DECC

SEVERN TIDAL POWER - SEA TOPIC PAPER

Communities

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ABBREVIATIONS

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The following abbreviations are used in this Topic Report:

ABP	Associated British Ports
AONB	Areas of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BERR	Department for Business, Enterprise and Regulatory Reform
CCW	Countryside Council for Wales
CHaMP	Coastal Habitat Management Plan
cSAC	Candidate Special Area of Conservation
DC	District Council
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
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIS	Geographical Information System
GOSW	Government Office for the South West
GVA	Gross Value Added
GW	Gigawatts
ha	Hectare
HGV	Heavy Goods Vehicle
IMD	Index of Multiple Deprivation
JSA	Job Seekers Allowance
LAD	Local Authority District
LNR	Local Nature Reserve
MSOA	Middle Layer Super Output Area
MW	Megawatt
NERC	Natural Environment and Rural Communities Act
NNR	National Nature Reserve
NP	National Park
NPS	National Policy Statement
NSR	Noise Sensitive Receptors
ODPM	Office of the Deputy Prime Minister
ONS	Office for National Statistics
OSU	Other Sea Uses
PPG	Planning Policy Guidance
PPS	Planning Policy Statements
PRoW	Public Rights of Way
REIS	Regional Economic Impact Study
RSS	Regional Spatial Strategy
SAC	Special Area of Conservation
SDC	Sustainable Development Commission
SEA	Strategic Environmental Assessment
SLR	Sea Level Rise
SOA	Super Output Area
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STP	Severn Tidal Power
SW	South West
SWO	South West Observatory

SWRA	South West Regional Assembly
SWRDA	South West Regional Development Agency
TAN	Technical Advice Note
TWh	Terawatt hours
UK	United Kingdom
UKCP	UK Climate Projections
UKCIP	United Kingdom Climate Impacts Programme
UN	United Nations
WAG	Welsh Assembly Government
ZTV	Zone of Theoretical Visibility

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 Communities topic paper forms part of the reporting arising from Phase 2, the main assessment of short-listed options.

Consultation

The following consultation activities have been undertaken:

- Scoping consultation in January 2009
- Technical Workshops held in June 2009 and January 2010
- Discussion with estuarine Local Authorities, Wye and Usk Foundation, Hinkley Power Station and Port of Bridgwater

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:

- Objective SE1: To create employment opportunities accessible to all
- Objective SE2: To avoid adverse effects on the local and regional economy
- Objective SE3: To promote the development of sustainable communities
- Objective SE4: To avoid adverse effects on physical and mental health
- Objective SE5: To avoid adverse effects on access to community services and facilities
- Objective SE6: To promote access to recreational facilities and open space
- Objective SE7: To avoid adverse effects on existing, proposed and committed land uses
- Objective SE8: To seek opportunities to improve degraded environments
- Objective SE9: To avoid adverse effects on the housing market

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.

Receptors

The two main receptors are the general population receptors, referred to as *spatial receptors*, and the economic activity, referred to as *sectoral receptors*. The spatial receptors can be subdivided on:

a) local population (i.e. local residents, local walkers using a green space, local landowners);
b) land use;
c) employment and other consequential socio-economic receptors (i.e. in-migration, housing);

The sectoral receptor covers the indirect effects on other economic sectors (such as marine aggregate extraction, commercial fishing and tourism).

Study Area

This broadly comprises the 12 estuarine Local Authority Districts (LADs) bordering the Severn Estuary and River Severn, from the Vale of Glamorgan in the west to Gloucester in the east on the north side of the estuary/river, and from West Somerset in the west to Stroud in the east on the south side of the river. Within this geographic area, the study area was refined to the Middle Layer Super Output Areas (MSOAs) to ensure the coverage of more localised socio-economic aspects. The MSOAs has a minimum population size of 5,000 persons (7,500 average).

Baseline environment up to 2009

Land use across the Wales and South West region is generally characterised by large areas of low density rural areas, with settlements of limited population. The rural areas are dominated by agriculture and protected sites. Population density is low in both Wales and SW England.

