

Planning Scotland's Seas

SEA of Plans for Wind, Wave and
Tidal Power in Scottish Marine Waters
Environmental Report

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Table of Abbreviations

AC	Alternating Current
AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
AIS	Automatic Identification System
ALS	Area of Landscape Significance
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
APQ	Area of Panoramic Quality
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
BAP	UK Biodiversity Action Plan
BGS	British Geological Society
CAMERAS	Co-ordinated Agenda for Marine, Environment and Rural Affairs Science
CAR	Controlled Activities Regulations
CCS	Carbon Capture and Storage
CO ₂	Carbon dioxide
cSAC	Candidate Special Area of Conservation
DC	Direct Current
EGPS	Electricity Generation Policy Statement
EC	European Commission
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMF	Electro-magnetic field
ESAS	European Seabirds at Sea
EU	European Union
EUNIS	European University Information Systems
FAME	Future of the Atlantic Marine Environment
GCR	Geological Conservation Review
GHG	Greenhouse Gas
GIS	Geographic Information System
HIE	Highlands and Islands Enterprise
HRA	Habitats Regulations Appraisal
IBA	Important Bird Area
ICES	International Council for the Exploration of the Sea

IPF	Initial Plan Framework
IPOA-SHARKS	International Plan of Action for the Conservation and Management of Sharks
IPR	Iterative Plan Review
IUCN	International Union for Conservation of Nature
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LDP	Local Development Plan
LPA	Local Protection Area
MAIB	Marine Accident Investigation Branch
MarClim	Marine Biodiversity and Climate Change
MaRS	Marine Resource System
MCA	Maritime and Coastguard Agency
MCCIP	Marine Climate Change Impacts Partnership
MCS	Marine Conservation Society
MPA	Marine Protected Area
MSD	Marine Strategy Directive
MSFD	European Marine Strategy Framework Directive
NORM	Naturally Occurring Radioactive Material
NPF3	National Planning Framework 3
NRIP	National Renewable Infrastructure Plan
NSA	National Scenic Area
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OUV	Outstanding Universal Value
PAG	Project Advisory Group
PFOW	Pentland Firth and Orkney Waters
PMF	Priority Marine Feature
PPS	Plans, Programmes and Strategies
pSAC	Possible Special Area of Conservation
RBD	River Basin Districts
RBMP	River Basin Management Plans
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
RLG	Regional Locational Guidance
RSA	Regional Scenic Area
RSPB	Royal Society for the Protection of Birds

RYAS	Royal Yachting Association Scotland
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SACN	Sea Anglers Conservation Network
SAMS	Scottish Association for Marine Science
SCAPE	Scottish Coastal Archaeology and the Problem of Erosion
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SFSA	Strategic Framework for Scottish Aquaculture
SHEP	Scottish Historic Environment Policy
SIMD	Scottish Index of Multiple Deprivation
SLA	Special Landscape Area
SMRRG	Scottish Marine Renewables Research Group
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
Sniffer	Scotland and Northern Ireland Forum for Environmental Research
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
SUDS	Sustainable Urban Drainage Systems
TCE	The Crown Estate
TLP	Tension Leg Platform
UKCIP	UK Climate Impacts Programme
UNCBD	United Nations Convention on Biological Diversity
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WFD	Water Framework Directive
WHS	World Heritage Site

1 Non-Technical Summary

1.1 Introduction

1.1.1 Marine Scotland is currently developing plans that will identify areas of Scottish marine waters that may be suitable for the development of offshore wind, wave and tidal technology. The plans will include option areas which will help to steer developers towards suitable areas for planning projects to go through a marine licensing process. The draft plans are currently going through public consultation and the submitted responses will be considered as the plans are developed. Furthermore the plans have been subject to environmental and socio-economic assessments. This Environmental Report documents the results of the Strategic Environmental Assessment (SEA) which is an assessment of the effects of the plans on relevant environmental receptors¹. In this assessment the effects of the plan on the following have been considered: biodiversity; flora; fauna; population and human health; water and the marine environment; climatic factors; marine geology and coastal processes; historic environment; and landscape and seascape.

1.2 What are the Plan Options and Alternatives and how were they assessed?

1.2.1 The SEA began by gathering information on the potential effects of current alternative technologies that might be developed within plan option areas in the future. This provided the following assessment of plan option areas with an overview of the potential effects of wind, wave and tidal devices. The Draft Plan Option areas which are displayed in Figure 1.1 below.

¹ SEA of the plans is required under the Environmental Assessment (Scotland) 2005

Draft Plan Options for wind, wave and tidal energy

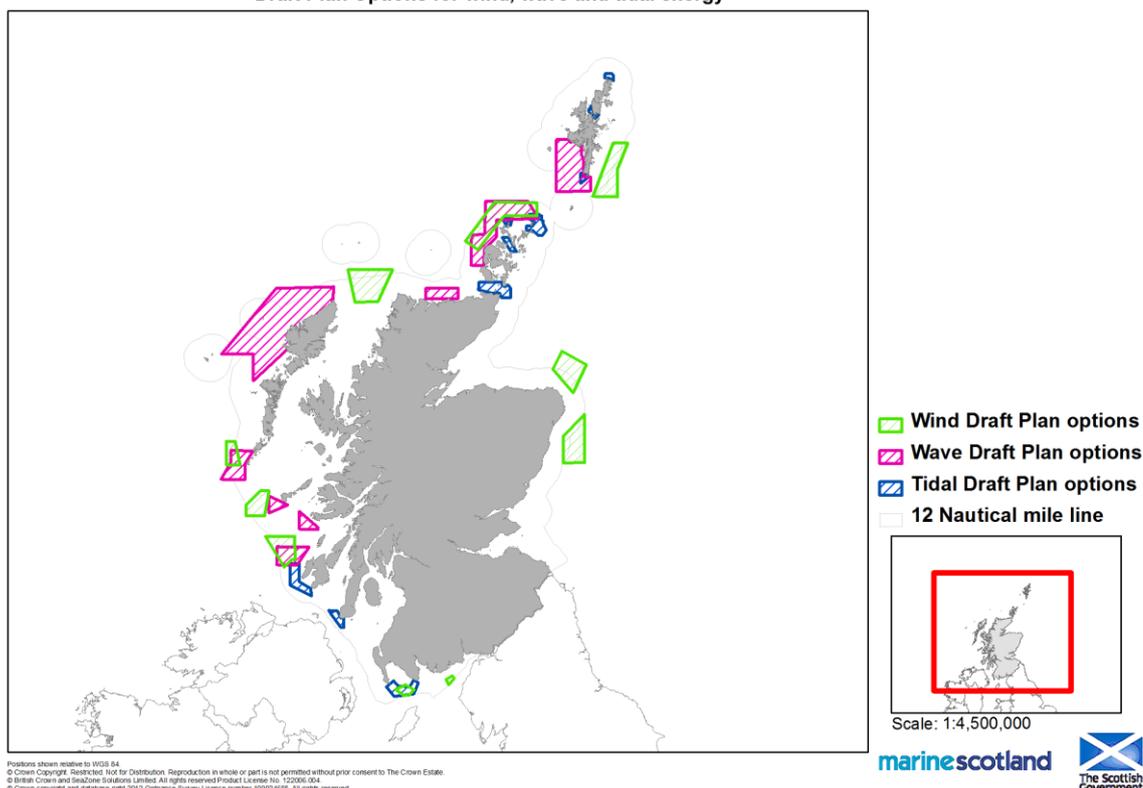


Figure 1.1: Draft Plan Options for Wind, Wave and Tidal Energy

1.2.2 The assessment of Draft Plan Options involved considering whether the potential effects of the devices, identified in the previous stage, would interact with the environmental receptors of relevance to each plan option. Information relating to the relevant environmental receptors has been collected and is presented in the separate Appendix B. Table 1.1 below provides a brief summary of some of the information that has been considered in this assessment.

Table 1.1: Summary of the environmental information collected to inform the assessments

SEA Environmental Receptor	Baseline Information collected
Biodiversity, flora and fauna	<ul style="list-style-type: none"> • Seabed (benthic) habitats and species. • Information on areas designated for nature conservation interest (including newly proposed Marine Protected Areas) and priority marine features. • Information relating to relevant bird species, cetaceans (e.g. dolphins and whales), elasmobranchs (e.g. sharks, skates and rays), seals, protected fish species, and shellfish. • Pressures on biodiversity including climate change.
Population and human health	<ul style="list-style-type: none"> • Population distribution and change. • Health risks and deprivation. • Marine related employment. • Recreational activity.

SEA Environmental Receptor	Baseline Information collected
Water and the marine environment	<ul style="list-style-type: none"> • Water quality and ecological status. • Transitional waters. • Shellfish waters. • Bathing waters.
Climatic factors	<ul style="list-style-type: none"> • Climate change emissions reduction targets and mitigation. • Climate change adaptation. • The interaction of climate change with other environmental receptors including coastal areas and marine ecosystems.
Marine geology and coastal processes	<ul style="list-style-type: none"> • Coastal and marine geological designations. • Vulnerabilities to climatic change. • Soils, sediments and bathymetry. • Coastal vulnerability and change. • Dredging and disposal
Historic environment	<ul style="list-style-type: none"> • Marine archaeology and designated wrecks. • Heritage and architectural assets and coastal designations.
Landscape and seascape	<ul style="list-style-type: none"> • Relevant areas designated for their landscape value, including National Scenic Areas and local designations. • Areas of wildness and wildland.

1.2.3 The assessment of Draft Plan Options sought to identify different types of effects, such as short or long term, directly relating to the installation of devices or as a result of change brought about by their installation. Where appropriate the assessments made recommendations that might help to improve the environmental performance of the plan during as it is delivered.

1.2.4 Following assessment of the individual Draft Plan Options the cumulative (or in combination) effects of development within multiple areas was considered. This assessment also included, as far as possible, the effects of other relevant offshore and coastal activities. The information on these other activities originated from their own SEAs and from project level environmental assessments.

1.2.5 The cumulative assessment was further informed by scenarios, developed within the socio-economic assessment, for the indicative occupancy of devices across the Draft Plan Options. These are presented in Table 1.2 below.

Table 1.2: Indicative occupancy scenarios for wind, wave and tidal energy

Scenario	Wind Indicative Occupancy (%)	Wave Indicative Occupancy (%)	Indicative Occupancy (%)
Low	4.8 – 26.5	0.2 – 0.6	0.8 – 2.5
Medium	11.6 – 26.5	0.5 – 0.6	2.6
High	25.1 – 26.5	1.0	5.1

1.2.6 Given the fact that there are uncertainties involved with predicting what effects may result from projects that are not yet planned the cumulative impact assessment was undertaken under by a risk based approach. This sought to identify where higher risks of significant effects might occur, whilst acknowledging that the identification of potential effects will continue through the project level Environmental Impact Assessment (EIA) process. The approach is set out in the table below.

