Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy

Oxford Archaeology with
George Lambrick Archaeology and Heritage
January 2008

This report has been commissioned by COWRIE Ltd

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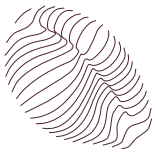

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Executive Summary

The development of offshore renewable energy to generate electricity is one of the key strategies being used by the UK Government to address the twin concerns of climate change and the need to secure energy supplies for the future. Implementation of the programme is underway for offshore wind farms and wave energy.

Oxford Archaeology, supported by George Lambrick Archaeology and Heritage Consultancy, was commissioned by COWRIE Ltd to produce guidance on the assessment of cumulative impacts on the historic environment arising from offshore renewable energy projects.

The guidance applies to all areas which are likely to be affected by an offshore energy development, thus covering onshore as well as the coastal and marine environments. The marine environment affected by offshore energy schemes comprises UK territorial waters and the Renewable Energy Zones, which have been identified beyond that limit.

The guidance is intended to assist developers of offshore renewable energy installations, environmental consultants from all disciplines, historic environment contractors, industry regulators and other authorities, including historic environment curators at national and local level, and the public.

SEA and EIA

The assessment of the potential impacts of offshore renewable energy developments is carried out through processes directed by the EU Directives for Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA). Both instances require, respectively, that the effects of development plans, programmes and projects on the archaeological and architectural heritage, landscape and other aspects of the environment are identified in advance. A component of this assessment is the identification of steps to prevent, minimise or compensate for any identifiable detrimental impacts. It is a legal requirement that this must include assessment of cumulative and synergistic effects, and this guidance will play a key role in this.

Cumulative and synergistic effects

A distinction can be made between 'cumulative' and 'synergistic' effects:

- Cumulative effects result from incremental changes caused by multiple impacts within a development plan, programme or project, and/or the effect of impacts in combination with other past, current and reasonably foreseeable developments, activities or natural processes.
- Synergistic effects (or impact interactions) arise from the combined result of different kinds of impact, either occurring within a proposed development plan, programme or project, or in combination with others.

The guidance identifies issues relating to the assessment of cumulative and synergistic effects at each stage of the SEA/EIA process from screening and scoping to decision-making and implementation. Appropriate assessment of cumulative effects relies heavily on how well individual effects within the development plan, programme or project are identified and assessed, and on how they relate to the effects of other developments and activities.

Quality Assurance and Key Guidance

SEA and EIA fundamentally influence major decisions on future developments which will have a permanent effect on the environment. There is a particular challenge to ensure that cumulative piecemeal loss of irreplaceable historic environment assets and complex relationships with other aspects of the environment are properly assessed to encompass adequately the historic environment in how change through development is delivered. This guidance should help to ensure that the legal requirement to assess cumulative and synergistic effects are met, that decision-makers are assisted in reviewing these requirements, and that appropriate, practicable and realisable measures to protect the historic environment are adopted. The guidance focuses on certain key elements of the cumulative assessment process, which are always relevant. These are as summarised below.

Integrated Approach
- Exchange of information between Environmental Assessment (EA) co-ordinators and specialists at all stages of the process.
- Consideration of potential cumulative effects at all stages of the process.
- Commission of joint surveys where practicable.

Consideration of Other Actions
- Identify all sources of potential cumulative effects within the particular project, plan or programme.
- Identify past, present and future actions which may contribute (or be contributing) to cumulative effects.

Adequate Scope
- Definition of a sufficiently wide study area, not necessarily the same for all aspects of the environment.
- Definition of a suitable time scale for future developments.
- Selection of other activities which may contribute to cumulative effects.

Baseline Study
- Ensure that the offshore, intertidal and terrestrial historic environments are all considered.
- Identify the significance of historic environment features.
- Identify levels of risk for unknown historic environment features.
- State criteria used in assessment.

Impact Dimensions
- Identification of direct, indirect and secondary effects and their time scales.
- Identification of beneficial and adverse effects.
- Identification of internal cumulative and synergistic effects.
- Identification of external cumulative and synergistic effects.
- Distinction between cumulative effects on physical fabric and setting/perceptual values.

Assessment Focus
- Focus on assessment of significant potential cumulative effects.
- Ensure that the coverage is sufficient to identify all potential cumulative effects.

Explicit Constraints
- Identify clearly any assumptions which have been made and any limitations on the extent of the assessment.

Mitigation Measures
- Selection of realistic mitigation measures.
- Identification of residual effects after mitigation.
- Provision for unforeseen effects.
- Agreement to implement mitigation.

Monitoring and Management
- Establishment of a monitoring programme for significant cumulative effects as part of the overall monitoring of the plan.
- Use of monitoring results to inform the accuracy of impact prediction and help improve future plan making.
- Documentation of agreed actions, including responsibility for their implementation.

Communication
- Summaries of significant potential cumulative effects.
- Cross-references to material from other environmental specialisms.
- Explicit basis for conclusions.
- Adequate coverage in non-technical summary.

Acknowledgements

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Oxford Archaeology would like to thank the COWRIE Steering Group for their assistance, support and advice during the compilation of this document, particularly Dr Chris Pater of English Heritage and his colleagues. They would also like to thank all those from heritage organisations and the renewable energy industry who provided comments on the draft report and attended the seminar in Oxford in September 2007.

This report was compiled by Jill Hind and Kelly Powell of Oxford Archaeology in conjunction with George Lambrick of George Lambrick Archaeology and Heritage. The project was managed on behalf of Oxford Archaeology by Ianto Wain.

1 Introduction

1.1 Offshore Renewable Energy

The United Kingdom has stated its commitment to the reduction in emission of the greenhouse gases, which are one of the causes of the ongoing climate change. One of the strategies by which this will be achieved is the increasing use of renewable energy sources, including those available offshore, to provide electricity. The Government has set ambitious targets, committing the UK to generating 10% of its energy needs from renewable sources by 2010, rising to 60% by 2050.

