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Historic Environment Guidance for wave and tidal renewable energy

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INTRODUCTION

In 2012, English Heritage commissioned Fjordr Ltd to prepare guidance on the interaction between wave and tidal energy generation and the historic environment [1]. Partnership funding from Historic Scotland and Cadw enabled the guidance to encompass Scotland and Wales.

This paper describes the key findings that emerged from a programme of extensive preparatory research and discussions with developers, regulators and archaeologists across Great Britain. It describes some effects of wave and tidal energy on the historic environment, with a particular focus on Scotland, and identifies options and best practice for ensuring that such development is undertaken sustainably.

SCOTLAND'S COASTAL AND MARINE HISTORIC ENVIRONMENT

A rich tapestry of historic buildings and archaeological sites survives at the coast edge, on the foreshore and under the sea, providing insight into Scotland's recent past and distant millennia. This heritage enhances the distinctiveness of the coast and attracts visitors to Scotland, contributing to the productivity of coasts and seas [2].

Figure 1 The Neolithic village of Skara Brae, Skaill Bay (Orkney). Crown copyright HS

Scotland's society places a high value on its heritage and since 1882, there have been measures in place to protect our most important monuments and buildings so that future generations can enjoy this heritage as we do. The significance of coastal and marine heritage is recognised by statutory designation of two coastal World Heritage Sites (St Kilda and the Heart of Neolithic Orkney), large numbers of 'listed' historic buildings or 'scheduled' monuments such as harbours, lighthouses, ecclesiastical sites and defensive features from castles to wartime installations. Recognition of the significance of underwater heritage is growing and protection for Scotland's outstanding marine environment under the Marine (Scotland) Act 2010 now includes designation of seven Historic Marine Protected Areas to help preserve historic shipwrecks of national importance.

The vast majority of known archaeological sites and historic buildings around our coast and underwater do not have statutory protection but may nevertheless be of interest. Furthermore, new discoveries are likely to come to light as exploration of our coasts and seas increases. International commitments under EU environmental assessment directives and conventions such as the European Convention on the Protection of the Archaeological Heritage (revised) (Valletta, 1992) require that impacts on the historic environment (as a whole) are considered and minimised through planning systems and environmental assessment procedures. These policy principles now extend across the UK Marine Area, most recently through the introduction of statutory marine planning and licensing, with policies specifically for the historic environment set out in the UK Marine Policy Statement [3] and draft Scottish National Marine Plan [4].

ARCHAEOLOGY IN HIGH-ENERGY ENVIRONMENTS.

Wave and tidal energy development is generally focussed in places where the sea conveys high levels of energy such as within tidal channels and off exposed headlands. As waves and currents are potentially hazardous to shipping, these places have historically often witnessed numerous shipwrecks. Adjacent coastal areas too were often places favoured for settlement, either to facilitate exploitation of marine resources, for ease of access to the sea-ways, or for the purposes of defence. In

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some areas of Scotland such as the inshore waters of Orkney, Shetland and the Western Isles, archaeologists are investigating the survival underwater of prehistoric landscapes and evidence of coastal settlement which has been submerged by Holocene sea-level rise.

There is a common question over the likelihood of the survival of archaeological material in the high-energy marine environment favoured for wave and tidal energy development. Evidence from several high-energy sites across Scotland suggests that archaeological material can survive. Although it is sometimes in poor condition, it can often still be significant and capable of interpretation (e.g the 16th- and 17th-century wrecksites of Kennemerland, Shetland; and Gran Grifon, Fair Isle) [5]. High-energy environments are not uniform and often contain niches within which low energy conditions prevail, such as gullies and behind rock outcrops, and where even fine-grained and delicate archaeological deposits can survive. It is therefore important that environmental assessment studies base assumptions about survival of archaeological material on direct evidence as opposed to remote environmental proxies.

INTERACTIONS BETWEEN MARINE RENEWABLE ENERGY AND THE HISTORIC ENVIRONMENT

Interactions between marine renewable energy developments and the historic environment are likely at all stages of construction and operation. Such impacts require to be considered from the outset in planning and environmental impact assessment processes. It is considered that change to the historic environment is most successfully managed when it is taken into consideration from the earliest stages of project planning.