Table 1.3: Risk Based Approach Used in this Report

Lower Risk	Medium Risk	Higher Risk
Based on the best available information whilst the environmental receptor may be impacted, the value and vulnerability of the environmental receptor is considered to be lower (e.g. whilst considered important the species or areas are undesignated or not considered to be of particular value or sensitivity, the environmental receptor may be considered replaceable).	Based on the best available information the environmental receptor may be impacted, although this may not be certain, and the value and vulnerability of the environmental receptor is not considered to be particularly high (e.g. local designations and features of interest, acknowledged importance of species, the environmental receptor is sensitive and/or difficult to replace).	Based on the best available information whilst the environmental receptor will be impacted, and the value and vulnerability of the environmental receptor is considered to be high (e.g. international level designations of species or areas containing important features, the environmental receptor is very sensitive and/or irreplaceable).
Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered low (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).	Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered to be notable (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).	Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered to be notable and significant to the point that the features within any location might be lost (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).
Whilst there is potentially a link or pathway between the type of renewable technology and the environmental receptor is not considered to be direct.	There is a clear link or pathway between the type of renewable technology and the environmental receptor under consideration.	There is a clear and strong link or pathway between the type of renewable technology and the environmental receptor under consideration.
Effects are likely to occur only in the short term (e.g. associated with the construction phase only)	Effects are likely to occur only in the short and medium term (e.g. initial loss of features or designations but that might recover in the long term).	Effects may occur from the short term but are likely to also be long term (e.g. loss of features or designations that cannot recover)

1.3 What did the Assessments conclude and what were the Recommendations?

1.3.1 The SEA identifies a number of potential effects associated with the development of offshore renewables in the Draft Plan Options presented in the

Plans. Detailed findings are presented in the report and are summarised below providing a brief summary of key findings from the assessment arranged by environmental topic.

- 1.3.2 This section also includes an overview of the key recommendations from the SEA. Recommendations include focus for the requirement for project level assessment and the targeting of further research to address uncertainties identified in the assessment process.

Biodiversity, Flora and Fauna

- 1.3.3 There is the potential for a range of effects on species and habitats. These include potential impacts to seabirds and diving birds from above water and submerged infrastructure, and uncertain risks to marine fauna including whales, dolphins, sharks, rays, seals and fish from the construction and presence of submerged infrastructure which includes collision and displacement. The potential for impacts is largely dependent on technology type and location. For example: some seabird collision risk is generally more to be associated with wind devices; potential for collision impacts to some seabirds and diving birds and marine mammals are likely to be associated with wave devices; and the potential for collision impacts to some diving birds and marine fauna is more likely to be associated with tidal devices.
- 1.3.4 Overlaps between Draft Plan Options, European level designations and proposed new national level designations of Marine Protection Areas (MPA) have been identified in some locations. The SEA recommended that whilst co-location is possible, projects in these Draft Plan Options will need to demonstrate through project level Environmental Impact Assessment (EIA) that significant adverse effects on the integrity European designations will be avoided and that development is compatible with the conservation objectives of the proposed MPA.
- 1.3.5 The importance of project level assessment, EIA and Habitats Regulations Assessment (HRA) is discussed, and the need to demonstrate avoidance of impacts on protected species and sites is a key recommendation. The existing programme of research programmes were identified as being able to provide information to address project-specific issues, targeting gaps in the evidence base and working towards addressing the uncertainties identified in the SEA. Furthermore, a Project Advisory Group to co-ordinate project level monitoring to assist in providing greater certainty for effects prediction on species and habitats at the project level. This will help to identify which species, if any, are particularly vulnerable.

Population and Human Health

- 1.3.6 Collision risk and potential displacement of recreational activities was identified as a key consideration of potential developments, particularly in areas such as the Solway Firth, Inner Hebrides and Orkney known as important recreational areas. The SEA recommended avoidance of areas with the heaviest commercial shipping and recreational activities where possible. It concluded

that the potential significant impacts of displacement of use may be avoided by working with the recreational sector to identify patterns of use. The adoption of mitigation measures such as use of navigational aids, infrastructure lighting and exclusion zones are recommended to reduce the potential for collision and accidents.

Water and the Marine Environment

- 1.3.7 While the potential for impacts on the water environment were identified, particularly in the construction and installation phase of works, effects such as turbidity and pollutant releases are likely to be localised and temporary. By building standard mitigation into construction and operational procedures, avoiding and managing pollution risk, and undertaking further investigation at the project level to consider the potential for effects in susceptible areas (e.g. hydrodynamic and water quality modelling), these impacts are considered to be manageable.

Climatic Factors

- 1.3.8 Overall positive effects are likely through the support of lower carbon energy generation in the development of offshore renewables. However, there is the potential for changes to hydrodynamics and wave energy associated with some technologies, particularly wave energy devices, and this could contribute to coastal erosion and accretion, in the right location and if devices can be demonstrated to lead to change. The potential scale of effects could be influenced by changes associated with climatic factors in locations with vulnerable coastlines. Project level assessment is recommended to reduce uncertainty and to determine the likelihood and significance of coastal impacts associated with these technologies.

Marine Geology and Coastal Processes

- 1.3.9 While the potential for adverse impacts such as scour has been identified. This is the effect of tidal motion moving sediments and potentially undercutting foundations, particularly for larger devices such as wind turbines with large footprints (e.g. gravity bases). Scour protection devices are available and can be incorporated into project design.
- 1.3.10 The assessment discusses potential for changes to hydrodynamics and coastal processes associated with some technologies. However, the significance of effects are not certain and would depend on the relationship between the type of device and local sea and coastal features. Therefore, consideration in project level EIA is recommended, through undertaking detailed assessment (e.g. including dynamic sediment modelling) to identify the potential for impacts from specific developments, and aid in the identification of mitigation (e.g. appropriate siting, design and arrangement of devices).

Historic Environment

- 1.3.11 The SEA identifies the potential for impacts on the setting of historic features, such as World Heritage Sites (WHS) and listed coastal buildings. Furthermore, impacts from the placement of devices on submerged marine archaeology, such as designated wrecks, were identified. It was also recognised that project level site surveys might provide positive effects by identifying previously unknown archaeological effects.
- 1.3.12 Effects on setting can be avoided by the appropriate location of devices, for example in order to avoid adverse impacts on the Heart of Neolithic Orkney WHS. Consideration of the potential effects of devices on the setting of important features of the historic environment should form an important component of project level EIA, whilst enabling the development of suitable mitigation measures where appropriate. Projects will also undertake seabed surveys and appropriate location of devices can avoid adverse effects on

Landscape and Seascape

- 1.3.13 The likelihood and magnitude of effects on landscape and seascape are discussed in regards of the potential visibility of wind, wave and tidal devices, to on and offshore receptors have been discussed in the SEA. Whilst wind technologies are potentially most visible, their development is more likely to be further from the coast and valued landscapes. Some wave and tidal devices may have more of their infrastructure under water or of lower height than wind devices. However these may be constructed closer to the coast and hence closer to some key receptors. The assessment has identified some of the sensitive coastal receptors.
- 1.3.14 Similarly, lighting of developments could have some degree of visibility, particularly at night, although evidence indicates that these may be more limited with distance from the coast.
- 1.3.15 The significance of effects on landscape and seascape character will depend on location within the Draft Plan Options and the design of devices and this forms part of project level EIA. The SEA therefore recommends that where possible, the significant effects can be avoided or mitigated through appropriate design and location. The assessment also highlights Draft Plan Options where effects on landscape and seascape may be particularly significant.

1.4 What are the Next Steps?

- 1.4.1 The Draft Plans and this SEA Environmental Report, alongside the Sustainability Appraisal Report and technical HRA and socio-economic reports are subject to a 16 week statutory consultation period. The relevant documents are available on the Scottish Government's website at <http://www.scotland.gov.uk/Consultations/Current> and in hard copy from:

Offshore Renewable Energy Planning
Marine Scotland
Policy and Planning
Area 1-A South
Victoria Quay
Edinburgh,
EH6 6QQ
Tel: 0300 244 1235

- 1.4.2 Submissions regarding this Environmental Report are invited from the public and interested stakeholder organisations. Responses are to be submitted in writing by 13th November 2013 to the above address, or emailed to: offshorerenewableenergy@scotland.gsi.gov.uk.
- 1.4.3 Following the completion of the consultation period, the Draft Plans will be reviewed and revised as appropriate by Marine Scotland (taking account of submissions received), and a final version will be formally adopted.
- 1.4.4 A SEA Post-Adoption Statement will be prepared to document the process and demonstrate how issues raised during consultation have been addressed by the final Plans. Once the final Plan has been published, the monitoring framework set out within this Environmental Report will be expanded and finalised to incorporate further detail on monitoring of key technical issues, and will be used to assess the impacts of the implementation of the Plans.

1.5 Questions for Consultees

- 1.5.1 Consultees are invited to submit responses in a format of their choice the following questions may be helpful to provide a focus for responses:
1. To what extent does the Environmental Report set out an accurate description of the current environmental baseline (Please give details of additional relevant sources)?
 2. Do you agree with the predicted environmental effects of the plans as set out in the Environmental Report?
 3. Do you agree with the recommendations and proposals for mitigation of the environmental effects set out in the Environmental Report?
 4. Are you aware of any additional ongoing research or monitoring that may help to fill gaps in the evidence base, particularly relating to the marine environment and its interactions with renewable energy devices (Please give details of additional relevant sources)?
 5. Are you aware of any further environmental information that will help to inform the environmental assessment findings (Please give details of additional relevant sources)?

