Offshore Renewable Energy Development Plan (OREDP) For Ireland

Strategic Environmental Assessment (SEA)

Volume 1: Non – Technical Summary (NTS)

Prepared: October 2010

Contents

1: Introduction

This document provides a Non-Technical Summary of the results of the Strategic Environmental Assessment (SEA) of the Offshore Renewable Energy Development Plan (OREDP) for Ireland. The detailed results from the assessment are presented in the Environmental Report (ER) which can be found at the website address below:

http://www.seai.ie/Renewables/Ocean_Energy/

SEA Legislation

The SEA of the OREDP was carried out in accordance with the following legislation and guidance:

- Directive 2001/42/EC 'Assessment of Certain Plans and Programmes' (SEA Directive).
- EC Environmental Assessment of Certain Plans and Programmes Regulations 2004 (S.I. 435/2004).
- Environmental Protection Agency (EPA) SEA Guidance 'Development of Strategic Environmental Assessment (SEA) Methodologies for Plans and Programmes in Ireland' (EPA 2003).

Subject of the SEA (Screening)

The OREDP, which is the subject of this SEA, includes scenarios for the development of offshore renewable energy in Irish waters up to 2030, including an initial review in 2015 and a full review in 2020. It has therefore been identified that, in accordance with the SEA Directive and Regulations, that an SEA is required on the basis that:

- The OREDP will be prepared for energy related development.
- The OREDP will contain scenarios for the development of offshore renewable energy, which could, in some areas off the coast of Ireland give rise to significant adverse effects.
- The OREDP is being prepared by the Department of Communications, Energy and Natural Resources (DCENR) for adoption at a national level.

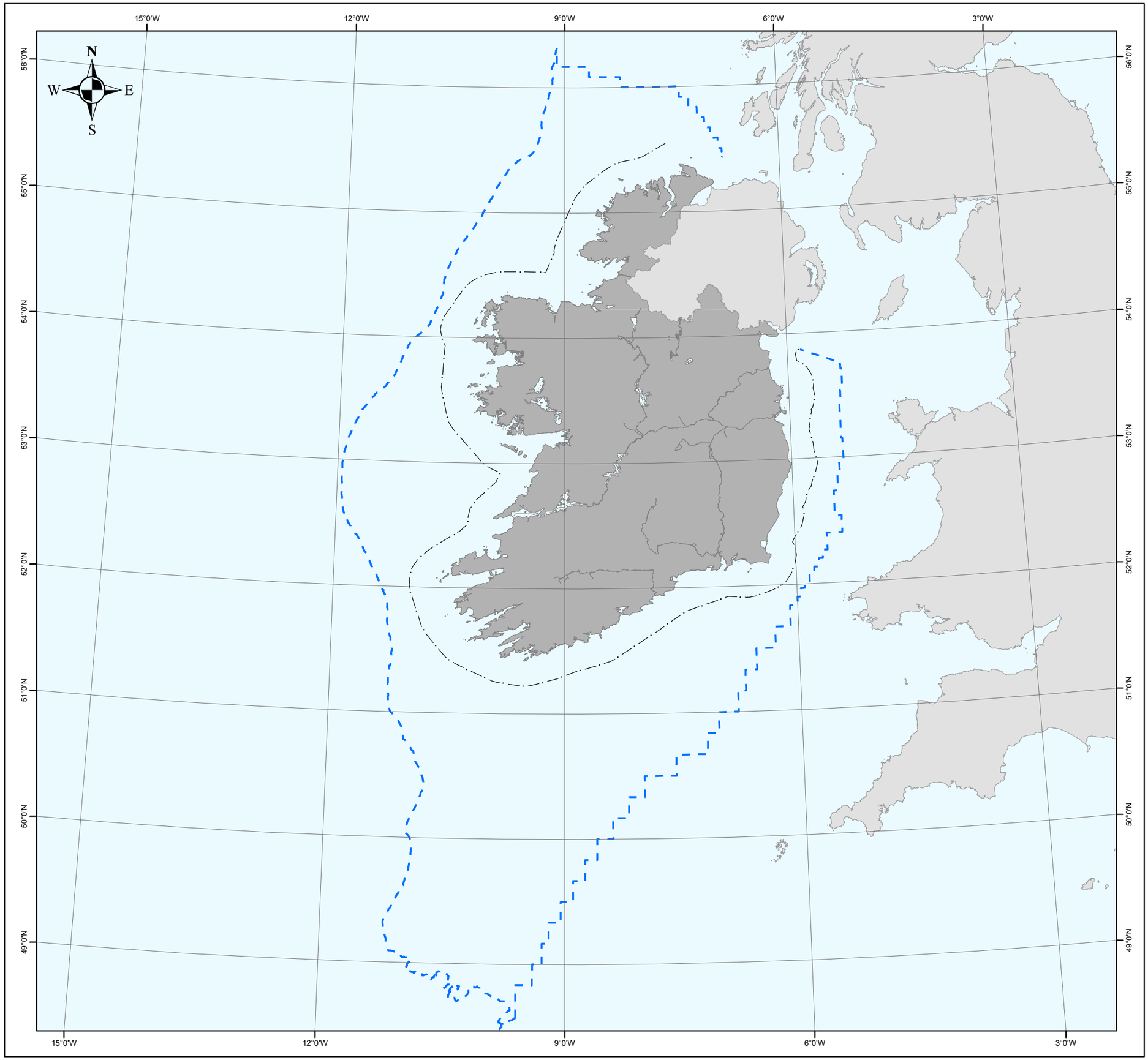
Scope of the SEA

The proposed scope of the SEA was set out in the scoping report that was prepared by SEAI in July 2009 for consultation. Responses from scoping consultation are presented in Chapter 4 of the Environmental Report and can be downloaded from the SEAI website http://www.seai.ie/Renewables/Ocean_Energy/. The responses from the scoping consultation process informed the scope of the SEA which includes:

- Timescale for the SEA and OREDP is 2030 with an initial review in 2015 and a full review in 2020.
- Focus of the SEA is the assessment of scenarios for the development of up to 4,500MW from offshore wind and 1,500MW from wave/tidal.
- The **SEA Study Area** includes:
  - All Irish waters from the Mean High Water Mark out to the 200m water depth contour off the west and south west coast of Ireland and the Irish Exclusive Economic Zone (EEZ) off the north, east and south east coast of Ireland.
  - The study area includes a number of **Assessment Areas** which include the main areas of resource identified for offshore wind, wave and tidal energy.
- The **SEA Assessment Areas** include:
  - Areas below Mean High Water Mark that encompass the main areas of resource for offshore wind (fixed and floating), wave and tidal energy, although potential effects above the Mean High Water Mark have been considered for particular SEA issues/subjects e.g. seascape.
  - Fixed foundation structures (offshore wind, wave and tidal) to 60m depth
  - Floating wind structures to a distance of 100km from the shoreline - this distance reflects the upper length limit of Alternating Current (AC) cable technology (for greater distances (beyond 100km) Direct Current (DC) cables would be required with convertor stations on land to convert to AC).
  - Tidal stream velocities of1.2m/s or greater.
- The assessment will consider:
  - Potential effects of scenarios for developing up to 4,500 MW of offshore wind and 1,500 MW of wave and tidal energy irrespective of commercial viability or other economic constraints.
  - Spatial distribution of suitable areas for development independently of the existing onshore power transmission grid.
  - Areas within Natura 2000 sites or areas protected under other national or international instruments.

Strategic Environmental Assessment of Wave, Tidal and Offshore Wind Development in Irish Waters

Figure 1.1: Study Area



Legend

Background

- Ireland
- United Kingdom
- Study area
- 12nm limit

Note 1: Not to be used for navigation

0 35 70 140 210 280 km

Date	Monday, October 4, 2010 10:12:52	
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Data Source	SEI, GEBCO, UKHO	
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Checked	Produced By	Louise Mann
	Reviewed By	Sally Holroyd

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SEA Issues/Subjects

The main issues covered in the SEA are listed below. This list is derived from the SEA Directive and refined to make it relevant to the coastal and marine environment. The effects of offshore wind and marine renewable energy developments on these issues/subjects are summarised in Section 6: Assessment Results. The issues covered in the SEA include:

- **Soil and water** (substrate including sediment, geology, geomorphology and coastal processes, water quality).
- **Biodiversity, flora and fauna** (protected sites and species including sea birds, fish, marine mammals and reptiles, benthic ecology).
- **Cultural heritage including archaeological heritage** (marine and coastal archaeological and historical natural/built environment including wrecks and submerged landscapes).
- **Population and human health** (commercial fishing, aquaculture, shipping and navigation including navigational safety, ports and harbours, recreation and tourism, radar interference and military practice areas).
- **Material assets** (cables and pipelines, coastal infrastructure, oil and gas infrastructure, aggregates, dredging and disposal areas).
- **Landscape/Seascape** (seascape quality and character).
- **Climatic factors** (Renewable energy developments, CO_2 emissions, carbon storage and responding to climate change e.g. threat of sea level rise on coastal infrastructure.

This SEA does not cover socio-economic impacts. The SEA does assess the potential effects on different marine sectors and users of the sea in terms of the potential for disruption to activities and physical displacement from certain areas within Irish waters. However, it does not use any economic or monetary values to quantify the potential effects of the disruption or displacement of marine activities.

Air Quality was scoped out of the SEA as it was determined at the scoping stage that atmospheric emissions from offshore wind and marine renewable energy developments are likely to be minimal and therefore unlikely to have a significant effect on air quality. However, effects on climate are included in the SEA.

SEA Steering Group

The SEA has been guided by a Steering Group comprising representatives from a range of stakeholders including:

- Sustainable Energy Authority Ireland (SEAI)
- Environmental Protection Agency (EPA).
- Department of Communications, Energy and Natural Resources (DCENR).
- Department of the Environment, Heritage and Local Government (DEHLG).
- National Parks and Wildlife Service (NPWS).
- Marine Institute.
- National Offshore Wind Association of Ireland (NOW Ireland).
- Marine Renewable Industry Association (MRIA).
- The Irish Environmental Network (IEN).
- Defence Forces.
- Department of Transport Ireland (DOT).
- Fáilte Ireland.
- EirGrid.
- Geological Survey of Ireland (GSI).

Differences between SEA and EIA

The main difference between EIA and SEA is the SEA focuses on the assessment of plans and programmes where as EIA focuses on individual projects. Consequently, SEA tends to cover large geographical areas and the plan/programme being assessed can include a range of different types of project relating to a number of different broad areas for development, whereas EIA is site specific and deals with only one project. This is reflected in the assessment of environmental effects where SEA focuses on identifying the 'likely' significance of 'potential' effects, whereas EIA deals with precise effects and evaluated actual significance. Further detail on the main differences between the EIA and SEA process is presented Chapter 1 of the Environmental Report.

Informing Preparation of the OREDP

The focus of the SEA is to test the scenarios set out in the OREDP for the development of up to 4,500MW from offshore wind and 1,500MW from wave and tidal energy within Irish Waters. Further detail on the OREDP developments scenarios is provided in Section 2.

With regard to informing the development of the OREDP, the main objective of the SEA is to identify where development is most likely to occur, identify the potential environmental constraints in those areas and, taking potential environmental effects/ constraints into account, assess the levels of development that could occur in a certain area (Assessment Area). The levels of development that could occur in a certain area are then reviewed against the development scenarios to determine which of the scenarios could be achieved without any likely significant adverse effects on the environment. In summary the SEA will:

- Identify whether it is possible to achieve the development scenarios set out in the OREDP.
- Identify broad areas for development, acknowledging that within those broad areas there are likely to be a number of data and knowledge gaps, therefore potential effects on certain receptors may be unknown.
- Identify where further information/data is required in order to determine the significance of potential effects on certain environmental receptors e.g. site or area specific surveys/studies, and what would need to be taken into account as part of a project level EIA for development in certain areas.

Assessment Limitations

There are a number of limitations associated with this SEA and areas/items of general concern or interest to a wider group of stakeholders that are not within the scope of this SEA. These are mainly related to:

- Data and knowledge gaps
- Scope of the SEA

The main limitations relating to this SEA include:

- Range of technologies and device types – with a number of wave and tidal technologies still emerging/being developed.
- Data and information gaps – in relation to the distribution, abundance etc of certain key environmental receptors.
- Knowledge gaps in relation to how different technologies/device types interact with the environment and how certain receptors respond to different devices.

The main exclusions from this SEA are summarised in Table 1.1 below.