The implications of the various wave and tidal technologies are largely driven by their configuration with respect to the seabed and their appearance at the surface, rather than the way in which electricity is generated. The direct construction impacts of devices that float in mid-water or on the surface will arise primarily from the system used to moor them, such as anchors or gravity moorings, and their associated chains and cables. Devices that are mounted on the seabed will also have impacts arising from the supporting structure, the footprint of which will vary widely.

Although they only need impact a narrow corridor, inter-array cables or pipes tend to be extensive and may give rise to direct effects during construction, depending on the type of ground and form of installation. However, so long as upstanding features are avoided, cables laid on the surface of the seabed are unlikely to have significant direct effects.

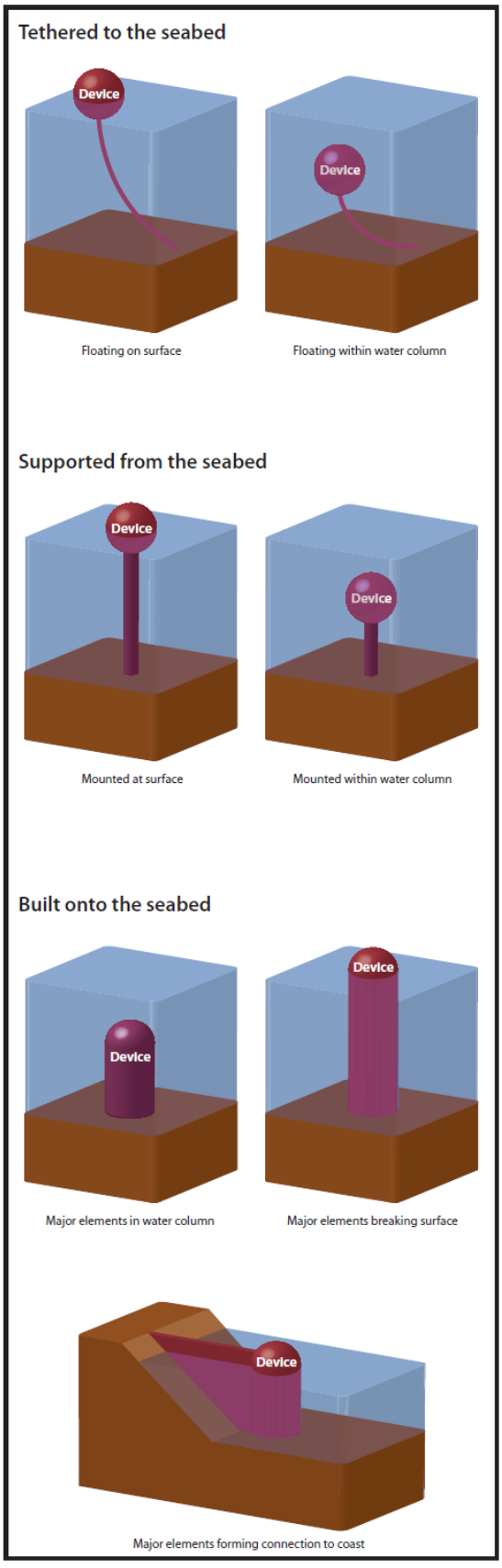

Figure 2 The configuration of wave and tidal devices on the seabed will have a major influence on the way in which devices impact the historic environment. Copyright English Heritage, Historic Scotland, Cadw.

Indirect effects may occur particularly if wave and tidal energy developments interfere with coastal processes such as current dynamics and sediment transport. These are factors which might cause a previously buried heritage asset to become exposed to degradation. Alternatively, increased sediment deposition or reductions in wave energy reaching the shore may be anticipated to have some beneficial effects for historic sites at the coast edge.

The surroundings of a historic asset or place contribute significantly to how it is experienced, understood and appreciated [6]. It is therefore important to consider whether the deployment of devices which are intended to be highly visible on the water surface, and the construction/operation of onshore infrastructure will have a visual impact on the 'setting' of important coastal heritage sites. However, by comparison with offshore wind installations which can be visible from far afield, visual impacts to setting will generally be more localised for wave and tidal installations than for other offshore renewables.

In planning for wave and tidal energy infrastructure projects, there may be opportunities to regenerate ports and harbours that were once very significant historically but which have declined for various reasons. Imagination and creativity on the part of both developers and curators can enable the historic character of ports to contribute to their renewed success as places to work and visit.

