DECC

SEVERN TIDAL POWER - SEA TOPIC PAPER

Terrestrial and Freshwater Ecology

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ABBREVIATIONS

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The following abbreviations are used in this Topic Report:

BAP	Biodiversity Action Plan
BERR	Department for Business, Enterprise and Regulatory Reform
BTO	British Trust for Ornithology
CCW	Countryside Council for Wales
cSAC	Candidate Special Area of Conservation
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EIA	Environmental Impact Assessment
EC	European Commission
EU	European Union
GIS	Geographical Information System
GW	Gigawatts
HRA	Habitats Regulations Assessment
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserve
MW	Megawatt
NE	Natural England
NERC	Natural Environment and Rural Communities Act
NNR	National Nature Reserve
NPS	National Policy Statement
ODPM	Office of the Deputy Prime Minister
PPG	Planning Policy Guidance
PPS	Planning Policy Statements
SAC	Special Area of Conservation
SDC	Sustainable Development Commission
SEA	Strategic Environmental Assessment
SNCI	Sites of Nature Conservation Importance
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STP	Severn Tidal Power
TAN	Technical Advice Note
TWh	Terrawatt Hours
UKCIP	United Kingdom Climate Impacts Programme
UN	United Nations
WFD	Water Framework Directive

NON TECHNICAL SUMMARY

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Introduction

A strategic environmental assessment (SEA) is being conducted as part of the Severn Tidal Power (STP) feasibility study, in accordance with the requirements of the EU SEA Directive and UK Regulations. The SEA comprises two phases: Phase 1, the scoping stage, has already been undertaken. This Terrestrial and Freshwater Ecology Topic paper forms part of the reporting arising from Phase 2, the main assessment of short-listed alternative options.

Consultation
The following consultation activities have been undertaken within this topic:

- SEA Scoping consultation in January 2009
- SEA Technical Workshops held in June and December 2009
- STP Environment Workstream meeting October 2008
- STP Environment Workstream teleconferences May, September and November 2009

SEA Objectives
SEA Objectives have been developed to enable alternative options to be compared. Objectives may not necessarily be met in full by a given alternative option, but the degree to which they do will provide a way of identifying preferences when comparing effects of alternative options. The SEA Objectives for this topic are listed below:

- TFE.1 To avoid adverse effects on designated terrestrial and freshwater wildlife sites of international and national importance
- TFE.2 To avoid adverse effects on valuable terrestrial and freshwater ecological networks.
- TFE.3 To avoid adverse effects on other protected terrestrial and freshwater habitats and species.
- TFE.4 To avoid adverse effects to national and local biodiversity target features including terrestrial and freshwater habitats and species.
- TFE.5 To minimise the risk of introduction of non-native invasive terrestrial and freshwater species.
- TFE.6 To conserve and enhance designated freshwater and terrestrial site features.
- TFE.7 To restore and enhance freshwater and terrestrial BAP species populations and/or BAP habitat.

Baseline Environment

Baseline information provides the basis for predicting and monitoring environmental effects, by describing the area that may be affected. Due to the long timescales associated with the construction and operation of alternative options, baseline information is considered over three time periods, to reflect the predicted changes in the area when considered without the development of a Severn Tidal Power project. The baseline therefore also describes the estuary in a 'do-nothing' scenario.

Baseline environment up to 2009

The baseline for the Terrestrial and Freshwater Ecology Topic has been developed entirely through desk based study using a range of published sources including, GIS mapping, databases and scientific reports.

The baseline environment for receptors up to 2009 identified a broad mix of terrestrial and freshwater ecology conservation features. This included SACs and Annex 1 habitats, Ramsar Sites (non waterbird interest), SSSIs & NNRs (non geological), LNRs, habitats & landscape corridors, lichens and fungi, plants, crustaceans and molluscs, invertebrates, herpetiles, birds (non waterbird species),

mammals. At the period up to 2009 it was identified that amongst the receptors there were many features subject to a range of pressures including climate change, development pressures and habitat management changes. Government and Regional strategies and targets were identified that set out measures to ensure a number of these receptors are enhanced and conserved.