In 2008, the total study area population was estimated to be 2.02 million, with Bristol, Cardiff, South Gloucestershire and North Somerset being the largest local populations.

For the purposes of this SEA, health and quality of life is considered to include noise, air quality, landscape and flood risk. The information is provided in detail in the Noise & Vibration, Air & Climatic Factors, Landscape & Seascape and Flood Risk & Land Drainage topic papers respectively. The summary provided here is related to general characteristics within the estuary, and location-specific characteristics applicable to the Communities topic.

The noise climate in the area of the landfall footprint for the alternative options is in the main a rural situation. Therefore the noise climate is relatively quiet consisting of farming activities and wildlife. Closer to the two motorway crossings, background noise associated with the roads increases. Across the study area, air quality is generally good, although areas with air quality problems have been reported within some of the estuarine local authorities comprising the air quality study area; these are largely associated with concentrations of industrial activity or traffic emissions associated with highways congestion within urban areas.

There are a number of Areas of Outstanding Natural Beauty (AONB) designated around or overlooking the study area, these include the Wye Valley, Cotswolds, Mendip Hills and Quantock Hills AONB. On the Welsh side of the estuary, the study area also takes in the Gwent Levels Landscape of Outstanding Historic Interest. The Estuary itself is framed by a number of substantial man-made landmarks, including the two road crossings, wind turbines at Bristol Port and the nuclear power station at Oldbury by way of example.

The study area includes areas identified by the Environment Agency as being subject to low levels of tidal and fluvial flood risk, with a number of residential properties falling within the 1:200 year flood plain.

In terms of access to recreation and tourism, a wide range of recreational activities occur throughout the study area, including walking (e.g. the All-Wales Coastal Path, Wye Valley Walk, River Parrett Trail), boating, bathing, wildfowling, bird watching and fishing. Specific examples include Cosmeston Lakes, Newport Wetlands Reserve, Brean Down, Flat and Steep Holm and the rivers Usk and Wye. The Glamorgan Heritage Coast extends west from the Vale of Glamorgan side of the study area; there are a further two Heritage Coast designations in wider area (The Gower and Exmoor).

Employment and other socio-economic issues (i.e. Housing)

Historically Wales was considered a country of mining and heavy industry, but the economy is now more diversified with growth in many sectors, including manufacturing; electricity, gas and water supply; wholesale and retail trade; hotels and restaurants; and real estate, renting and business activities. The key business sectors in the South West of England are primarily service-based

industries, with the fastest growing being business services, other services, education, and hotels and catering.

Tourism is one of the largest employment sectors in the Severn Estuary. Each year over 7.5 million visits are made to Somerset, Avon and South East Wales by UK residents alone, together bringing over £1billion to the region. Employment in tourism exceeds 70,000 in the Study Area and accounts for over 7% of total employment. Within the Study area over 45,000 persons are employed in construction, some 5% of the total workforce.

The ports and especially the Port of Bristol are also important economic activities employing around 6,000 including indirect employment in port service industries such as transport services. The marine aggregates industry (another important Severn Estuary activity) employs an estimated 1,100 persons in the Study Area. Commercial and other employment generating fishing and angling employs relatively few persons, estimated to be less than 100.

In Wales the Super Output Areas (SOAs) with the highest percentage of the most deprived ten percent in Wales, for access to services deprivation, are located outside of the study area. In South West England access deprivation has increased within the region between 2000 and 2007 for a number of services. Within the study area the local areas (MSOAs) suffering relatively high deprivation are concentrated in Cardiff and Bristol, with pockets of deprivation in Newport, Gloucester, North Somerset and Sedgemoor.

Future baseline during construction (2014-2020), operation (2020-2140) and decommissioning

In general, dramatic changes to the land use around the estuary is not anticipated. Future land use across the area is guided by various Planning documents on one hand and existing land use is governed and guided by conservation designations on the other hand. Broadly, speaking, for Wales, this is led by the Wales Spatial Plan and the various Local Development Plans developed by the various local authorities. Within the South West, the higher level planning document is the Regional Spatial Strategy, which informs the development of the Local Development Frameworks of the local authorities. Guided and governed by this framework, there are a number of known proposed developments likely to be completed by 2020, including the Seven Power development at the former Uskmouth A site.