Wind, wave and tidal power are all to form part of the UK renewable energy strategy. Offshore renewable energy plant construction has the potential to have significant impacts on many aspects of the environment, including the historic environment. These include cumulative and synergistic impacts and this document addresses them specifically with respect to the historic environment, as part of a range of guidance documents commissioned by COWRIE. It is aimed at all those involved in the environmental assessment process, regulatory bodies, developers and specialist consultants. No offshore project can be considered to operate solely within the marine environment, and for renewable energy there are implications not only for the seabed, where the generators are located, but also for the foreshore through which the electricity cables must pass and the land on which associated infrastructure will be located.

Within UK territorial waters most of the UK seabed is owned and licensed by the Crown Estate. Outside this limit, within the UK's designated Renewable Energy Zone (REZ) of international waters, the right to issue leases is still held by The Crown Estate. REZs were established by the Energy Act (2004).

1.2 Marine Historic Environment

The sea, seabed and foreshore of northern Europe including the British Isles have been exploited by humans for over half a million years. Lands extending across the continental shelf were occupied periodically by ancient peoples before rising waters repeatedly inundated the landscape. Watercraft from prehistory to the present day enabled travel across the evolving seas but many were lost en route that now survive as wrecks.

Britain is a maritime nation that has an internationally rich heritage of seafaring trade and coastal defence. In addition to visible buildings, monuments and landscapes, submerged and buried land surfaces, settlements, boats, ships and aircraft, and remains of harbours, quays, fortifications and other archaeological remains contribute to the value of this heritage as part of the UK's national identity. They not only contribute to people's cultural understanding and sense of place, but can also have a role in tourism and education. Once destroyed, these important physical remains of Britain's history are lost forever and there is a responsibility to avoid unnecessary damage and record unavoidable loss for the benefit of present and future generations. Environmental Assessment (EA) procedures are intended to balance the needs of development with the need to avoid unnecessary or unsustainable environmental damage, including the historic environment.

1.3 SEA and EIA

Offshore renewable energy projects must be covered by wide scale Strategic Environmental Assessment (SEA), required under European Directive 2001/42/EC: *The assessment of the effects of certain plans and programmes on the environment*, to analyse the environmental implications of development 'plans' and 'programmes' needed to implement Government policy such as deriving energy from offshore installations. The two levels of assessment – strategic and project-based – should be used together for the most effective protection of the environment.

The nature and magnitude of offshore renewable energy projects means that they are required to undergo SEA and also EIAs as required by the European Union Directive 85/337/EC: *The assessment of the effects of certain public and private projects on the environment* and Directive 97/11/EC: *Amendments to Directive 85/337/EC*. SEAs covering offshore

renewable energy may be focused on the industry in general or within a particular marine area in which projects will be located. Both SEA and EIA require that any potential impacts on the environment are identified and proposals to eliminate, reduce or compensate for these impacts are drawn up.

Studies of existing SEA and EIA documents, for example the Planarch 2 report (Lambrick and Hind 2005), have found that the coverage of cumulative impacts is an area of weakness and that the historic environment seldom features in their discussion. The preparation of this specific guidance is intended to help overcome difficulties with this important area of environmental assessment and improve the quality of recommendations and their implementation.

1.4 Cumulative and synergistic effects

Documents, including EU Guidance (European Commission (1999), often make a distinction between *cumulative* effects which are essentially additive and *synergistic* effects or *impact interactions*. The term *in-combination* effects is also used.

Impact interactions or ***Synergistic Effects*** arise from the reaction between impacts of a development plan, programme or project on different aspects of the environment.

Aggregate or ***Cumulative Effects*** are those that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the plan, programme or project itself.

The principal guidance documents available in relation to cumulative effects are listed in Appendix A.

2.1 Development Impact and the Historic Environment

Individual historic assets and areas are important to society as tangible, non-renewable parts of people's history. The most obvious impacts of development on the historic environment are physical changes to the ***fabric*** of features or to their ***setting***. Such impacts can affect people's ***perception*** of the heritage in terms of the understanding and appreciation of the asset and the contribution they can make to knowledge of the historic environment.

The impacts on setting and perceptual value of historic assets go beyond the effects of visual or noise impacts. Historical associations and context are important, including a sense of place, as described in *A Force for Our Future* (DCMS 2001, 7), but aesthetic and spiritual values extend beyond the past. Connections with works of art are one example of this.

'**Fabric**' is the extant physical character of an asset or the features that give an area its historic character.

'**Setting**' can be defined as the physical surroundings of an historic feature or area influencing how it is understood and appreciated.

'**Perception**' is the different ways people value historic features and their setting.

Perceptual value and the historic environment are discussed in more detail in Appendix B.

2.2 Responsibility for Assessment

In both SEA and EIA, specialist studies are carried out to identify potential impacts on the physical fabric of the historic environment, but it is common for much of the consideration of setting/perceptual issues to be covered in other studies. They are, however, an important aspect of the historic environment and should receive specialist consideration.

Responsibility for the assessment of the interactions between effects from the various aspects of the project and those arising different projects and activities should be shared among all environmental specialists, although the lead co-ordinator or developer has overall responsibility for the final assessment. They should ensure that the necessary exchange of information take place and monitor to avoid double counting of impacts.

Table 1. Summary of the historic environment, potential sources of impact of plans and projects and their effects.