2 Introduction to the Assessment

2.1 Sectoral Marine Planning

- 2.1.1 Marine Scotland has developed a process of sectoral marine planning to identify the most sustainable locations in Scottish Waters for the development of commercial scale offshore renewable energy.
- 2.1.2 Separate plans are being prepared for wind, wave and tidal energy in Scottish Waters. Each of these plans is developed through a planning process which has been constructed through a staged approach².
- 2.1.3 The scoping stage of the process was the first to be undertaken. This involved using the Crown Estate Marine Resource System (MaRS) which is a GIS based system that has enabled Marine Scotland Science to undertake a technical and scientific exercise to identify areas of constraint and opportunity. The outcome of this was the identification of strategic search areas which were suitable for renewable energy development.
- 2.1.4 Building upon the scoping study, the next stage of the process was the development of draft Regional Locational Guidance (RLG). At this point, consideration was given to more detailed environmental, technical and socio-economic issues in relation to the strategic search areas identified in the scoping study. The resultant information was then made available online for informal comment in draft locational guidance.
- 2.1.5 The areas of search were then published within draft Initial Plan Frameworks (IPF). These early stage documents outlined the potential options for areas of search along with the process for developing the plan which includes a Sustainability Appraisal, comprising a Strategic Environmental Assessment (SEA), Habitats Regulations Appraisal (HRA), and Socio-Economic Assessment.
- 2.1.6 The draft RLGs and IPFs for the wind, wave and tidal plans were made available for an initial period of comment during a pre-consultation process that covered September and October 2012. The pre-consultation process involved workshops held with key sectoral stakeholders and organisations. Furthermore, regional workshops were held in 10 locations across the country in order to engage with members of the public.
- 2.1.7 The results of the consultation events and the information presented in the draft RLGs were used to refine the search areas included in the draft IPFs and developing options to be taken forward within the draft plan. Scottish Ministers' decided on the Draft Plan Options in January 2013.
- 2.1.8 The Draft Plan Options have been subject to SEA, which forms part of the Sustainability Appraisal, and this will further inform the development of a draft

² Sectoral Marine Planning Information is available online at: <http://www.scotland.gov.uk/Topics/marine/marineenergy/Planning> (accessed 14/3/2013)

plans. Alongside the Sustainability Appraisal Report and the draft Plans, the SEA Environmental Report, will be subject to consultation with statutory consultees and the public. All consultation responses received will be compiled and presented in a Consultation Analysis Report. This document will also provide an analysis of the key issues arising.

2.1.9 The issues and responses arising from the consultation on both the plans and the Sustainability Appraisal Report will then be used to inform the Final Sectoral Marine Plans, which will be put before Scottish Ministers for adoption. When the plans are adopted, a Post-Adoption Statement will be produced which will provide an account of the development of the plan post consultation and an audit of consultation exercise. The full plan making process is depicted in Figure 2.1.

SECTORAL MARINE PLANNING

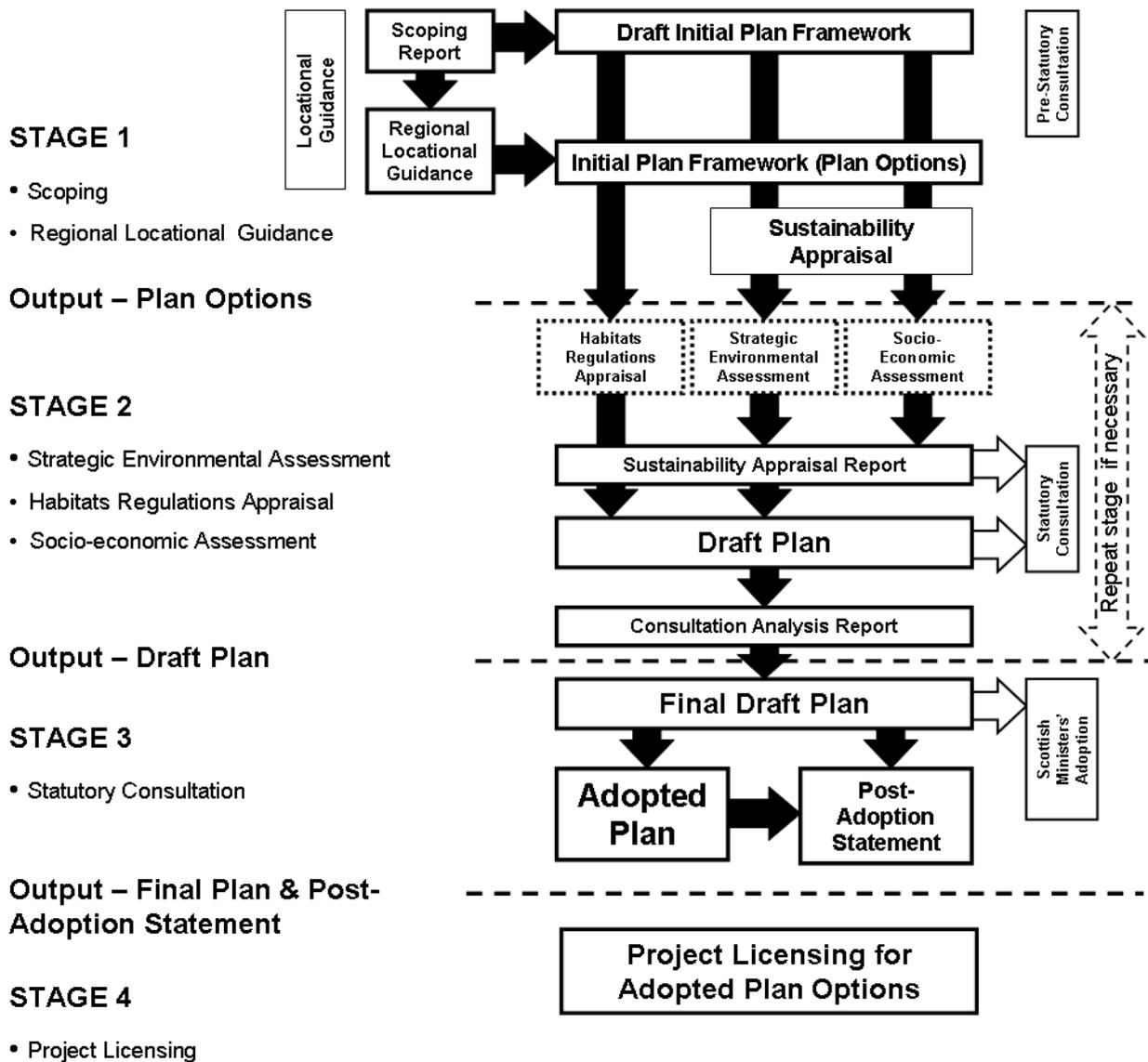


Figure 2.1 Sectoral Marine Planning

2.1.10 What follows within this report is the SEA of the Draft Plans for Offshore Wind Energy, Wave Energy and Tidal Energy in Scottish Territorial Waters.

2.2 The Draft Plan for Offshore Wind Energy in Scottish Waters

2.2.1 Marine Scotland is currently undertaking a review of its Sectoral Marine Plan for offshore wind energy development in Scottish Territorial Waters ('the draft Plan'). The draft Plan covers both Scottish territorial waters³ and Scottish offshore waters⁴.

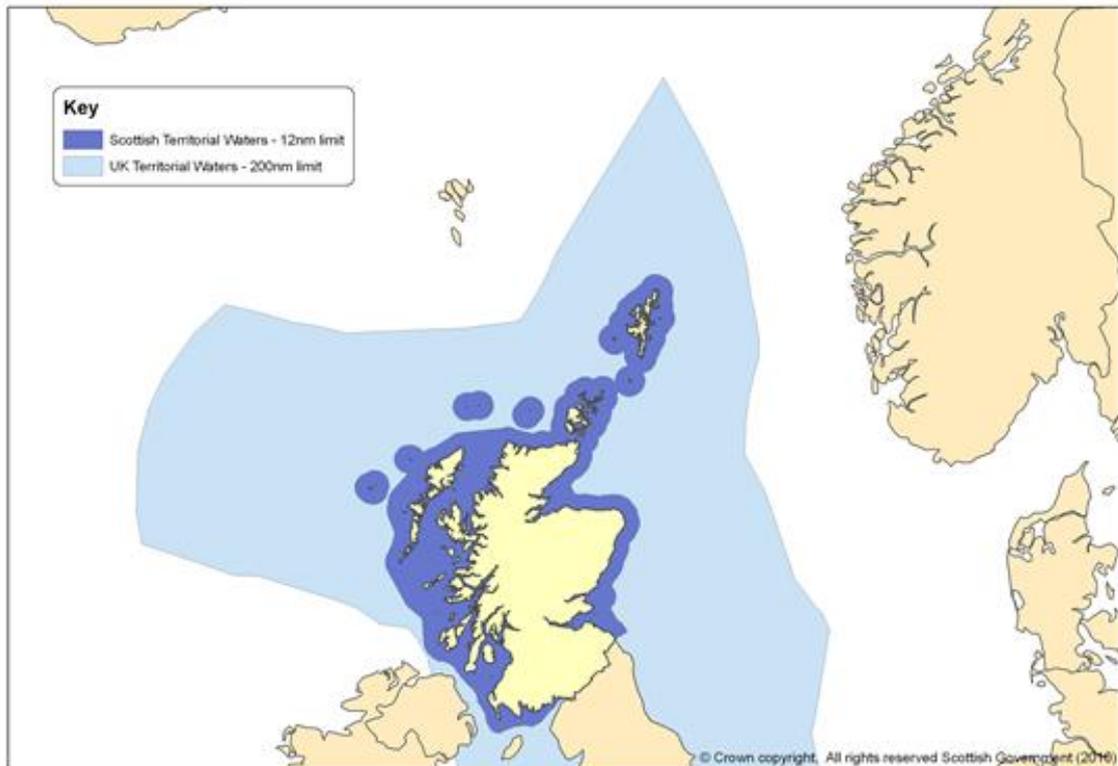


Figure 2.2 Map showing Scottish Territorial Waters and Scottish Offshore Waters

2.2.2 Scottish Ministers adopted '*Blue Seas - Green Energy: the Plan for Offshore Wind Energy in Scottish Territorial Waters*' in March 2011⁵. Blue Seas Green Energy set out a number of areas for offshore wind energy development including six 'sites' for development in the short term, and around 25 further 'areas of search' for consideration in the medium to longer term. It contained commitments to further research, data collection, stakeholder engagement and monitoring to accompany this programme of development. It also made a commitment to a 2 year review period, reflecting the fast pace of change within the offshore renewable sector.

2.2.3 Blue Seas, Green Energy considers the potential of Scottish territorial waters to accommodate offshore wind energy developments in the short, medium and

³ Scottish territorial waters cover 0-12 nautical miles from the shoreline

⁴ Scottish offshore waters cover 12-200 nautical miles from the shoreline

⁵ Marine Scotland (2011) *Blue Seas - Green Energy A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters* [Online] Available at: <http://www.scotland.gov.uk/Publications/2011/03/18141232/0> (accessed 14/2/2013)

long term, see **Figure 2.3**. It was also subject to a Sustainability Appraisal which comprised a SEA⁶, HRA⁷ and socio-economic assessment⁸.