Future baseline during construction: 2014-2020

The future baseline during construction 2014-2020 falls within the period over which a number of conservation targets have been set across the UK. JNCC (2007a) identifies that between 2007 and 2020 a significant improvement to the Natura 2000 features is predicted through conservation actions that have already been undertaken but the effects of which are yet to be fully evident. The report also acknowledged that additional measures would be required in order to meet the high levels of favourability that have been targeted. For both England and Wales, targets have been set with regard to the maintenance and enhancement of protected sites. Both countries have set a target to bring into favorable or recovering condition (known as 'target condition') 95% of the areas of SSSIs by December 2010.

The implementation of the water resources strategies for England and Wales was identified as a mechanism which work towards achieving the WFD objectives of ‘good’ ecological status and ‘good’ chemical status for surface waters by 2015 thereby reverting several of the factors identified for the unfavourable status of some receptors.

Significant changes resulting from climate change were not predicted during the construction period.

Future baseline during operation 2020-2140, decommissioning and longer term trends

Over the operational period climate change was identified as a highly significant issue for a large number of the terrestrial and freshwater ecology receptors. It was assumed that continued maintenance and enhancement of the designated site network, including those sites within the study areas, will continue to be of high priority for the Government and statutory agencies. It was considered that the provision of legal designations will come to be of growing importance as the demands for undeveloped land become increasingly pressured in line with population rise.

Climatic changes are anticipated to result in hotter mean annual temperatures, with wetter winters and drier summers, and higher rainfall intensity overall. By 2050, winter surface water flows are predicted to increase by between 10-15% above baseline but summer flows to decrease by over 50% and as much as 80% in places. It is estimated that these patterns could result in a reduction in total annual average river flow by up to 15% (EA, 2009).

Higher mean temperatures will result in reduced dissolved oxygen concentrations in rivers, whilst lower summer flows will reduce the potential for dilution of effluents. These factors alone will make it progressively harder to achieve WFD objectives. Without regulation, nutrient concentrations can be expected to increase and turbidity to reduce in inland surface waters, particularly in summer. The potential for the occurrence of algal blooms on inland surface waters will therefore become increasingly likely.

Adaptive management of water dependent habitats and species reliant upon the habitats will be an increasingly important approach to ensure the continued maintenance of ecosystems. In the operational and decommissioning period maintenance of existing terrestrial and freshwater ecosystems are likely to present considerable challenges and increased pressures would be likely to result in a reduction of the overall biodiversity that these sites support.

Key Environmental Issues and Problems

The terrestrial and freshwater ecology receptors within the baseline study areas are all interrelated and changes to one of the receptors is highly likely to influence one or more of the others. For example in the case of features such as habitats, plants and invertebrates any changes both beneficial and adverse are highly likely to have a corresponding influence on many other receptors.

The baseline study areas support a wide range of interest features including a large number of designated sites at a European and National level. However beyond the boundaries of designated sites are pockets of habitat, corridor networks and features that help to ensure the continued ecological function of the designated areas. These features are not easily identified through desk study alone but they are known to be present and it is important that their significance is not ignored.

The features supported within the baseline study areas are in varying levels of condition. These pose challenges for conservation agencies to meet targets set by Government to halt biodiversity decline. This is further compounded by the predicted influences of climate change. A number of strategic documents have been produced that set out the approaches to help combat climate influence though they acknowledge that it is unlikely that it will be feasible to retain biodiversity features as we know them today. What is far less certain and present problems for the delivery of future initiatives, is the actual levels of climate change that will occur as measures need to be implemented now that could be relevant in 100 years, notwithstanding that climate predictions beyond 50 years hence are uncertain.