	Offshore	Intertidal	Terrestrial	Potential sources of impact	Effects on the heritage
Shipwrecks/ aircraft	• Protected wreck sites • Known, unprotected • Loss sites • Unknown • Artefacts and scatters	• Wrecks and hulks	• Buried wrecks and aircraft	• Construction/maintenance and decommissioning of features • Construction and monitoring traffic • Intrusive site prospection • Changes to scour patterns • Vibration • Accidents • Changes to environmental conditions • Appearance of development	• Direct damage/destruction • Severance of associated features • Destabilisation, decay and corrosion • Long-term preservation of archaeology • Loss of or intrusion on setting
Submerged landscapes and below-ground remains	• *In situ* settlement • Palaeoenvironmental features • Artefacts and scatters	• *In situ* settlement • Finds scatters, including those eroded from cliffs • Palaeoenvironmental evidence	• *In situ* settlement • Palaeoenvironmental deposits • Artefacts	• Construction/maintenance and decommissioning of features • Construction and monitoring traffic • Intrusive site prospection • Changes to scour patterns • Vibration • Changes to environmental conditions	• Direct damage/destruction • Severance of associated features • Destabilisation, decay and corrosion • Compression
Standing structures and monuments	• Seaforts, army towers • Lighthouses • Lightships and other moored structures	• Lighthouses • Docks • Flood and coastal defence • Industrial sites incl. fishing • Jetties, moles, piers etc.	• Standing buildings and monuments e.g. those for navigation or defence • Landscape features • Historic areas and places	• Construction/maintenance and decommissioning of features • Construction and monitoring traffic • Intrusive site prospection • Temporary structures • Vibration • Appearance of development • Restrictions on intervisibility	• Direct damage/destruction • Loss or severance of associated features • Loss of or intrusion on setting • Alterations to views and public appreciation
Historic character and perceptual value	• Historic seascape character • Cultural and historic associations • Features used for navigation	• Historic landscape and seascape character • Cultural and historic associations • Features used for navigation	• Cultural and historic associations • Historic landscape and seascape character • Features used for navigation	• Appearance of development • Physical changes to area (especially historic features) • Changes of use • Altered usage patterns, particularly leisure/tourism • Changes in planning status	• Changes to character (including enhancement) • Severance or fragmentation of historic relationships • Loss of legibility of historic character • Changes arising from economic repercussions through tourism/ regeneration

3.1 What are cumulative and synergistic effects?

Effects arising from one particular project can be classed as 'internal', while those arising from other projects and activities are 'external'. As with individual effects, synergistic and cumulative ones may be beneficial as well as adverse, may be permanent or temporary and can be indirect. They can take a wide range of forms.

3.1.1 Principal sources of impact from renewable energy schemes

It is possible that a single offshore energy installation will itself result in cumulative impacts on the historic environment over its various phases, arising from the impacts and effects identified in Table 1. Installations also tend to be clustered in a limited number of areas. These impacts may be temporary or permanent. The timetable for the different stages of the various projects will also be significant as levels of impact will depend on whether the stages run concurrently and whether development work will be continuous or broken up by periods of inactivity.

3.1.2 Sources of cumulative impacts relative to other types of development

Construction of an offshore renewable energy facility may well not be the first or only development to have had an impact on the historic environment of its specific location and the surrounding area, and this needs to be understood properly.

Examples of synergistic effects or impact interactions

- The effect of the same impact affecting different physical aspects of the environment as reflected in EA specialist topics – examples: the cumulative effect of disturbing both habitats and species and archaeological remains.
- The cumulative effect of the same impact affecting different perceptual values of the environment – example: changes to legibility of historic character added to visual impact changing the significance of a feature.

Examples of 'internal' cumulative effects

- The submerged landscapes and wrecks affected by turbine foundations for a windfarm.
- The cumulative significance of numerous individual effects of different types in the same area – example: the cumulative effect of multiple minor disturbances related to foundations, cable laying, scour etc.
- The cumulative effect of multiple impacts on different environmental resources in the same area – example: damage to foreshore features, construction of sub-station and visual impacts, all impairing the survival of historic assets and altering the historic character of the area.

Examples of 'External' cumulative effects: in-combination spatial, chronological or sectoral effects

- The cumulative effect of recurrent physical or perceptual impacts of new developments diminishing the historic environment of an area over time – example: visual intrusion on the setting of an important historic site from several offshore energy installations.
- The cumulative effect for the historic environment of several developments in an area affecting multiple heritage assets – example: several renewable energy developments intruding on the setting of several monuments and buildings connected with seafaring and defence.
- The positive cumulative effect of archaeological information generated by survey and other mitigation measures – example: the positive benefits of gradual build up of knowledge of previously unidentified submerged landscapes offshore.
- The indirect cumulative effect of past current and future activities on the survival of historic environment assets – example: renewable energy development causing minimal direct disturbance but excluding other activities, such as fishing causing bottom scour.

For the assessment of cumulative impacts it is necessary to identify:

- what developments have significantly affected the area's historic environment in the past;
- what ongoing activities or natural processes are affecting its condition and survival; and
- what other developments are proposed in the short- to medium-term future that are likely to contribute to significant effects on the historic environment.

It is important that natural processes as well as human activities are considered since this may well determine the 'do-nothing' scenario, i.e. the changes to the historic environment which are likely to occur without any development taking place. The effects of development may well change the natural dynamics of the marine environment in particular, with knock-on effects for the survival of the historic environment features and deposits.

4.1 General considerations

4.1.1 Structure of assessment

Two general issues need to be considered in developing a well-structured approach to assessing cumulative effects of development.

First, a logical approach is needed to establish how the assessment of synergistic and cumulative effects will be 'modelled' from individual ones. There is no single best way to do this, since there are different ways in which individual impacts can be grouped which may be more appropriate for one case than another. Figure 1 below indicates one possible approach.