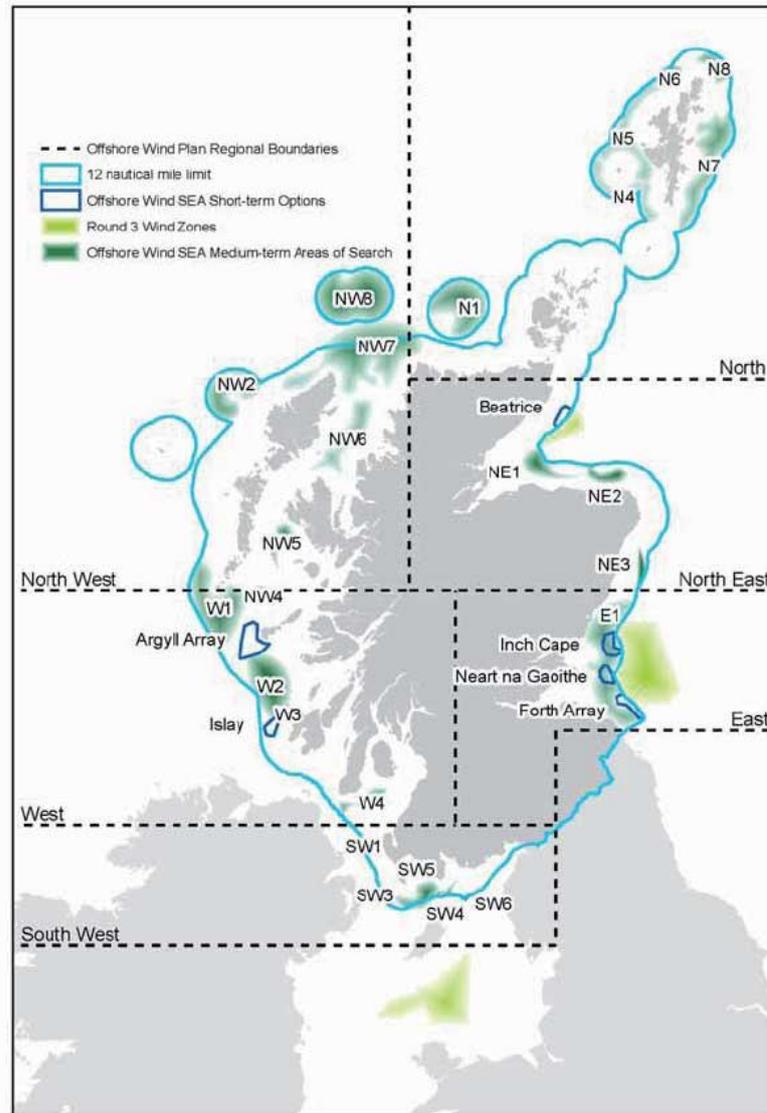


Figure 2.3 Areas of search identified in ‘Blue Seas, Green Energy’ (2011)

2.2.4 Blue Seas Green Energy was developed in consultation with key stakeholders, including industry and environmental stakeholders. A commitment was made to review the plan within 2 years of its initial adoption. The 2011 Offshore Wind Plan stated that the review would consider broadening the geographic scope of the Plan to cover Scottish Waters out to the 200 nautical mile limit. It also included a commitment to a detailed review and testing of the way in which medium term development areas were identified within the first plan.

⁶ Marine Scotland (2011) Strategic Environmental Assessment (SEA) of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters [Online] Available at: <http://www.scotland.gov.uk/Publications/2010/05/14155353/0> (accessed 14/2/2013)

⁷ Marine Scotland (2011) Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Appropriate Assessment [Online] Available at: <http://www.scotland.gov.uk/Publications/2011/03/22092539/0> (accessed 14/2/2013)

⁸ Marine Scotland (2011) Marine Scotland: Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish Territorial Waters: Costs and Benefits to Other Marine Users and Interests [Online] Available at: <http://www.scotland.gov.uk/Publications/2011/03/22104736/0> (accessed 14/2/2013)

2.3 The Draft Plans for Offshore Wave and Tidal Energy in Scottish Territorial Water

- 2.3.1 At the same time as the aforementioned review, Marine Scotland is also commencing preparation of two Sectoral Marine Plans for Wave and Tidal Energy in Scottish Territorial Water. Both plans will cover Scottish territorial waters and Scottish offshore waters.
- 2.3.2 A Marine Renewables SEA was undertaken during 2004-06 and an Environmental Report was published in 2007 which examined the environmental effects of developing wave and tidal power. This informed the preparation and delivery of the Scottish Government's strategy for the development of marine energy in Scotland's marine environment out to 12 nautical miles. This SEA is therefore being undertaken as a 'maintenance exercise' to take account of policy developments in the Scottish marine renewables sector and will build on the conclusions of the 2007 SEA.
- 2.3.3 The 2007 SEA also provided marine developers with data on the most appropriate and best locations to place wave and tidal devices on the north and west coasts of Scotland; setting out the issues which had to be tackled to facilitate the breakthrough of the wave and tidal energy sectors. The reports from the SEA and responses to the consultation are available to view online at: <http://www.scotland.gov.uk/Publications/2007/03/seawave>.
- 2.3.4 The 2007 SEA reported that there were considerable marine renewable energy resources around Scotland and that there were also significant levels of existing users and constraints within the marine environment. The SEA highlighted that the sector would require locational guidance and simplified regulation and that uncertainties concerning environmental interactions with new technology deployments would need to be addressed.
- 2.3.5 In July 2011 a SEA scoping study was undertaken on the development of a Sectoral Plan for Wave and Tidal Energy in the Scottish Renewable Zone. Since that scoping study a decision has been made to produce separate plans for Wave and Tidal Energy. The scoping study explained that ongoing studies have been undertaken by The Crown Estate (TCE) and Marine Scotland to identify suitable areas in Scottish territorial waters for wave and tidal development.
- 2.3.6 The draft plans for Wave and Tidal Energy will build on the areas identified to date (shown in Figure 2.4) which have the potential to be classed as areas for development.
- The eleven Pentland Firth and Orkney Waters (PFOW) agreement areas;
 - The five areas of interest identified through the Saltire Prize Programme;
 - Regional Locational Guidance work; and

- The three sites included in TCE's Further Scottish Leasing Round announced in May 2011.

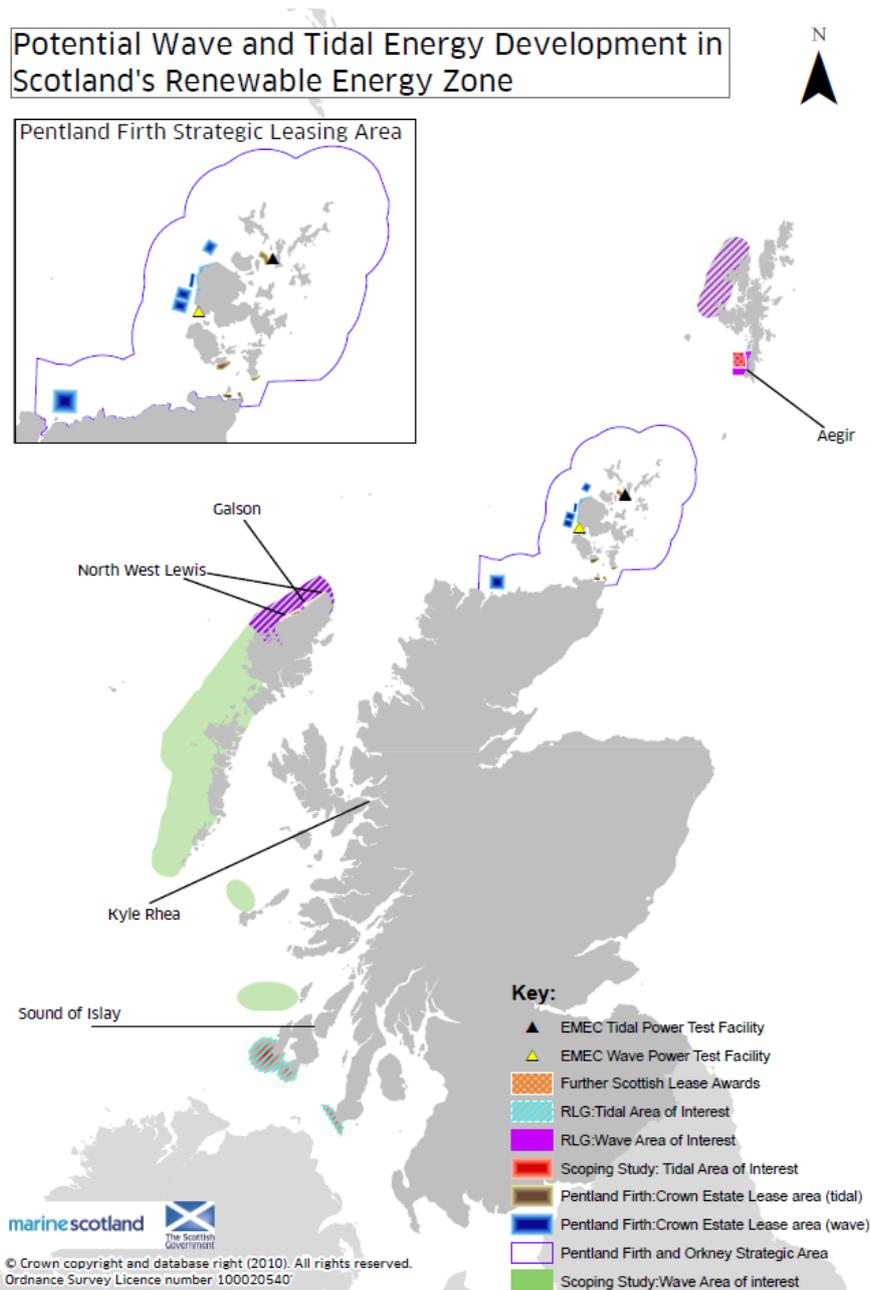


Figure 2.4: Initial Wave and Tidal Areas of Energy Potential

2.4 The Relationship with Emerging Plans for Offshore Wave and Tidal Energy

- 2.4.1 As noted in **Section 2.1**, the review of the Plan for Offshore Wind Energy in Scottish Territorial Waters has been undertaken alongside the production of new Sectoral Marine Plans for Wave and Tidal Energy technologies. These draft plans ('the draft plans') have also been subject to Sustainability Appraisal and the findings of the SEA for each technology are reported in this

Environmental Report which, together with all three plans, are the subject of statutory consultation.