The 2017 population in the study area is projected to be 2.2 million persons. Between 2017 and 2031 population growth is projected to continue at an average of 0.9%/year for the study area as a whole to a 2031 projected total of 2.5 million persons. There are no UK projections of future population beyond 2081.

Future noise sources contributing to the non-residential environment will result in changes of 1-3dB if the source of this noise increased in size significantly. Air quality in the potential construction period is predicted to be good, and is though it will continue to be so at least until the early part of the operational period.

There will be little noticeable change to the landscape around the estuary with current land-uses continuing and major landmarks such as the bridges and power stations remaining unchanged. In the period beyond 2020, landscape change is likely to remain heavily related to development around the estuary.

Access within and around the estuary is not anticipated to alter dramatically, although it is likely that localised changes associated with development and economic fluctuations will take place. There exists a proposal for a Severn Sea Ferry to convey passengers between Welsh and English ports across the Estuary. This is planned to be operating as early as 2010/2011.

Between 2009 and 2020 tidal flood risk for the majority of properties will remain low. Where the risk of tidal flooding is higher and funding allows, properties are likely to receive improved protection through state (or private) intervention. In the operating period studies have shown that, if there was no active response, predicted sea level rise would cause flood risk to increase and lowland areas to suffer greatly increased flooding. However, it is assumed that state intervention through investment in flood defences and other flood management methods would be justified to mitigate the majority of this risk.

The economy, employment and other socio-economic issues

Over the past 60 years the real growth in economic productivity in the UK has averaged 2.1%/year. If this continues into the future the local economies in the study area will grow at around 2%/year plus the growth in population. Extrapolating this out to 2140 will give huge but misleading estimates of future economic welfare and will ignore the effects of major future external impacts such as climate change. It will ignore also the impact on future incomes of meeting presently unforeseen spending commitments, private and public, and would give a very misleading idea of any level of future free resources. Whilst productivity improvements are expected to continue, in the absence of insight into future social and economic commitments it is not possible to assess the impact of future levels of income. For this reason it is not possible to project an economic baseline to 2140.

There are no direct official estimates of future employment numbers so we have used population growth projections to estimate future sector employment on the assumption that as local populations grow local economies and economic sectors expand broadly in proportion. This being the case tourism and construction employment in the study area is expected to grow around 9% up to 2017 and a further 60% to 2140. This method has also been applied to Marine Aggregates projected employment to 2017 and to 2140 (assuming demand can be met by supply).

Direct and indirect employment at the Severn Estuary ports (Bristol, Cardiff, Newport and Sharpness) is estimated at some 6,000 in 2008 growing to 6,200 in 2017 and 7,000 in 2047. There are no more distant employment estimates (i.e. beyond 2047).

Future employment in commercial and other employment generating fishing and angling is expected to continue at less than 100 throughout the period to 2140 with employment in salmon and sea trout tourism fishing declining over time in response to climate change.

Given the relativistic nature of social and economic deprivation there will always be communities relatively worse off. What is unknown and cannot be predicted is whether the presently identified communities with high levels of deprivation will continue to be so in the longer term. They are assumed to be to 2020 but no assessment can be made into the more distant future.

Key Environmental Issues and Problems

Of the 5 ports in the study area Port of Bristol is by far the largest employer accounting for 83% of Severn Estuary port employment (an estimated 5,000 FTE out of 6,000 FTE in total).

The port's attraction to users depends in part on vessel accessibility and tidal and other restrictions. Maintaining vessel accessibility is a key issue for Port of Bristol and the employment generated.

Salmon and sea trout are migratory species and require free access to the sea (and vice versa). Maintaining this free access is a key issue for tourism fishing on the Rivers Usk, Wye and Severn. Over time climate change is expected to reduce salmon and sea trout stocks in the Rivers Usk, Wye and Severn.

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.

