coast, in Coles, J., Fenwick, V., and Hutchinson, G. (Eds.) *A Spirit of Enquiry: Essays for Ted Wright*. Wetland Archaeological Research Project/Nautical Archaeology Society/National Maritime Museum.

Hegarty, C., and Newsome, S. (2005). *The archaeology of the Suffolk coast and inter-tidal zone: a report for the National Mapping Programme*. Bury St Edmonds: Suffolk County Council; Swindon: English Heritage.

Hegarty, C., and Newsome, S. (2007). *Suffolk's defended shore: coastal fortifications from the air*. Swindon: English Heritage.

Herbert, N.M. (Ed.). (1988). *A history of the county of Gloucester, volume IV* (Victoria history of the Counties of England).

Herbert, N.M. (Ed.). (1996). *A History of the County of Gloucester V* (Victoria History of the Counties of England).

Hewett, J. (2006). *Pierless Defences at Minehead*. [online] Available from: <http://www.bbc.co.uk/ww2peopleswar/stories/61/a8923061.shtml> [Accessed 09 MAY 2007].

Hildich, M. (1997). Preliminary survey of coastal archaeology including the intertidal zone between Wain's Hill (Clevedon) and Sand Point (Worle), North Somerset. *Archaeology in the Severn Estuary*, 8, 99-102.

Hooke, D. (1985). *The Anglo-Saxon landscape. The kingdom of the Hwicce*. Manchester: Manchester University Press

Jenkins, G. (1974). *Nets and coracles*. David and Charles: Newton Abbott.

Jennings, S., Orford, J.D., Canti, M., Devoy, R.J.N., and Straker, V. (1998). The role of relative sea-level rise and changing sediment supply on Holocene gravel barrier development: the example of Porlock, Somerset, UK. *The Holocene*, 8 (2), 165-181.

Joint Nature Conservation Committee (JNCC). (2008). *Habitat account - Marine, coastal and halophytic habitats*. [Online] available from: <http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=h1140> [Accessed 25 MAY 2008].

Jones, J., Tinsley, H., McDonnell, R., Cameron, N., Haslett, S., and Smith, D. (2005). Mid Holocene Coastal Environments from Minehead Beach, Somerset, UK. *Archaeology in the Severn Estuary*, 15, 49-69.

Kirby, R. (1994). The evolution of the fine sediment regime of the Severn Estuary and Bristol Channel. *Biological Journal of the Linnean Society*, 51(1-2), 37-44.

Kirby, R., and Shaw, T.L. (2004). *Severn Barrage, UK – environmental reappraisal*. [online] Available from: <http://www.thomastelford.com/journals/DocumentLibrary/ENSU1580106.pdf> [Accessed 30 JUL 2008].

Landscape Design Associates. (2004). *Landscape character assessment: Gloucestershire and Forest of Dean*. Bristol: The Countryside Agency.

Land Use Consultants. (2004). *Landscape character assessment of Exmoor National Park*. London: Exmoor National Park Authority.

Langston, W.J., Chesman BS, Burt GR, Hawkins SJ, Readman J, and Worsfold, S. (2003). *The Severn Estuary (possible) Special Area of Conservation Special Protection Area, Marine Biological Association occasional publication number 13*. [Online] available from:
http://www.mba.ac.uk/NMBL/publications/charpub/pdf/Severn_Estuary.pdf [Accessed 15 JUL 2008].

La Trobe-Bateman, E. (1999). *Avon Extensive Urban Areas Survey: Clevedon*. Weston-super-Mare. North Somerset Council.

La Trobe-Bateman, E., and Russett, V. (1999a). *Avon Extensive Urban Areas Survey: Portishead*. Weston-super-Mare. North Somerset Council.

La Trobe-Bateman, E., and Russett, V. (1999b). *Avon Extensive Urban Areas Survey: Weston-super-Mare*. Weston-super-Mare. North Somerset Council.

Lawler, M., Parkhouse, J., and Straker, V. (Eds.). (1992). *Archaeology of the Second Severn Crossing*. The Glamorgan-Gwent Archaeological Trust Ltd

Leech, R.H. (1981). The Somerset Levels in the Roman-British period. In Rowley, R.T. (ed.), *The evolution of marshland landscapes: papers presented to a conference on marshland landscapes held in Oxford in December 1979*. Oxford: Oxford University Department for External Studies.

Lewis, S. (1848). 'Milverton - Minsterworth', *A Topographical Dictionary of England*. [online] Available from:
<http://www.british-history.ac.uk/report.aspx?compid=51153>. [Accessed 07 AUG 2008].

Loader, R., Westmore, I., and Tomalin, D. (1997). *Time and Tide : an archaeological survey of the Wootton-Quarr coast*. Newport. Isle of Wight: Isle of Wight Council.

Locock, M. (1997). A prehistoric trackway at Cold Harbour Pill, Redwick, Gwent. *Archaeology in the Severn Estuary*, 8, 9-12.

Locock, M. (1999). Iron Age and Later Features at Greenmoor Arch, (Gwent Europark), *Newport Archaeology Severn Estuary* 10, 128-30.

Locock, M., and Lawler, M. (1995). Brean Down sea defences: field evaluation. *Archaeology in the Severn Estuary*, 6, 23-28.

Lowry, B. (1999). The Anti-Invasion Defences of Western Command in 1940. *Fort: the international journal of fortification and military architecture*, 27, 159-177

- Lynch, K. (2002). *Somerset Voices, Oral History Archive – Brendan Sellick*. [online] Available from: <http://www.somersetvoices.org.uk/people/?entryid=835&EntryId4=835&char=S> [Accessed 15-MAY-2008].
- McDonnell, R. (1980). Tidal fish weirs in West Somerset in Burrow I. *Somerset Archaeology 1979. Proceedings of the Somerset Archaeology and Natural History Society, 124*, 134-5.
- McDonnell, R. (1993). Preliminary archaeological assessment in Bridgwater Bay: Gore Sand and Stert Flats. *Archaeology in the Severn Estuary, 4*, 41-46.
- McDonnell, R. (1994). Bridgwater Bay: a summary of its geomorphology, tidal characteristics and intertidal cultural resource. *Archaeology in the Severn Estuary, 5*, 87-114.
- McDonnell, R. (1995a). *Bridgwater Bay: A Rapid Preliminary Assessment of Gore Sand and Stert Flats*. Wedmore: R. McDonnell.
- McDonnell, R. (1995b). Island evolution in Bridgwater Bay and the Parrett Estuary: an historical geography. *Archaeology in the Severn Estuary, 6*, 71-84.
- McDonnell, R. (2001). *Minehead Sea Defence Scheme Archaeological Report, Vol 1: Assessment, Survey and Evaluation*. The Environment Agency.
- McDonnell, R. (2003a). Saxon timber from Porlock Marsh. *Proceedings of the Somerset Archaeology and Natural History Society, 147*, 183-185.
- McDonnell, R. (2003b). *Bridgwater Bay Archaeological Memoir 08.09.03 Fish Weir Sampling Excursion*. Taunton: Somerset County Council Architectural and Historic Heritage Group.
- McDonnell, R. (2003c). *Bridgwater Bay Archaeological Memoir 14.05.03 Fish Weir Sampling Excursion*. Taunton: Somerset County Council Architectural and Historic Heritage Group.
- Miles, I. (1993). Bogs and Inundations. *Somerset Industrial Archaeological Society Report No. 7*. Somerset Industrial Archaeological Society & Westonzoyland Engine Trust.
- Mills, J., and Palmer, R. (2007). *Populating clay landscapes*. Stroud: Tempus Publishing Ltd
- Mullin, D. (2005). *Rapid Coastal Zone Assessment for The Severn Estuary Project Design*. Gloucester: Gloucestershire Archaeology Service Environment Department.
- Mullin, D. (2008). *Severn Estuary Rapid Coastal Zone Assessment, Phase 1 Report for English heritage (HEEP Project no. 3885)*. Unpublished draft.

Murphy, A. (2005). *A Brief for Rapid Coastal Zone Assessment Surveys: English Heritage and RCHME version 7*. London: English Heritage

Murphy, A. (2008). *Lime Kiln Project*. [online] Available from:
http://www.watchetconservationsociety.co.uk/project_limekiln.html [Accessed 6 AUG 2008]

Musgrove, D. (1997). The medieval exploitation and reclamation of the inland peat moors in the Somerset Levels. *Archaeology in the Severn Estuary*, 8, 89-97.

Nayling, N. (1999). Medieval and later fish weirs at Magor Pill, Gwent levels: coastal change and technological development. *Archaeology in the Severn Estuary* 10, 99-113.

National Maritime Museum. (2008). *Maritime Museum ship models – Bridgwater flatner*. [online] Available from:
<http://www.nmm.ac.uk/collections/explore/object.cfm?ID=SLR1845> [Accessed 19 MAY 2008].