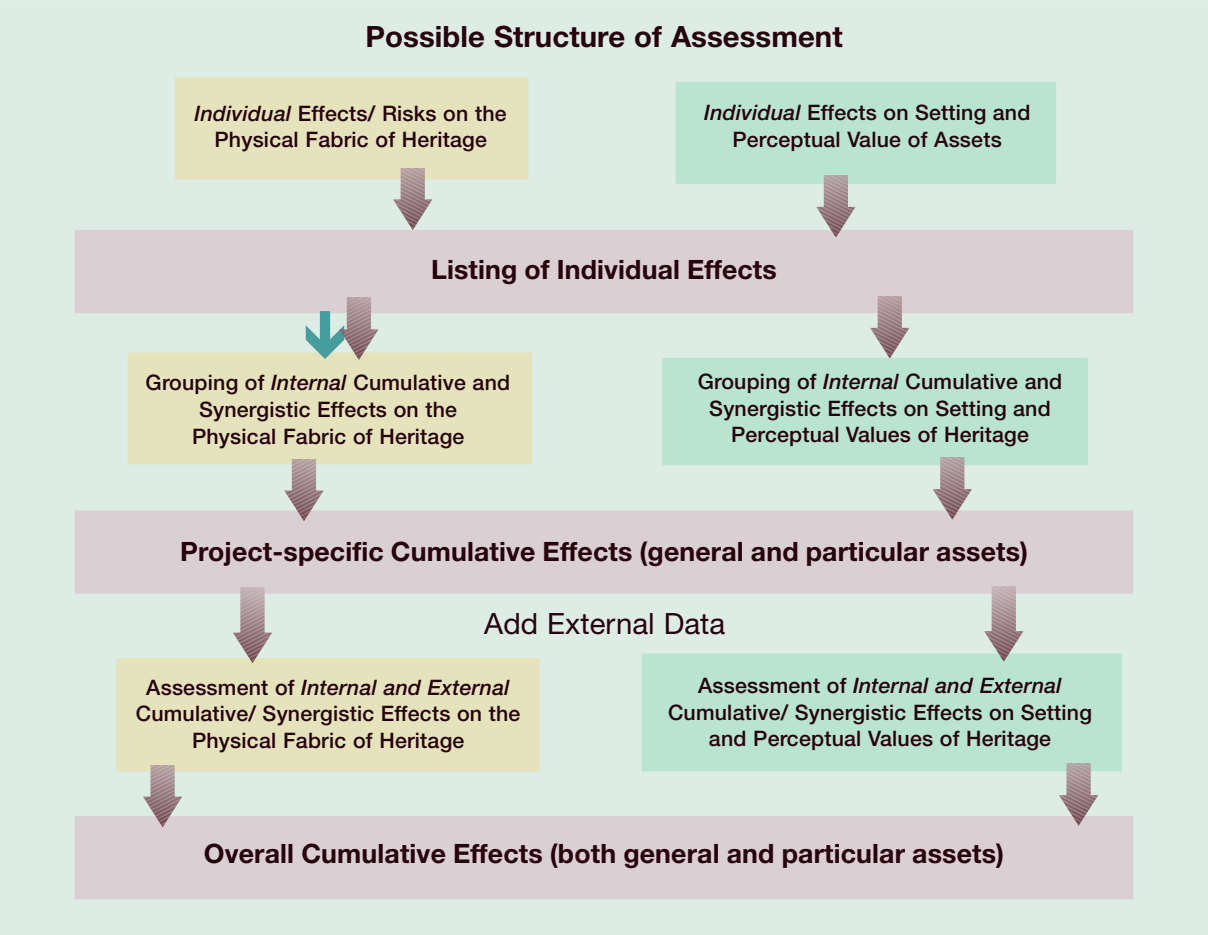
4.2 Scoping and Baseline Studies

4.2.1 Geographical boundaries for assessing cumulative effects

Establishing what geographical boundaries should be set for the assessment of cumulative effects is an important issue that needs to be considered on a case-by-case basis.

The geographical areas over which cumulative effects on the fabric of historic environment features may occur will very often be different from the areas over which effects on perceptual values could occur. These may also be different from other environmental topics. There is thus no single one-size-fits-all solution to defining the area needing to be taken into account to assess cumulative effects.

Figure 1. Stages of cumulative impact assessment.



The nature of offshore developments also raises the possibility of transboundary impacts if the cumulative effects will be experienced outside UK territorial waters Renewable Energy Zones (REZ), especially those that are cumulative with developments under other jurisdictions, and appropriate information gathered.

How the extent of potential cumulative effects might influence a study area

- A single offshore development might require only the footprint plus a buffer (perhaps c 2 km) and a 500 m cable corridor.
- The possible cumulative extent of scour indirectly triggered by a number of offshore energy or other structures, which may extend over several km, as shown by recent work undertaken by Southampton University, The National Oceanographic Centre and English Heritage (http://www.noc.soton.ac.uk/soes/research/groups/geophysics/aggregates/Index.htm).
- A sequence of wrecks of different periods affected by the same treacherous navigation hazards in a particular area.
- Visual envelopes have only very limited relevance to the setting and character of most of the submerged and buried marine historic environment whose perception is based on cognitive rather than visual understanding.
- Effects arising close to the boundary of UK waters that might have cumulative effects with developments of adjacent States, triggering the need to consider transboundary effects.

4.2.2 Sources of data

The range and sources of baseline data and surveys required to assess the individual impacts of a plan, programme or project are outlined in *Historic Environment Guidance for the Offshore Renewable Energy Sector* (COWRIE 2007). However, the baseline characterisation should be independent of the development proposal. Assessing synergistic and cumulative effects involve additional sources of data.

Sources of data needed to assess synergistic and cumulative effects

- Assessment of *internal* synergistic and cumulative effects will be reliant on the identification of individual impacts across a range of environmental topics.
- Assessment of *external* synergistic and cumulative effects will usually require additional data related to other developments, socio-economic activity and natural processes.
- It will often be cost effective to gather data about external activities at the same time as the basic historic environment data needed for assessment of the individual effects.