Table 1.1: Scope of SEA

Inside of Scope of the SEA	Outside the Scope of SEA
Potential environmental effects will be identified and assessed at a strategic level.	Effects will not be assessed at a project specific level. The SEA also does not replace the need for project level EIAs to be carried out.
The SEA will provide baseline information pertinent to the strategic issues associated with the potential development of offshore renewable energy.	The SEA will not replace the need for developers to collect detailed project specific baseline data.
The SEA will inform the development and implementation of the OREDP.	The SEA will not specifically address issues of grid development policy, socio-economic development, or policy relating to consent procedures but will cross refer to other work where relevant.
The SEA will help identify areas where there may be opportunities for, or environmental constraints against, development.	The SEA will not demarcate specific sites or areas for development or avoidance but will identify the technical issues leading to constraints or opportunities
	The SEA will not examine the commercial viability of development or provide cost benefit analysis.

2: Overview of the Offshore Renewable Energy Development Plan (OREDP)

Background

Under Directive 2009/28/EC, Ireland's target is that 16% of all energy (heat, transport and electricity) consumed is from renewable sources by 2020. In addition, the Irish Government set its national targets for the production of energy from renewable sources at 33% by 2020 (The Energy White Paper, 2007). This target was then increased to 40% in the 2009 Carbon Budget.

National Renewable Energy Action Plan (Ireland)

Ireland's 'National Renewable Energy Action Plan' (NREAP) sets out how Ireland will meet the overall target of 16% set out under Directive 2009/28/EC which will broadly be made up of 12% heat from renewable sources (RES-H), 10% transport from renewable sources (RES-T) and 42.5% electricity from renewable sources (RES-E).

The NREAP identifies that offshore renewable energy (offshore wind, wave and tidal energy) will make a significant contribution to the RES-E element of Ireland's overall renewable energy target.

Delivering Offshore Renewable Energy in Ireland

Delivery of offshore renewable energy in Ireland is being approached from a technical and strategic level. At a technical level, delivery is being actively supported through the National Strategy for Ocean Energy prepared in 2005 by the Marine Institute and the Sustainable Energy Authority for Ireland (SEAI). This strategy includes a number of initiatives including the establishment of wave and tidal testing facilities and supporting research and prototype development by industry.

At a strategic level, the Government's Sea Change: A Marine Knowledge Research and Innovation Strategy for Ireland 2007 – 2013 sets out key national level research and economic initiatives for driving forward the development of the marine sector in Ireland.

OREDP

Aim of the OREDP

The aim of the OREDP is to set out scenarios for the development of up to 4,500MW from offshore wind energy and 1,500MW from wave and tidal energy in Irish waters up to 2030, including an initial review in 2015 and a full review in 2020, and to set out a longer term vision for the growth of the offshore renewable energy sector in Ireland.

Objective of the OREDP

The objectives of the plan are to:

- Describe the policy context for development of the offshore marine renewable sector;
- Provide information on the state of play on activities and initiatives that are underway in the marine renewable energy sector;
- Set out some development scenarios for the period 2030; and
- Set out the long term vision for the sector.

Main Proposals within the OREDP

The SEA is based on the main proposals set out in the OREDP which include a series of scenarios for the development of up to 4,500MW from offshore wind and 1,500MW of wave and tidal energy within Irish waters. These development scenarios, as set out in Table 2.1 below are based on the following:

- **Low**: This scenario consists of the 800MW of offshore wind to receive a grid connection offer under Gate 3. It also includes 75MW of wave and tidal development, which is included in the Table 10 modelled scenario in the National Renewable Energy Plan (NREAP).
- **Medium**: This scenario consists of 2,300MW of offshore wind, which comes from the Table 10 non-modelled scenario of the NREAP (broadly based on the combination of offshore wind projects with either foreshore lease or grid connection) and the 500MW of wave and tidal energy in the same table (the Government's 2020 ocean energy target).
- **High:** This scenario consists of 4,500MW of offshore wind and 1,500MW of wave and tidal current. These figures come from the SEA Scoping Report.

Table 2.1: Development Scenarios

Development Scenarios to 2030			
	Low Scenario (MW)	Medium Scenario (MW)	High Scenario (MW)
Wind	800	2,300	4,500
Wave and Tidal	75	500	1,500

Longer Term Vision for the Growth of the Offshore Renewable Energy Industry

The plan also provides information on other areas and factors that potentially influence the establishment and long term growth of the offshore renewable energy industry but which are outside the scope of the OREDP and therefore do not form part of this SEA.

These include areas for growth and/or future investment such as the development of grid connected test facilities and evolution of appropriate regulatory, consenting and trading mechanisms.

The OREDP also identifies a number of factors that need to be addressed in the period up to 2030 to enable the full exploitation of the natural resources within Ireland's ocean territory and for Ireland to become an exporter of offshore renewable energy to the rest of Europe. These factors, which fall outside scope of the OREDP and therefore are not part of this SEA, include:

- Technological advances in wave and tidal devices;
- Technological advances in harnessing wave, tidal and offshore wind energy in more arduous conditions such as off the west coast of Ireland;
- Grid developments to facilitate increased capacity;
- Increased joined up working with Northern Ireland, rest of the UK and Europe on the development of offshore grid;
- Development and provision of onshore infrastructure e.g. ports to support the construction and maintenance of offshore renewable energy developments.
- An improved and streamlined regulatory framework.

3: Approach and Method

The approach applied to the assessment of the effects of offshore wind, wave and tidal energy developments on the marine and coastal environment of Ireland comprises three parts:

Part 1: Generic environmental effects (Chapter 10).

Part 2: Detailed assessment of specific Assessment Areas (Chapter 11).

Part 3: Cumulative assessment (Chapters 12 and 13).

Part 1 of the assessment (**Generic Assessment**) is non spatial. The focus of this part of the assessment is to provide a review of existing information and knowledge on the potential effects that the different technologies and device characteristics considered as part of this SEA could have on the main environmental receptors covered by the SEA.

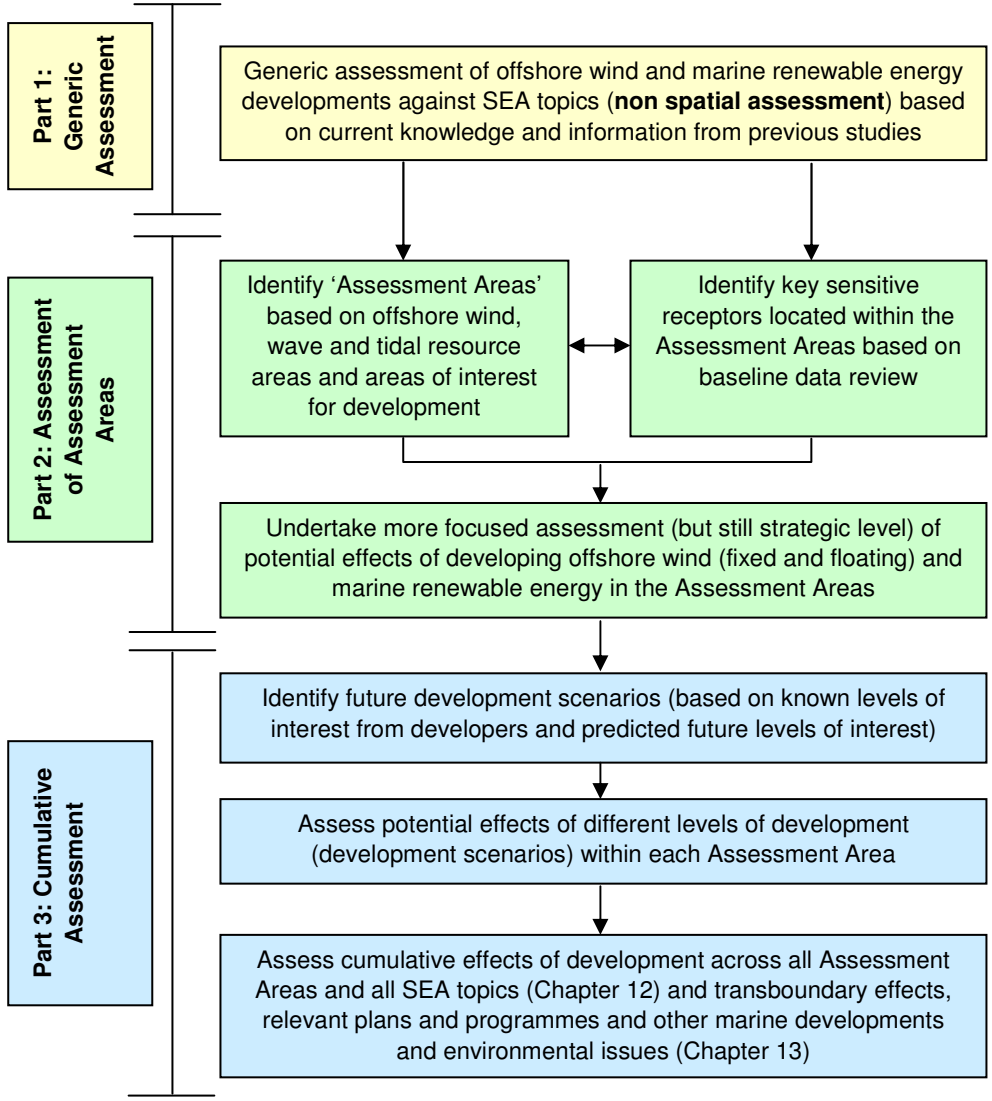
Parts 2 and 3 of the assessment focus on assessing the potential effects of the different technologies and device characteristics, and cumulative effects of different amounts of development (MW) on the key environmental receptors known to be present within/or associated with the main '**Assessment Areas**' within the study area.

The purpose of the **Assessment Areas** is to:

- Improve the manageability of the study area.
- Focus the assessment on the main areas of offshore energy resource (offshore wind, wave and tidal) within Irish waters.
- Reflect the main areas of current and future developer interest.

It is acknowledged that developers may seek to develop sites located outside the main assessment areas. Although these sites may not be included in the Assessment Areas **this SEA does not preclude development outside these areas.** These areas have been covered by Part 1: Generic Assessment and any development in the study area (within or outwith the Assessment Areas) will also have to be considered on a case by case bases and subject to a project level Environmental Impact Assessment (EIA).

Figure 3.1: Approach to the Assessment



Assessment Methodology

The method used in Parts 2 and 3 to assess the likely significance of potential effects on the majority of subjects covered by this SEA is summarised in Figure 3.2 below. This assessment method reflects an objective approach to the assessment of effects e.g. effects have been assessed based on specific quantifiable facts and figures. However, by nature, seascape assessments tend to be more subjective.

Consequently the method applied to the seascape assessment differs slightly from the method described below. This is necessary to reflect the more subjective nature of the seascape assessment. Details of the seascape assessment are presented in Chapter 6 of the Environmental Report.

Figure 3.2: Assessment Method

Identification of how offshore wind and marine renewable energy technologies/device characteristics interact with the marine environment (based on generic effects identified in Part 1).

↓

Identification of key receptors (in relation to SEA issues/subjects) located within the Assessment Areas that could potentially be affected by commercial scale offshore wind, wave or tidal developments.

↓

Assessment of likely significance of potential effects of commercial scale offshore wind, wave and tidal developments WITHOUT mitigation.

↓

Identification of mitigation measures that could be implemented to reduce, avoid or offset the overall likely significance of potential effects.

↓

Assessment of residual effects (likely significance) of commercial scale offshore wind, wave and tidal devices WITH mitigation.

Presentation of Results

Part 1: Generic Assessment

Results from Part 1 of the assessment are provided in Chapter 10 of the Environmental Report (Generic Assessment). This includes a review of all potential effects for each of the stages of a commercial offshore renewable energy development from installation, through operation, maintenance to decommissioning for the different SEA subjects and key environmental receptors.

Part 2: Assessment of Assessment Areas

The results of the 'assessment area' assessment (Part 2) are presented in a series of matrices which include the following information:

- SEA subjects where potential strategic environmental effects could occur.
- Type of potential effect.
- Phase of the development during which the potential effect is likely to occur e.g. installation, operation, maintenance and decommissioning.
- Device characteristics that are likely to give rise to potential effects.
- Device types (offshore wind (fixed and floating), wave and tidal).
- Assessment of potential effect (effect without mitigation).
- Summary of key environmental sensitivities (from baseline data) and description of potential effect.
- Description of possible project level mitigation measures that could be implemented to reduce, avoid or offset possible adverse effects.
- Assessment of potential residual effects (effects with mitigation).

A summary of the key results from this assessment are presented in Section 6 below.

Confidence levels have been assigned to the results from the assessment of the main assessment areas to reflect the level of certainty by which conclusions can be drawn from the results. Confidence levels (low, medium and high) are of particular importance in terms of this SEA as they are necessary to reflect where known data and knowledge gaps influence various results from the assessment.