Neumann, H. and Bell, M. (1996). Intertidal survey in the Welsh Severn Estuary, in *Archaeology in the Severn Estuary*, 7, 3-20.

Nevard, C. (2002). *A Brief History of the Somerset Dorset Joint Railway*. [online] Available from:
<http://www.sdrtd.org.uk/resources/history.htm> [Accessed 22 FEB 2007].

Newman, M. (2008). *Bomb causes alert for Burnham-On-Sea emergency services*. [online] Available from:
<http://www.burnham-on-sea.com/coastguard/suspected-bomb-10-04-08.shtml> [Accessed 11 APR 2008].

Newman, R. (1983). The effect of orcharding and the cider industry on the landscape of West Gloucestershire c.1600-1800. *Transactions of the Woolhope Naturalists Field Club* 44 (2), 202-214.

Olney, G. (2008). *Postcards of the past, Weston-Super-Mare, Somerset*. [online] Available from:
<http://www.oldstratforduponavon.com/westonsupermare.html> [Accessed 15 MAY 2008].

O'Neil, H. and Grinsell, L.V. (1960). Gloucestershire Barrows. *Transactions of the Bristol and Gloucestershire Archaeological Society*, 79, 5-143.

Orford, J. (2007). *Porlock Gravel Barrier*. [online] Available from:
<http://www.jncc.gov.uk/pdf/gcrdb/GCRsiteaccount3213.pdf> [Accessed 11 APR 2008].

Osborne, M. (2004). *Defending Britain*. Stroud: Tempus.

O'Sullivan, A. (2003). Place, memory and identity among estuarine fishing communities: interpreting the archaeology of early medieval fish weirs, in *World Archaeology* 35 (3), 44-468

- Paget-Tomlinson, E. (1993). *The illustrated history of canal and river navigations*. Sheffield: Sheffield Academic Press.
- Pannett, D.J. (1981). Fish weirs of the River Severn. In Rowley, R.T. (Ed.) *The evolution of marshland landscapes: papers presented to a conference in Oxford in December 1979*. Oxford: Oxford University Department for External Studies, 144-157.
- Pannett, D.J. (1987-8). Fish weirs of the River Severn. *Folk Life*, 26, 54-64
- Pawle, G. (1956). *The Secret War, 1939-45*. London: Harrap.
- Pearson, M. (1991). Coast defence radar. *Fort: the international journal of fortification and military architecture*, 19, 93-106
- Perrott, D. (1983). *The Ordnance Survey guide to the waterways, 1: South*. London: Robert Nicholson and Ordnance Survey.
- Phillips, C.W. (1931). Earthworks on Walton Common Down, near Clevedon. *University of Bristol Spelaeological Society Proceedings*, 4 (1), 34-42.
- Pilbeam, A. (2006). *The Landscape of Gloucestershire*. Stroud: Tempus.
- Pinsent, M. (1983). The defences of the Bristol Channel in the last two centuries [Bristol, Cardiff, Barry]. *Fort: the international journal of fortification and military architecture*, 11, 62-76
- Portishead Railway Group. (2007). *Portishead Railway Group – history of the line*. [online] Available from: <http://www.portisheadrailwaygroup.org/html/history.html> [Accessed 27 MAR 2007]
- Price, E., and Spry, N. (2004). Notes on a Timber Trackway Close to the River Severn at Hinton. *Glevensis* 37, 42.
- Priest, R., Crowther, S., and Dickson, A. (2007). *National Mapping Programme: the Leadon Valley sand and gravel aggregate area, ALSF project No. 4832*. Swindon: English Heritage.
- Rendell, S., and Rendell, J. (1993a). *Steep Holm: The story of a small island*. Stroud: Alan Sutton Publishing.
- Rendell, S., and Rendell, J. (1993b). Steep Holm - a brief summary of archaeological research. *Archaeology in the Severn Estuary*, 4, 47-54.

Reynolds, M., and Platt, S. (2007). *Medieval moated sites*. [online] Available from: <http://www.channel4.com/history/microsites/T/timeteam/about.html> [Accessed 25 OCT 2007]

Rahtz, P., Hirst, S., and Wright, M.S. (2000). *Cannington cemetery: excavations 1962-3 of prehistoric, Roman, post-Roman, and later features at Cannington Park Quarry, near Bridgwater, Somerset*. London: Society for the Promotion of Roman Studies.

Riches, P. (2007). *Survey of Longbrook Camp. Dean Archaeology Group Report 20, Part One*. Lydney: Dean Archaeology Group.

Riley, H. (1995). Brean Down, Somerset: interim report on a new survey by the Royal Commission on the Historical Monuments of England. *Archaeology in the Severn Estuary* 6, 13-22.

Riley, H. (1998a). *Intertidal palaeoenvironmental and archaeological features at Gravel Banks and Severn Beach, Severn Estuary, near Avonmouth*. Exeter: Royal Commission on the Historic Monuments of England.

Riley, H. (1998b). Intertidal survey at Avonmouth and Oldbury-on-Severn 1998. *Archaeology in the Severn Estuary*, 9, 79-82.

Riley, H. (2001). *Porlock Bay, Porlock, Somerset. Archaeological Investigation Report Series AI/19/2001*. Exeter: English Heritage.

Riley, H. (2006). *The Historic Landscape of the Quantock Hills*. Swindon: English Heritage.

Riley, H., and Wilson-North, R. (1997). *The Field Archaeology of North Hill: An Archaeological Survey of the Exmoor National Park Holding by the RCHME*. Exeter: RCHME.

Riley, H., and Wilson-North, R. (2001). *The Field Archaeology of Exmoor*. Swindon: English Heritage.

Rippon, S. (1992). The exploitation of the North Somerset Levels in the Roman period. *Severn Estuary Levels Research Committee Annual Report 1992*, 35-38.

Rippon, S. (1993). The Severn wetlands during the historic period. *Archaeology in the Severn Estuary*, 4, 31-35.

Rippon, S. (1994). The Roman settlement and landscape at Kenn Moor, North Somerset; interim report on survey and excavation 1993/4. *Archaeology in the Severn Estuary*, 5, 21-34.

Rippon, S. (1995). The Roman settlement and landscape at Kenn Moor, Avon; second interim report on survey and excavation, 1994/5. *Archaeology in the Severn Estuary*, 6, 21-34.

- Rippon, S. (1996). Roman and medieval settlement on the North Somerset Levels: survey and excavation at Banwell and Puxton, 1996. *Archaeology in the Severn Estuary*, 7, 39-52.
- Rippon, S. (1997a). *The Severn Estuary: Landscape Evolution and Wetland Reclamation*. Leicester: Leicester University Press.
- Rippon, S. (1997b). Roman and medieval settlement on the North Somerset Levels: the second season of survey and excavation at Banwell and Puxton, 1997. *Archaeology in the Severn Estuary*, 8, 41-54.
- Rippon, S. (1998). Medieval settlement on the North Somerset Levels; the third season of survey and excavation at Puxton, 1998. *Archaeology in the Severn Estuary*, 9, 69-78.
- Rippon, S. (2000). The historic landscapes of the Severn Estuary Levels. *Archaeology in the Severn Estuary*, 11, 119-135.
- Rippon, S. (2002). *Infield and Outfield: the early stages of marshland colonisation and the evolution of medieval field systems*. *Lincolnshire Archaeology and Heritage Report Series No. 5*. [online] Available from: <http://eric.exeter.ac.uk/exeter/bitstream/10036/23874/1/Infield.PDF> [Accessed 29 APR 2008].
- Rippon, S. (2008). *Coastal Trade in Roman Britain: the Investigation of Crandon Bridge, Somerset, a Romano-British Trans-shipment Port Beside the Severn Estuary*. Forthcoming.
- Rowbotham, F.W. (1978). The River Severn at Gloucester with Particular Reference to its Roman and Medieval Channels. *Glevensis Gloucestershire and District Archaeological Research Group* 12, 4-9.
- Rowbotham, F. (1993). The fish weirs of the River Severn. *Glevensis: Gloucestershire and District Archaeological Research Group*, 27, 4-6.
- Rutter, I. (1829). *The Westonian Guide, including a descriptive account of Woodspring*. [online] Available from: http://books.google.co.uk/books?id=GqsHAAAAQAAJ&pg=PA28&lpg=PA28&dq=birnbeck+island+sprats&source=web&ots=usmRmEq5sP&sig=W18liHvTqwuRr9SACX-5ovbdpo&hl=en&sa=X&oi=book_result&resnum=4&ct=result#PPA22,M1 [Accessed 21-JUL-2008]
- Rutter, J. (1840). *A New Guide to Weston-Super-Mare*. Shaftesbury: J. Rutter.
- Salisbury, C.R. (1991). Primitive British fishweirs. In Good, G.L., Jones, R.H., and Ponsford, M.W. (eds.) *Waterfront Archaeology, CBA Research Report 74*. London: Council for British Archaeology.
- Saville, A. (Ed). (1984). *Archaeology in Gloucestershire from the earliest hunters to the industrial age*. Cheltenham: Cheltenham Art Gallery & Museums and Bristol & Gloucestershire Archaeological Society.