- 2.4.2 This Environmental Report also contains a cumulative effects assessment of the Wind, Wave and Tidal Plans. The findings of that assessment have been used to inform the Sustainability Appraisal.

2.5 This Strategic Environmental Assessment (SEA)

- 2.5.1 The draft plans fall within the parameters of the Environmental Assessment (Scotland) Act 2005, Section 5(4) whereby it is necessary to conduct an SEA. The SEA screening undertaken by Marine Scotland determined that the plans all had the potential to give rise to significant environmental effects, therefore that a full environmental assessment was required⁹. Marine Scotland also carried out SEA scoping exercises to identify the scope and level of detail of the assessments¹⁰.
- 2.5.2 Given the potential scope of the plans' geographic impacts, the SEA has been undertaken in accordance with both the requirements of the Scottish Environmental Assessment (Scotland) Act 2005 and the UK Environmental Assessment of Plans and Programmes Regulations 2004.
- 2.5.3 This Environmental Report now accompanies the Sustainability Appraisal Report for consultation alongside the draft plans. Following the consultation, a report summarising the consultation findings will be published, and the plans will be finalised.

2.6 The Relationship to the Habitats Regulations Appraisal (HRA)

- 2.6.1 A HRA is required under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). The HRA is an appraisal of the potential for the plans to impact on sites designated under the European Habitats or Birds Directives as Special Areas for Conservation (SAC) or Special Protection Areas (SPA). The process has identified whether the Draft Plan Options have the potential for likely significant effects on European sites, either alone or in-combination. Areas of search which were found to have the potential for likely significant effects were then subject to an 'appropriate assessment' which considered the draft plans' implications for the European sites in view of the sites' conservation objectives. A view was then taken on whether the draft plans will avoid adverse effects on the integrity of European sites.
- 2.6.2 It is also a requirement of SEA to consider impacts on European sites and as such the SEAs have drawn on the HRA work undertaken in considering the potential for significant environmental effects.

⁹ A copy of the SEA determination is available here: <http://www.scotland.gov.uk/Topics/marine/marineenergy/Planning/screening> (accessed 14/05/2013)

¹⁰ Marine Scotland (2012) Strategic Environmental Assessment Screening and Scoping Report [online] Available at: <http://www.scotland.gov.uk/Topics/marine/marineenergy/Planning/seascoping> (accessed 18/3/2013)

2.7 The Relationship to the Sustainability Appraisal (SA)

2.7.1 As previously detailed the SEA and the HRA will form the environmental pillar of the integrated Sustainability Appraisals for the draft plans while the socio-economic assessment will provide information on the other aspects of sustainability.

2.8 Draft Plan Assessment and Reasonable Alternatives

2.8.1 The first stage of consideration of alternatives was to set out the potential environmental effects associated with a range of different offshore wind, wave and tidal technologies that are currently considered to have potential for implementation in Scottish marine waters. Once the potential type of effects arising from the alternative technologies were identified, these were then applied to spatial and locational constraints identified in the baseline data for each of the Draft Plan Options for wind, wave and tidal power. This helped to identify the type of effects that might be expected to occur within the Draft Plan Options should subsequent project implementation go ahead.

2.8.2 The draft plans contain options refined from the areas of search following the period of pre-consultation which are set out in **Figures 2.5 – 2.7**. The Draft Plan Options form the alternatives for consideration within the assessments. The options provide a set of locations to which environmental constraints and receptors can be attributed. The naming system is that applied and referred to in the assessment of the Draft Plan Options set out in Appendix D.

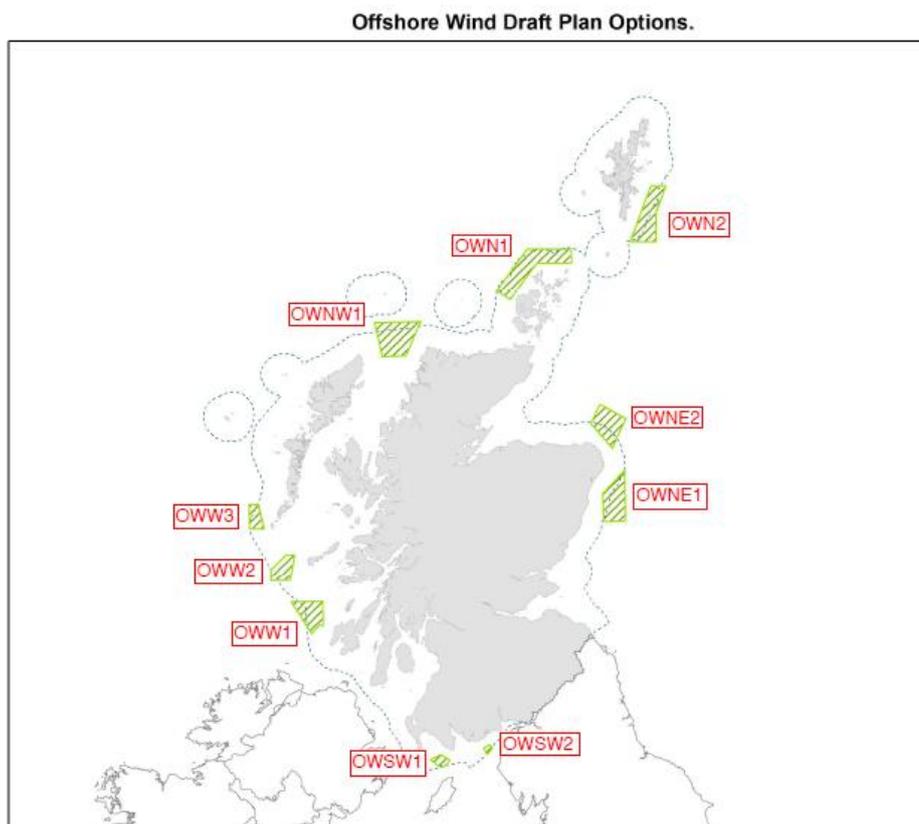


Figure 2.5: Draft Plan Options for Wind Energy

Wave Draft Plan Options.

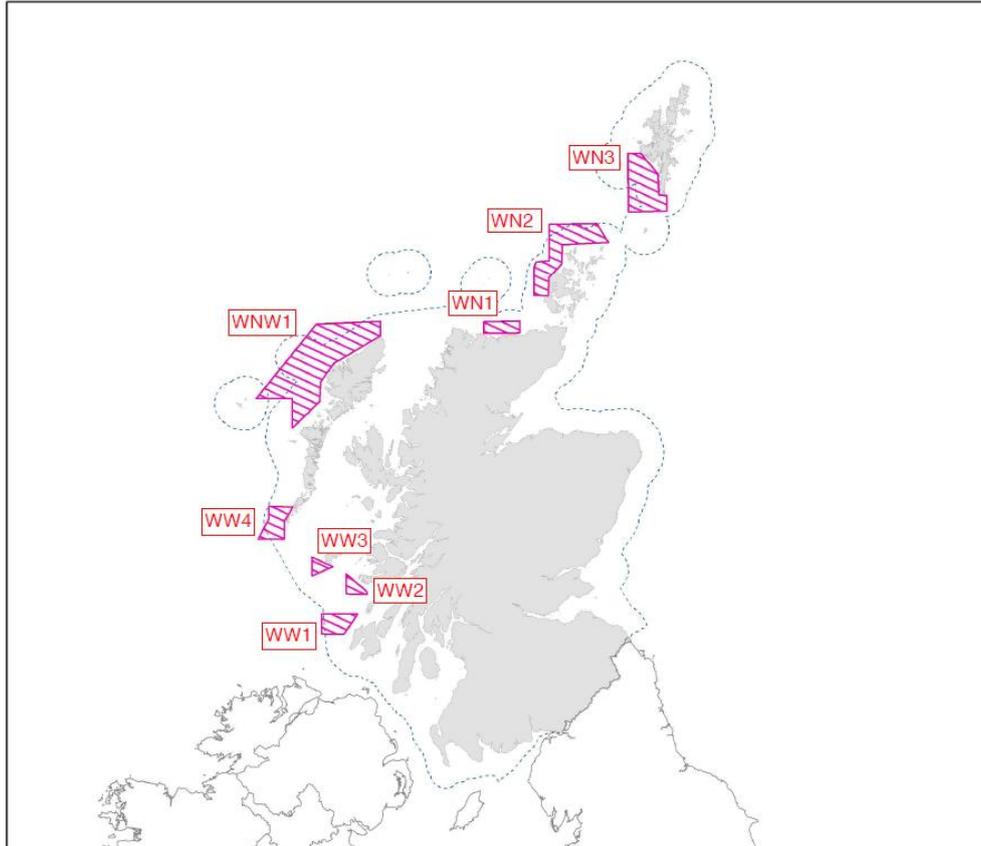


Figure 2.6: Draft Plan Options for Wave Energy

Tidal Draft Plan Options.