A proper consideration of impact interactions and synergistic effects requires liaison between specialists. For synergistic effects arising in combination with other developments or trends, other SEAs and EIAs will need to be considered in relation to the significance of such effects. It is not practical to identify all developments and activities which have ever had some impact on a particular area or may theoretically do so in the future: baseline studies should focus on the most significant changes and especially on any sources of ongoing impacts.

It is important to establish the significance of the remaining potential or value of the resource as the baseline of past impacts, so that the implications of further impacts can be assessed in terms of capacity for further change.

How potential synergistic effects can influence compilation of baseline data

- Visual and landscape specialists need to be informed of heritage features and areas for which an assessment of visual intrusion is needed in relation to issues of setting.
- The co-occurrence of important geomorphological features and wildlife habitats and historic features such as submerged land surfaces and wrecks should be established.
- The contribution of important historic landscape, townscape and seascape character to overall landscape and seascape character.
- For consideration of 'internal' cumulative effects, data relating to survival, condition

and potential this will often come from standard sources consulted through desk studies supplemented by results of field and marine survey.
- For 'external' cumulative effects information on past change will be gathered through the studies needed to establish the wider background to the study area, and from other SEAs and EIAs. Additional comments may be sought from statutory and other consultees.

The principal sources of information for other developments would be a SEA or EIA, if available. Although the information available may not allow detailed assessment, even a scoping report or consultation with the relevant authority may at least allow the potential for significant cumulative effects to be identified.

Example of sources of data examined to assess cumulative effects of a windfarm
For the Cirrus Shell Flat Array offshore windfarm in Liverpool Bay a wide range of other types of project were considered, and the availability of data for each project was tabulated, grouped by development sector according to whether an Environmental Statement was available and if so whether in hard copy or digitally, and whether other data sources were available. The overall pattern of availability of data is given below summarising the table in the Environmental Statement (ES).

Sector (no projects)	Paper ES	Digital ES	Other data	ES unavailable
Windfarms (9)	3	7		
Oil and Gas (14)	4	8	2	
Aggregates (4)			2	2
Waste (12)				12
Other projects (6)		2	3	1

4.3 Impact Analysis and the Significance of Effects

4.3.1 General principles

The core aim of environmental assessment is to identify significant effects on different aspects of the environment and its value to people, by weighing the value of the historic assets affected against the scale of the impact. Various techniques for this are explained in Historic Environment Guidance for the Offshore Renewable Energy Sector (COWRIE/Wessex Archaeology 2007).

It is important to recognise that the presence, extent, condition and character of archaeological remains is often poorly understood, and potential impacts on them may best be identified in terms of levels of risk.

Basis of judging Significant Effects
- The combination of the importance of the resource PLUS the level of impact.
- A judgement of RISK can be made where POTENTIAL importance or level of impact is uncertain.
- A confidence rating for the significance of effects can be valuable.

Importance/potential criteria and issues to consider
- Designations.
- Professional and policy standards.
- Local values.

Issues for assessing levels of impact
- Understanding both the known and potential resource.
- State of preservation.
- Physical and visible character of development.
- Effects of how development is carried out as well as final product.
- Effects on how people appreciate and understand the history of their surroundings.
- Judgement of other relevant specialists (e.g. visual).

This approach can be scaled up from individual impacts to consider the significance of synergistic and cumulative effects, but judgements get more complicated as more factors come into play from consideration of interactions with other environmental topics and the overall cumulative effect of impacts of varying types (direct/indirect, adverse/beneficial, permanent/temporary) are considered together.

Most EAs judge significance of effect as change from present conditions. As a result, past

impacts are usually regarded as having degraded the resource, and impacts are thus judged less significant than if it were better preserved. But this approach is not well suited to assessing cumulative effects, where the overall outcome rather than the level of change is what matters, as shown in Figure 2.

For assessing the degree of change the existing position is treated as a neutral starting point. For measuring the outcome of cumulative effects of a development in conjunction with others the starting point needs to be an assessment of current condition (good or bad) which depends on how past activities have effected the resource; from this the overall outcome of further change can be judged.

There is no set method which should be used for assessing cumulative effects, but the significance of a change and what represents an acceptable level of change needs to be considered.

Key questions to address in assessing the significance of cumulative effects

Past change may have devalued an asset but is the remaining value still significant and critically endangered?
- What key characteristics and potential will survive?
- Will they be stable or unstable?
- Is the accumulated loss still within acceptable limits of change?

How significant are the effects of the development when considered cumulatively?
- Is the overall significance of multiple impacts greater or less than the 'sum of the parts'?

Can mitigation measures reduce the significance of adverse cumulative effects to an acceptable level?
- Assessing the overall residual significance of cumulative effects should take into account agreed proposals to avoid or mitigate impacts.

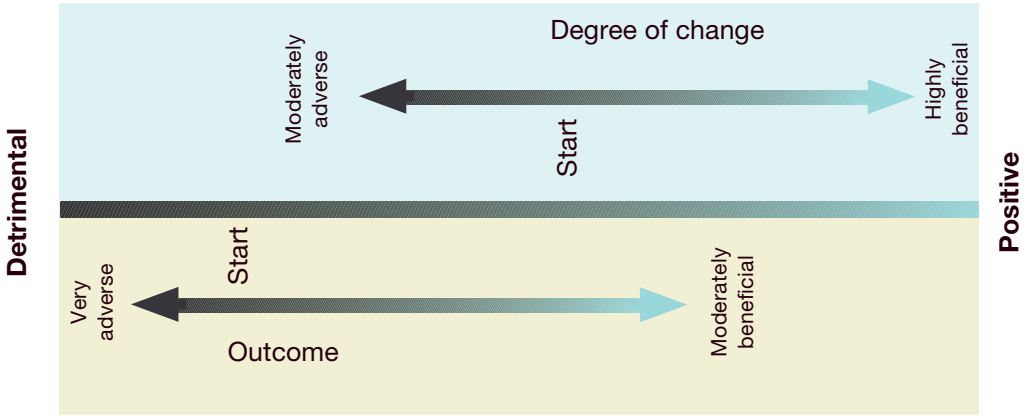
4.3.2 Methodological approaches to assessing synergistic and cumulative effects

A variety of methods have been developed for assessing cumulative and synergistic effects and these are compared in Appendix C.