Mitigation measures

Project level mitigation measures have been taken into account in the assessment of likely significance of potential effects. Although it is acknowledged that the measures identified will not necessarily be incorporated into the plan (OREDP) they are recognised as current best practice and therefore these measures should be incorporated into future projects. However, it is considered to be reasonable to assume that they would be implemented by a responsible developer and that they are likely to be necessary in order to achieve consent at the project level e.g. as part of the EIA process.

Cumulative Assessment

The cumulative assessment was split into two sections:

Section 1: Cumulative effects: testing OREDP development scenarios (Chapter 12 of the Environmental Report).

Section 2: Cumulative effects: other plans, programmes and marine developments (Chapter 13 of the Environmental Report).

Section 1: Testing OREDP Development Scenarios

The cumulative assessment is the main focus of the SEA. The aim for this part of the assessment is to assess the potential effects that varying levels of development e.g. numbers of commercial scale offshore renewable energy developments (offshore wind, wave and tidal) and total megawatts (MW) produced would have on the environment within each of the assessment areas.

The results from this assessment are then reviewed in order to determine whether it would be possible to achieve the high level scenario presented in the OREDP for developing 4,500MW from offshore wind and 1,500MW from wave and tidal energy.

The results from this assessment are presented in Chapter 12 of the Environmental Report and concluded in Section 7 of this NTS.

Section 2: Dealing with Existing and Proposed Developments

Existing and proposed developments have been taken into account in the assessment of the cumulative effects. However, it is not the focus of the SEA to examine individual sites for development.

In terms of identifying the amounts (MW) of development that could be accommodated in each Assessment Area (with and without environmental constraints), existing and proposed developments have been taken into account in the overall total (MW) that could potentially be developed in an area. For example, in Assessment Area 1: East Coast (North), the assessment has identified that there is potential to develop between 1200MW and 1500MW from offshore wind without likely significant adverse effects on the environment. However the assessment also recognises that of that 1200MW to 1500MW, 480MW have already been granted a foreshore lease or are due to receive an offer of grid connection, therefore taking into account existing projects the remaining resource in that Assessment Area is between 720MW and 1020MW.

Section 3: Other Plans, Programmes and Developments

The cumulative assessment also considers the potential effects of implementing the OREDP in combination with other marine developments implemented through other plans and programmes. These include:

- Requirements for the implementation of the OSPAR Convention, Habitats Directive and Marine Strategy Framework Directive (MSFD)
- Proposals for marine planning in Ireland.
- Transboundary effects of other plans and programmes in Irish, Northern Ireland, rest of UK and European Waters such as the Ireland Offshore Strategic Environmental Assessments (IOSEAs) 1 to 4, Northern Ireland Offshore Renewable Energy Strategic Action Plan (ORESAP), The Crown Estate (UK) leasing rounds for offshore wind (Rounds 1, 2 and 3 and Scottish Offshore Wind), and the DECC UK Offshore Energy SEA 2 (OESEA2).

4: Technologies

This SEA focuses on the following types of device:

- Offshore Wind (Fixed and Floating)
- Wave
- Tidal Stream

Offshore Wind (Fixed and Floating)

Offshore wind devices are generally the most advanced and standardised types of devices. The most common type of commercial scale offshore wind farm that is deployed today is the Horizontal Axis wind turbine:

Horizontal Axis Wind Turbine

Each turbine has a capacity of between 3MW and 5MW. They have a height from base to tip of around 80m to 120m and a tower height of about 60m to 80m. The blades are typically 40m long.

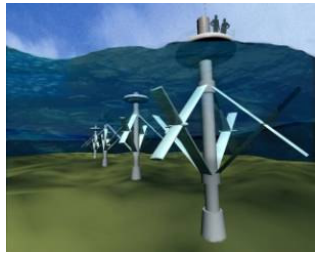
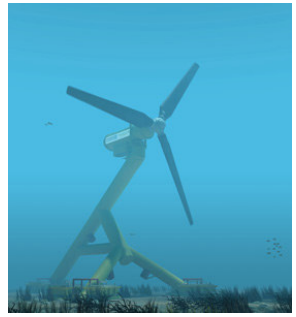
Most offshore wind developments to date have been built in shallower water (e.g. less than 30m depth) with either piled or gravity base foundations. However, new devices are currently being tested that would enable deployment in deeper water e.g. 40m to 60m depth.

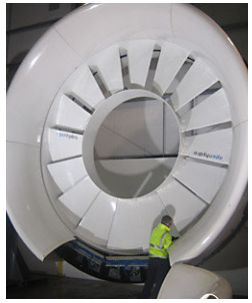
Arklow Bank, East Coast of Ireland.

These include turbines that use quadropod jacket bases in waters of around 45m depth and floating devices which use moored platforms and are currently being tested at full scale. These could enable windfarms to be developed in much deeper waters e.g. more than 100m depth.

Wave and Tidal

The technologies for extracting energy from waves (wave height or energy from the motion of waves) and tidal streams are still being developed and tested. Consequently there are a wide range of different types of wave and tidal devices that needed to be taken into account in the SEA. Some of the different devices are illustrated below:



(Sources: clockwise from top left: AquaMarine Power (Oyster), Ecofys, Hammerfest HS1000, Pelamis Wave Power Ltd, OpenHydro, Marine Current Turbines Ltd (SeaGen), Wavebob).

5: Offshore Renewable Energy Resource

Overview of Potential Resource

Chapter 8 of the ER identifies that there is a huge potential resource of offshore wind and wave energy in the waters around Ireland, in particular off the west coast where the prevailing westerly winds and wave fetch (distance of open water over which waves are formed) are strongest. There also some smaller, more discrete areas of tidal resource. These are mainly located off the east coast and northwest coast around Donegal. Tidal resource was also identified in the Shannon Estuary.

However, most of the resource identified is purely theoretical, in that whilst it exists, a large proportion of it cannot be exploited for a number of reasons, mainly relating to the technical feasibility and economic viability of harnessing energy from such extreme, harsh and challenging environments. However there are a number of locations off the coast of Ireland where there are potential opportunities for exploiting the available offshore wind, wave and tidal resources.

Assessment Areas

In order to make the make the study area more manageable and provide more detail and focus to the assessment of cumulative effects the study area was split into seven Assessment Areas. Key factors used in identifying these Assessment Areas include:

- The extent of available resource (theoretical and technical) for offshore wind, wave and tidal (based on information in Chapter 8 of the ER).
- Development/operating parameters and constraints associated with each of the technologies as discussed in Chapter 7 of the ER.
- Feedback from developers on current and possible future areas of interest for developments.
- Review of current development patterns taking into account technical feasibility of where development is likely to occur.

The Assessment Areas listed below extend out from the coast (mean high water mark) to a distance of 100km from shore. This reflects the upper length limit of Alternating Current (AC) export cable technology. For distances greater than 100km Direct Current (DC) cables will be required, with convertor stations on land to convert to AC).

Table 5.1: Assessment Areas

Assessment Area	Technology	Location
1	Wind	East Coast - North
2	Wind & Tidal[1]	East Coast - South
3	Wind[2]	South Coast
4	Wind & Wave	West Coast - South
5	Wind & Wave	West Coast
5a	Tidal	Shannon Estuary
6	Wind & Wave & Tidal[1]	West Coast - North

Note 1: Wave resource is not considered in Assessment Area 3, as although there is some resource in this area it was considered to be too far offshore for development within the timeframe of the SEA. It was decided to only focus on wave resources in the more accessible near shore areas on the southwest, west and northwest coast where developer interest is predicted to be initially focused (Assessment Areas 4, 5 and 6).

Note 2: Only those areas of significant tidal resource suitable for the development of commercial tidal arrays were considered in the assessment. It is recognised that there are a number of smaller discrete areas of tidal resource around the Irish coast. However, due to their scale these areas were only considered to be more suitable for demonstration or test projects rather than full scale commercial developments. The exception to this is the Shannon Estuary where both developers and environmental authorities have indicated that there is interest in the development of a commercial scale tidal array in this area.

The Assessment Areas are illustrated in **Figure 5.1** below.

Operating Parameters

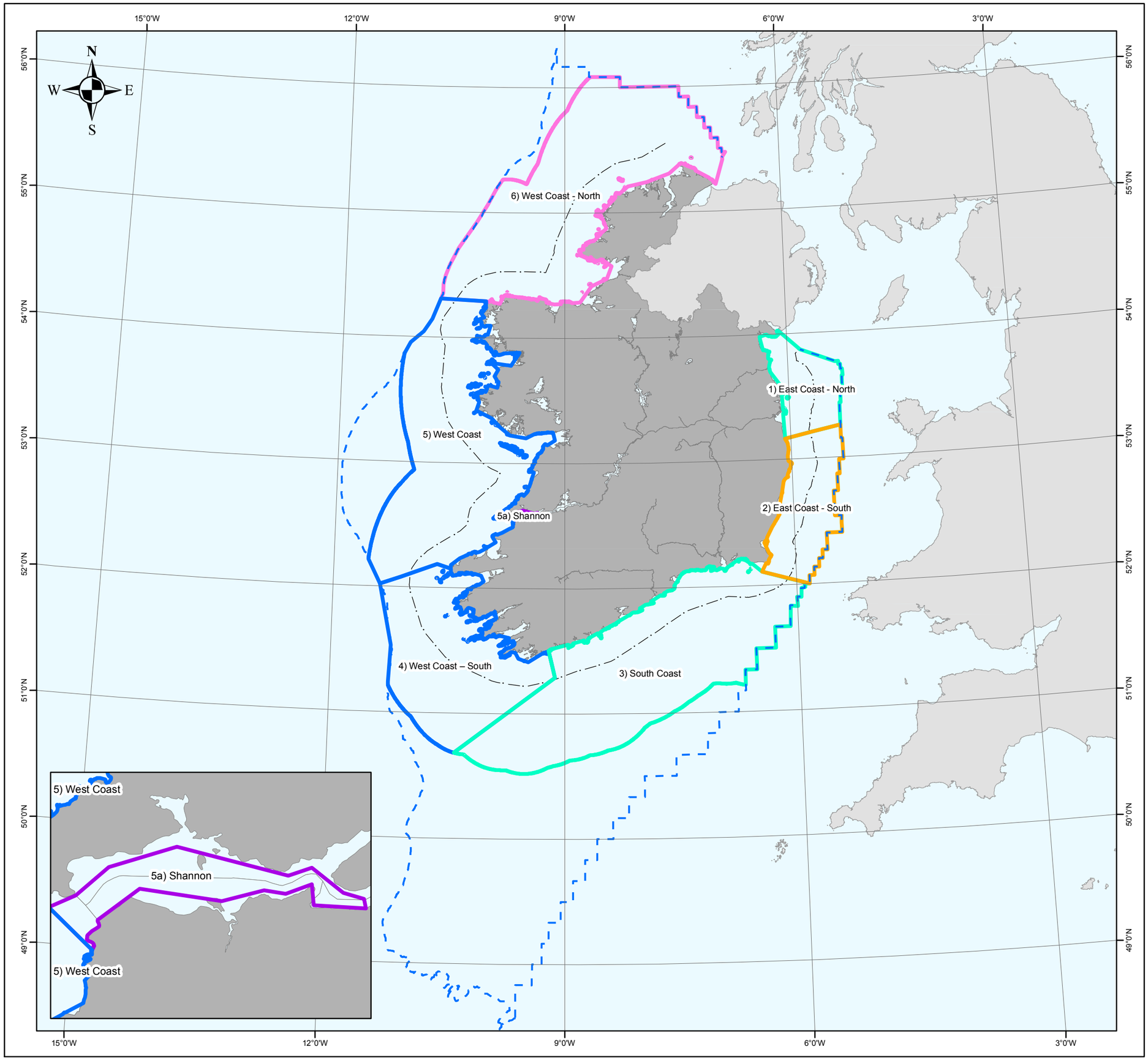
The operating/development parameters used to assist the identification of the potential resource within the study area are presented in Table 5.2 below:

Table 5.2: Development/Operating Parameters

Development/Operating Parameters		Fixed Wind	Floating Wind	Tidal	Wave
Water Depth		10m to 60m	60m to 200m	20m to 80m	10m to 100m
Constraining Threshold		> 7.0 m/s mean annual wind speed at 100 m height	> 7.0 m/s mean annual wind speed at 100 m height	Peak Spring Current Flow >1.2 m/s	Mean annual wave power (kilowatts) per metre of wave crest (WC) >20 kW/mWC
Approximate MW/km^2		10	10	50	10
Average Turbine/Device Generating Capacity		5 MW	2.3 - 5 MW	1 MW	0.5 MW to 5 MW
Average Scale of Commercial Development	MW	300 MW	300 MW	50 MW	30 MW
	Km^2	30km^2	30km^2	1km^2	3km^2

Strategic Environmental Assessment of Wave, Tidal and Offshore Wind Development in Irish Waters

Figure 5.1: Assessment Areas



Legend

Background

- Ireland
- United Kingdom
- Study area
- 12nm limit

Assessment Areas

- Wind
- Tidal
- Wind and Wave
- Wind and Tidal
- Wind, Wave and Tidal

Note 1: Assessment Areas extend from the coast (Mean High Water) to a distance of 100km, within the boundary of the Irish Exclusive Economic Zone only

Note 2: Not to be used for navigation

0 35 70 140 210 280 km

Date	Monday, October 4, 2010 10:25:45	
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Checked	Produced By	Louise Mann
	Reviewed By	Sally Holroyd

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6: Assessment of Assessment Areas - Results

The following section provides a summary of the following:

- Key sensitive receptors located within/associated with the main Assessment Areas.
- Summary of the likely significance of potential effects of the different technologies on the key sensitive receptors taking into account mitigation (residual effects).