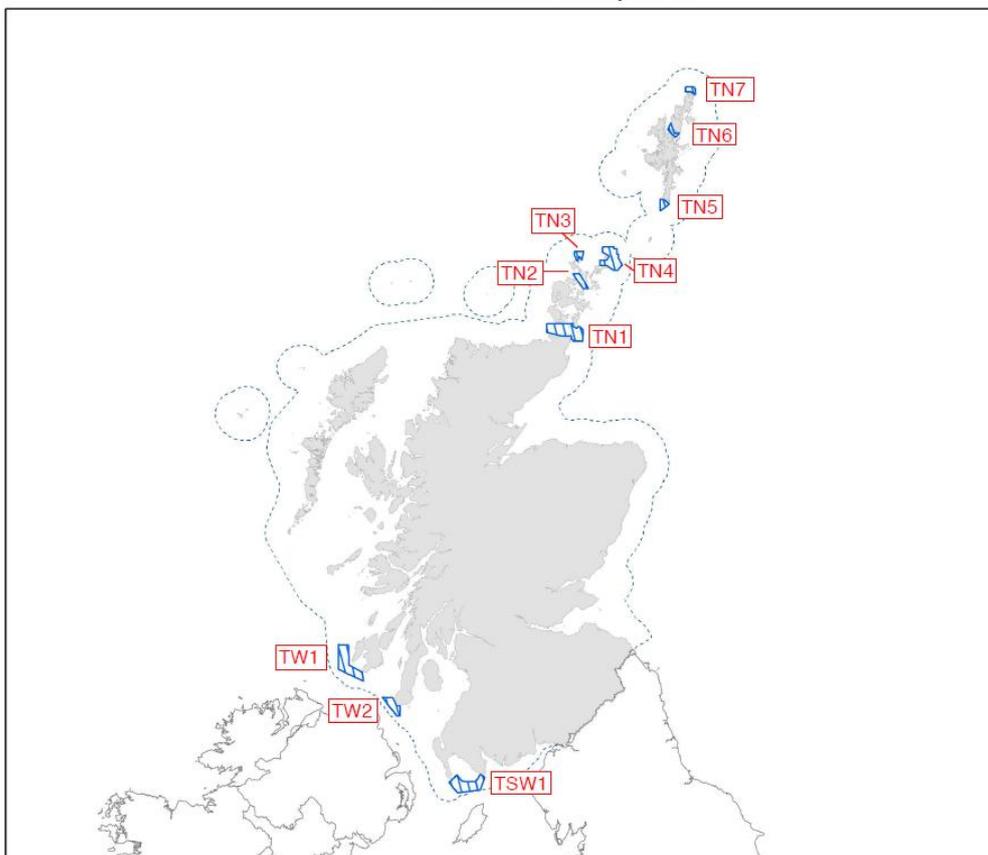


Figure 2.7: Draft Plan Options for Tidal Energy

2.8.3 A third stage of alternatives has been considered, essentially broad scenarios for the potential occupancy of technologies within the Draft Plan Options. The scenarios, originating from the accompanying socio-economic assessment, effectively give low, medium and high scenarios that give an indication of how an individual Draft Plan Option may be developed at project implementation. Details of the scenarios are given in **Table 2.1**. The scenarios were used within the context of the cumulative impact assessment to help gauge the potential level at which renewables devices could be deployed across the Draft Plan Options. The occupancy scenario alternatives enables the assessment to consider whether the magnitude of an effect is altered by smaller or larger areas of development, or whether an effect is related simply to the presence of devices and independent of the areas of development.

Table 2.1: Indicative occupancy scenarios for wind, wave and tidal energy

Scenario	Wind Indicative Occupancy (%)	Wave Indicative Occupancy (%)	Indicative Occupancy (%)
Low	4.8 – 26.5	0.2 – 0.6	0.8 – 2.5
Medium	11.6 – 26.5	0.5 – 0.6	2.6
High	25.1 – 26.5	1.0	5.1

2.8.4 In summary the assessment has been undertaken using the following stages of alternatives assessment:

- Stage 1: Identify the range of environmental effects associated with alternative offshore wind, wave and tidal technologies.
- Stage 2: Identify environmental effects of applying the range of effects identified in Stage 1 to the alternative Draft Plan Options.
- Stage 3: Cumulative impact assessment and assessment of the potential effects associated with the alternative scenarios for occupancy.

2.9 Structure of this Environmental Report

2.9.1 The structure of this document is set out as follows:

- Section 1: Non-Technical Summary
- Section 2: Introduction to the Assessment
- Section 3: The Approach to the Assessment
- Section 4: Context and Legislation
- Section 5: Environmental Baseline
- Section 6: Environmental Assessment
- Section 7: Recommendations, Mitigation and Monitoring

2.10 Summary

2.10.1 A summary of the details of the draft plans which are the subject to the SEA are provided below.

Table 2.2: Key Facts

Name of Responsible Authority	Marine Scotland.
Title	Sectoral Marine Plans for Offshore Wind, Wave and Tidal Energy in Scottish Territorial Waters.
Purpose	To provide a framework for the development of commercial scale offshore wind, wave and tidal energy in the waters around Scotland.
What prompted the PPS	A commitment was made to reviewing the Plan for Offshore Wind Energy in Scottish Territorial Waters (2011) every 2 years. Commitment to produce plans for wave and tidal energy.
Subject	Renewable energy, marine environment.
Period covered	Not specified.
Frequency of updates	Future review cycles have not yet been identified.
Area covered by PPS	Scottish Waters (0 to 200 nautical miles from shore)
Summary of nature / content	The Plan will identify potential areas for offshore wind energy development.
Purpose and/or objectives of PPS	To optimise the sustainable development of offshore energy in the marine environment.
Contact point	Lewis Hurley Environmental Assessment Team Scottish Government 2-J (South) Victoria Quay Edinburgh EH6 6QQ Email: lewis.hurley@scotland.gsi.gov.uk

3 The Approach to the Assessment

3.1 Overview

3.1.1 The alternatives, as described in Section 2.8, provide the basis for the assessments of the draft plans. The SEA and draft plan processes were undertaken alongside each other in order for the results of the SEA, together with the results of the HRA and Socio-Economic Assessment, to inform the development of the final draft plans. The following Section sets out the approach to the assessment.

3.2 Scoping the Assessment

3.2.1 Scoping reports were produced in August 2012 for the wind energy plan and a joint scoping in July 2011 for the wave and tidal plans. These were consulted upon with the statutory bodies. The reports set out the approach to the assessments of the plans, which this assessment is based upon, and the information required for the assessment. During this process it was determined that the air quality topic would be scoped out of the assessment, as at a national level the Plan's effects on it will not be significant.

3.2.2 The material assets topic has now also been scoped out of this project, as set out in the wave and tidal scoping. Whilst this topic could cover a range of material to covering the effects on other marine users it is felt that these have been adequately considered within the assessments. The impacts on commercial fisheries, including the potential for long term displacement of fishing activities, will be covered within the socio-economic assessment. The potential for effects on spawning and nursery grounds have been covered, as far as possible, within the biodiversity, flora and fauna section of this SEA. The socio-economic assessment will also consider displacement of commercial shipping, recreational boating and tourism. Issues of navigational safety and collision risk for vessels have been covered, as far as possible, within the population and human health section of this SEA.

3.2.3 Consultation responses on the scoping reports have been reviewed and where appropriate have been built into the assessments. The approach to the assessments is set out below.

3.3 Approach to the Assessment

3.3.1 The first phase of the assessment was the assessment of alternative technologies. The purpose of this stage was to identify the range of potential effects that could result from the installation and operation of wind, wave and tidal energy devices in the marine environment. The assessment has drawn on a number of different sources of information. This included the results of previous SEAs, research studies including those undertaken for Marine Scotland and by the marine energy industry, guidance for the environmental

assessment of devices, and available Environmental Impact Assessments of marine renewable energy projects where relevant. The detail of the assessment of technologies is documented in Appendix C.

- 3.3.2 The design of some device technology is still developing with testing and refining ongoing, in particular tidal technologies but also some wave. Therefore the potential effects specific to an individual technology or device may at this stage be uncertain. Whilst they may ultimately provide solutions for development within Draft Plan Options, as yet potential impacts for commercial scale deployment may have not yet been fully ascertained. In these instances professional judgement has been used to consider whether the effects of similar technologies would also be applicable. Where this is the case it has been documented within Appendix C.
- 3.3.3 During the development of this assessment, stakeholders included within the project advisory group (PAG) recommended that relevant environmental information on potential impacts could be reviewed and drawn, as far as possible, into the assessment from the Environmental Impact Assessment (EIA) process of existing or emerging offshore wind, wave and tidal projects. Whilst it is acknowledged that many environmental effects are likely to be dependent on site specific factors, the findings of previous project level assessments undertaken around the Scottish coastline have helped to broadly identify potential issues and environmental impacts that may, in general terms, be associated with different renewable technologies in the coastal and marine environment.
- 3.3.4 Stakeholders in the PAG also indicated that some of the information available in EIAs is currently under review within the marine licensing and consenting process, and is yet to be validated by the wider sector. For this reason, a detailed review of EIAs has not been formally presented within this report. As such it is just their more general findings that have been incorporated into this assessment.
- 3.3.5 In some instances some of the general findings of project level information have also fed into the consideration of potential cumulative impacts associated with plan option areas. Specifically, those in the close vicinity of existing or emerging offshore renewables developments (e.g. in Orkney, Shetland, Western Isles, Aberdeenshire coast and the Solway Firth).
- 3.3.6 However, as project level EIA work progresses, and data is obtained through further investigative work at the consenting stage and via operational monitoring programmes, this information could then be used in a more formal basis to help feed into the evidence base of future plan level assessment.
- 3.3.7 Once the evidence base was established and the potential impacts of the devices were established, the second stage of assessment was undertaken. This encompassed an assessment of each of the alternative Draft Plan Options against the environmental baseline, reflecting on the environmental features of

the option areas and the potential effects identified in the assessment of technologies.

- 3.3.8 The assessment methodology followed the tabular approach set out at the scoping stage, and involved the completion of a table for each Draft Plan Option and for each SEA topic scoped into the assessment, as shown by Table 3.1. Given the amount of relevant baseline information required for the assessment and presented in Appendix B, the first column of the table highlights only the key relevant headline baseline information for an individual Draft Plan Option, rather than all of the detail considered in the assessment. This provided a means for the relevant environmental baseline and problems to be a key component of the framework for the assessment. This approach is known as a ‘baseline-led assessment’ and sets the context of Draft Plan Options within their receiving environment.
- 3.3.9 The second column discussed the potential effects of developing the type of device promoted within the Draft Plan Option, on the receiving environment. The third column describes the characteristic of the effect. This provides a summary of the relevant dimensions of effects set out in Schedule 3 (6) of the Environmental Assessment (Scotland) Act 2005. This includes the timescale of effects, whether effects are permanent or temporary, positive or negative, and whether there are particular secondary, cumulative or synergistic effects where these could be determined and relevant to the assessment of significance.
- 3.3.10 The final column considers the potential mitigation that might be available to prevent, reduce and as fully as possible offset any significant adverse effects. The results of these assessments are set out in Appendix D.

Table 3.1: Example Assessment Table

SEA Topic	Key Baseline Evidence	Potential for Effects	Characteristics	Mitigation Available and Potential Residual Effects
Biodiversity, Flora and Fauna				
Etc.				

- 3.3.11 The next stage of the assessment was the cumulative assessment. This sought to firstly identify the potential impacts of development of devices in multiple Draft Plan Options, then investigated the effects of the Draft Plan Options alongside the developments set out in previous plans and the projects in development. This stage of assessment was informed by the SEA of existing plans and the general effects identified in reviewing project level EIA. As part of this process the assessment considered the broad scenarios for high, medium and low occupancy of the total Draft Plan Options set out in Section 2.8.
- 3.3.12 The assessments of individual Draft Plan Options, alongside the range of effects of potential devices, demonstrate the difficulties in apportioning the precise significance of effects. As a result the cumulative impact assessment has been informed by a risk-based approach. This seeks to identify where higher risks of significant effects might occur, whilst acknowledging that the

identification of potential effects will continue through the project level EIA process. Table 3.2 sets out the rules that have been used to guide this risk based approach.