A broad approach to methods of assessing synergistic and cumulative effects

Expert Judgement is vital
- Specialist EA consultants and engineers (Historic Environment specialists liasing with others).
- Regulators' advice is especially important in relation to external cumulative effects.
- Judgements need to be systematic and based on accepted standards.

Figure 2. Distinguishing change and outcome.



Spatial analysis is fundamental to assessing impacts
- Must include spatial information about developments as well as the historic environment.
- Can locate past and foreseeable impacts of other projects and trends relative to project and identify overlapping areas of impact (especially visual).

Matrices help collate and summarise complex judgements (see Appendices G and H for examples)
- Can systematise judgements without risking over-simplification of scoring.
- Can be 'nested' to allow summaries of detail to be fed into more strategic levels of analysis and assessment.

To support these
- Checklists help to ensure issues are considered (may be basis of matrices).
- Network analysis or flow diagrams are potentially very useful for identifying complex effects.
- Predictive modelling is potentially important but relies on robust data and methods.
- Assessment of carrying capacity/ limits of acceptable change is desirable but methods are not well developed for the historic environment.

4.3.3 Concepts and criteria for establishing the value of historic features and areas and the scale of impacts affecting them

Fabric
A selection of criteria for assessing the value of historic features in terms of their physical fabric has been developed.

Typical criteria and other considerations for judging the value and potential of historic environment features and areas
- Statutory criteria e.g. Scheduled Monument criteria.
- Research issues.
- Professional and policy standards.
- Understanding likelihood of undiscovered elements.
- Understanding of archaeological and historical context.

Setting
For setting, there are no agreed criteria, but a number of factors need to be considered. They are more wide ranging than purely visual ones.

Factors influencing the character of setting
- The character of the feature/area itself.
- Views of the feature/area.
- Topography and other natural conditions.
- Views from the feature/area.
- Nearby vegetation and habitats.
- Visual ambience and approaches.
- Nearby buildings and structures.
- Noise environment and other activity.
- Archaeological context.
- Cultural/historical associations.

Perceptual
Perceptual values mainly relate to how historic fabric and setting are understood and appreciated through a variety of ways in which people interact with the historic environment. In some respects these become more important as a general consideration in relation to cumulative effects than for individual ones.

Examples of perceptual values attached to historic features and areas
- Intellectual understanding – through archaeological, historical, architectural or geographical investigation.
- Appreciation through the human senses – especially visual, also noise.
- Knowledge of history and context – why the asset is where it is.
- Historical association – battle site or other event.
- Aesthetic – artistic and cinematic associations.
- Sense of place – such as the 'White Cliffs of Dover', literary links, tradition and local myths.
- Economic – the historic environment can be important for tourism, regeneration etc.
- Educational – the historic environment offers important opportunities for learning.

Key attributes
In considering these values it is often helpful to focus on some of the key attributes of the historic features and places involved.

Examples of considerations defining key attributes of heritage assets and areas

- Features with an intrinsic visual function – e.g. a lighthouse or beacon.
- Designed visual relationships and approaches to a historical place – e.g. the open views of the horizon from a coastal fort or battery; a designed vista from an historic park over open sea.
- How features were used historically – e.g. relationships between quay, customs office and warehouses in a port.
- Attached historical attributes – e.g. the use of buildings and monuments as navigation marks.
- Historical events – e.g. the area of a naval battle relative to the wrecks of lost ships; or a trail of jetsam relative to currents and the topography of a reef or sand bank where a vessel foundered.
- Historical or cultural association – e.g. views depicted in well-known art or descriptions in literature.

In relation to cumulative effects 'Historic Seascape Character' can encapsulate many of these values at a broader level, and can be very relevant to the assessment of cumulative effects on the historic environment.

4.3.4 Assessing Levels of Impact and Significance of Synergistic and Cumulative Effects

Scale of Impacts

The overall range and nature of potential sources of impacts on the physical fabric of historic environment assets are summarised below.

Examples of different kinds of physical alteration to historic environment assets

- Partial or total loss of fabric through direct impacts or indirect impacts such as scour.
- Compression, decay, distortion or other damage.
- Loss of integrity of sites and areas through physical severance, fragmentation or isolation from surroundings.
- Indirect benefits of reducing ongoing damage through mitigation of other effects such as prevention of scour or increased deposition of sediment.

Physical changes to either fabric or setting can alter an asset's contribution to knowledge and wider appreciation.

In relation to issues of setting, effects are synergistic in terms of interaction with visual assessment, tourism etc. Several developments in one area may add significantly to the overall effect on the setting of a particular feature or monument, but this needs to be considered in terms of historic values.

The cumulative effects on different aspects of setting and perceptual values of the historic environment can be grouped in broader terms.

Historic Landscape Characterisation/Historic Seascape Characterisation takes as its focus the concept of 'time-depth' in the present landscape/seascape. It defines areas whose dominant character is a reflection of the shared historic processes which have shaped them. Those expressions of shared character are often repeated in other areas which have been shaped by similar processes, allowing the definition of Character Types and to map, using GIS, their expressions across any given locale, sub region, region adopting the most appropriate scale. The definition of Character Types (and Sub-Types) is based on an assessment of a range of attributes derived from a diversity of data sources. It is an essentially neutral database, designed to inform assessments, rather than to dictate which are more important/significant that others. Consequently as Historic Landscape Characterisation/Historic Seascape Characterisation has comprehensive coverage, it accepts change will happen, but provides a means of enabling historic environment input to that process.