Sensitive Receptors

Table 6.1 below provides an overview of the key sensitive receptors located within each of the Assessment Areas. However, it should be noted, the marine environmental off the coast of Ireland is very rich, diverse and extensive. A full description of Ireland's marine environment (based on information available as of October 2010) is provided in Chapter 9 of the Environmental Report.

Table 6.1: Summary of Key Receptors

Assessment Areas	Key Receptors
Assessment Area 1: East Coast (North)	▪ Large number of protected sites including eight SACs designated for benthic habitat, one SAC designated for marine mammals, 17 SPAs, 13 Important Bird Areas (IBAs), six Ramsar sites and three MPAs. ▪ Number of seabird colonies with population counts of 30,000 to 70,000. ▪ There are some populations of grey and harbour seal. ▪ There have also been some sightings of bottlenose dolphin, harbour porpoise, leatherback turtle and basking shark. ▪ Nursery areas for mackerel, cod, haddock, herring, horse mackerel and whiting. ▪ Spawning areas for cod, herring and whiting. ▪ Main shellfisheries include *Nephrops*, cockles, razor clams and periwinkles. ▪ Main fin fisheries include whitefish, whiting, haddock, black sole and plaice. ▪ High shipping intensity in the area with vessels entering Dublin and surrounding ports. ▪ Main seascape types include low plateau (Type 3) and low lying coastal plain (Type 4). These are generally considered to have low sensitivity to offshore wind and other offshore renewable energy developments. However, there are areas of higher seascape sensitivity. ▪ Two offshore wind areas, due to receive a grid connection offer and awaiting a foreshore lease decision by the Minister in the area (Oriel and Dublin Array).
Assessment Area 2: East Coast (South)	▪ Number of protected sites including three SACs designated for benthic habitats, eight SPAs, one Ramsar site and six IBAs. ▪ Isolated bird colonies with counts between 500 and 2500. ▪ One small population of grey seals and two small populations of harbour seal. ▪ Some sightings of bottlenose dolphin, harbour porpoise, leatherback turtle and some occasional isolated sightings of basking shark. ▪ Nursery areas for mackerel, cod, horse mackerel and whiting and spawning areas for whiting. ▪ Main shellfisheries include edible crab, scallops, oyster, periwinkle and whelks. ▪ Fin fisheries include cod, ray species, black sole and plaice. ▪ High shipping intensity in particular for cargo vessels leaving Wexford. ▪ Rosslare is major commercial and ferry port. ▪ Main seascape types include the less sensitive low plateau (Type 3) and low lying coastal plain (Type 4). ▪ Arklow Bank existing windfarm lease area, southern section of Dublin Array and Codling Bank lease area.

Assessment Areas	Key Receptors
Assessment Area 3: South Coast	▪ Large number of protected sites including 10 SACs designated for benthic habitats, two SACs designated for marine mammals, five SPAs, seven Ramsar sites, one MPA (Tramore Dunes and Mudflats) and 14 IBAs. ▪ Largest bird colony is on Saltee Island with population counts of 10,000 to 30,000. ▪ Small populations of harbour and grey seals. Larger population of grey seals in the east. ▪ There have been large numbers of bottlenose dolphin and harbour porpoise sightings, sightings of leatherback turtle and significant sightings of basking shark. ▪ Nursery areas for mackerel, cod, haddock, hake, herring, megrim, whiting, white belly angler monk and black belly angle monk. ▪ Spawning areas for mackerel, cod, haddock, horse mackerel, megrim and whiting and herring. ▪ Shellfisheries in the area include *Nephrops*, edible crab, lobster, shrimp, scallop, crayfish, whelk and oyster. ▪ Fin fisheries include herring, cod, haddock, whiting, angler fish, megrim, hake, black sole, plaice and ling. ▪ Shipping intensities within the area are generally moderate with higher shipping intensities around the ports of Cork and Waterford. ▪ There are a number of marinas, surf spots, blue flag beaches and coastal walks. ▪ Three seascape types including low lying plateau, low lying coastal plain and large bays. Large bays are most sensitive to offshore wind farms. ▪ There are five dredging and disposal sites in the area. ▪ There are also a number of oil and gas lease/exploration areas and infrastructure.
Assessment Area 4: West Coast (South)	▪ There are a very large number of protected sites including eight SACs designated for benthic ecology, five SACs designated for marine mammals, nine SPAs, five MPAs, one Ramsar site and nine IBAs.

Assessment Areas	Key Receptors
Assessment Area 4: West Coast (South)	▪ Number of bird colonies with counts of 10,000 to 30,000. ▪ There are significant populations of harbour and grey seal. ▪ There have been significant sightings of harbour porpoise, bottlenose dolphin, leatherback turtle and basking sharks. ▪ Nursery areas for mackerel, cod, blue whiting, haddock, hake, horse mackerel, megrim, whiting, white belly angler monk and black belly angler monk. ▪ Spawning grounds for mackerel, haddock, herring, horse mackerel and whiting. ▪ Shellfisheries in the area include *Nephrops*, edible crab, lobster, shrimp, spider crab and scallops. ▪ Fin fisheries include angler fish, megrim, black sole, plaice, hake and haddock. ▪ Shipping intensity is generally low to moderate with a greater number of tankers and cargo vessels than passenger vessels. ▪ Main ports include Bantry Bay and Castletownbere. ▪ Large number of marinas and sailing clubs, surf spots, blue flag beaches and coastal walks. ▪ Large part of the coast forms part of the Skellig Micheal World Heritage Site (WHS). ▪ Main seascape type in this area is rugged peninsulas with drowned valleys and large bays, both of which are highly sensitive to offshore wind and other offshore renewable energy developments. ▪ Seascape character is an integral part of the overall character and atmosphere of the WHS. ▪ There are some dredging and disposal sites in the area. ▪ Hibernia D telecommunications cables passes through the area.
Assessment Area 5: West Coast (Central)	▪ Significant number of protected sites including 21 SACs designated for benthic habitats and species, ten SACs designated for marine mammals, 22 SPAs, six MPAs, four Ramsar sites and 18 IBAs. ▪ Large number of bird colonies.

Assessment Areas	Key Receptors
Assessment Area 5: West Coast (Central)	▪ Significant populations of harbour seal and breeding populations of grey seal. ▪ Significant sightings of harbour porpoise and bottlenose dolphin, large number of sightings of leatherback turtle and occasional sighting of basking shark. ▪ Suggested migratory corridor for humpback whale. ▪ Nursery area for mackerel, cod, blue whiting, haddock, hake, herring, horse mackerel, megrim, whiting, white belly angler monk and black belly angler monk. ▪ Spawning areas for mackerel, blue whiting, haddock, hake, herring, horse mackerel, megrim and whiting. ▪ Shellfisheries include *Nephrops*, edible crab, spider crab, lobster, shrimp and oyster. ▪ Fin fisheries include haddock, megrim, black sole, hake and angler fish. ▪ Shipping intensity is low to moderate with more tankers and cargo vessels than passenger vessels. ▪ High number of marinas, sailing clubs, surf spots and clubs, blue flag beaches and coastal walks. ▪ Submarine exercise and transit area to the north. ▪ Varied and complex seascape character with number of seascape types including large bays and sea loughs, offshore islands, dramatic high cliffs, peninsula's and headlands, sandy flats and flat or low lying complex islands and peninsulas. These seascape types are all of moderate to high sensitivity to offshore wind and other offshore renewable energy developments. ▪ Three potential nominees to the World Heritage List. ▪ There are a number of dredging and disposal sites. ▪ Gas pipeline to the north that runs to the Corrib Gas field. ▪ Number of power and telecommunications cables connecting the mainland to Inis Bo Finne and Aran Islands.
Assessment Area 5a: Shannon Estuary	▪ Area covered by the Lower River Shannon SAC which is designated for bottlenose dolphins and number of SPAs. ▪ High intensity of shipping movements through main part of estuary.

Assessment Areas	Key Receptors
Assessment Area 6: West Coast (North)	▪ Significant number of protected sites including 20 SACs designated for benthic habitats and species, 12 SACs designated for marine mammals, 29 SPAs, two MPAs, four Ramsar sites and 14 IBAs. ▪ Large number of bird colonies. ▪ Significant populations of harbour seal and breeding populations of grey seal. ▪ Significant sightings of harbour porpoise and bottlenose dolphin, leatherback turtle and basking shark. ▪ Nursery areas include mackerel, cod, haddock, hake, herring, horse mackerel, megrim, white belly angler monk and black belly angler monk. ▪ Spawning grounds for mackerel, whiting, haddock, hake and herring. ▪ Shellfisheries include *Nephrops*, edible crab, lobster, shrimp and oyster. ▪ Fin fisheries include cod, haddock, megrim, black sole, whiting, plaice, ray and ling. ▪ Shipping intensity is low to moderate with a moderate amount of cargo vessels. ▪ Two major ports include Sligo and Killybegs. ▪ Large number of marinas, sailing clubs, surf clubs and surf spots, blue flag beaches and coastal walks. ▪ Large submarine exercise and transit area. ▪ Complex and varied seascape with number of seascape character types including large bays and sea loughs, numerous offshore islands, dramatic high cliffs, peninsula's, headlands, sandy flats, flat/low lying complex islands and peninsulas. These seascape types are all of moderate to high sensitivity to offshore wind and other offshore renewable energy developments. ▪ No active oil and gas development. ▪ Hibernia A telecommunications cable passes through this assessment area.

Summary of Potential Effects

Summary of Effects
Water, Soil and Sediment
Geology, geomorphology and sediment processes – scouring: There is potential that the presence of structures on the seabed, in particular piled foundations, could lead to localised scouring of the seabed, in particular where the sediment comprises sand and gravel. Potential significant adverse effects could be reduced by careful site selection informed by hydrodynamic modelling at the project stage. The likely significance of residual effects will be negative to negligible.
Geology, geomorphology and sediment processes – changes in coastal processes: Potential significant adverse effects on coastal process resulting from the extraction of energy from the existing wave and tidal regime could be reduced or avoided through careful site selection and modelling. The likely significance of residual effects will be negative to negligible.
Accidental contamination from devices and vessels as a result of storm damage or failure or collision – this could occur in all assessment areas for all types of development (offshore wind, wave and tidal). Should this occur it is likely to have a significant adverse effect on water quality, birds, marine mammals, marine reptiles, benthic ecology and fish and shellfish. However, the likelihood of this occurring is low and the risks of contamination from devices can be reduced through appropriate designs and integration of mechanisms to protect against any leakage of potential contaminants should a device get damaged or failure occur. The likely significance of any residual effects is therefore negligible.
Biodiversity, Flora and Fauna
Benthic ecology – substratum loss: All three technologies could potentially have significant adverse effects on benthic habitats and species due to substratum loss resulting from the attachment of devices to the seabed. These effects are likely to be greatest for piled devices and gravity bases. With increased information on species and habitat distributions and abundance and appropriate siting of developments to avoid sensitive habitats and species the likely significance of any residual effects would be negative/negligible.