Table 3.2: Risk Based Approach Used in this Report

Lower Risk	Medium Risk	Higher Risk
<p>Based on the best available information whilst the environmental receptor may be impacted, the value and vulnerability of the environmental receptor is considered to be lower (e.g. whilst considered important the species or areas are undesignated or not considered to be of particular value or sensitivity, the environmental receptor may be considered replaceable).</p>	<p>Based on the best available information the environmental receptor may be impacted, although this may not be certain, and the value and vulnerability of the environmental receptor is not considered to be particularly high (e.g. local designations and features of interest, acknowledged importance of species, the environmental receptor is sensitive and/or difficult to replace).</p>	<p>Based on the best available information whilst the environmental receptor will be impacted, and the value and vulnerability of the environmental receptor is considered to be high (e.g. international level designations of species or areas containing important features, the environmental receptor is very sensitive and/or irreplaceable).</p>
<p>Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered low (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).</p>	<p>Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered to be notable (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).</p>	<p>Based on the best available information the number and extent of environmental receptors, potentially impacted, is considered to be notable and significant to the point that the features within any location might be lost (e.g. species, people, designations, in light of the relative to the total size and extent of the environmental receptor).</p>
<p>Whilst there is potentially a link or pathway between the type of renewable technology and the environmental receptor is not considered to be direct.</p>	<p>There is a clear link or pathway between the type of renewable technology and the environmental receptor under consideration.</p>	<p>There is a clear and strong link or pathway between the type of renewable technology and the environmental receptor under consideration.</p>
<p>Effects are likely to occur only in the short term (e.g. associated with the construction phase only)</p>	<p>Effects are likely to occur only in the short and medium term (e.g. initial loss of features or designations but that might recover in the long term).</p>	<p>Effects may occur from the short term but are likely to also be long term (e.g. loss of features or designations that cannot recover)</p>

3.3.13 The final stage of the assessment provides a means to summarise the overall effects of the draft plans against the SEA objectives identified in the scoping phase. The objectives are aspirational and formed from the objectives of wider plans, programmes and strategies set out in Appendix A. This ‘objective led approach’ provides a useful measure to draw together and comment on the combined performance of the plans. The SEA objectives are set out later in the Table 3.3

Table 3.3: SEA Objectives

SEA Objectives
Biodiversity, Flora and Fauna
To safeguard marine and coastal ecosystems, and their interactions.
To avoid adverse effects on the integrity of Natura sites (NB: this will be established through the parallel HRA work)
Population and Human Health
To avoid adversely affecting recreational users.
To avoid adverse effects on human health and safety.
Water and the Marine Environment
To avoid pollution of the coastal and marine water environment.
To maintain or work towards good ecological status.
Climatic Factors
To reduce greenhouse gas emissions from the energy sector.
To ensure that adaptation to climate change impacts are taken into account, e.g. through consideration of resilience, changing environmental sensitivity
Marine Geology and Coastal Processes
To avoid exacerbating coastal erosion.
To maintain integrity of coastal processes
To maintain and protect the character and integrity of the seabed
Historic Environment
To protect and, where appropriate, enhance the historic marine environment.
To avoid damage to known and unknown coastal and marine archaeology.
To avoid adverse effects on the character and setting of historic sites and buildings.
Landscape / Seascape
To avoid where possible, or minimise, adverse effects on landscape/seascape
To promote the protection of seascape and coastal landscapes
To avoid or minimise adverse visual effects

3.4 Meeting the Requirements of the 2005 Act

3.4.1 The following table sets out how this report has set out to meet the requirements of the Environmental Assessment (Scotland) Act 2005. The text in bold indicates which part of the requirement can be located at the signposted section.

Table 3.4: Compliance checklist

2005 Act Requirements for Environmental Reports	Location within this Report
An outline of the contents and main objectives of the plan or programme , and of its relationship (if any) with other qualifying plans and programmes (Schedule 3 (1)).	Section 2
An outline of the contents and main objectives of the plan or programme, and of its relationship (if any) with other qualifying plans and programmes (Schedule 3	Section 2 and Section 4.2

2005 Act Requirements for Environmental Reports	Location within this Report
(1)).	
The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme (Schedule 3 (2)).	Section 5 and Appendix B
The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme (Schedule 3 (2)).	Section 5
The environmental characteristics of areas likely to be significantly affected (Schedule 3 (3)).	Section 5 and Appendix B
Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (as last amended by Council Directive 97/62/EC) (Schedule 3 (4)).	Section 5 and Appendix B
The environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation (Schedule 3 (5)).	Section 4 and Appendix A
The environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation (Schedule 3 (5)).	Section 4 and Appendix A
The likely significant effects on the environment, including— (a) on issues such as— (i) biodiversity; (ii) population; (iii) human health; (iv) fauna; (v) flora; (vi) soil; (vii) water; (viii) air; (ix) climatic factors; (x) material assets; (xi) cultural heritage, including architectural and archaeological heritage; (xii) landscape; and (xiii) the inter-relationship between the issues referred to in heads (i) to (xii); (b) short, medium and long-term effects; (c) permanent and temporary effects; (d) positive and negative effects; and (e) secondary, cumulative and synergistic effects (Schedule 3 (6)).	Section 6 and Appendix C and D
The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme (Schedule 3 (7)).	Section 6 and 7, Appendix C and D
An outline of the reasons for selecting the	Section 2.8

2005 Act Requirements for Environmental Reports	Location within this Report
alternatives dealt with , and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of expertise) encountered in compiling the required information (Schedule 3 (8)).	
An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of expertise) encountered in compiling the required information (Schedule 3 (8)).	Section 3
A description of the measures envisaged concerning monitoring in accordance with section 19 (Schedule 3 (9)).	Section 7
A non-technical summary of the information provided under paragraphs 1 to 9 (Schedule 3 (10)).	Section 1

3.5 Difficulties encountered in compiling the Information

- 3.5.1 Whilst new information on the marine environment continues to emerge there remain some uncertainties regarding the interactions between marine features and potential new marine infrastructure.
- 3.5.2 Whilst a great deal of research has been undertaken on Scotland’s marine and coastal environments through public bodies such as Marine Scotland Science and SNH, and in academic and industry sectors, it is widely acknowledged that significant data gaps remain. In some instances, these gaps in knowledge have introduced a degree of difficulty in undertaking this assessment, primarily in the compilation of relevant and useful baseline information, and in the evaluation of the likelihood and extent of potential effects that may be associated with particular renewable devices.
- 3.5.3 As a result there is difficulty in the certainty of effects prediction within the assessments, introducing a necessarily degree of caution in both predicted significance of effects and recommendations for the response to these. For example, more comprehensive information regarding the movements of migratory species such as cetaceans, salmon and lamprey, seabirds and elasmobranchs could have added greater detail and precision to the assessment, however reliable and accepted information is yet to be available. Had this been available it would have the potential to provide a better steer on the potential for impacts in a spatial context, and a stronger link to the Draft Plan Option areas.
- 3.5.4 Uncertainty in the likelihood and severity of specific potential impacts of devices has introduced a degree of uncertainty into the assessment. Examples include the precise effects of Electromagnetic Forces (EMF) on elasmobranchs and other fish, the collision and entanglement risk for cetaceans and seal with

submerged infrastructure, and the precise level of sedimentation impacts from installing technologies and the ability of benthic habitats to withstand this.

- 3.5.5 During the course of the assessment a number of data sources have been used to provide a picture of the key environmental constraints and issues. Given the wide variety of above and below water species and features that have been considered in the assessment, where possible some 'interpretive' data sources were reviewed in order to attempt to provide a better spatial picture of use and potential effects. Cetacean and basking sharks distributions, and potential seabird displacement and collision risk, has been included in the baseline in an attempt to provide this spatial picture. These interpretations are based on the best available data. It is acknowledged that data sets may be older and incomplete.
- 3.5.6 Views expressed on the use of this information from the PAG have been mixed. It is acknowledged that the use of these data sources involves grouping of marine features (i.e. all cetaceans and seabirds), and that this adds a degree of uncertainty to their results. For example an area with a lower cetacean encounter rate may still contain the majority of sightings of a rarer species. Therefore, the use of encounter rates as an indicator of distribution can introduce the potential for bias towards more larger and more prominent species over those with smaller population size and more vulnerable species. Similarly, an area with a lower collision risk for seabirds could still be frequented at times by an individual species most at risk from collision.
- 3.5.7 Where interpretive data has been used within this assessment it has been used to simply provide an indication of potential 'hot spots', rather than identification of areas with limited constraints, with the uncertainty in the use of the data noted. This helps to add a slightly more informed picture of spatial risk to some mobile species.
- 3.5.8 In some instances, where the potential benefit and scope for additional research has been identified in order to fill gaps in data and our understanding of effects, recommendations have been included in this assessment. The results of the Review of the Scottish Marine Monitoring Network undertaken for Marine Scotland¹¹ will also help to demonstrate information that could fill some of these gaps.
- 3.5.9 Further uncertainties remain within in the assessment and are inherent with the continual evolution of offshore renewables technologies and infrastructure. As new devices are designed and tested some potential effects could diminish and others arise. For example, below water wave technology could have reduced landscape effects but potentially increased collision risk.
- 3.5.10 Furthermore, marine planning in itself is new and evolving, reflected in concurrent consultation on the National Marine Plan (NMP), and Marine Protection Areas (MPAs). As consultations on these documents have not been

¹¹ Marine Scotland (2012) Marine Monitoring Network Review, Prepared by Halcrow for Marine Scotland [online] Available at: <http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/Themes/networkreview> [accessed 21/05/2013]

undertaken at the time of assessment there remains some uncertainty on their final content. Therefore, the location and extent of final MPA boundaries are yet to be finalised, and as a result there is uncertainty over the extent of overlaps between proposed MPA and Draft Plan Options. Therefore there is a need to revisit this relationship after the end of the consultation period.

- 3.5.11 There remains a degree of uncertainty surrounding the potential impacts of some supporting activities as a result of the precise location of activities being unknown. For example, the location of dredging that might be required to provide fill for gravity base devices, and the precise location of onshore/offshore grid connections and cables linking devices to the electricity grid. Where possible the potential and general effects of these activities are mentioned within the assessments but have a limited spatial focus as acknowledged in the appropriate sections of this report.
- 3.5.12 Many of these gaps, limitations and difficulties have fed into the generation of recommendations as set out in Section 7 of this report.