Scheduled Ancient Monument. (2001). *Four medieval fish weirs 500m east of the harbour. SAM notification 33730* [File Ref AA 75713/1. 28 SEP 2001].

Severn Estuary Partnership (2002/2003). *Severn Estuary Gateway site*. [online] Available from: <http://www.severnestuary.net/> [Accessed 08 APR 2008].

Severn River Crossing PLC. (2005). *Historical Overview*. [online] Available from: <http://www.severnbridge.co.uk/history.shtml> [Accessed 16 MAY 2008].

Small, F., and Stoertz, C. (Eds.). (2006). *Gloucestershire Forest of Dean National Mapping Programme Report*. Swindon: English Heritage.

Smith, J. (2007). *The Somerset and Dorset Railway Trust*. [online] Available from: <http://www.sdrt.org.uk/news/news2007/burnham.htm> [Accessed 22 FEB 2007].

Somerset Archaeological and Natural History Society. (1981). *Steep Holm: a survey*. Taunton: Somerset Archaeological and Natural History Society.

Somerset County Council. (2008). *Somerset Fisheries: Mudhorsemen, eels and glatting*. [online] Available from: <http://www.somerset.gov.uk/tourism/food/past-pages/pastpages.htm> [Accessed 16 MAY 2008].

Somerset County Council. (2007). *Somerset Brick and Tile Museum*. [online] Available from: <http://www.somerset.gov.uk/somerset/culturecommunity/museums/somersetmuseums/bricktile/> [Accessed 05 AUG 2008].

Somerset HER. (1994). *Coast artillery battery, Minehead Harbour, Minehead*. [online] Available from: <http://webapp1.somerset.gov.uk/her/details.asp?prn=35359> [Accessed 29 OCT 2007]

South Gloucestershire Council. (2005). *The South Gloucestershire Landscape Character Assessment SPD*. Bristol: South Gloucestershire Council.

South Gloucestershire Council. (2006). *The Archaeology of the Severn Estuary: A guide for planners, developers, decision makers and local communities*. [online] Available from: <http://www.severnestuary.net/sep/pdfs/severnarchaeodesignguidefinal06.pdf> [Accessed 03 APR 2008].

South West Maritime History Society. (2008). *Meeting at Salcombe, Saturday 4th November 2000 – the friends of the flatner*. [online] Available from: <http://www.swmaritime.org.uk/article.php?articleid=269&atype=m> [Accessed 19 MAY 2008].

- Strachan, D. (1997). Dating of some inter-tidal fish weirs in the Blackwater estuary. *Blackwater Estuary Management Plan (BEMP) Area Archaeological Project, report no.1*. Chelmsford: Essex County Council.
- Strachan, D. (1999). Blackwater Foreshore Survey 1995-6: revisiting the Hullbridge sites. *Estuary Management Plan (BEMP) Area Archaeological Project, report no.1*. Chelmsford: Essex County Council.
- Sykes, C.M. (1938). Some Flint Implements from the Blackstone Rocks, Clevedon. *Proceedings of the University of Bristol Speleological Society* 5 (1), 75-79.
- Tacchi, D. (2003). *Somerset Pillboxes*. [online] Available from: <http://www.pillboxes-somerset.com/> [Accessed 14 JUN 2007].
- Tann, J. (1965). Some problems of Water Power – a Study of Mill Siting in Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society, LXXXIV*. 53-77.
- Taylor, J.N. (1974). *Fishing on the Lower Severn*. Gloucester: Gloucester City Museums.
- Thewingedone. (2003). *Second World War, People's War – A child's Memories*. [online] Available from: <http://www.bbc.co.uk/ww2peopleswar/stories/98/a2014598.shtml> [Accessed 02 FEB 2007]
- Thorn, C. and Thorn, F. (1980). *Domesday Book 8: Somerset*. Chichester: Phillimore.
- Tierney-Jones, A. (2008). *Last round-up for the mud-horse fisherman*. [online] Available from: <http://www.telegraph.co.uk/earth/main.jhtml?view=DETAILS&grid=&xml=/earth/2008/03/22/eamud122.xml> [Accessed 15 MAY 2008].
- TourUK (2004). *Kewstoke Tourist information*. [Online] available from: <http://www.touruk.co.uk/north-somerset/kewstoke.htm> [Accessed 30 JUL 2008].
- Townley, E. (1998). Fieldwork on the Forest Shore: Stroat to Woolaston, Gloucestershire. *Archaeology in the Severn Estuary*, 9, 83-85.
- Truscoe, K. (2007). *Rapid Coastal Zone Assessment for the Severn Estuary: Assessment of Environment Agency Lidar Data. Trail Areas: Somerset and Gloucestershire*. Taunton: Somerset County Council Unpublished report:
- Turner, R. (2005). Archaeology and the death of coastal fishing in Britain. *Journal of Wetland Archaeology*, 5, 79-86.

Ulf-Hansen, P.F. and Boyce, D.C. (1997). *Exmoor and The Quantock Hills Natural Area Profile (NA 87)* [online] Available from: http://www.english-nature.org.uk/SCIENCE/NATURAL/NA_Details.asp?NA_ID=87&S=87&R=0. [Accessed 30 OCT 2007]

University of Southampton School of Ocean and Earth Science (2008). *UK salt marshes in retreat: anthropogenic versus natural origin: Group J*. [online] Available from: <http://www.soes.soton.ac.uk/teaching/courses/oa217/groupj.pdf> [Accessed 11-APR-2008].

Warren, D. (2000). *Now you see it – Then you didn't!: The Inter-Channel Stop Line*. Taunton: The Somerset Industrial Archaeological Society.

Wills, H. (1985). *Pillboxes: A study of UK defences, 1940*. Leo Cooper

Wilson, D. R. (2000). *Air photo interpretation for archaeologists*. Stroud: Tempus.

Wilson, R.J.A. (2002). *A guide to the Roman remains in Britain*. London: Constable.

Winton, H. (2005). *Malvern Hills AONB: A report for the National Mapping Programme, survey report AER/4/2005*. English Heritage unpublished report.

Witts, C. (2000). *River Severn Floods*. [online] Available from: <http://www.severntales.co.uk/page78.html> [Accessed 15-MAY-2008].

Appendix I - Archaeological Scope of the Survey

Earthworks, plough levelled features and buried remains

All cropmarks and soil marks which represent sub-surface features of archaeological origin have been recorded. Some earthworks for example, field boundaries, have not been mapped where they are clearly marked on the 1st edition Ordnance Survey Maps unless they are associated with other mapped features. Features which have an uncertain date or thought to be possible geological marks have been recorded where they are associated with or may be confused with other archaeological features.

Military

Military buildings and structures from the Second World War (Pre-1945) were recorded. Within urban areas and where large military sites and grouped features, such as camps, depots and airfields were identified, they were mapped as an extent of area, although full descriptions were provided in the NMR (AMIE) record. However, where individual structures within these larger sites, such as pillboxes, were already recorded as a single record in the NMR (AMIE) database, these features were mapped individually. Cold war structures were also recorded.

Ridge and Furrow and Water Meadows

Medieval and/or post-medieval ridge and furrow and water meadows were also recorded. Levelled and extant fields of ridge and furrow were depicted using different conventions and furrow directions were indicated by arrows. Areas of water meadows thought to pre-date 1945 have also been transcribed and recorded.

Land Improvement Drainage

Post-medieval and/or 20th Century drainage patterns were recorded as a polygonal area within individual Quarter sheets owing to the extensive nature of the drainage systems. Smaller areas of post-medieval drainage were recorded in association with ridge and furrow.

Industrial Archaeology

Areas of industrial archaeology have been recorded where the features can be recognised to predate 1945 and where their industrial buildings are no longer extant.

Fish Weirs/Fish Traps

Fish weirs have in most cases been mapped and recorded as separate sites. Weirs have also been recorded where no visible structure remains instead showing only as faint depressions in the intertidal mud.

Appendix 2 - Sources

The main photographs sources consulted were:

- National Monuments Record

A collection of approx 12,700 aerial photographs comprising vertical sorties from the RAF and Ordnance Survey as well as specialist oblique photography were viewed.

- Unit for Landscape Modelling (formerly Cambridge University Committee for Air Photography, CUCAP)

The project consulted all available vertical and oblique aerial photographic prints listed in the online catalogue (<http://venus.uflm.cam.ac.uk/>)

Monument information was consulted from the following SMRs/HERs:

- Gloucester County Council Sites and Monuments Record
- South Gloucestershire HER
- Somerset County Council HER
- North Somerset Council HER
- Bristol City Council HER

Lidar information was viewed and assessed by Krysia Truscoe (see Appendix 4.) by the Environment Agency Lidar Data.