Two specific methodologies were developed to interpret and adapt the baseline information for the assessment of the socio-economic effects. The first required collation of local authorities' demographic and employment indicators to be able to assess key socio-economic issues. This spreadsheet contains Nomis data on employment, economically active, JSA and employment rates by gender. The 2017 employment estimates applied National Statistics LAD project population growth rates to the LAD "in employment" estimates (i.e. employment expanded as per projection population growth). This data was then used as a basis for assessing the various employment linked effects anticipated for each alternative option.

The second cross-referenced relevant GIS project data against the identified MSOA study area (i.e. properties, transport infrastructure, communities' services and facilities, PRoW, recreational areas, landtake and development land area) to identify which MSOAs were most likely to be physically affected as result of an STP alternative option.

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	Approx. Length	Operating mode	Turbine type	No. Turbines	Annual energy output	No. Caissons	No. 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

The Communities topic has identified potentially significant effects arising from:

- Loss of employment from ports business as a result of the perceived disruption to commercial shipping in the estuary;
- Loss of fishery-based employment as a result of effects on migratory and estuarine fish;
- Cumulative construction related effects on certain MSOAs for some of the alternative options. In the case of L3d, there is potential for further cumulative construction phase effects should the development of such an alternative option coincide with new nuclear development at Hinkley Point.

In addition, in the case of B3, B4, B5 and L3d, there is potential for further cumulative construction phase effects should the development of such an alternative option coincide with new nuclear development at Oldbury Power station, Hinkley Point power station, the Port of Bristol Deep Sea Container Terminal and expected increase in house building in North Somerset.

A summary of key effects resulting from the alternative options predicted in relation to the Communities' topic receptors are given below:

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

Construction employment 7,500 – 8,500 FTE/year during 4 peak years of construction plus 750 – 1,000 FTE permanent operational employment.

Following the REIS Medium Impact scenario (confirmed by REIS Phase Re-working and Updated Assessment) the B3 barrage is expected to reduce Severn Estuary ports' trade by 30% during construction and 60% during operation. Assuming employment levels reflect port trade, this would yield a significant adverse effect of around 1,850 FTE being lost during construction and 4,200 FTE lost during operation.

The location of the B3 structure at Brean Beach and Lavernock Point is expected to have adverse effect on local tourism at each of these locations.

The relocation of Marine Aggregate dredging downstream of B3 may affect the dredging cycle and reduce activity and employment in the industry.

The SEA's migratory and estuarine fish assessment identifies the potential for the collapse of salmon and sea trout populations within the Rivers Wye and Severn and to a lesser extent the Usk as a result of B3 Brean Down to Lavernock Point Barrage (STP 2010d). This may lead to the cessation in salmon and sea trout fishing and its related employment within the Severn Estuary and tributary rivers - a significant, permanent, reversible, adverse effect commencing during construction. There are also predicted to be adverse effects on eel populations within the Rivers Severn and Wye, potentially leading to the partial or complete closure of heritage (elver) fisheries within the Severn Estuary and tributary rivers.

This alternative option is likely to have significant adverse effects on health and quality of life of the population of the Vale of Glamorgan 008 and Sedgemoor 002 MSOA resulting from the concentration of construction activities in these areas and the resultant disruptions from construction traffic, air quality and landscape issues during the construction period.

Alternative Option B4: Shoots Barrage

Construction employment 2,000 – 3,000 FTE/year during 3 peak years of construction plus 100 – 200 FTE permanent operational employment.

No effect expected on Marine Aggregates extraction.

The SEA's migratory and estuarine fish assessment identifies the potential for the collapse of salmon and sea trout populations within the Rivers Wye and Severn and to a lesser extent the Usk as a result of B4 Shoots Barrage (STP 2010d). This may lead to the cessation in salmon and sea trout fishing and its related employment within the Severn Estuary and tributary rivers - a significant, permanent, reversible, adverse effect commencing during construction. There are also predicted to be adverse effects on eel populations within the Rivers Severn and Wye, potentially leading to the partial or complete closure of heritage (elver) fisheries within the Severn Estuary and tributary rivers.