DEALING WITH UNCERTAINTY AND RISK

Less is known about the archaeology that survives beneath Scotland's waves by comparison with what is known about archaeology on land. Developers, regulators and curators are therefore likely to encounter uncertainty about the effects of wave and tidal schemes on the historic environment, both in relation to what archaeology survives and about the significance of sites affected. These uncertainties introduce risks for developers. For example, once consent is granted, successful construction and operation may be put at risk if new archaeological discoveries cause delay and expense.

Much can be done cost effectively to reduce the risk posed by heritage issues in relation to consenting of wave and tidal developments by improving the evidence base and working together. In Scotland, the focus of effort on Pentland Firth and Orkney Waters (PFOW) has prompted area-based strategic studies and remote sensing surveys by Marine Scotland and the Crown Estate. The data gathered during this work has been interrogated by archaeologists under the auspices of the Historic Scotland-funded Project Adair [7] in an effort to improve the baseline record. However, the requirements of environmental assessment mean that there is also an onus on developers, prior to development, to obtain direct evidence of what archaeology survives on or under the seafloor and what the impacts on heritage might be.

It is sensible to adopt a phased or staged approach involving desk-based studies, broad-scale site investigations and if appropriate more detailed investigations as certainty about scheme designs and possible impacts improves. Deferring archaeological investigations entirely to later stages may mean that risks to the consent and/or construction of a development remain unresolved.

Inventories of archaeological sites are a critically important source of data on the historic environment. In addition to the large numbers of records of maritime sites in the national Canmore record (www.rcahms.gov.uk), local inventories are maintained by Local Authority Archaeology Services across Scotland and are the usual starting point for collating coastal and land-based evidence.

Site investigations by geophysics and geotechnical surveys are as important for dealing with historic environment issues as they are for other marine sectors. Other forms of site investigation – such as drop-camera, ROV or diver-investigations – can also provide valuable archaeological evidence. It is essential to integrate site investigations to include archaeological objectives which should be overseen by appropriately qualified archaeologists alongside engineering or environmental objectives. The principle of an integrated approach can also be extended to post-development monitoring surveys - for example to monitor concerns about indirect impacts such as the risk of archaeological material being exposed by changes in sediment transport.

ENHANCING PUBLIC BENEFIT

In satisfying environmental requirements to address heritage issues in the course of consent, developers create knowledge that can be used to generate social and economic benefits.

The historic environment is fascinating to many people. At the end of projects, developers and their archaeological consultants will often publish important results from investigations through papers in academic journals and monographs. Data and archaeological reports will be deposited for long-term preservation and public access with data archive centres recognised through the Marine Environmental Data and Information Network (MEDIN). Sharing knowledge in this way furthers understanding of the past and supports 'adaptive management' – using the consequences of previous management so that decision making becomes more effective with experience.

However there are also opportunities to extend the benefit of archaeological investigations through effective outreach to the public. Leaflets and booklets, web interpretation, public talks, television programmes, and promotion of access opportunities (for recreational diving, coastal walks and sea-kayaking), can all be effective ways to promote a positive message, both for the historic environment and the marine renewables industry.

CONCLUSIONS

The recent growth in wave and tidal energy may be seen as the latest phase of a very long relationship with the sea for resources, driven this time by recognition that future use must be more sustainable than in previous centuries. As we have seen, there is significant potential for the interaction of marine renewables projects and the historic aspects of the marine and coastal environments. Guidance is available to assist developers and their environmental teams to manage change to this finite and non-renewable resource. In producing this guidance, the aim of the partner organisations is that as we shape the environment of the future, early cooperation between developers, regulators, curators and archaeologists will help to ensure that this new use of the sea does not detract from what remains of our predecessors' use of our coasts and seas.

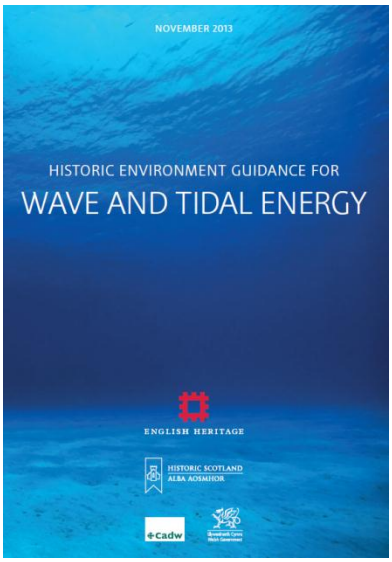

Figure 3 Wave and tidal guidance for the historic environment is now available online.

ACKNOWLEDGEMENTS

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