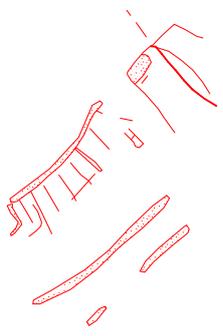
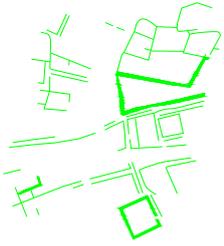
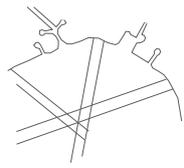
Historic maps were also consulted as an additional source to aid in monument interpretation and as an alternative base map for rectification purposes where the modern OS landline data did not have enough control points that matched the historic aerial photography.

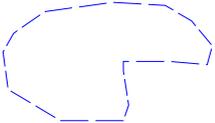
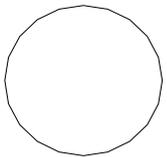
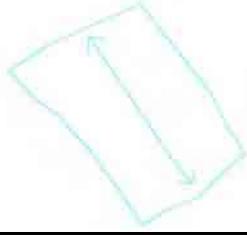
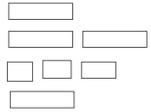
Appendix 3 - NMP Methodology

Digital Transcription

All photographs are rectified using the Aerial 5.29 computer rectification package. A digital terrain model function is also used to compensate for steep or undulating terrain. Due to the nature of some of the photographs and their location in the intertidal area, control points are sometimes hard to obtain and some control points are taken from soft boundaries i.e. hedges, river courses, intertidal watercourses and diffuse field boundaries. However, all control points have an average error of less than 2 metres and are accurate to within 0.9m of each other. All archaeological features are then transcribed at 1:10,000 scale and mapped using English Heritage standard mapping conventions in AutoCAD. An average level of accuracy of less than 2 metres to the map is achieved and this gives an overall accuracy of plotted features, to true ground position, within 5-15m metres.

AutoCAD NMP Conventions and Layers

Layer name	Colour	Linetype	
BANK 1 (red) CONTINUOUS The outline of all features seen as banks or positive features, eg platforms, mounds and banks; also to be used for the agger of Roman Roads. Thin banks will appear on this layer as a single line.			
BANKFILL 1 (red) FILL: DOT SCALE: 2.25 ANGLE: 53 A stipple that fills the bank outline 'bank'.			
DITCH 3 (green) CONTINUOUS All features seen as ditches; also excavated features, eg ponds and pits.			
DITCHFILL 3 (green) FILL – SOLID			
EXTENT OF AREA8 (grey) DASHEDX2 The extent of large area features such as the perimeters of airfields, military camps, mining/extraction areas.			

Layer name	Colour	Linetype	
LARGE CUT FEATURE	5 (blue)	ACAD_ISO02W100	
Formerly the 'T-hachure', now represented by a dashed line. To be used for large cut features such as quarries, ponds, and perhaps scarps that can not easily be depicted with the use of either bank or ditch.			
MONUMENT POLYGON	7 (white)	CONTINUOUS	
Used to define the extent of a group of AutoCAD objects corresponding to a single monument in the NMR database.			
RIGARRLEVEL	6 (magenta)	ACAD_ISO03W100	
Arrow depicting direction of rig in a single block ridge and furrow, seen as earthworks or cropmarks, but known to have been ploughed level.			
RIGDOTSLEVEL	6 (magenta)	DOTX2	
Outline of a block of ridge and furrow, seen as earthworks or cropmarks, but known to have been ploughed level.			
RIGARREWK	4 (cyan)	CONTINUOUS	
Arrow depicting direction of rig in a single block of ridge and furrow seen as earthworks on the latest available aerial photographs.			
RIGDOTSEWK	4 (cyan)	DOTX2	
Outline of a block of ridge and furrow still surviving as earthworks on the latest available aerial photographs.			
STRUCTURE	9 (grey)	CONTINUOUS	
Used for features which do not easily fit into other categories because of their form, eg tents, radio masts, paint (camouflaged airfields).			
Other Layers:			
(VIEWPORT)	7 (white)	CONTINUOUS	
Used in conjunction with the printing macros			
(SHEET)	7 (white)	CONTINUOUS	
Used in conjunction with printing macros			
GRID	7 (white)	CONTINUOUS	
Drawn automatically by a macro at correct NGR			
RASTER	7 (white)	CONTINUOUS	
Used to load raster images so they can be easily switched off.			

NMR Archaeological database (AMIE)

As a result of the aerial survey to date, a total of 928 new monument records have been identified and created in the NMR's database (AMIE), as well as the revision of 373 existing records. The existing records were updated and/or revised where the form or extent of the site could be clarified or where more detailed information

was necessary to provide a better understanding of the site. Newly recorded monuments are given an indexed and textual description and are translated onto the English Heritage in-house Geographic Information System (WebGIS). All monument records are given a unique identifying number, known as a HOB UID (Heritage Object Unique Identifier) as well as the older NMR reference numbering system relating to the Ordnance Survey mapsheet e.g. SO 71 NE 9/HOB UID I13299.

An archive drawing record was created for each Ordnance Survey quarter sheet, providing information on the compiler, dates of work, associated events, sources including the best aerial photographs of the site and other indexed information. These event records have been linked to all the monument records for that sheet and to a parent event record for the whole project.

- The Severn Estuary NMP: Rapid Coastal Zone Assessment – Collection Record: AF00213
- Gloucestershire County Council: The Severn Estuary NMP: Rapid Coastal Zone Assessment – Event record: I441254

Appendix 4 Severn Estuary RCZAS lidar review

Rapid Coastal Zone Assessment for the Severn Estuary

(Project No. 3885PD)

Assessment of Environment Agency Lidar Data

Trial Areas: Somerset and Gloucestershire

Krystyna Truscoe, Somerset County Council



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I. Introduction: Lidar

Lidar (Light detection and ranging) is an airborne survey method in which height differences on the land surface are measured. Very slight changes in elevation can be picked up and this survey technique results in a detailed digital terrain model, in which archaeological sites can be identified; sometimes even those sites which had been thought to have been levelled by ploughing.

Lidar survey is based on the principle of measuring distance through the time taken for a pulse of light to reach a target and return. Airborne lidar uses a pulsed laser beam which is scanned from side to side as the aircraft flies over the survey area measuring between 20 and 1000 ground elevation points per second. Even small variations in height can be picked up and the result of the survey is an accurate model of the land surface at metre and sub-metre resolution (Bewley et al 2005, 637). Lidar also has the capacity to penetrate many types of woodland canopy (Devereaux et al 2005, 651) meaning that archaeological sites can potentially be identified both in open ground and under tree cover.

Lidar data was provided by the Environment Agency for the following areas:

Gloucestershire: Five 2 km square lidar tiles: SO 72 14, SO 74 14, SO 74 16; and one tile covering an area extending from SO 7600 1406 to SO 7646 1600: SO 76 16 (Quarter sheets: SO 71 NE, SO 71 SW and SO 71 SE). The area extends from Westbury on Severn in the south west to Minsterworth in the north east.

Somerset coast: Five 2 km square lidar tiles: ST 22 46, ST 24 44, ST 26 42, ST 26 44 and ST 26 46 (Quarter sheets: ST 24 NW, ST 24 NE, ST 24 SW and ST 24 SE). The area extends from Stockland Bristol in the south west to the Steart Flats in the north east.

The two survey areas were chosen primarily to look at a possible Roman flood defence at Elmore in Gloucestershire and at an area of intertidal mud in Somerset. The trial was undertaken in order to see if lidar data could be used as a complementary tool for archaeological survey in this environment, in addition to aerial and field survey. The Somerset area also includes an area of flood defences within a bend of the River Parrett in the parish of Pawlett.

The lidar was flown at 2m resolution over the following dates: ST24 comprised three flights from September 2001, March 2003 and November 2004; SO71 ranged over three flights from November 1999, December 2005 and between December 2005 and January 2006.

The data was processed as follows: it was initially converted to x,y,z ASCII via the Environment Agency's inbuilt program; it was imported into QT Modeler; and then exported as QT file to be viewed in three dimensions in QT Reader (Applied Imagery software © John Hopkins University Applied Physics Laboratory). The data was also processed as hill-shaded GeoTIFFs in 2km square tiles.

Both the flat GeoTIFFs and the QT files were then viewed in order to aid the interpretation of features. In QT Reader the lidar tile can be turned in order to change the angle that the sun is falling across it, meaning that features can be viewed under the most beneficial conditions. The georeferenced flat files can be dropped straight into the mapping programme (Autodesk Map 3D 2007). These files are processed in such a way that the archaeology is shown as favourably as possible, ie, by ensuring that the shadows are falling in a way that shows archaeological sites to their best advantage.