Climate change effects are compounded by the influences of population growth and the built environment that increasing populations generate. Pressures for undeveloped land are likely to be greater than ever before and this poses a threat to those areas of non designated land that fulfil so many valuable functions to ecosystems. Increasingly water resources will need to be safe-guarded and managed to maximum efficiency, such measures are likely to offer potential benefits to freshwater ecology receptors.

Evaluation of Plan Alternatives

Assessment Methodology
The SEA Directive specifies the criteria that should be taken into account when determining the likely significant effects of the plan and thus these criteria have been adopted throughout the assessment process of this SEA. This topic paper therefore considers the characteristics of the effects and of the area likely to be affected.

This topic has also used the following specific assessment methods.

The assessment focussed on identifying effects two key stages, construction and operation.

The construction of an option is considered to be broadly comparable to that of other types of large developments such as bridges and roads. During the construction stage of an option the issues considered are associated with; permanent and temporary habitat loss, habitat fragmentation, habitat degradation, species mortality, disturbance (including noise and vibration, visual) and pollution (air, ground and water).

The operation of an option in the Severn Estuary is expected to result in changes to the natural tidal cycle which in turn could result in changes to the wider hydrological regime elsewhere within the zone of influence through the restriction of fluvial discharge to the estuary. A number of the terrestrial and freshwater ecology receptors have interest that is dependent on surface or groundwater, or both and the existing tidal cycles and behaviour of The Severn Estuary influences the wider hydraulic features in the catchment zone. Any changes arising to the tidal cycle from the operation of an option could result in changes to these sites also. During operation of an option the issues considered are associated with; changes to the natural fluctuations of water levels, changes to water quality and

changes to all habitats, flora and fauna associated with such habitats, including habitat degradation and/or habitat loss.

Both stages of the assessment utilised GIS and the operational assessment also used outputs from the Flood Risk & Land Drainage Topic which utilised Hydrodynamic 1-D models.

Alternative Options
There are five shortlisted alternative options that are being assessed within Phase 2 of the SEA for their likely significant effects. These alternative options and key parameters associated with the alternative options are:

Alternative	Location	Length (approx)	Operating mode	Turbine type	No. turbines	Annual energy output	Caissons	Locks
B3: Brean Down to Lavernock Point Barrage	Lavernock Point to Brean Down	16km	Ebb only	Bulb-Kapeller	216 (40MW)	15.1 to 17.0 TWh/year	129	2
B4: Shoots Barrage	West Pill to Severn Beach	7km	Ebb only	Bulb-Kapeller	30 (35MW)	2.7 to 2.9 TWh/year	46	1
B5: Beachley Barrage	Beachley to land directly to the east on the English side	2km	Ebb only	Straflo	50 (12.5MW)	1.4 to 1.6 TWh/year	31	1
L2: Welsh Grounds Lagoon	River Usk to Second Severn Crossing	28km	Ebb only	Bulb	40 (25MW)	2.6 to 2.8 TWh/year	32	1
L3d: Bridgwater Bay Lagoon	Brean Down to Hinckley Point	16km	Ebb & Flood	Bulb-Kaplan	144 (25MW)	5.6 to 6.6 TWh/year	42	1

Assessment of Likely Significant Effects on the Environment

Alternative Option B3: Brean Down to Lavernock Point Barrage (also known as Cardiff to Weston)

At the construction phase likely significant direct, far-field and cumulative effects have been identified which include; permanent habitat loss, temporary habitat loss, habitat fragmentation, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant direct and consequential effects have been identified which include; permanent habitat loss, habitat enhancement, species mortality.

At the decommissioning phase likely significant direct effects have been identified which include; permanent habitat loss, habitat creation, species mortality, species disturbance, habitat degradation.
At the operation phase likely significant indirect effects have been identified which include; reduction in species abundance.

Effects are considered to be significant as a result of the value and vulnerability of receptors, nature of effect and magnitude of effect

Alternative Option B4: Shoots Barrage

At the construction phase likely significant direct, far-field and cumulative effects have been identified which include; permanent habitat loss, temporary habitat loss, habitat fragmentation, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant direct and consequential effects have been identified which include; permanent habitat loss, habitat enhancement, species mortality.