Alternative Option B5: Beachley Barrage

Construction employment 1,500 – 3,000 FTE/year during 3 peak years of construction plus 80 – 100 FTE permanent operational employment.

No effect expected on Marine Aggregates extraction.

The SEA's migratory and estuarine fish assessment identifies the potential for the collapse of salmon and sea trout populations within the Rivers Wye, Severn and Usk as a result of B5 Beachley Barrage (STP 2010d). This may lead to the cessation in salmon and sea trout fishing and its related employment within the Severn Estuary and tributary rivers - a significant, permanent, reversible, adverse effect commencing during construction. There are also predicted to be adverse effects on eel populations within the Rivers Severn and Wye, potentially leading to the partial or complete closure of heritage (elver) fisheries within the Severn Estuary and tributary rivers.

Alternative Option L2: Welsh Grounds Lagoon

Construction employment 3,000 – 4,000 FTE/year during 4 peak years of construction plus 120 – 180 FTE permanent operational employment.

Possible effects on Marine Aggregates dredging cycle for Bedwyn Sands and North Middle Ground extraction.

The SEA's migratory and estuarine fish assessment identifies the potential for the collapse of salmon and sea trout populations within the Rivers Wye, Severn and Usk as a result of L2 Welsh Grounds Lagoon (STP 2010d). This may lead to the cessation in salmon and sea trout fishing and its related employment within the Severn Estuary and tributary rivers - a significant, permanent, reversible, adverse effect commencing during construction. There are also predicted to be adverse effects on eel populations within the Rivers Severn and Wye, potentially leading to the partial or complete closure of heritage (elver) fisheries within the Severn Estuary and tributary rivers.

It is likely to have significant adverse effects on health and quality of life of the population of Monmouthshire 009 and Newport 015 as a result of the cumulative disturbance from increased traffic and associated air quality and landscape issues during construction.

Alternative Option L3d: Bridgwater Bay Lagoon

Construction employment 4,000 – 6,000 FTE/year during 5 peak years of construction plus 200 – 300 FTE permanent operational employment.

The location of the L3d structure at Brean Beach is expected to have adverse effect on local tourism at this location.

The SEA's migratory and estuarine fish assessment identifies the potential for the collapse of salmon and sea trout populations within the Rivers Wye and Severn and to a lesser extent the Usk as a result of L3d Bridgwater bay Lagoon (STP 2010d). This may lead to the cessation in salmon and sea trout fishing and its related employment within the Severn Estuary and tributary rivers - a significant, permanent, reversible, adverse effect commencing during construction. There are also predicted to be adverse effects on eel populations within the Rivers Severn and Wye, potentially leading to the partial or complete closure of heritage (elver) fisheries within the Severn Estuary and tributary rivers.

This alternative option is likely to have significant adverse effects on health and quality of life of the population of the West Somerset 004 and Sedgemoor 002 due to important disruptions due to traffic and air quality and landscape issues during construction.

It is thought that the above effects could be further compounded should the development of the L3d alternative option take place concurrently with the development of a new nuclear facility at the proposed Hinkley Point C site. It is not thought that the presence of one or other of these schemes would prevent the other from operating.

Assumptions, Limitations and Uncertainty

Assumptions

- The REIS Medium Impact scenario is a scenario but is considered to be the best indicator of effect at the present time.
- The buffer zones are indicative and the location of onshore developments requires more detailed study
- For the purpose of clarity, the decommissioning phase has been assumed to be a reversal of the construction phase.
- All construction traffic has been assumed to be composed of HGVs.
- All on-site construction traffic has been assumed to be composed of HGVs.
- Where a population has been referred to, it has been assumed that the community's total population is subject to air quality effects.
- Construction activity occurs uniformly across the construction buffer area.
- Future public access for receptors remains unchanged from the current baseline.
- No new landscape or seascape/marine designations of national importance or greater are formed within the study area.
- The consideration of consequential development and effects arising from these is not alternative option or location specific, owing to the speculative nature of determining what form potential consequential development might take. As a result, a concise high level qualitative assessment can only be made on the likely effects arising from consequential development.
- The expected proportion of locally recruited labour is that up to 20% of construction labour will be recruited locally provided this does not exceed 10% of the local area's supplier of construction sector employment.
- With up to 20% of construction labour locally recruited the balance 80%+ will be incomers combining a mix of daily commuting construction workers from the wider sub-region and more distant incomers requiring local accommodation.
- There is evidence that long construction projects generate some relocation (in-migration) of construction workers and their families, and that the extent of relocation is determined by the length of the construction period. For the STP alternative options with their different construction periods we have assumed 2.5% relocation/year of expected construction.
- The experience of other major projects is that the majority of construction workers requiring accommodation find it in local bed and breakfast accommodation, commercial and budget hotels and other short term lettings.