National Mapping Programme Methodology

All archaeological features were mapped according to National Mapping Programme (NMP) standards. The NMP methodology entails the interpretation, mapping and recording of all archaeological sites from the Neolithic to the twentieth century from aerial photographs. Palaeochannels and former watercourses, features not traditionally mapped from aerial photographs and not included within the NMP standard methodology, were also mapped from lidar and drawn as ditched features.

	Bank	Used for drawing upstanding earthworks or levelled features
	Ditch	Used for drawing all negative features seen as cropmarks and earthworks or levelled features
	Quarries	Used for extraction pits and other large cut features
	Structure	Used for structures, eg, Second World War buildings
	Levelled ridge and furrow	
	Upstanding ridge and furrow	

Figure 1-1: National Mapping Programme drawing conventions

Lidar and Aerial Photographs

The capacity of lidar survey to create a highly accurate ground surface model means that many archaeological features can be identified as long as they have some, even very slight, difference in height to their surroundings. Therefore, sub-surface features, which may be visible as cropmarks on aerial photographs, will not be visible on lidar, but very slight earthworks can often be identified. However, in the same way as aerial photographs, a lidar presents a snapshot of a particular moment in time. Comparison with aerial photographs demonstrates that, while they cross over to a great extent in terms of what can be seen, archaeological sites identified using one survey method may not always be present on the other. Where lidar can be very useful is in monitoring the survival of sites on the ground surface. For example, archaeological sites that were thought to have been levelled can be shown to survive as very slight earthworks, or sites that were extant on the most recent aerial photographs may be shown on lidar to have now been levelled. The use of current lidar in this way could be particularly useful for the monitoring of inaccessible sites.

When the two survey methods have been used for National Mapping Programme projects, such as in the Mendip Hills, they have been found to be complementary. Lidar is then a useful tool in helping us to build up a more complete picture of the archaeology of an area, in addition to aerial photographs alone. A lidar survey can also be particularly helpful in areas where only a small amount of oblique

photography exists. Oblique photographs are generally taken with the object of recording archaeology. Whereas there is a lot of information to be gained from vertical photography, particularly historic examples, the images were not taken with archaeology in mind. Therefore, consideration will not have been given to lighting and slight earthwork sites can not always be clearly seen. A round earthwork, such as a barrow or windmill mound, may have lost height and become spread over time. It will be difficult to identify on aerial photographs because it is unlikely to cast a clear shadow, but it may still be identified on lidar.

Results from the trial areas

Gloucestershire

The visibility of banked or ditched features on lidar, such as moats or flood banks, is generally more consistent with the aerial photographic evidence than is the case with some other classes of earthworks, for example, ridge and furrow.

The flood bank at Elmore known as the Great Wall (National Monument Record (NMR) HOB UID 766021) is suggested by Allen and Fulford to date from a reclamation of land in the later Roman period from the post-glacial estuarine alluvium that underlies this area (1990: 29). It was suggested that this flood bank extended from a point to the north of Bridgemacote, to the northwest, falling short of the River Severn by approximately 375m (ibid: 18). The lidar appears to show that the bank is preserved for a further 30m to the north of the extent visible on aerial photographs, running parallel to a field boundary. The flood bank then seems to be preserved in the line of a later field boundary for the remainder of the extent suggested by Allen and Fulford. It is not clear, however, whether the flood bank itself is preserved beneath the line of the hedgerow. Extant ridge and furrow adjacent to the east of the field boundary complicates the picture on the lidar in the suspected northern area of the Great Wall. It is unclear whether what could be the flanking ditch to the east of the flood bank is in fact a deep, well preserved, furrow. No significant height difference could be detected from the lidar data on either side of the Great Wall. When measured by reorienting the tile (SO 7614) in QT Reader the difference that could be measured was only 7cm.

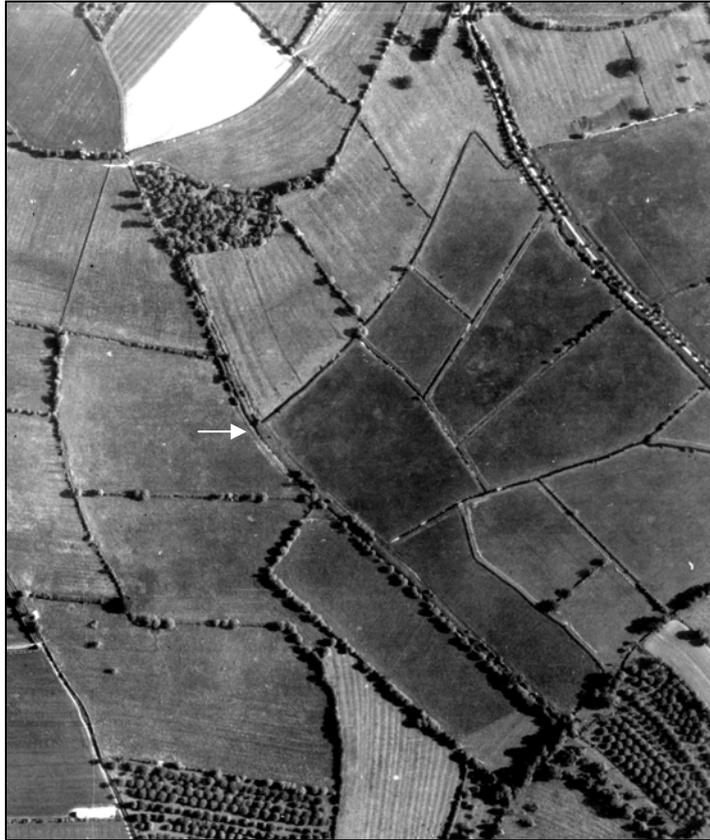


Figure 1-2: The Great Wall of Elmore with the northern extent to which it could be confidently mapped from aerial photographs marked with an arrow. (RAF 106G/UK/1558 3001 02-APR-1946)

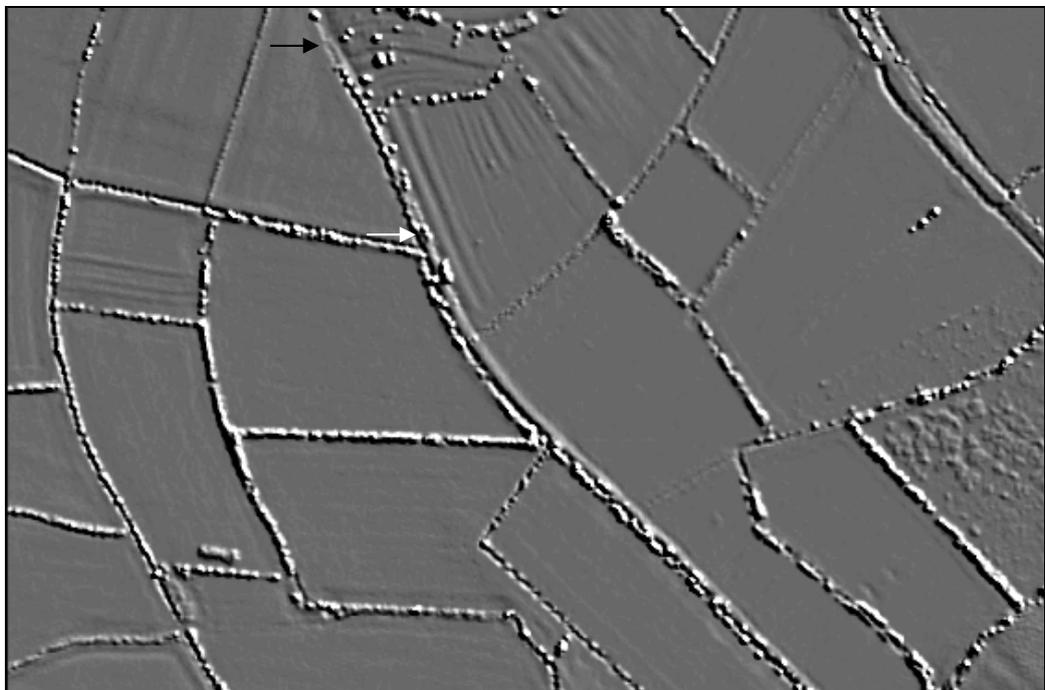


Figure 1-3: Lidar tile showing the same area as above with an extension to the Great Wall marked with by a white arrow and a possible further section to the north marked by a black arrow © Environment Agency Lidar, SO 7614, 2007

Two examples of moated sites near Minsterworth recorded from aerial photographs taken in 1946 reflect the fact that visibility of banked or ditched

features on lidar is generally consistent with the aerial photographic evidence. A site at Bagley Farm (NMR HOB UID 1448146) is recorded as being plough levelled on photographs of 1970. The lidar confirms how effectively this was done, as no traces survive on the surface. The second moated site recorded nearby at Lower Ley Farm (NMR HOB UID 1448149) is recorded as still visible as an earthwork on the 1970 photographs. This moated site is also visible on the lidar, therefore adding information to the record by showing that the site survives into the present day.