Summary of Effects
Biodiversity, Flora and Fauna
Benthic ecology, marine mammals, seabirds and fish - habitat exclusion: All three technologies could lead to habitat exclusion through occupying areas of the seabed, surface and water column. The overall effect of this is unknown but is likely to be more significant in areas used by breeding (marine mammals), feeding (marine mammals, fish and seabirds) and spawning (fish). The likely significance of residual effects is unknown. However, potential likely significant adverse effects could be avoided or reduced by siting developments outside protected sites, breeding, feeding and spawning areas. Time constraints for construction could also mitigate against effects.
Marine mammals, marine reptiles, seabirds and fish - collision risk from operational wave and tidal devices: the potential effects of collision with operational devices on marine mammals, marine reptiles, fish and seabirds (diving and pursuit) are unknown. However, it is likely that these effects will be greater for tidal devices than wave devices which generally have lower rates of motion and fewer moving parts. Likely residual effects are currently unknown, although with increased information on species distributions and their interactions with tidal devices and appropriate siting of devices the potential for a likely significant adverse effect could be reduced.
Marine mammals, marine reptiles, seabirds and fish - collision risk from operational offshore wind farms: Operational offshore wind farms could potentially have a significant adverse effect on birds in flight, in particular on key migratory routes. The significance of any potential effects on marine mammals, marine reptiles and fish colliding with offshore wind turbine foundation structures is likely to be negligible and the level of harm would be low given there are no moving parts. The likely significance of residual effects for birds is negative and other species are negligible.
Marine mammals, marine reptiles, fish and seabirds - noise from the installation of piled devices: In terms of the installation of devices the most significant source of noise is from the piling of offshore wind and tidal turbine foundations. Noise from piling activities can have significant adverse effects on marine mammals, marine reptiles, fish and possibly seabirds (diving and pursuit feeders). Although potential effects can be reduced by avoiding breeding and spawning seasons and well as using Marine Mammal Observers, exclusion zones, passive noise monitoring, pingers or bubble curtains the likely residual effects are still likely to be negative to significant adverse.

Summary of Effects

Biodiversity, Flora and Fauna

Marine mammals, marine reptiles, fish and birds - noise from the operation of tidal devices: In terms of the three technologies, tidal devices currently have the greatest potential to generate underwater noise from the frequent and regular movement of submerged turbines (wave moving parts tend to be at or above the surface, wind moving parts are all above surface). There is potential for noise from operational tidal devices could affect fish, marine mammals and seabirds (diving and pursuit) in terms of habitat exclusion and disorientation. However, the likely significance of any residual effect is unknown.

Marine mammals, marine reptiles, fish and birds - barriers to movement: There is still uncertainty over the potential effects of commercial arrays (all technologies) on marine mammals, marine reptiles and fish (particularly migratory species e.g. salmon) in terms of creating barriers to movement. Barriers to movement are more likely to occur in constrained areas e.g. Lough mouths, inter-island channels and around headlands. These tend to coincide with areas of tidal resource. The potential causes of barriers to movement include noise from arrays/devices, a perceived risk of harm from collision with moving parts and the presence of physical barriers, which are more likely be caused by tidal developments although large wave arrays may also create physical barriers in areas of open water. Although potential barriers to movement could be reduced by limiting the number of developments in constrained areas, avoiding key migratory routes and feeding/breeding transit areas and modifying the configuration/layout of certain developments to minimise the creation of physical barriers, the likely significance of any residual effects is still unknown.

EMF Impacts – whilst there is no evidence that operating power cables have caused a change to behaviour and migration for marine fish, reptiles and mammal species, there is evidence that some species of fish and marine reptiles can detect electric fields, and circumstantial evidence that cetaceans can detect magnetic fields. Given that most of the existing anecdotal evidence demonstrating lack of an avoidance reaction is based on operating interconnectors, and the effect of interturbine cable arrays could cause a more concentrated effect, the scientific community believes that more research is needed to quantify this potential effect. The significance of any likely residual effects is unknown.

Summary of Effects

Cultural Heritage including Archaeological Heritage

Damage or loss to archaeological remains / historic features – there is potential that device installation and cabling activities could have a significant adverse effect on archaeological sites and features (marine and coastal). However, with appropriate site investigations and appropriate siting of devices and routing of cables, the likely significance of any residual effects would be negligible.

Population and Human Health

Commercial fisheries- direct disturbance of commercial fishing grounds: The physical presence of devices and associated cables or noise generated by piling activities and the operation of devices could potentially have a significant adverse effect on fishing grounds. However, through appropriate siting of devices outside key traditional commercial fishing grounds and key nursery and spawning areas the likely significance of any residual effects could be reduced to negative or negligible.

Commercial fisheries - long term displacement from fishing grounds: The presence of an offshore renewable energy development in certain locations could lead to the displacement of fishermen from key fishing grounds. Although, through the appropriate siting of developments potential adverse effects could be reduced, the likely significance of the effect depends on the importance of the fishing ground and whether displacement would lead to increased pressure on stocks in other areas. Therefore the likely significance of any residual effects could potentially range from significant adverse to negligible across the different assessment areas.

Commercial fisheries - recovery of fish stocks: The exclusion of commercial fishing activities from certain areas could have positive residual effects on fish stocks in certain locations.

Mariculture: Shellfish and finfish farming areas are unlikely to be directly affected by offshore renewable energy developments directly but could be affected by the installation of export cables (substratum loss or disturbance and smothering). All shell and fin fish farms would need to be avoided as part of the design and detailed export cable routes to prevent any likely significant adverse effects from cabling activities.

Summary of Effects

Population and Human Health

Shipping and navigation - reduced navigational safety and collision risk: The presence of arrays in navigational and shipping channels can affect navigational safety and increase the risk of collision either directly or by displacing vessels into areas where there is a higher intensity of vessel movements. The significance of these effects depends on the type of development and the intensity of vessel movements in certain locations. In terms of the device types the level of displacement is likely to be greater for wind and wave developments as these tend to occupy larger areas than tidal developments which have much higher energy densities and therefore occupy smaller areas. Wind and wave devices also occupy entire water column (wind) or sea surface (wave) where as tidal devices could potentially be fully submerged at depths which would allow shipping and tidal developments to co-exist. Likely residual effects in areas of high vessel movements could be significant adverse. However, in areas of lower vessel densities the likely significance of any potential effects is likely to reduce to negative or negligible.

Increased navigational safety: In some locations the presence of offshore renewable energy developments may act as navigational aids by marking out and creating an area of exclusion around potentially hazardous areas of water such as submerged sandbanks. However, the likely significance of this potential effect will depend upon the number of vessel movements in an area and the overall effects of the developments in terms of wider displacement of vessel movements into other shipping channels.

Recreation and tourism: There are a number of marine and coastal recreational activities that occur across the study area, and could therefore be affected or disrupted by commercial offshore renewable energy developments either directly (disruption to or exclusion from recreational sailing areas) or in directly through effects on visual amenity and seascape quality. Any likely significant adverse effects can be reduced by siting developments outside the main sailing and watersports areas. Additional navigational aids may be also be required for developments located near to main recreational sailing routes to reduce the potential collision risk. The likely significance of residual effects is likely to range from negligible to negative depending on the location of individual developments.

Summary of Effects

Population and Human Health

Indirect effects on recreational assets/features: potential effects on wildlife, bathing water quality and seascape/visual amenity are covered under the specific topics. However, there is the potential that any likely significant adverse effects on these features would also have indirect effects on these important recreational assets. Measures to reduce or avoid likely significant effects are discussed in reference to the relevant SEA subjects.

Aviation collision risk: There is the potential for aircraft to collide with devices that protrude above the surface water (mainly offshore wind developments). The potential effects of this collision risk are likely to be adverse significance where developments are located on main flight paths from airports. There is also the potential for collision with search and rescue operations (helicopter and plane.) However, given that there are no 'Potential to Interfere' areas within any of the assessment areas the likely significance of these potential effects can be reduced by siting developments away from major flight paths and search and rescue deployment areas ensuring offshore wind turbines are lit with aviation lights in accordance with the 'Offshore Wind Farms Conspicuity Requirements'

Radar interference: Potential effects from radar interference are only likely to be generated by offshore wind farm developments as wave and tidal devices generally do not protrude more than a few meters above the water surface. As there are no 'Potential to Interfere' NERL areas within the study area the likely significance of any residual effects from offshore wind farms are likely to be negligible.

Military practice areas: Although these overlap with all of the assessment areas information on the nature and frequency of the activities that occur in these practice areas was not available for this SEA. Therefore the potential effects could range from significant adverse to negligible.

Summary of Effects

Material Assets

Cables and pipelines: A number of cables and pipelines pass through the different Assessment Areas. Although direct damage to a cable or pipeline would have likely significant adverse effects as telecommunications or gas and electricity supplies could be severely disrupted, there are recognised guidelines (ICPC), protocols (e.g. crossing agreements) and buffer zones (usually 500m) that would have to be adhered to by developers. Application of these guidelines, protocols and buffer zones would avoid or significantly reduce the risk of any adverse effects occurring. The significance of any likely residual effects will therefore be negligible to no effect.

Access restrictions to existing dredging and disposal sites: Depending on the location of offshore renewable energy developments, these areas would be avoided or any potential significant effects would be reduced through the implementation of spatial management of activities around the dredging and disposal areas and the application of other recognised good practice.

Sterilisation or restricted access to potential aggregate dredging or extraction areas: When identifying locations for future offshore renewable energy developments it will be necessary to identify all potential aggregate dredging/extraction sites. Further consultation will be required at project EIA stage to determine the potential effect of an offshore renewable energy development on that resource.

Landscape/seascape

Seascape: Offshore wind farms are likely to have more significant effects on seascape than wave and tidal devices as a larger proportion of the development is visible above the water surface. Large sections of the west coast of Ireland has been identified as being highly sensitive to offshore wind farms due to their remote, rugged, exposed and often dramatic high scenic value, particularly along the south west coast around the Skellig Michael World Heritage Site (WHS). It is likely that, in these more sensitive locations, offshore wind farm developments and some wave and tidal developments depending on device type, would have significant effects on seascape character. The significance of these potential effects could be reduced by increasing the distance of the development from the shore or changing the layout/configuration of individual developments. More detailed assessments would be required for specific projects.

Summary of Effects

Climatic Factors

Climate: The development of offshore renewable energy will have a positive effect on the wider marine environment in terms of combating potential adverse effects that are attributed to climate change.

Carbon and gas storage areas: Offshore renewable energy developments could sterilise potential future carbon and gas storage sites. However, given that there are currently no sites identified in the study area, the potential residual effects are unknown.

7: Cumulative Assessment

The main focus for the cumulative assessment is to assess the extent to which varying amounts (MW) of development (offshore wind, wave and tidal) can be accommodated within each of the assessment areas and across the entire study area without likely significant adverse effects on the environment or other marine users/activities.

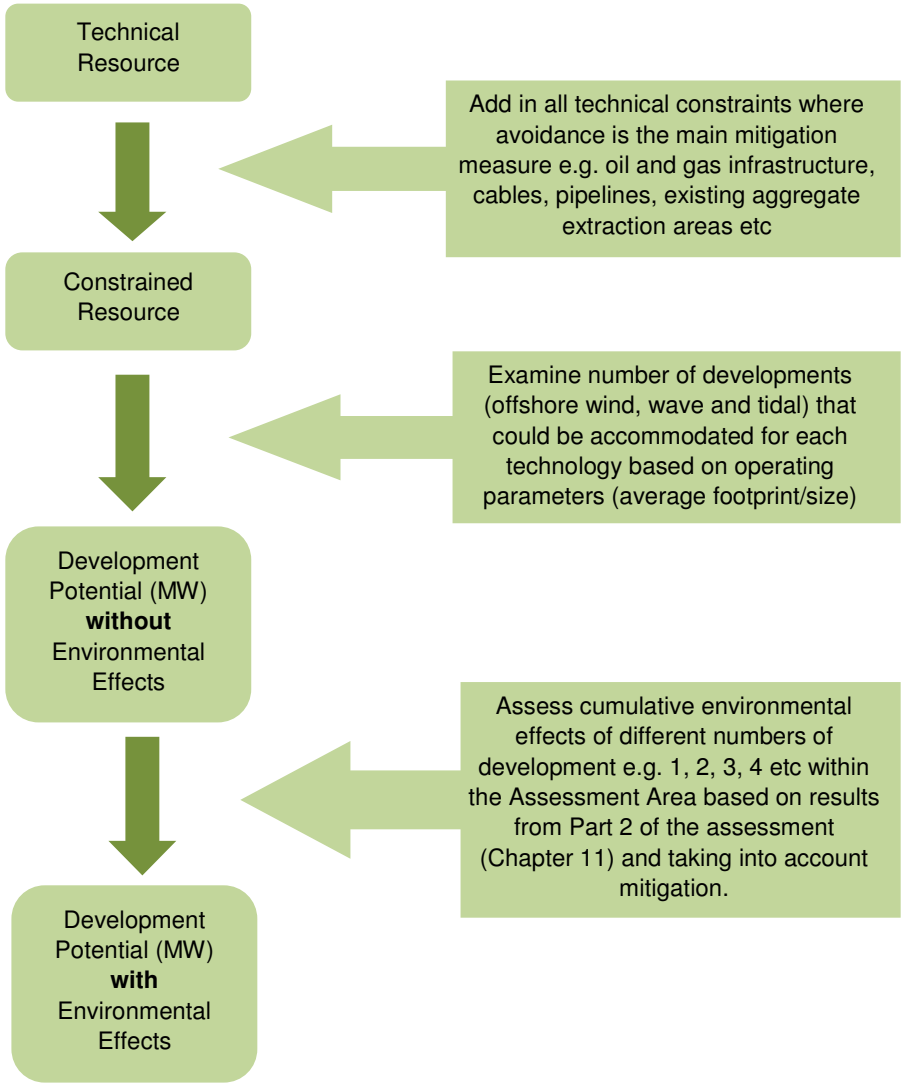
The results from the assessment were then reviewed to determine the extent to which the amounts (MW) of development identified would contribute towards achieving the scenarios for developing 4,500MW from offshore wind and 1,500MW from wave and tidal energy in Irish waters as set out in the OREDP.