At the decommissioning phase likely significant direct effects have been identified which include; permanent habitat loss, habitat creation, species mortality, species disturbance, habitat degradation. At the operation phase likely significant indirect effects have been identified which include; reduction in species abundance.

Effects are considered to be significant as a result of the value and vulnerability of receptors, nature of effect and magnitude of effect.

Alternative Option B5: Beachley Barrage

At the construction phase likely significant direct effects and cumulative effects have been identified which include; species disturbance, habitat degradation.

At the operation phase likely significant direct effects have been identified which include; permanent habitat enhancement.

At the decommissioning phase likely significant direct effects have been identified which include; permanent habitat loss.

At the operation phase likely significant indirect effects have been identified which include; reduction in species abundance.

Effects are considered to be significant as a result of the value and vulnerability of receptors, nature of effect and magnitude of effect.

Alternative Option L2: Welsh Grounds Lagoon

At the construction phase likely significant direct effects and cumulative effects have been identified which include; permanent habitat loss, temporary habitat loss, habitat fragmentation, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant direct and consequential effects have been identified which include; permanent habitat loss.

At the decommissioning phase likely significant direct effects have been identified which include; habitat creation, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant indirect effects have been identified which include; reduction in species abundance.

Effects are considered to be significant as a result of the value and vulnerability of receptors, nature of effect and magnitude of effect.

Alternative Option L3d: Bridgwater Bay Lagoon

At the construction phase likely significant direct and cumulative effects have been identified which include; permanent habitat loss, temporary habitat loss, habitat fragmentation, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant direct and consequential effects have been identified which include; habitat enhancement.

At the decommissioning phase likely significant direct effects have been identified which include; permanent habitat loss, species mortality, species disturbance, habitat degradation.

At the operation phase likely significant indirect effects have been identified which include; reduction in species abundance.

Effects are considered to be significant as a result of the value and vulnerability of receptors, nature of effect and magnitude of effect.

Assumptions, Limitations and Uncertainty

Assumptions in the assessment of effects have included; climate change scenarios as set out in the baseline receptor conditions, efforts would be made to avoid affecting sensitive receptors where siting of the development feature (such as cable routes) is unknown. Some precautionary assumptions regarding the presence of flora and fauna have been made.

Limitations and uncertainties exist with regard to; the quantitative changes to water levels as a result of outfall flow prevention and reduction and the magnitude of effect, the locations and magnitudes for far-field construction effects and magnitude of far-field operation effects, the likely significance of cumulative and consequential effects.

Measures to prevent, reduce and as fully as possible offset any significant adverse effects

The measures identified to prevent or reduce likely significant adverse effects identified within this topic are described below.

No specific measures to prevent or reduce effects to terrestrial and freshwater ecology receptors were undertaken at the optimisation stage.

It is considered that through the application of measures to prevent or reduce effects many of the significant effects can be resolved. Key measures during construction will be:

- Avoidance/prevention: measures taken to avoid or prevent significant effects, e.g. scheme location, scheme layout; timing of site works.
- Reduction: measures taken to reduce significant effects, e.g. retaining walls; pollution interceptors.
- Construction phase effects can be prevented or reduced through adjustments to the landfall locations and adjustment to locations of onshore works depots/site compounds, etc.
- Timing of construction works, especially site clearance is another measure that can be effective in reducing and preventing significant effects.
- General best practice during construction will also be an important factor in offsetting and reducing effects especially for disturbance and potential pollution effects.

Operational effects can be prevented or reduced by management of water levels. Measures that could be adopted principally revolve around freshwater and seawater level management including;

- Pumping
- Changing low water level of alternative option through sluices
- Creation of attenuation areas to store water

Offsetting measures within this SEA are measures to as fully as possible offset any significant adverse effects on the environment. These measures therefore make good for loss or damage to an environmental receptor, without directly reducing that loss/damage. In this SEA 'compensation', a subset of offsetting, is only used in relation to those measures needed under the Habitats Directive.