Large areas of Ridge and furrow were mapped and recorded from aerial photographs in the area either side of the River Severn in Elmore and Minsterworth parishes. The lidar results show that only small areas to the south of the River Severn in Elmore parish survive as surface earthworks, although many of these areas were extant on the most recent, available, photographs, taken in 1970. Two of the previously mapped areas are visible on lidar and in both cases extensions to these areas are visible. In Minsterworth parish, to the north of the Severn, again, not all of the ridge and furrow recorded as extant from aerial photographs was visible on lidar. However, an area immediately to the north of Minsterworth recorded as being plough levelled could be identified as an upstanding earthwork on lidar. Newly identified areas of ridge and furrow could also be identified on lidar.

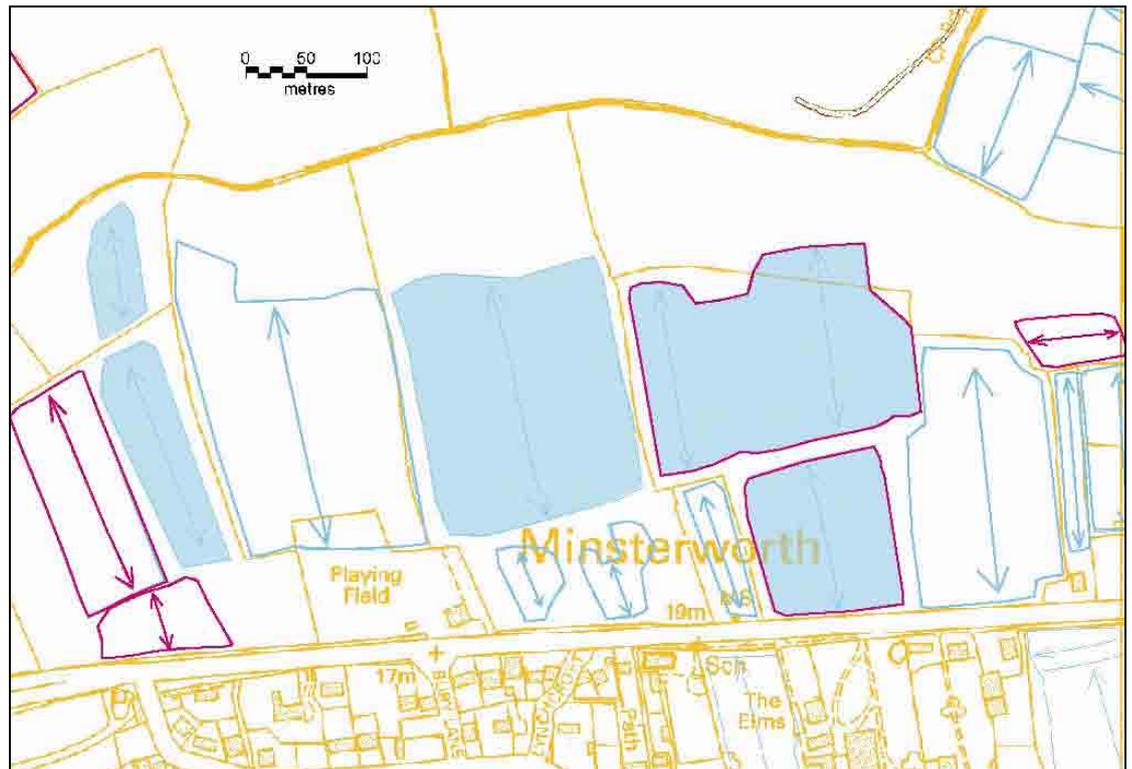


Figure 1-4: Ridge and furrow north of Minsterworth. Shaded blue = previously unrecorded areas of ridge and furrow from lidar survey; blue with pink outline = areas found to be extant previously mapped as levelled. Map base © Crown Copyright. All rights reserved. English Heritage 100019088. 2007

Of the extensive ridge and furrow recorded from aerial photographs in Longney parish, very little was visible on lidar. Only ridges, possibly used for tree planting, were still visible to the east of Walmore Common (NMR HOB UID 1448175). This differential visibility of ridge and furrow continues to the west of Walmore Common (Westbury-on-Severn parish): of the ridge and furrow recorded as extant from the latest available aerial photographs, only a small proportion can be identified as still upstanding on lidar; previously unrecorded areas of extant ridge and furrow could be identified and areas previously recorded as being levelled were shown to be extant on lidar.

A possible Bronze Age barrow, or Medieval or Post Medieval windmill mound, was newly identified on lidar to the east of Bays Court, Westbury-on-Severn, centred at SO 7497 1344, on the edge of the 30m contour. The possible barrow is located in an area that was covered by trees on the available aerial photographs and on the 1st edition Ordnance Survey map. It is defined by a sub-circular mound which measures 16m in diameter. Sections of a surrounding ditch can be seen to the northeast and west of the mound.

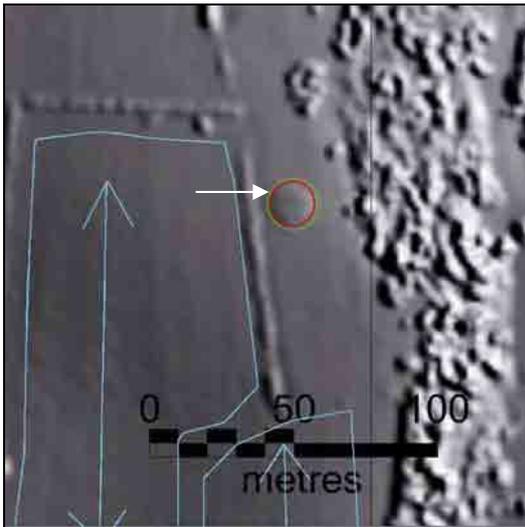


Figure 1-5: Possible barrow or windmill mound, south east of Bays Court, Westbury on Severn.
©Environment Agency Lidar, 2007

The size and surrounding ditch suggest that it could be a barrow (Wilson 2000: 101). The possible barrow is also situated on a relatively high ground which would mean that it would be visible on a crest if seen from the river located 131m to the east.

This mound could also be interpreted as a medieval or post medieval windmill mound. It is located in a field named *Windmill Field* on the Westbury-on Severn tithe map (1839), suggesting that this interpretation is the correct one. Medieval post-mills stood on crosstrees which were generally embedded in a mound surrounded by a ditch (Wilson 2000: 108), matching the morphology of the mound found on lidar. However, it may be an example of a barrow reused as a windmill mound, as could often be the case if the barrow was located in a favourable position (ibid: 157). Further investigation on the ground would be necessary to confirm either interpretation.

The visibility of features defined by banks and ditches on lidar, with the exception of ridge and furrow, is fairly consistent with the findings from aerial photographs in Westbury-on-Severn parish. Examples are: post medieval drainage on Walmore Common (NMR HOB UID 1446094); and a moated site to the north of Crowgate Cottage, Bollow (NMR HOB UID 1445766). The moated site appears slightly differently on lidar to how it was visible on aerial photographs. The site was mapped as a platform surrounded by a boundary ditch which measures up to 7m in width. The lidar shows the boundary as being defined by a narrower ditch,

measuring up to 5m in width, with an external bank which measures up to 9m in width.

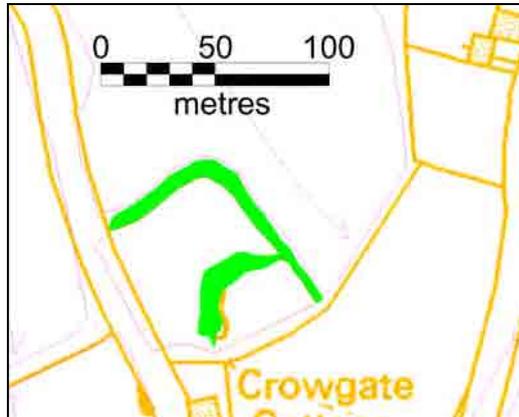


Figure 1-6: Moated site, Bollow, recorded from aerial photographs

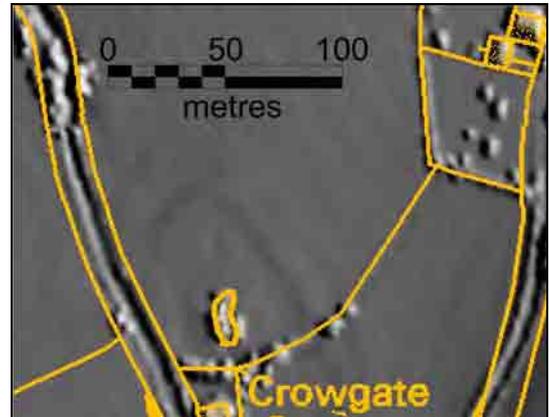


Figure 1-7: Moated site, Bollow, as it appears on lidar

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Additional Medieval or Post Medieval drainage ditches could be identified in the vicinity of those already mapped to the east and west of Oakle Street and to the south of Churcham. However, not all ditched features recorded on aerial photographs appear to be still extant on the lidar, for example, post medieval drainage to the west of Yew Tree Farm (NMR HOB UID 1445648). A moated site at Yew Tree Farm (NMR HOB UID 1445667) is obscured by dense tree cover on the lidar data and may therefore still be extant.