4.4 Mitigation

4.4.1 General principles of mitigation

Avoiding and reducing significant effects is mainly achieved through planning of the location of development and good design to minimise impacts.

The preamble of the 1985 EIA Directive promotes two principles that are especially pertinent to issues of cumulative effects on the non-renewable historic environment:

- "preventing nuisances at source rather than subsequently trying to counteract their effects".
- "the need to take effects on the environment into account at the earliest possible stage in all the technical planning and decision-making process".

Mitigation measures will deal with the remaining effects that cannot be avoided. With respect to cumulative effects, it is especially pertinent that impacts should be minimised to avoid serious piecemeal degradation. It is, however, not always possible to mitigate for a particular impact e.g. the provision of lights to ensure safety of navigation at night.

The SEA process is especially important for avoiding detrimental effects at a strategic level, and should establish a framework for addressing the cumulative effects of individual developments. It is also important that developers do provide a commitment to the mitigation process.

Proposals for mitigation should also include the basis for monitoring effects and the implementation of environmental management measures to ensure that unforeseen effects are dealt with and the effectiveness of mitigation measures can be judged for future reference. This is particularly pertinent in the offshore area where the presence of archaeology can be unpredictable at best. Mitigation is the mechanism for dealing with cumulative effects in two main areas: loss of or damage to physical fabric, and degradation of perceptual value. Siting of offshore developments is of particular relevance to preventing and avoiding cumulative effects on setting and perceptual values.

The final assessment of whether renewable offshore energy will have a significant effect on the historic environment should take account of mitigation measures that have been formally agreed. An example of an assessment of possible cumulative effects on the historic environment and their residual significance after mitigation, was carried out for the Scottish Offshore Energy SEA (http://www.seaenergyscotland.co.uk/).

In order to assist in effective mitigation and monitoring COWRIE is establishing a central record of survey data, accessible through a database.

4.5 Reporting

4.5.1 Content

It is a requirement that significant cumulative and synergistic effects be included in a SEA Environmental Report or an EIA Environmental Statement. Detailed analysis may be provided in the specialist report or background information. It is important that the rationale for how these effects are reported is clear.

Considerations for how cumulative and synergistic effects are reported in an Environmental Report or Statement

- Ensure the factors considered and basis of judgement and grading of significance are clear.
- The kinds of effect requiring assessment should be explained clearly.
- Results should be summarised in specialist reports in ways that facilitate being compared with the assessments of other environmental issues.
- The text explaining cumulative effects may be derived from statements included in matrices or other analyses, but will be most useful as a simple account of what is significant.
- It may be appropriate to illustrate the spatial occurrence of cumulative effects from GIS analysis.

4.5.2 Reporting – co-ordination

Ensuring proper coverage of synergistic and cumulative effects is a challenge for the assessment team, and especially the EA co-ordinator.

Important points for co-ordinating coverage of synergistic and cumulative effects

- EA co-ordinators and specialists need to liase closely.

- In pulling results of different specialists together it is important to identify interactions and avoid double counting.
- Material relating to different specialisms should be cross-referenced in the text.
- The structure of how cumulative effects are presented needs careful consideration.
- The non-technical summary must faithfully reflect specialist assessment.
- Regulators need to check that all other relevant developments and other environmental changes have been taken into account.

4.6 Implementation monitoring and review

4.6.1 Requirement and responsibility

Monitoring is a requirement for SEAs, and should involve formal auditing and review of outcomes. This logically indicates that projects covered by EIAs under the framework of a plan or programme subject to SEA should be monitored.

This especially applies to cumulative effects, and monitoring should seek to ensure that medium long-term implementation of plans and programmes can be adjusted to deal with problems that arise. For example mitigation strategies in project EIAs may need to be altered if significant effects are not being adequately addressed.

Monitoring involves defined tasks and other stakeholders with common areas of interest. The evaluation of monitoring data and any subsequent conclusions are likely to remain the remit of the relevant competent authority responsible for completing the SEA.

Stakeholders	Tasks
• Private Organisations • Monitoring Team • Environmental Authorities • Planning Authority and Decision Makers	• Data Collection • Processing of Data • Interpretation Evaluation • Conclusions and Policy Implications

Currently developers are required to comply with the conditions of their lease, from The Crown Estate as landowner of the seabed, and with terrestrial planning conditions. Apart from any audits of compliance with Food and Environment Protection Act (FEPA) 1985 licence conditions, offshore monitoring is left rather informally to existing regulators and the state heritage agencies acting in a general advisory capacity. Onshore monitoring is the remit of local planning authorities.

4.6.2 Monitoring practicalities

Environmental management protocols are a recognised approach for ensuring that adverse individual and cumulative effects are minimised and benefits maximised. Specialist archaeological protocols are commonly employed for the historic environment where the level of uncertainty is high.

However protocols do not provide an overview of the results of all such monitoring in relation to cumulative impacts arising from more than one development, which will merge into the requirements for monitoring SEAs, and this responsibility of regulatory and environmental authorities to whom results are reported.

There do not appear to be any established procedures for monitoring the cumulative impact of developments on either the setting of historic environment features or broader issues of landscape and visual impact, despite the well-recognised effects of piecemeal development. For World Heritage Sites (WHS), the UNESCO World Heritage Committee, may intervene, but for non WHS locations there is no body charged with a similar monitoring role, other than specific initiatives of local planning authorities and state heritage agencies.

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Appendix A. Guidance on Cumulative Impacts

SEA is still too new for a large body of guidance on cumulative impact to have emerged. The most comprehensive so far is *Draft guidance on Cumulative Effects Assessment of Plans* (Cooper 2003). This document adapts existing methodologies developed for projects to suit plans, and provides a direct comparison of the two.