This was achieved through the following:

1. Defining the **theoretical** and **technical** resource within Irish waters for each technology. A definition of these different resource types is provided below:
   - **Theoretical resource**: gross energy content within the study area.
   - **Technical resource**: theoretical resource limited by existing technical limitations such as water depth and other parameters.
2. Identification of development scenarios as set out in the OREDP (section 2).
3. Identification of the Assessment Areas (Section 5)
4. Identification of operating parameters for different technologies (Section 5).
5. Identification of existing and proposed developments within Irish waters (offshore wind developments in Gate 3 or with Foreshore Lease consents).
6. Identification of technical constraints (which would need to be avoided by any offshore renewable energy development).
7. Identification of amounts of development (MW) that could be accommodated within each assessment area taking into account technical constraints only.
8. Identification of environmental constraints.
9. Assessment of amounts of developments (MW) (based on incremental increases) that could be accommodated in each assessment area taking into account environmental constraints and mitigation. The results from this are presented in a series of assessment matrices.

The approach to assessing potential cumulative effects in the Assessment Areas is illustrated in Figure 7.1 below:

Figure 7.1: Approach to Identifying Development Potential in each Assessment Area



Approach to Assessing Effects in Relation to SEA Receptors

In terms of the cumulative assessment the SEA subjects have been split into technical and environmental constraints. All technical constraints have been taken into account as part of the cumulative assessment. These constraints are summarised below.

In terms of the environmental constraints, each of the sensitive receptors e.g. protected sites, birds, benthic habitats, archaeological remains etc, have all been dealt with in a certain way. This is based on the nature and character of the potential interactions of each receptor with offshore renewable energy developments the likely significance of any potential effects based on the findings from the generic assessment and the assessment of the Assessment Areas presented in Chapters 10 and 11 of the ER. Details of how each of the SEA environmental constraints have been dealt with the in cumulative assessment is provided in Chapter 12 of the ER and summarised below.

Technical Constraints

The following SEA issues/subjects have been identified as technical constraints and as such have been taken into account when identifying potential areas where development could occur:

- Aquaculture sites
- Disposal and dredging areas (based on 1000m buffer around point data)
- Cables and pipelines (all buffered by 1000m)
- Areas where shipping intensity is more than 100 vessels per month
- All defence danger areas
- All oil and gas lease areas
- Existing oil and gas infrastructure (other than pipelines)

Environmental Constraints

The following provides an overview of how each of the SEA subjects/environmental constraints has been dealt with in the cumulative assessment:

- Water and Soil (Sediment):
  - Coastal modelling would be carried out at project stage to inform site selection to minimise adverse effects on coastal processes.
  - Appropriate good practice measures would be integrated into project designs to minimise the risk of contamination from devices.
- Biodiversity, Flora and Fauna:
  - All protected sites (MPAs, Ramsar, SPAs, SACs, IBA etc) have been avoided when identifying potential areas for development (see note below on addressing Natura Sites and Marine Protected Areas (MPAs).
  - Seal breeding and haul out sites have been avoided.
  - Potential marine mammal migratory routes and feeding hotspots (where known) have been avoided where possible.
  - Consideration has been given to ensuring sufficient spacing between commercial developments to minimise the potential for the creation of barriers to movement and large scale habitat exclusion.
- Cultural Heritage including Archaeological Heritage:
  - Known areas of archaeological importance are avoided.
  - Where there is potential for archaeological remains it is assumed appropriate surveys would be carried out at the project level to inform site selection, the siting of individual devices and routeing of export cables.
- Ports, Shipping and Navigation:
  - Areas with high intensity of vessel movements (e.g. 100 per month) and main routes in and out of ports have been avoided.
- Commercial Fisheries:
  - Consideration has been given to maximising space between commercial developments to minimise displacement from traditional fishing grounds.
- Recreation and Tourism:
  - Key recreational sites are avoided where possible. Effects on other recreational activities are considered under other subjects e.g. seascape.
- Seascape:
  - Due to the complexity of the seascape character around Ireland, a separate methodology was developed to assess potential effects on seascape. Further detail on this is provided in Chapter 6 of the Environmental Report.

Addressing Natura Sites and Marine Protected Areas (MPAs)

The Assessment of the Assessment Areas (Chapter 11 of the Environmental Report) identifies that development within Natura sites is likely to have significant adverse effects on the integrity and conservation objectives of those sites. These conclusions reflect the fact that at the strategic level the type and nature of development that could occur in a certain area is unknown and that there are still a number of data and knowledge gaps relating to the potential effects of offshore renewable energy developments on marine wildlife in general.

The objective of Chapter 12 was to test whether it is possible, based on a number of assumptions, to achieve the development scenarios set out in the OREDP without likely significant adverse effects on the environment. One of these assumptions was that development would not occur within Natura sites. This reflects the findings of Chapter 11 and the necessity of avoiding likely significant effects. This was not to scope out Natura sites from the assessment, but to identify if and how development could occur without resulting in adverse effects. If this approach had not been applied then the assessment would have inevitably concluded that unacceptable adverse effects would result from Plan.

However, given that there are a number of uncertainties surrounding potential development within Natura sites (relating to data and knowledge gaps) it should be recognised that whilst it is possible to achieve the scenarios in the OREDP without developing in these sites, individual developers may still seek to develop within these protected sites. Where this is the case it would be the responsibility of the individual developer as part of the Foreshore Lease Consenting Process and in accordance with the Habitats Directive to provide the necessary evidence for the regulatory authorities to demonstrate that a specific project or number of projects in a certain location would not have a significant adverse effect on the integrity or conservation objectives of a given site.

In conclusion, development should not take place within Natura sites unless it can be comprehensively demonstrated at the project level that no significant adverse effects on the integrity and conservation objectives of the site would occur.

Results from the Cumulative Assessment

Table 7.1 below provides a summary of the main results of the cumulative assessment in terms of the potential amounts of development (MW) that could be accommodated within each of the Assessment Areas without likely significant adverse effects on the environment.

Table 7.1: Summary of Results from the Cumulative Assessment

Assessment Area	Total amount of development (MW) that could potentially occur within each assessment area without likely significant adverse effects on the environment (taking into account mitigation).				
	Fixed Wind (MW)	Wave (MW) 10 to 100m Water Depth	Wave (MW) 100m to 200m Water Depth	Tidal* (MW)	Floating Wind** (MW)
1: East Coast (North)	1200 to 1500***	-	-	-	-
2: East Coast (South)	3000 to 3300****	-	-	750 to 1500	-
3: South Coast	1500 to 1800	-	-	-	6000
4: West Coast (South)	600 to 900	500 to 600	3000 to 3500	-	5000 to 6000
5: West Coast	500	5000	6000 to 7000	-	7000
5a: Shannon Estuary	-	-	-	0	-
6: West Coast (North)	3000 to 4500	7000 to 8000	6000 to 7000	750 to 1500	7000 to 8000
Total Development Potential (MW) without likely significant adverse effects	**9800 to 12500**	**12500 to 13600**	**15000 to 17500**	**1500 to 3000**	**25000 to 27000**

Notes:

* = the tidal resource is based on tidal stream technologies only and does not include tidal barrages.

** = although there is a large potential floating offshore wind resource this is still very much an emerging technology. It is therefore unlikely that this technology would be developed at a commercial scale by 2020, or even possibly 2030.

*** = The development potential in Assessment Area 1 takes into account the proposed Oriel Windfarm (330MW) and the northern section of Dublin Array (approx 150MW).

**** = The development potential in Assessment Area 2 takes into account the approved Arklow Bank Windfarm (520MW) and Codling Bank (1,100MW) and the southern part of the proposed Dublin Array windfarm (approx 214MW) which is due to receive a grid connection offer in the Gate 3 process

(-) = Limited technical resource available. These areas may contain potential resource for each of the technologies. However, the resource assessment has concluded that for technical reasons e.g. water depths/distances from shore etc, the resource that is available is unlikely to be developed in the timescale of the OREDP (e.g. by 2030).

Wave energy was split between the shallower (10m to 100m depth) and deeper water resource (100m to 200m depth). It is likely that initial wave development which would occur in the main timeframe of the OREDP e.g. 2015 to 2025 is likely to occur in the shallower areas which tend to be located closer, with deeper waters being exploited in the longer term e.g. 2025 to 2030 and beyond.

The figures (MW) included in the table indicate the amounts of development that could **potentially** be accommodated within an area without likely significant adverse effects on the environment. These figures are not 'caps' on the total level of development that could occur. They simply reflect the results from the assessment of cumulative effects. There are still a number of uncertainties/unknowns. Consequently there is potential that with increased certainty e.g. filling of data and information gaps that these levels of development (MW) in an area could increase or decrease.

Assessment Matrices:

The key findings from these tables have been used to inform the results presented in Table 7.2. Further discussion of these results is provided below.

Table 7.2: Assessment of Potential Cumulative Effects with Mitigation

Assessment Area	Technology Type and Amounts (MW)			Summary of Cumulative Effects (Including Mitigation)
Assessment Area 1: East Coast (North)	Number of Commercial Fixed Wind Developments			Cumulative effects across all receptors for the development of 1200MW arrays are generally negligible to negative. Installation of five or more arrays in this area may cause significant adverse effects primarily associated with the potential presence of wind farm constraints either side of a very busy shipping channel and commercial fisheries. Effects associated with collision risk and habitat exclusion on birds, and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of likely adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Based on the general seascape character in this area it is likely developments within 0 to 15km from the coast would have moderate cumulative effects on seascape, these effects reducing to slight with increased distance from shore.
	600 MW	1200 MW	1800 MW	
	Negligible	Negative	**Unknown/ Significant adverse**	
Assessment Area 2: East Coast (South)	Number of Commercial Fixed Wind Developments			Cumulative effects across receptors for development of up to 1800MW are generally negligible to negative. Installation of seven or more arrays in this area may cause significant adverse effects primarily in relation to effects on protected sites and birds located on the adjacent coastline, and commercial fisheries. Effects relating to collision risk and habitat exclusion on birds could also be of adverse significance. Possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of likely adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Potential effects on seascape are likely to be of moderate significance within 15km of the coast, reducing to slight further offshore.
	900 MW	1800 MW	2700 MW	
	Negligible	Negative	**Unknown/ Significant adverse**	
	Number of Commercial Tidal Developments			Cumulative effects across receptors for development of up to 750MW are generally negligible to negative. Installation of more than 1500MW in this area may cause negative effects primarily associated with the potential impacts on marine mammals, commercial fisheries and navigation. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Potential effects on seascape are likely to be of moderate significance within 5km of the coast, reducing to slight within increased distance offshore.
	100 MW	750 MW	1500 MW	
	Negligible	Negative	**Unknown/ Significant adverse**	

<table>
<tr><th>Assessment Area</th><th colspan="3">Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="4">Assessment Area 3: South Coast</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="2">Potential cumulative effects across receptors for development of between 300MW and 900MW are generally negligible to negative. Further development of up to 1800MW is generally negative to significant adverse. The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 20 – 25m from the coastline. This area overlaps with the area of highest shipping intensity running adjacent to the coastline, and some of it also overlaps with marine SACs at Hook Head, and Saltee Islands, therefore limiting the available area for offshore wind deployment without significant environmental effects.