Offsetting compensation needs are only anticipated where measures to prevent and reduce cannot be successfully implemented. Likely examples would include legally protected sites and species. Effects on these sites and species, owing to their location, may be unavoidable and as such legal process would require that appropriate measures are undertaken. In the case of European Protected Species and designated sites this would be likely to include the provision of alternative habitats through either creation and/or enhancement/extension.

Assessment against SEA Objectives

This topic paper includes a full assessment of how each alternative option performs against each SEA Objective over the course of its entire life-cycle.

In summary:

TFE 1: Through the application of measures to prevent, reduce or as fully as possible offset significant effects it is considered that objective can be met for all alternative options.

TFE 2: Through the application of measures to prevent, reduce or as fully as possible offset significant effects it is considered that objective can be met for all alternative options.

TFE 3: Through the application of measures to prevent, reduce or as fully as possible offset significant effects it is considered that objective can be met for all alternative options.

TFE 4: Through the application of measures to prevent, reduce or as fully as possible offset significant effects it is considered that objective can be met for all alternative options.

TFE 5: At the SEA level in the absence of effects that remove endemic features that limit and or prevent the spread of invasives it is considered that there are no apparent effects.

TFE 6: It is considered that the objective can be met for some alternative options (B3, B5 and L3) for some designated freshwater and terrestrial site features.

TFE 7: It is considered that objective can be met for all alternative options for some designated freshwater and terrestrial site features.

Plan Implementation

Legislation and policy compliance

This paper contains a review of legislation and policy that is specifically relevant to this topic. An assessment has been made as to whether each alternative option would be compliant with existing relevant legislation and policy.

For all options where potential effects to European sites has been identified an assessment of compliance with the Habitats Regulations[1] will be required and integrated into the selection of the preferred option or options to enable an informed decision and to ensure that the chosen option or options can comply with the law.

Likely significant negative effects were identified for terrestrial and freshwater ecology receptors these included features of SACs, SSSIs, Ramsar Sites and NNRs, as well as species protected under the Habitats Regulations, Wildlife and Countryside Act and listed as UK and Local BAP species. However it was concluded that measures to reduce, prevent and offset would be likely to avoid adverse significant effects and comply with legislation and policy.

Due to the predicted of likely significant effects for features of European Sites, it is necessary to recommended that the sites affected are taken forward to Stage 2 ('Appropriate Assessment') of the HRA process to assess the potential impacts in detail and consider the requirements for measures to prevent or reduce adverse effects and potentially compensation under the HRA.

Monitoring of significant environmental effects

The SEA Directive requires that monitoring measures are described within the environmental reporting. The monitoring proposals contained within this paper are applicable to all of the alternative options under consideration.

Successful monitoring will be through a monitoring plan that sets out the aims, objectives, methods, response requirements and reporting procedures for a monitoring programme.

To monitor significant effects an accurate and detailed baseline must first be established, in addition this will be a likely requirement of any subsequent detailed assessments should an alternative option be taken forward.

A complete baseline assessment of those areas where effects are predicted and an appropriate buffer for all receptors would be required. This would be of particular importance for non-designated areas where the baseline conditions are usually far less thoroughly documented. It is likely that two years of baseline data would be required to provide a condition assessment against which effects could be monitored.

Prior to construction it is envisaged that measures to prevent, reduce and offset will be implemented, it is likely that these measures will need monitoring to ensure they achieve the desired objectives.

Monitoring would be required for sensitive receptors throughout the construction phase and in particular for those areas where measures to prevent, reduce and offset have been implemented.

A monitoring period for ten consecutive years following commencement of operation would be appropriate; continued with a strategic monitoring programme throughout the operational life of the scheme.

[1] The Conservation (Natural Habitats, &c.) Regulations 1994 (SI 1994/ 2716). From 1 April 2010, the regulations will be replaced by The Conservation Of Habitats And Species Regulations, 2010.