The most comprehensive guidance on dealing with cumulative and synergistic impacts is that produced for the European Commission, *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (EC 1999). This is, in fact, one of only a handful of documents which have been designed specifically to address these issues, the other major example a US document from 1997, *Considering Cumulative Effects under the National Environment Policy Act*, produced by the US Council on Environmental Quality. This addresses assessment at project level, the equivalent of the European EIA.

Cumulative impacts are included in the other guidance, both general and for specialist areas, but not in any detail. In most cases advice only extends to restating the need for them to be addressed.

Several documents have been produced with specific guidance for the assessment of the impacts of renewable energy, including offshore projects. General documents include *Cumulative Impact of Wind Turbines* (CCW 2007), *A Guide to Assessing the Cumulative Effects of Wind Energy Development* (LDA 2000) and *Handy Hints on Impact Assessment Issues for Renewable Energy Developments in Orkney* (OREF 2006). Although these appear to be aimed at cumulative impacts generally, in practice they concentrate on visual and landscape issues. Specific guidance on these topics also exists, such as *Environmental Impact Assessment of Windfarms: The historic environment and the Problem of 'Setting'* (Masser 2006).

The same emphasis on visual impacts is seen in documents dealing with specifically offshore developments such as *Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report* (DTI 2005). *Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements* (CEFAS 2004) is mainly concerned with natural heritage, and only mentions the historic environment very briefly.

Appendix B. Extent of the historic environment susceptible to impact

Landscape/Visual/Perceptual

In addition to the physical evidence of past human societies and their use of the environment, there are aspects of the physical attributes of places that relate to how they are perceived and appreciated by people in terms of perception rather than evidential content. These include attributes of setting, amenity, landscape and seascape character and historical, social or artistic association.

This is particularly pertinent with regards to the coastal zone which is an interface between two fundamentally different environments and one imbued with a high spiritual and recreational value (Hill *et al*. 2001, 6). Communities can have long relationships with the sea as a source of livelihood and subject of myths and legends (*ibid*, 5).

In both SEA and EIA, it is common for the majority of the consideration of these issues to be covered outside the historic environment section. They are, however, an important aspect of the historic environment and should receive specialist consideration. This is particularly exemplified by the possible impact of development of the visibility and intervisibility on features which traditionally have a maritime function. It is universally recognised that one has a different perspective of the land from the sea as from the land itself. For instance, shorelines can appear flattened and without perspective. Often two different names can be given to the same landmark from sea and land such as Crooks Peak in the Mendips, known as 'See Me Not' by the maritime community (Parker 2001, 35). Distinctive features have long been used as navigation guides, and are sometimes marked as such on charts. Medieval mariners carried 'prospects' – sketches of the coastline as seen from the sea, marking such features. These often had (and still have) specific technical functions when aligned, which when passed would permit a vessel to turn or alter direction after clearing a hazard (*ibid*). Additionally, certain areas of sea are traditionally important as transit points where local knowledge of sea conditions is passed on. As such landscape or 'seascape' studies should "learn to perceive the landscape and the settlements as they were seen with the eyes of the sailor or fishermen in the past" (Crumlin-Pedersen 1996).

Appendix C. Comparison of Methods for Cumulative Impact Assessment

(From EC 1999 with minor edits)

Method	Description	Advantages	Disadvantages
Expert Opinion	• A means of both identifying and assessing indirect and cumulative impacts and impact interactions. Expert Panels can facilitate exchange of information on different impacts	• Can consider such impacts as an integral part of the assessment	• Some specialists or experts may be remote from the main project team
Consultation and Questionnaire	• A means of gathering information about a wide range of actions, including those in the past, present and future which may influence the impacts of a project	• Considers potential impacts early on • Can be focused to obtain specific information	• Prone to errors of subjectivity • Questionnaires can be time-consuming and have poor response
Checklists	• Provide a systematic way of ensuring that all likely events resulting from a project are considered. Information presented in a tabular format	• Systematic method • Can develop 'standard' checklist for similar projects	• Can miss important effects • Nature of cause-and-effect relationships not specified
Spatial analysis	• Uses *Geographical Information Systems* (GIS) and overlay maps to identify where the cumulative impacts of a number of different actions may occur • *Impact interactions*. Can superimpose a project's effects on selected receptors or resources to establish areas where impacts would be most significant	• GIS flexible and easy to update • Can consider multiple projects and past, present and future actions • Allows clear visual presentation	• GIS can be expensive and time consuming • Difficult to quantify impacts • Problems in updating overlays
Network and systems analysis	• Based on links and interaction pathways between individual elements of the environment, and that when one element is specifically affected this will also affect those elements which interact with it	• Mechanism of cause and effect made explicit • Use of flow diagrams can assist with understanding of impacts	• No spatial or temporal scale • Diagrams can become too complex
Matrices	• A more complex form of checklist. Can be used quantitatively and can evaluate impacts to some degree. Can be extended to consider the cumulative impacts of multiple actions on a resource	• Good visual summary of impacts • Can be adapted to cover indirect and cumulative impacts and interactions • Matrices can be weighted/impacts ranked to assist in evaluation	• Can be complex and cumbersome to use
Carrying capacity analysis	• Based on the recognition that thresholds exist in the environment. Projects can be assessed in relation to the carrying capacity or threshold determined, together with additional activities	• Addresses accumulation of impacts against thresholds • Considers trends in the environment	• Limited to data available. Not always able to establish the threshold or carrying capacity for particular resources
Modelling	• An analytical tool which enables the quantification of cause-and-effect relationships by simulating environmental conditions. This can range from air quality or noise modelling, to use of a model representing a complex natural system	• Quantifies cumulative effects • Geographical and time-frame boundaries are usually explicit • Addresses specific cause-and-effect relationships	• Often requires significant time and resources • Can be difficult to adapt models to a particular project • Depends on available data

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