Installation of between 2100MW and 2700MW in this area is likely to have significant adverse effects on protected sites and birds located on the adjacent coastline, and commercial fisheries. Potential effects in relation to collision risk and habitat exclusion on birds and possible barrier effects to birds, marine mammals and reptiles moving along the coast are also likely to be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Given that most developments would be located very close to the coast, potential cumulative effects on seascape are likely to range from moderate to substantial, particularly where developments affect sensitive seascape types such as large bays which are prominent along the eastern section of the coast in this area.</td></tr>
<tr><td>900 MW</td><td>1800 MW</td><td>2700 MW</td></tr>
<tr><td>Negligible to Negative</td><td>Unknown/ Significant adverse</td><td>Unknown/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Floating Wind Developments</td><td rowspan="4">Cumulative effects across receptors for development of 6000 MW are generally negligible - negative. The potential for adverse effects increases as the size of the area exploited increases. The most significant potential effects are associated with commercial fisheries in terms of exclusion from traditional fishing grounds and marine wildlife due to habitat exclusion and possible barriers to movement, many of which require further work and site specific survey in order to better understand the level of potential effect. In terms of seascape, potential effects reduce from moderate to slight between 24km and 35km from the coast and are generally considered to be negligible beyond 35km as it is difficult to see anything beyond this distance. Providing that the floating wind developments are located in offshore areas (more than 24km from the coast and ideally 35km) potential cumulative effects on seascape character will be slight to negligible.</td></tr>
<tr><td>3000 MW</td><td>6000 MW</td><td>9000 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
</table>

Assessment Area	Technology Type and Amounts (MW)			Summary of Cumulative Effects (Including Mitigation)
Assessment Area 4: West Coast (South)	Number of Commercial Fixed Wind Developments			The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 15m from the coastline, and there is therefore very limited potential to site devices away from sensitive receptors. Potential effects in relation to collision and habitat exclusion on birds and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Seascape character throughout in this area is highly sensitive to offshore wind developments. Any development within 15km of the coast is likely to have a substantial effect on seascape, in particular the Skellig Michael WHS. These effects are also likely to be of substantial to moderate significance up to 24km from the shore, reducing to slight/moderate further offshore e.g. more than 24km and slight/negligible at 35km. There are also likely to be significant adverse impacts on tourism and recreation where devices are sited within Dingle Bay, which is one of the few areas where shallow waters extend far enough to accommodate commercial scale arrays outside of the main shipping lanes.
	600 MW	1200 MW	1800 MW	
	Negative	**Unknown/ Significant adverse**	**Unknown/ Significant adverse**	
	Number of Commercial Wave Developments			Cumulative impacts across receptors for development of up to 3000 MW is generally negligible – negative (although potential adverse affects are greater in the inshore areas). Potential effects in relation to wave arrays relate mainly to potential effects on protected sites and mammals located on the adjacent coastline, navigation and commercial fisheries. Potential effects in terms of collision risk and habitat exclusion impacts on birds, marine mammals, fish and reptiles further offshore, and possible barrier effects to marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Wave developments are likely to have less of an effect on seascape character than fixed offshore wind developments. However, the seascape character along the south west coast is considered to be highly sensitive to all forms of development, particularly in regard to potential effects on the Skellig Michael WHS. Although potential effects on seascape can be reduced by increasing the distance of development from the shore, it is likely that even at a distance of up to 15km from the coast a large number of wave developments could have a moderate effect on seascape.
	300 to 600 MW	3000 MW	4500MW	
	Negligible	Negative	**Negative/ Significant Adverse**	

Assessment Area	Technology Type and Amounts (MW)			Summary of Cumulative Effects (Including Mitigation)
Assessment Area 4: West Coast (South)	Number of Commercial Floating Wind Developments			Potential cumulative effects across receptors for development of 5400 MW are generally negligible - negative. Potential adverse effects are likely to increase with larger areas exploited and the most significant potential impacts are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significance of any potential effect. Potential seascape effects can be minimised by developing beyond 24km from shore.
	2700 MW	5400 MW	8400 MW	
	Negligible	Negative	**Unknown/ Significant adverse**	
Assessment Area 5: West Coast (Centre)	Number of Commercial Fixed Wind Developments			Potential cumulative effects across receptors for development of up to 300MW are generally negligible. Further development of between 600MW and 900MW is generally negative to significant adverse. The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 15 - 25 km from the coastline. Installation of up to three arrays in this area could potentially have significant adverse effects on protected sites and birds located on the adjacent coastline. Potential effects on terms of collision risk and habitat exclusion impacts on birds, and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the likely significance of any potential effects on marine mammals, fish, birds, turtles and benthic ecology. Seascape character throughout in this area is generally highly sensitive to offshore wind developments. Any development within 15km of the coast is likely to have a substantial effect on seascape. Any potential effects are also likely to be of substantial to moderate significance up to 24km from the shore. These effects would reduce to slight further offshore e.g. more than 24km, with effects becoming negligible at 35km.
	300 MW	600 MW	900 MW	
	Negligible	**Negative/ Significant adverse**	**Unknown/ Significant adverse**	
	Number of Commercial Wave Developments			Potential cumulative effects across receptors for development of between 1000MW to 3000 MW are generally negligible - negative. Potential effects up to 6000MW are generally negative although effects are likely to be more significant in the inshore areas. Potential effects are primarily associated with protected sites and mammals located on the adjacent coastline, navigation and commercial fisheries. Potential effects in terms of collision risk and habitat exclusion on birds, marine mammals, reptiles and fish, and possible barrier effects to marine mammals moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the likely significance of any potential effects on marine mammals, fish, birds, turtles and benthic ecology.
	1000 to 3000 MW	3000 to 6000 MW	More than 7000 MW	
	Negligible	Negative	**Negative/ Significant adverse**	

<table>
<tr><th>Assessment Area</th><th>Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="5">Assessment Area 5: West Coast (Centre)</td><td colspan="3">Number of Commercial Wave Developments (Continued)</td><td rowspan="3">In terms of seascape effects, there are a number of sections of the coastline in this assessment area where seascape character is considered to be sensitive to wave developments. It is therefore likely that, a large number of developments located within 0km to 5km of the coast could potentially have moderate to substantial effects on seascape character. However, these potential effects could be avoided or reduced to slight/negligible by siting developments more than 15km from the coast.</td></tr>
<tr><td>1000 to 3000 MW</td><td>3000 to 6000 MW</td><td>More than 7000 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Negative/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Floating Wind Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of 7200 MW are generally negligible - negative. The likely significance of potential effects increase with larger areas exploited and the most significant potential effects are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significant of any effect.

Potential moderate to substantial effect on seascape can be reduced by siting developments more than 24km from the coast. However, it is likely that moderate to substantial effects could occur at this distance where the overall number of developments increases. Where there are large numbers of developments any moderate to substantial effects can be further reduced/avoided by siting developments more than 35km from the coast.</td></tr>
<tr><td>3600 MW</td><td>7200 MW</td><td>10,800 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
<tr><td rowspan="3">Assessment Area 5a: Shannon Estuary</td><td colspan="3">Number of Commercial Tidal Developments</td><td rowspan="3">It is likely that any commercial scale tidal development in the Shannon Estuary is likely to have a significant adverse effect on the Lower Shannon Estuary SAC and a number of SPA sites that are also associated with the estuary. There are also likely to be significant adverse effects on shipping and navigation due to the high intensity of vessels within the estuary. Potential effects on seascape are likely to moderate to slight, particularly for tidal devices that can be fully submerged. There are also likely to be adverse effects on commercial fisheries within the estuary.</td></tr>
<tr><td>50 MW</td><td>100 MW</td><td>150 MW</td></tr>
<tr><td>Unknown/ Significant adverse</td><td>Unknown/ Significant adverse</td><td>Unknown/ Significant adverse</td></tr>
</table>

Assessment Area	Technology Type and Amounts (MW)			Summary of Cumulative Effects (Including Mitigation)
Assessment Area 6: West Coast (North)	Number of Commercial Fixed Wind Developments			Water depths within this area allow more potential for development further offshore away from the most sensitive areas, particularly to the north of the area. Potential cumulative effects across receptors for development of 3000MW are generally negligible to negative. Installation of 4500MW in this area may cause negative effects primarily associated with the potential impacts on shipping, commercial fishing and nature conservation. Potential effects associated with collision risk and habitat exclusion on birds, and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential effects on marine mammals, fish, birds, turtles and benthic ecology. Moderate to substantial seascape effects could be reduced/avoided by increasing the distance of developments from shore e.g. beyond 24km.
	1500 MW	3000 MW	4500 MW	
	Negligible	Negative	Negative	
	Number of Commercial Wave Developments			Potential cumulative effects across receptors for development of between 1500MW and 7000MW are generally negligible to negative as there is more flexibility for siting developments further offshore. More studies are needed to understand effects on marine wildlife. A large number of developments within 0 to 5km of the coast are likely to have moderate to substantial effects on the main sensitive seascape types in this area. These potential effects can be reduced to slight/negligible by increasing the distance of developments from shore (e.g. beyond 15km from the coast).
	1500MW	3000MW to 6000MW	7000MW to 8000MW	
	Negligible	Negative	Negative	
	Number of Commercial Tidal Developments			Potential cumulative effects across receptors for development of up to 750MW are generally negligible to negative. Installation of up to 1500MW in this area may have negative effects on shipping, commercial fishing and nature conservation. Potential effects in relation to collision risk and habitat exclusion impacts on birds, marine mammals, fish and reptiles and possible barrier effects to marine mammals and reptiles moving along the coast could also be of adverse significance. Clustering of a large number of tidal developments within 0km to 5km of the coast could have moderate to substantial effects on seascape character. These effects could be reduced by installing developments further offshore (10km/15km) or installing fully submerged devices.
	100 MW	750 MW	1500 MW	
	Negligible	Negative	Negative	
	Number of Commercial Floating Wind Developments			Potential cumulative effects across receptors for development of 7200 MW are generally negligible - negative. The likely significance of effects increase with larger areas exploited and the most significant potential effects are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significance of any potential effects. Potential effects on seascape can be reduced by siting developments more than 24km from the coast, preferably 35km offshore.
	3600 MW	7200 MW	10,800 MW	
	Negligible	Negative	**Unknown/ Significant adverse**	

Summary of Results from the Cumulative Assessment

This section summarises the opportunities for the development (development potential) for each of the different technologies (fixed and floating wind, wave and tidal energy) within each of the assessment areas. The development potential reflects the amounts of development (MW) that could **potentially** be accommodated in each area without likely significant adverse effects on the environment or other marine activities/users. These findings are based on the results from the cumulative assessment presented in Chapter 12 of the Environmental Report and summarised in Table7.2 above.

Overview of Development Potential (MW) for Fixed Offshore Wind

- Areas with greatest potential for fixed offshore wind development are Assessment Areas 1, 2 and 6, the east coast and the west coast (north) respectively.
- Opportunities for fixed offshore wind development along the majority of the south and west coast (south and central) are significantly constrained by water depth which drops to more than 60m depth within a few meters from the shore.
- Where there are potential areas for development these tend to be located in coastal/inshore locations and are in very close proximity to/within protected sites and near to a number of other sensitive receptors e.g. breeding bird and seal colonies. Consequently opportunities for development in these areas without likely significant adverse effects on the environment are very limited.
- The seascape character along the entire west coast (in particularly the south around the Skellig Micheal WHS) is considered to be very sensitive to offshore wind developments, further restricting opportunities for high levels (MW) of development in coastal/nearshore areas.
- East and North West coast is much shallower, increasing the potential to find alternative sites to avoid protected sites and sensitive receptors and to site developments further offshore particularly off the North West coast.
- Main constraints on east coast relate to shipping and navigation, protected sites and associate sensitive receptors (birds, marine mammals, fish and reptiles) although the abundance of these is less on the east coast than the west coast.
- Potential effects on commercial fisheries are a key consideration in all areas, and are likely to be more significant in constrained areas such as the east coast.

Overview of Development Potential (MW) for Floating Wind and Wave Energy

- Assessment Areas 4, 5 and 6 (the west coast) have the greatest potential for both floating wind and wave developments.
- Floating wind and wave developments are less constrained by water depth. This increases the potential for siting developments further offshore away from protected sites, sensitive receptors and other marine activities in coastal areas.
- There are also more opportunities for identifying alternative sites within certain offshore areas should surveys/studies carried out at the project stage identify potential significant constraints in certain location.
- Opportunities to site developments further offshore also decrease the potential for likely significant effects on the sensitive seascape areas along the west coast.
- The main constraints on potential development (floating wind and wave) off the west coast include commercial fisheries and interactions with mobiles species (marine mammals, fish and reptiles), in particular the potential for a number of large scale commercial developments to create barriers to movement of these species along key migratory routes.

Overview of Development Potential (MW) for Tidal Energy

- Opportunities for tidal development are limited to Assessment Areas 2 and 6.
- The Shannon Estuary contains a significant tidal stream resource. However, the assessment concludes that any commercial scale development in this area is likely to have significant adverse effects on the Lower Shannon Estuary SAC (designated for bottlenose dolphin and Annex I habitat) and surrounding SPAs. The area also experiences very high intensities of vessel movements (shipping), further constraining any potential for commercial scale development in this area.
- However, there could be potential for developing test or demonstration projects in the Shannon Estuary.
- Further studies are likely to be required to fully identify the opportunities for tidal energy in Assessment Areas 2 and 6 due to the potential for tidal developments in coastal/nearshore areas to have likely significant adverse effects on marine mammals, reptiles, fish and birds (diving and pursuit) due to potential collision risk (on migratory routes or in feeding areas) and possible habitat exclusion.