- In the absence of information on the skills mix required for operations and maintenance it will be assumed that 50% of staff can be recruited locally and 50% will be incomers from outside the local area.
- The long term baseline (2020 – 2140) for Atlantic salmon and sea trout reported in the SEA Migratory and Estuarine Fish Topic Paper shows substantial declines in modelled mean rod catches in the rivers Usk, Wye and Severn under each of the four different climate change assumptions adopted. In this Communities Topic Paper we assume Atlantic salmon and sea trout fishing supported employment is directly dependent upon fish catches in each of the three rivers and the assumption made is that employment levels will vary with catch levels.
- For marine aggregates it is assumed employment is directly related to landings of aggregates at each of the main aggregate landing ports in the study area.

Limitations and Uncertainty

- Tidal power technology is relatively new, hence the need for this study. With this is mind, it must be acknowledged that the identified effects are based on the limited availability of information
- There is uncertainty about the location of the caisson yard on the Welsh side of the Severn Estuary. This uncertainty makes it not possible to identify the likely location of caisson yard employment on the Welsh side. The assumption made is that this employment will be somewhere in the area Newport, Cardiff and Vale of Glamorgan
- There is uncertainty about the climate change assumptions adopted in the modelling of future mean rod catches of Atlantic salmon and sea trout. In this Communities Topic Pater we have adopted the best case assumption whilst recognising that the adverse effect could be greater than the case used as the basis for employment projection

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

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

The main measures that were taken during optimisation to prevent or reduce adverse effects on Communities' receptors are as follows:

- The alignment of the alternative options was changed from the original schemes in order to reduce the footprint on designated habitats and habitat features, and reduce the effect on historic environment, land and seascape, and local population.
- Alternative operating mode (ebb and flood operation), and variation in turbine and sluice numbers were modified, generating in turn a change in tidal range impact and change in effects on habitats and habitat features, water quality, port access and flood risk (PB/BV, July 2009[1]).
- Further refinement, including the introduction of measures necessary to prevent or reduce effects, and more detailed consideration of engineering design requirements, was carried out as the outputs of studies undertaken during the SEA became available.

The Communities topic has identified potentially significant effects arising from:

- Loss of employment from ports business as a result of the perceived disruption to commercial shipping in the estuary;
- Loss of fishery-based employment as a result of effects on migratory and estuarine fish;
- Cumulative construction related effects on certain MSOAs for some of the alternative options. In the case of L3d, there is potential for further cumulative construction phase effects should

[1] Options Definition Report. Version 1- Preliminary Options definitions for Review and Assessment (PB/BV, July 2009)

the development of such an alternative option coincide with new nuclear development at Hinkley Point.

Loss of employment from the ports

Despite the engineering measures proposed in the Navigation topic paper, the Phase 1 REIS (DTZ, 2009) and the Phase 2 update, both suggest that there will be significant adverse effects to port business resulting from the perceived effects of the alternative options, particularly B3 Brean Down to Lavernock Point, on shipping operations within the estuary.
In order to prevent or reduce such losses, it is recommended that consultation measures targeted at altering the perception that the construction phase will restrict navigation to the Estuary's ports are implemented. Whilst the details of these measures will need to be defined, it is suggested that as minimum these entail discussions with both the port operators and the shipping companies using the existing navigation are targeted.