Somerset Coast

Archaeological sites in the inter-tidal zone recorded from aerial photographs were generally not clearly identified on lidar. This may have been due to the dynamic nature of the environment. Lidar and aerial surveys would need to be carried out when the maximum amount of the inter-tidal zone is exposed. It is possible that more information could have been gained from a more detailed survey, for example, at 1m resolution. However, it is also possible that the ephemeral nature of most of the intertidal archaeological sites means that they are no longer upstanding structures. An example is fish weirs that are constructed of a line of wooden posts, which are sometimes only visible on aerial photographs as a disturbance in the water as the sea moves past them. These types of sites are often only visible on some of the historic aerial photographs due to their

ephemeral nature. As mentioned above the conditions under which any type of airborne survey is carried out will greatly affect the visibility of archaeological sites.

The remains of three possible fish weirs are visible on lidar on Steart Flat, north west of Steart. The remains of six possible fish weirs were newly identified from lidar on Steart Flats to the east of Hinkley Point Power Station. An extension to the fish weir recorded at NMR HOB UID 1450108 is visible on lidar nearby, but seventeen other weirs recorded from aerial photographs in the same area could not be identified.

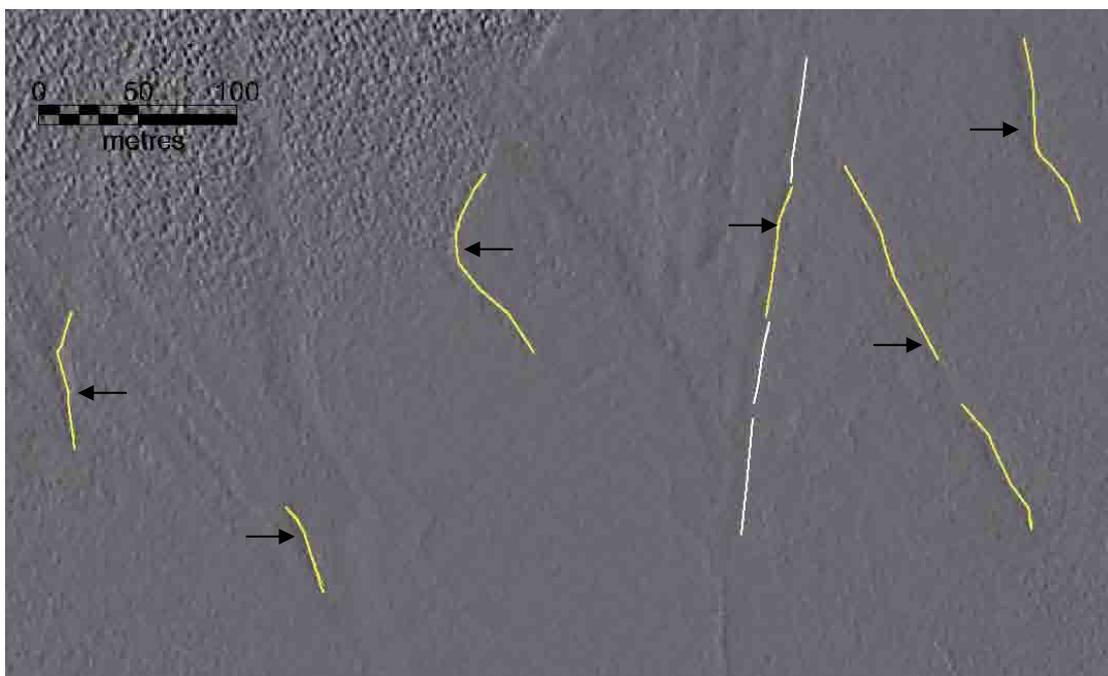


Figure I-8: Fish weirs on Steart Flats, east of Hinkley Point Power Station. Key: grey = mapped from aerial photographs; yellow = mapped from lidar. © Environment Agency Lidar, 2007

The visibility of banked and ditched features on lidar on dry land is fairly consistent with the findings from aerial photographs. An example is the flood banks along the River Parrett at Pawlett Hams (NMR HOB UID 1449437) which are recorded as being mainly extant on the latest aerial photographs, but with some sections having been ploughed levelled by 1983. The lidar data confirms the state of the embankments. Most of the banks can still be identified as upstanding on lidar, but sections of banks recorded from photographs taken in 1947, such as between ST 2793 4250 and ST 2787 4280, have been levelled.

Extensions to medieval or post medieval flood banks to the west of Steart (recorded at NMR HOB UID 1450223) can be identified as upstanding banks on

lidar, therefore confirming the aerial photographic results and adding information to them. Confirmation of a site recorded as having been levelled is demonstrated in the case of a ditched enclosure to the south east of Steart (NMR HOB UID 1450260). The enclosure was mapped from photographs taken in 1947 and recorded as levelled by 1974. As with the Gloucestershire moated site noted above the lidar confirms that the site was completely levelled, since no traces are visible on the ground surface.

Additions to a system of medieval or post medieval drainage can be identified on lidar at Pawlett Hams. The drainage system (NMR HOB UID 1449399) consists of predominantly north-south oriented ditches which underlie the modern pattern of drainage. A probable consequence of the wide scale construction of the post medieval and modern drainage ditches and rhynes in this area, is that none of the ridge and furrow recorded at Pawlett Hams from aerial photographs, taken between 1947 and 1974, is visible on lidar.

Possible palaeochannels, defined by narrow, curvilinear ditches, extend from east to west in the northern area of Pawlett Hams. These channels are parallel to the line of the River Parrett and are on a different orientation to the later drainage systems.

Relict patterns of drainage are also clearly visible on lidar to the southwest of Steart. A medieval or post medieval drainage ditch complex (NMR HOB UID 1450256) was recorded as still visible on aerial photographs taken in 1974 and the lidar data demonstrates that a large part of the complex is extant. Additions to the Medieval or Post Medieval drainage system mapped in the aerial survey on Wall Common and the course of palaeochannels are also visible on lidar.

The lack of survival of upstanding ridge and furrow is a theme reflected across nearly all of the Somerset area, presumably because of the construction of subsequent layers of drainage systems. An exception is the area to the east of Catsford Common. Here most of the ridge and furrow is not visible on lidar, but three fragmentary blocks in the area recorded at NMR HOB UID 1450132 could be identified. In each case, the areas visible on lidar were those which were already recorded as having been plough levelled on the aerial photographs.

As mentioned above, the visibility of banked and ditched features on lidar is fairly consistent with the aerial survey results, but, new sites and differences in appearance of known sites can still be identified.

An example of a site which is different in appearance on lidar and aerial photographs is The Pound (NMR HOB UID1450214) located to the east of Steart. The site appears to be defined by a semi-circular platform on aerial photographs. On lidar it appears as a semi-circular enclosure surrounded by a bank. The surrounding bank may be very low in elevation, gradually levelled over time, but it supports the interpretation of the site as a stock enclosure.

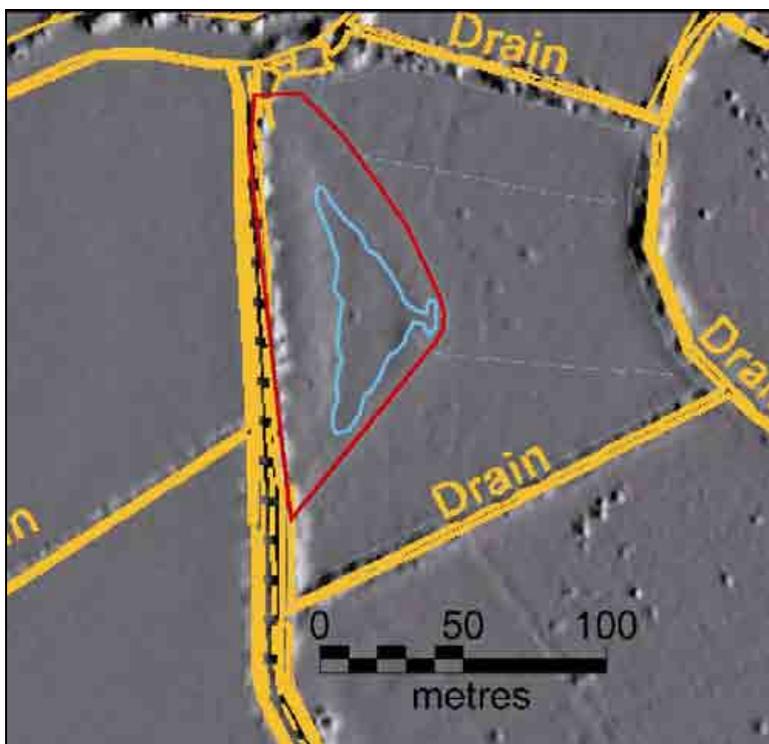


Figure 1-9: The Pound, east of Steart. The site was mapped as a platform (outlined in red) but appears to be a raised bank around an enclosure on the lidar (interior outlined in blue) © Environment Agency Lidar, ST 2644, 2007; Map base © Crown Copyright. All rights reserved. English Heritage 100019088. 2007

An example of a newly discovered site is a possible windmill mound identified on lidar to the south west of Steart, centred at ST 2524 4501. The mound is sub-circular in shape and measures 17m in diameter. It is similar in size and morphology to a post medieval windmill mound recorded from aerial photographs 731m to the south east (NMR HOB UID 191202) and may also be the same type of site. The justification for the interpretation of the previously recorded windmill mound is given as being due to “the size and situation of the feature in an area of flat

reclaimed marshland” (National Monuments Record). Therefore it is likely that other windmill mounds could be found in the same area.