Achieving OREDP Development Scenarios

The following section considers the results of the cumulative assessment in regard to achieving the development scenarios set out in the OREDP.

Achieving Development Scenarios for Fixed and Floating Wind

Overall, the scenario for offshore wind set out in the OREDP is to develop 4,500MW by 2030. This includes both fixed and floating wind. Based on the results from Chapter 11 of the ER (the assessment of the assessment areas) and the assessment of cumulative effects (Chapter 12 of the ER) it has been identified that in total there is potential to develop between **9,200MW** and **12,000MW** from fixed wind and at least 27,000MW from floating wind.

Based on these figures, it would appear that it would therefore be possible to achieve the scenario for 4,500MW from wind by 2030. However, there are a number of factors that need to be taken into consideration with regard to these figures. These include:

- Floating wind is still an emerging technology. It is therefore unlikely that there would be any significant commercial scale developments in operation by 2020, or even possibly 2030. Therefore although there is significant potential for the development of this technology in Irish waters, its overall contribution towards achieving the scenarios set out in the OREDP may be limited.
- Opportunities for offshore wind off the south and west coast (Assessment Areas 3, 4, and 5) are significantly constrained by water depth, shipping and navigation, seascape, protected sites and other sensitive receptors close to shore. Although the assessment has identified some development potential in these areas, they generally appear to be unsuitable for fixed wind development.
- Therefore given the limitation with floating wind and constraints on the south and west coast for fixed wind development it is likely that the 4,500MW scenario identified in the OREDP would have to be met with fixed wind developments in Assessment Areas 1, 2 and 6.
- There is potential for the 4,500MW scenario to be met entirely with development in Assessment Area 6. However, although it is acknowledged in the Grid25 plan that new infrastructure and transmission network reinforcements will be provided along the west coast, precise detail on the future availability of grid connections and capacity in this area is currently unknown and could therefore prove to be a limiting factor in developing off the North West coast.
- The 4,500MW scenario could also potentially be achieved entirely with fixed wind developments off the east coast (total identified potential for Areas 1 and 2 is between 4,200MW and 4,800MW) providing no significant adverse effects are identified at the project stage for example in terms of shipping and navigation and nature conservation.
- Of the potential 4,200MW to 4,800MW, there is already 2,314MW either consented or due to receive a grid connection offer in the Gate 3 process. It is therefore likely that there would be limited additional development required in this area to achieve the 4,500MW scenario.

Achieving Development Scenarios for Wave and Tidal Energy

Overall, in terms of wave and tidal energy, the scenario set out in the OREDP is to develop 1,500MW by 2030. The results from the assessment conclude that overall the potential developable wave resource, in both shallow (10m to 100m depth) and deeper water (100m to 200m depth) is significant, totalling between 27,500MW and 31,100MW across all areas, with at least 12,500MW in shallower waters. In comparison, the overall potential tidal energy resource is much more constrained, ranging between 1,500MW to 3,000MW across Assessment Areas 2 and 6.

Based on these figures, it would appear that the development scenario for 1,500MW for wave and tidal energy could be achieved entirely from wave energy, with a contribution from tidal energy. However there are a number of factors to take into consideration:

- Most of this resource is located off the west coast. Consequently, although there is a significant resource, realisation of this potential resource, even achieving the scenario of 1,500MW will not only depend on industry developing this technology to a commercial scale by 2020 with significant progress by 2030, but will also depend on the provision and availability of necessary onshore infrastructure such as grid connections and capacity.
- There is no tidal potential in the Shannon Estuary due to environment constraints.
- There is potential for tidal energy to contribute towards achieving the scenarios of 1,500MW for wave and tidal energy, although potential environmental constraints associated with this technology are generally greater than wave developments due to the close proximity of the resource to the coast. There is more scope for avoiding protected sites and sensitive receptors in Assessment Area 6, although the availability of grid connections in this area is still a consideration.

Cumulative Assessment: Other Plans and Programmes

The SEA also looked at the potential cumulative effects that could occur as a result of implementing the OREDP in association with other relevant statutory instruments, plans and programmes that relate specifically to Ireland. The findings from this assessment included:

- **Habitats Directive and OSPAR**: Under these regulatory instruments, Ireland is statutorily obliged to establish networks of protected sites which include Natura 2000 and MPA respectively. In terms of this SEA, potential effects on all existing Natura 2000 (SPAs and SACs) and MPAs (as of October 2010) have been assessed in Chapters 10, 11 and 12 of the Environmental Report. Any further Natura 2000 and MPA sites designated after this date will have to be assessed as part of supporting assessments (e.g. EIA and Appropriate Assessment) for all Foreshore Lease application for individual projects.
- **Marine Strategy Framework Directive (MSFD) 2008**: Under the MSFD the Irish Government has to prepare a strategy for the management of Irish waters which includes the implementation of monitoring programme based on specific targets and indicators to measure Good Environmental Status (GES). It has been identified that there could be a number of potential synergies between this and the monitoring requirements for this SEA. Further information in relation to this is provided in Chapters 15 and 16 of the Environmental Report.
- **Ireland's proposals for Marine Planning**: Although there are currently no statutory requirements to prepare marine plans in Ireland, future plans could assist with the delivery of future offshore renewable energy developments in certain areas. Baseline data collected as part of this SEA may also be useful in informing the preparation of marine plans for certain areas.
- **Grid 25 Implementation Programme**: This SEA has been carried out at the same time as the SEA on the Grid 25 Implementation Programme. However, there are limited interactions between the two plans/SEAs due to there being limited information in terms of where offshore renewable energy development will be located and therefore where they are likely to require connections to the onshore transmission network. However, the Grid 25 plan does acknowledge that transmission network reinforcements are required along the west coast to accommodate increased generation from both onshore and offshore renewables

Cumulative Assessment: Transboundary Effects

The SEA also assessed other offshore plans, programmes and projects that could have in-combination effects with the OREDP. These included:

- Petroleum Affairs Division – Ireland Offshore Strategic Environmental Assessments (IOSEAs) 1 to 4.
- Northern Ireland Offshore Renewable Energy Strategic Action Plan (ORESAP).
- The Crown Estate Leasing Round for Wave and Tidal Developments in the Pentland Firth and Orkney Waters.
- The Crown Estate (TCE) Scottish Offshore Wind Licensing Round.
- Islay Tidal Project.
- The Crown Estate (TCE) Offshore Wind Licensing Rounds 1, 2 and 3 including extensions to Rounds 1 and 2.
- The Department of Energy and Climate Change (DECC) UK Offshore Energy SEA 2 (OESEA2)
- Welsh Assembly Government (WAG) Ministerial Policy Statement on Marine Energy in Wales (July 2009).
- Potential development in Isle of Man waters.
- Europe's Onshore and Offshore Wind Energy Potential: An Assessment of Environmental and Economic Constraints (European Environmental Agency EEA).

In terms of the plans, programmes and developments listed above, it was identified that potential transboundary and in-combination effects are most likely to occur in relation to the Northern Ireland ORESAP and the potential cumulative effects on seascape, nature conservation and shipping and navigation resulting from a number of offshore wind developments around Lough Foyle and Carlingford Lough.

Other potential transboundary effects relate mainly to the plans/programmes involving development in the Irish Sea/Channel e.g. development off the coasts of Wales and the Isle of Man and in the Liverpool Bay Offshore Wind Round 3 Zone. The main effects identified relate to reduced navigational safety due to main shipping channels being constrained and possible barriers to movement for marine mammals, reptiles and fish that migrate or transit along the Irish channel.

8: Mitigation and Monitoring

The results from the assessment indicate that there is potential to achieve the higher level scenario presented in the OREDP for the development of 4,500MW from offshore wind and 1,500MW from wave and tidal energy without likely significant adverse effects on the environment. However, there are important qualifications to this conclusion, primarily resulting from gaps in data and information relating to the marine environment and from limited knowledge and understanding on the effects of certain technologies and types of devices on specific sensitive receptors. Further detail on the main data, information and knowledge gaps identified in this SEA is provided in Chapter 14 of the Environmental Report.

Taking those qualifications into account, it is necessary as part of the SEA process to identify appropriate mitigation measures/actions to avoid, reduce or offset any potential significant adverse effects on the environment, and to monitor any unforeseen effects on the environment. As part this SEA a series of **Actions** have been identified which focus on mitigating and monitoring the potential environmental effects resulting from the implementation of the OREDP. In addition to these actions there are also a number of specific **project level mitigation measures** which have been integrated into the overall assessment of effects:

- **Plan Level Actions:** These actions that are incorporated into the plan (OREDP) in order to avoid, reduce or offset and monitor significant adverse effects. These relate to strategic level measures that have been identified as being appropriate for the scenarios for the development of offshore renewable energy, as set out in the OREDP, to be achieved in a way that avoids or minimises potential adverse effects on the environment and monitors potential unforeseen effects.
- **Project Level Mitigation Measures:** These are measures that are not necessarily directly incorporated into the plan but are recognised as good practice and it is assumed that these would be incorporated into future projects. It is recognised that the OREDP cannot guarantee that these measures will be implemented. However, it is considered reasonable to assume that these measures would be implemented by a responsible developer and they are likely to be necessary in order to achieve development consent/Foreshore Leases at the project level. **Further detail on the specific project level mitigation measures is provided in Chapter 15 of the Environmental Report.**

Plan Level Actions:

The main actions identified for avoiding or reducing potential significant adverse effects and monitoring unforeseen effects include:

Collaboration and Coordination:

- **Action 1:** Development of a mechanism for greater coordination between all state bodies concerned to improve the effectiveness of the delivery of the OREDP as policy develops. This could include an enhanced role for the existing multi-body Ocean Energy Steering Committee.
- **Action 2:** Collaborative working with the existing Ocean Energy Advisory Group to assist/advise SEAI and DCENR with taking forward the OREDP.

SEA Monitoring Requirements:

- **Action 3:** In accordance with Article 17 of the SEA Regulations 2004, the group identified in the mechanism for enhanced co-ordination in Action 1 shall ensure the significant environmental effects of the implementation of the plan are monitored. This will ensure that unforeseen adverse effects are identified at an early stage and that appropriate remedial action is taken as required.

Addressing Data, Information and Knowledge Gaps:

- **Action 4:** DCENR and SEAI, in the context of the offshore renewable energy sector, should collaborate with the lead authorities on the MSFD and other statutory requirements that are taking forward requirements relating to collation, management and dissemination of data and information collected for the marine environment so that data is made publicly available so that it may be taken into account by those developers and bodies involved in the siting, design, consenting and permitting of individual projects.

Consenting and Permitting:

- **Action 5:** Future foreshore consenting processes by the relevant authorities should take into account the broad findings and assessment of this SEA and AA in terms of location and constraints.

Consenting and Permitting:

- **Action 6:** The foreshore consent process should require developers to put in place appropriate monitoring programmes to assess the effects of their development.
- **Action 7:** The foreshore consenting authority should consider the application of an incremental (the 'deploy and monitor') approach as part of the scaling up of offshore renewable energy developments.

Guidance and Advice:

- **Action 8:** The project level mitigation measures/EIA Guidance prepared as part of the SEA should be incorporated into National EIA Guidance for offshore renewable energy developments.
- **Action 9:** Development and maintenance of a GIS database tool to inform the Foreshore Consenting process, lead by the Marine Institute.

9: Next Steps and Consultation

Consultation

This SEA Non-Technical Summary, the Environmental Report and the draft OREDP will be available for consultation from **5th November 2010 for 12 weeks.**

All comments received on the Draft OREDP and the Environmental Report will then be reviewed and addressed where appropriate prior to adoption of the OREDP in spring 2011. An SEA Statement will be published once the OREDP is adopted. This will set out how the findings from the SEA and comments from public consultation have been integrated into the final OREDP.

The Environmental Report is available to download from the SEAI website:

http://www.seai.ie/Renewables/Ocean_Energy/

All comments received from consultation on the Environmental Report will also be available to view on the website.

Further Information

Further information on the SEA can be found at:

http://www.seai.ie/Renewables/Ocean_Energy/

Comments on the Environmental Report and Draft OREDP

All comments on the Environmental Report and OREDP should be submitted by:

Email to:	**oreseaconsultation@seai.ie**
Post to:	**SEA Consultation** Sustainable Energy Authority of Ireland Wilton Park House, Wilton Place, Dublin 2