Loss of fishery based employment

Whilst the numbers of jobs associated with this effect are small (less than 40 FTE) This effect is predicted to be significant in the sense that it represents the loss of most, if not all of the employment in this sector depending on which alternative option is being considered.

A number of measures to prevent or reduce adverse effects have been considered to reduce salmon, sea trout and eel mortality during transit of the B3, B4 and B5 barrages and upon entering or leaving the L2 and L3d lagoons, but the efficacy of these measures remains uncertain.

Construction related effects on population receptors

For all alternative options, there will be disruption to local communities caused by a large increase in regular HGV traffic delivering materials to site. For alternative options B3, L2 and L3d this is predicted to be significant for the MSOAs affected.

In order to prevent or reduce these effects the following measures are proposed:

- Reducing the number of vehicles on local roads through rationalising deliveries and use of larger vehicles. This would require consideration of logistical management, including timing and location of deliveries, and may require the use of materials transfer hubs to maximise the efficacy of the measure.
- Delivery of construction materials by alternative routes, such as by rail or by sea and maximising the use of existing temporary/permanent works arrangements. It is already planned to bring in embankment/rock fill material by rail to a railhead for transfer to ship for delivery to site. It is proposed that this approach could be extended to include other construction materials that would otherwise be brought by road.

Given the potential benefits of such an approach, it is recommended that consideration is given to applying a similar approach to the other two alternative options (B4 and B5) where construction effects would still be felt, but the current predicted effect arising from HGV traffic is lower.

In general, attention to addressing these effects through design informed by further environmental assessment and good management in the execution of any of the alternative options would prevent or at least reduce the severity of the effect.

For the purposes of this SEA, 'offsetting measures' are measures intended to make good for loss or damage to an environmental receptor, without directly reducing that loss/damage.

For effects on Communities receptors, it is considered that offsetting would likely take the form of financial compensation to make good for losses incurred, nuisance caused or loss of amenity. Such compensation is generally adopted as a last resort, once all other measures have been exhausted through examination and application during later design stages.

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:

Objective SE1: To create employment opportunities accessible to all

All alternatives will create local employment opportunities accessible to all, with B3 and L3d generating significantly more employment during construction and operation than L2, B4 and B5.

Objective SE2: To avoid adverse effects on the local and regional economy

B3 is expected to have adverse effect on the Severn Estuary ports, on salmon and sea trout tourism fishing, heritage (elver) fishing and on tourism at Brean Beach and Lavernock Point. The effects are not readily mitigable.

B4 and B5 are expected to have adverse effects on salmon and sea trout tourism fishing and heritage (elver) fishing, not readily mitigable.

L2 is expected to have adverse effects on salmon and sea trout tourism fishing and heritage (elver) fishing, not readily mitigable.

L3d is expected to have adverse effects on salmon and sea trout tourism fishing, heritage (elver) fishing and tourism at Brean Beach, none of which are readily mitigable.

Objective SE3: To promote the development of sustainable communities

All of the alternatives are expected to lead to some in-migration of population as some incoming temporary construction workers are expected to settle in the area with their families, as are all of the incoming operational staff. However, with the expected dispersion of in-migrants in the receptor communities and the difference in social and demographic characteristics of the two groups of in-migrants, the expected levels of in-migration are not expected to affect the population characteristics of the receptor communities.

Objective SE4: To avoid adverse effects on physical and mental health

All alternative options will result in a change to the local environment in terms of disruption due to traffic, air emissions, noise, landscape and flood risk. Likely significant negative effects are predicted under the alternative options B3, L2 and L3d. Unmitigated, these changes are in turn likely to result in a change to the health and well-being of the local population.

However, with the measures presented in the above section in place, and following good design and construction practices, it is considered that it will be possible for all of the alternative options to be implemented with a neutral or perhaps minor positive performance against this Objective.

Objective SE5: To avoid adverse effects on access to community services and facilities

All alternative options are expected to lead to some adverse effects on access to community services and facilities, being more important the effects for the alternative options B3 and L3d. However, significant negative effects have not been predicted for any of the alternative options.