The newly recorded windmill mound may survive as a very low earthwork which would have been difficult to identify on aerial photographs. As mentioned above (p5) a low, round, earthwork, such as a windmill mound, may be difficult to identify on aerial photographs because it is unlikely to cast a definite shadow. The ability to change the angle of the light source when processing lidar data means that sites such as these may be more visible.

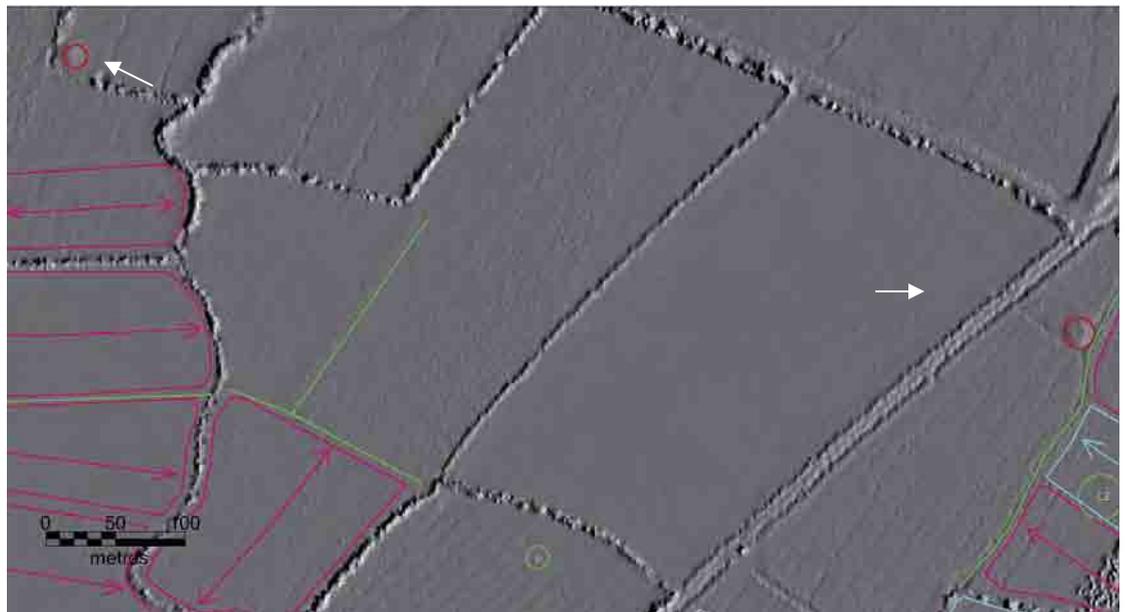


Figure 1-10: Two possible windmill mounds (circled) on Steart Marsh. The mound to the south east was recorded from aerial photographs while the mound to the north west was identified on lidar. © Environment Agency Lidar, 2007

Conclusions

Comparison of lidar with aerial photographs in the Somerset and Gloucestershire trial areas demonstrates that, while they cross over to a great extent, sites identified using one survey method may not always be present on the other. This can be due to a number of factors, including: the land use in the intervening period between the last available aerial photographs being taken and the date of the lidar survey, for example, increased ploughing or construction of new drainage systems; and tree cover, which can be an issue on both the aerial photographs and lidar.

The capacity of lidar to pick up sites that survive as slight earthworks, or sites that were thought to have been levelled, is demonstrated through the large areas of ridge and furrow recorded in both areas. While a large proportion of the ridge

and furrow could not be identified on lidar, and has therefore presumably been levelled, fragmentary blocks in both the Somerset and Gloucestershire areas were identified as extant earthworks in areas previously recorded as being either upstanding or levelled. New areas were also identified as extant ridge and furrow.

The identification of surviving fish weirs was comparable to that of the ridge and furrow. For example, while many of the fish weirs recorded from aerial photographs on Steart Flats were not visible on lidar, possible new weirs and an extension to a previously recorded site were identified.

Overall, the visibility of banked features, such as flood embankments, and ditched features, such as moated sites or drainage ditches, on lidar is fairly consistent with the findings from aerial photographs. New sites were also identified: the possible barrow or windmill mound to the east of Bays Court, Westbury on Severn, in the Gloucestershire area; and, the possible post medieval windmill mound to the south west of Steart, in the Somerset area.

Lidar presents a detailed picture of the land surface and has the capacity to provide information on the survival of known archaeological sites. It may, therefore, be a useful tool for monitoring the condition of monuments, especially in inaccessible sites and such dynamic environments as those in the trial areas. While banked monuments were visible to a similar extent as mapped from aerial photographs, lidar's capacity to remove a certain amount of woodland and foliage can make the extent of sites easier to map. For example, flood banks, such as those in the Elmore area, appear as quite well defined.

In areas where there is a shortage of specialist oblique photography, generally taken with the object of recording archaeology, a lidar survey can remedy the situation to some extent. The capacity when processing the data to change the direction of the light source so that earthwork sites are shown to their best advantage is particularly useful. Lighting is a key consideration when photographing earthworks in specialist, oblique, photography, but is not generally a factor when carrying out a vertical aerial survey.

Where the lidar did not seem able to add significantly to the data gained from the aerial survey was in the inter-tidal zone of the Somerset trial area. While additions

could be made to the mapping of a number of the fish weirs, the majority could not be identified on lidar. This could be due to a number of factors, including the ephemeral nature of the inter-tidal sites, the conditions when the lidar survey was carried out and the resolution of the lidar data. However, the fact that newly identified sites were recorded from the lidar shows the potential of this survey technique in an inaccessible environment.

Overall, lidar functions as a complementary tool to aerial and field survey. Lidar provides a detailed model of the ground surface, so any monument with even a slight change in height or depth can be identified. An experienced field surveyor would also be able to recognise slight earthwork sites and possibly to add more detail. The wide scale of a lidar survey means that it would be a potentially useful tool for identifying areas which would benefit from more detailed ground survey.

Where lidar is limited, in a way that is comparable to aerial photographs, is that it presents a snapshot in time. Therefore there will be features that have been ploughed out or removed that will only be visible on some of the historic photography. The fact that lidar will only show a feature which has a difference in height to its surroundings means that aerial photographs will always be the only method of recording sub-surface remains visible as cropmarks.

The detailed ground surface model which results from a lidar survey suggests that this technique has potential for use in the assessing of the survival of archaeological sites, particularly in inaccessible areas. Sites thought to have been levelled, in other areas where this survey method has been used, have been identified using lidar. For example, sections of the Roman road leading to the mining settlement at Charterhouse have been mapped during the Mendip Hills AONB aerial survey, where no earthworks were thought to have survived (<http://www.english-heritage.org.uk/server/show/nav.10591>).

Bibliography

Allen, J R L and Fulford, M G 1990. Romano-British and later reclamations on the Severn salt marshes in the Elmore area, Gloucestershire. In, *Transactions of the Bristol and Gloucestershire Archaeological Society*, 108: 17-32

Bewley, Robert et al 2005. New light on an ancient landscape: Lidar survey in the Stonehenge World Heritage Site. In, *Antiquity*, 79:636-647

Devereux, B J et al 2005. The potential of airborne lidar for detection of archaeological features under woodland canopies. In, *Antiquity*, 79:648-660

National Monuments Record – information on monument records or National Mapping Programme mapping is available through <http://www.english-heritage.org.uk/server/show/nav.1530>

Wilson D R 2000. Air Photo Interpretation for Archaeologists. Stroud: Tempus

GDR/TI/192 Westbury-on-Severn tithe map and apportionment 1839

<http://www.english-heritage.org.uk/server/show/nav.10591>

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