It is also possible that demand for certain services and facilities may change as a result of population changes linked to the alternative options; some of the regional construction/decommissioning

employment requirements are expected to be covered by workers from outside the region; this may put pressure on local services and housing market since the in-migrant employees will require an accommodation within reasonable commuting distance of the construction site and a possible increase of the demand of local services, such as schools, hospitals, etc. However, as mentioned in Objective SE3, with the expected dispersion of in-migrants in the receptor communities, the estimated levels of in-migration are not expected to increase significantly the demand for services and facilities.

Objective SE6: To promote access to recreational facilities and open space

None of the alternative options will actively promote access to recreational facilities or open space, given their focus as energy generating projects.

All alternative options are anticipated to provide an opportunity for development within the local area. It is conceivable that a major tidal power scheme will facilitate or attract other developments. And one of the consequential developments identified through this SEA are the provisions for altered water-based recreation and tourism.

Objective SE7: To avoid adverse effects on existing, proposed and committed land uses

The effects summarised under Objective SE2 are also relevant here, with changes to economic activities likely to be translated into changes in land-use.

All of the alternative options will potentially affect, some known areas proposed or committed for development. This means that, there is some potential for cumulative effects with proposed/committed projects. Although these interactions have been identified, it is not thought that the presence of any of these schemes would prevent the others from operating.

Objective SE8: To seek opportunities to improve degraded environments

All of the Alternatives will generate employment opportunities within access distance to areas of high deprivation. The numbers of job opportunities will vary by alternative (see Objective SE1 discussed above) and the numbers potentially able to benefit will also vary by alternative

As mentioned in Objective SE6, whilst not the purpose of any of the Severn Tidal Power alternative options, it is conceivable that a major tidal power scheme will facilitate or attract other developments (i.e. altered water-based recreation and tourism, and energy intensive industry), which in turn it will result in a change of land use and an encouragement of regeneration/development within the local area.

Given the uncertainties associated with the above, it is not considered possible to speculate on whether the alternative options as currently described will support this Objective. There is undoubtedly potential for this to occur, but this will be dependant on the detailed design and planning stages of any of the alternative options.

Objective SE9: To avoid adverse effects on the housing market

As reported above in relation to SEA Objective 3, all of the alternatives are expected to lead to some in-migration of population as a proportion of incoming temporary construction workers are expected to settle in the area with their families as are all of the incoming operational staff. However, with the expected dispersion of in-migrants in the receptor communities the expected levels of in-migration are expected to be readily accommodated in the 2014 – 2020 housing stock in the receptor communities.

Plan Implementation

Legislation and policy compliance

The Objectives assessment in section 4 concluded that the alternative options considered would for the most part have either a positive or neutral effect in relation to the SEA Objectives. From this it is

concluded that there are likely to be no compliance issues with regard to existing legislation and policy in respect to these aspects.

All alternative options score negatively against the employment Objective (SE2). Therefore, there exists the potential for the alternative options to perform poorly in the light of economic aspects of the regional and local planning strategies, policies and frameworks. Furthermore there is potential for poor compliance with fish conservation policies and legislation; more detail is provided in the regard within the Marine and Estuarine Fish topic paper (STP, 2010d).

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.

Table 1 sets out a high level framework for monitoring. The framework for this topic includes a brief description of monitoring proposed and the relationship between proposed monitoring, predicted likely significant environmental effects and receptors affected.

Table 1. Monitoring of significant environmental effects

Significant Effect	Relevant receptor	Description of monitoring
Loss of employment	Ports of Bristol, Cardiff, Newport and Sharpness	Monitor port employment
Loss of employment	Rivers Usk, Wye and Severn Atlantic salmon and Sea trout fishing supported employment; and Rivers Severn and Wye heritage (elver) fishing supported employment	Monitor mean rod catches as indicator of employment
Effects on Health & Quality of Life	Population within affected MSOAs	Baseline monitoring programme to ensure development of suitable design elements to prevent/reduce effects and to inform construction monitoring requirements. Construction monitoring programme to ensure efficacy of the above and identify any remedial actions required during construction phase. This should include: Noise Air Quality Visual effects Traffic