4 Context and Legislation

4.1 Background and Scottish Marine Context

- 4.1.1 The Environmental Assessment (Scotland) Act 2005 requires responsible authorities to identify the policy context in which a plan is brought forward and the environmental protection objectives relevant to the plan that is being assessed.
- 4.1.2 The Marine (Scotland) Act 2010¹² and the Marine and Coastal Access Act 2009¹³ provide the context for marine planning of Scotland's waters out to 200 nautical miles and give new marine conservation responsibilities. From 6 April 2011, under the Marine (Scotland) Act 2010 the Scottish Government is responsible for the new marine licensing system for activities carried out in the Scottish inshore region of UK waters from 0-12 nautical miles (nm). Under the Marine and Coastal Access Act 2009, they are also the licensing and enforcement authority for the Scottish offshore region from 12-200nm (other than reserved matters).
- 4.1.3 Additionally the measures contained within the Directive 2000/60/EC on establishing a framework for Community action in the field of water policy, or the Water Framework Directive (WFD), are implemented to 3 nautical miles.

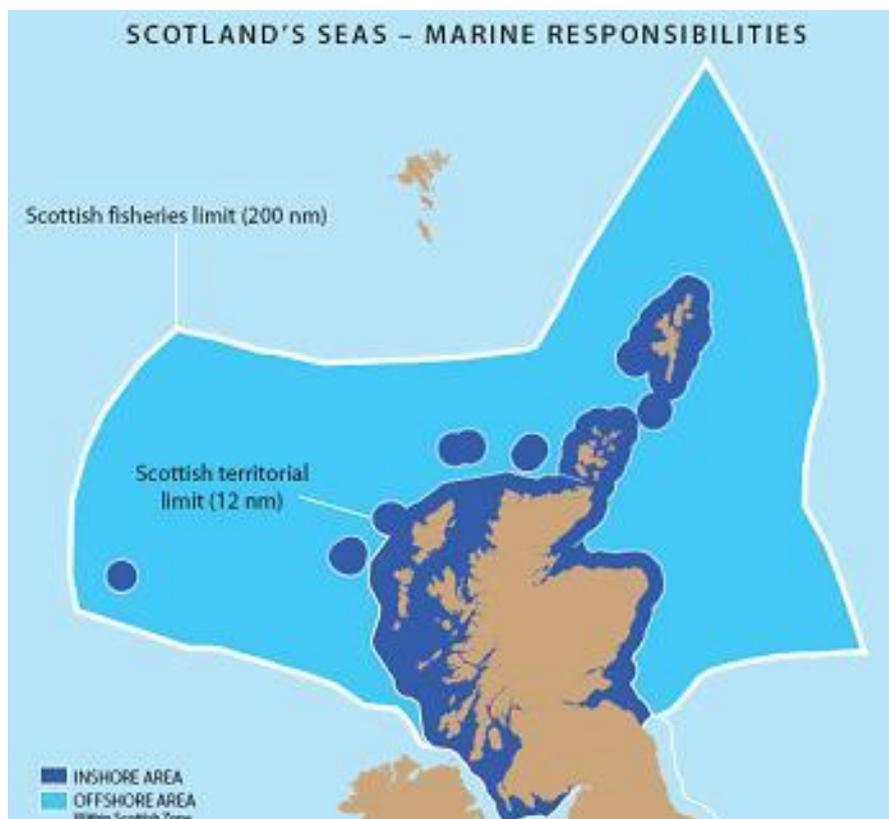


Figure 4.1: Inshore and offshore limits of Scottish territorial waters

¹² Marine (Scotland) Act 2010 2010 asp 5 [Online] Available at: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf (accessed 20/2/2013)

¹³ Marine and Coastal Access Act 2009 [Online] Available at: <http://www.legislation.gov.uk/ukpga/2009/23/contents> (accessed 20/2/2013)

- 4.1.4 The Marine (Scotland) Act created a new legislative and management framework for the marine environment to manage the competing demands of the use of the sea whilst protecting the marine environment. It provides for the preparation and adoption of a National Marine Plan and for the delegation of marine planning functions to a regional level.
- 4.1.5 The NMP is currently in preparation and is available for consultation alongside this document. The NMP sets out the strategic objectives for the Scottish marine area including important marine activities such as aquaculture, conservation, recreation and tourism ports, harbours and shipping, alongside renewable energy. It therefore provides the over-arching policy framework for the review of *Blue Seas Green Energy* as well as the Sectoral Marine Plans for wave and tidal energy in Scotland's Territorial Waters.
- 4.1.6 The Marine (Scotland) Act 2010 also sets out a new regime for marine licensing which will simplify the existing regulations. This new licensing regime, which came into force in April 2011, covers all anticipated activities in the marine environment which currently require licensing (apart from aquaculture within 3 nautical miles which local authorities have the power to regulate). Marine plans, as defined in the Act, will be material considerations within decisions made on licensing.
- 4.1.7 Scotland has made international commitments to establish an ecologically coherent network of MPAs using powers established within the Marine (Scotland) Act 2010 and the UK Marine and Coastal Access Act 2009. Consultation on the draft MPAs is also being undertaken alongside this document.
- 4.1.8 Existing protected areas (SACs, SPAs, Ramsar sites, and Sites of Special Scientific Interest (SSSI)) will make a significant contribution to the MPA network. Three different types of MPAs will be set up: Nature Conservation MPAs, Demonstration and Research MPAs and Historic MPAs. The MPAs will protect important marine habitats and wildlife, geology and geomorphology, as well as features of cultural importance such as shipwrecks and submerged landscapes.

4.2 The Plan Context

Key Plans and Legislation

- 4.2.1 There are a significant number of policy and legislative drivers at national, European and international levels which apply to the various sectors that make use of the marine environment (including the offshore renewable energy sector).
- 4.2.2 The UN Convention on the Law of the Sea (UNCLOS) defines the rights and responsibilities of nations in their use of the world's oceans; establishing guidelines for businesses, the environment, and the management of natural

resources¹⁴. The framework emphasises the need to balance competing interests and objectives within the marine environment.

- 4.2.3 Key European marine legislation includes the European Marine Strategy Framework Directive (MSFD)¹⁵ and the European Integrated Maritime Policy¹⁶. The former requires member states to "*take necessary measures to achieve or maintain good environmental status in the marine environment by the year 2020 at the latest*" and extends the requirements of the WFD into seas beyond 1nm. The latter aims to deliver a sustainable development approach for Europe's oceans and seas.
- 4.2.4 At the UK level, 'Our Seas – A Shared Resource'¹⁷ sets out high level objectives for the UK marine environment. These include; achieving a sustainable marine economy; ensuring a strong, healthy and just society; living within environmental limits; promoting good governance; and using sound science responsibly. Renewable energy is strongly supported by the strategy.
- 4.2.5 The Scottish Government has committed to achieving the EU 2020 renewables target, i.e. 20% of EU's energy consumption from renewable sources by 2020. As stated in the Electricity Generation Policy Statement (EGPS), Scottish Ministers aim for renewable sources to generate the equivalent of 100% of Scotland's gross annual electricity consumption by 2020, with an interim milestone of 31% by 2011¹⁸.

4.3 The Relationship with Environmental Objectives of Related Plans, Programmes and Strategies

- 4.3.1 The Environmental Assessment (Scotland) Act 2005 requires responsible authorities to identify the broader policy context and the environmental protection objectives relevant to the plan that is being assessed. Appendix A provides a detailed table of relevant Plans, Programmes and Strategies (PPS) and the environmental objectives they contain. A summary of these objectives and themes is provided below.

Biodiversity, Flora and Fauna

- 4.3.2 Biodiversity PPS range from broad commitments to protection and enhancement of key species and habitats to objectives that focus specifically on conserving marine ecosystems. In relation to the coastal environment this includes: planning for the protection of migratory species, including birds and fish stocks; protection of coastal wetland habitats; and management of alien

¹⁴ UN Convention on the Law of the Sea (1982) [online] Available at: http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm (accessed 4/3/2013)

¹⁵ European Marine Strategy Framework Directive (2007) [online] Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0056:EN:NOT> (accessed 4/3/2013)

¹⁶ European Integrated Maritime Policy 2007) [online] Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0575:FIN:EN:PDF> (accessed 4/3/2013)

¹⁷ HM Government, Northern Ireland Executive, The Scottish Government, Welsh Assembly Government (2009) Our seas – a shared resource: High level marine objectives [online] Available at: <http://www.scotland.gov.uk/Resource/Doc/1057/0080305.pdf> (accessed 4/3/2013)

¹⁸ Scottish Government (2012) Electricity Generation Policy Statement [Online] Available at: <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/EGPS2012> (accessed 20/2/2013)

species. The list of priority habitats and species is lengthy, with marine features accounting for a significant proportion of all protected habitats. Particular protection is afforded to migratory birds, cetaceans and sharks through international agreements.

- 4.3.3 There is strong emphasis on an ‘ecosystems approach’ to managing and restoring marine and coastal environments. Protected sites as part of the Natura 2000 network also form a key component of the protection of fauna and flora. European and Scottish policies reflect the objectives of an ecosystems approach, including how they work and the services they provide to people. An example of this in the context of the marine environment is protection of seals, sustainable management of fish stocks and the supporting habitats of both. Building resilience to climate change is also a cross cutting theme.
- 4.3.4 The marine environment supports sea fisheries, finfish and shellfish aquaculture. Managing fish stocks is a complex area which interacts with the biodiversity, flora and fauna policy framework. Conservation and the precautionary principle are the main elements behind the international policy framework. Within Scotland fishing practices are also regulated in relation to protection of the seabed and the need to manage conflict between different fishing practices. Aquaculture is also a highly regulated area reflecting the key issues of sea lice, and control and reduction of escapes. Shellfish are dependent on high water quality, and this is reflected in the need to protect and improve coastal waters for shellfish growing. The use of the marine environment for energy generation is also a key area where conflict needs to be managed between different users of the marine environment.

Population and Human Health

- 4.3.5 Relevant objectives that support population and human health include those which aim to control bathing water quality. Access legislation and guidance on recreational use are also relevant considerations. The main provisions relate to the control of pollution and waste disposal at sea. The right of responsible access includes coastal areas where there may be interaction between marine activities and recreational users. The social and economic impacts of development proposals will be considered in the socio-economic assessments of the plans, but reported within the overarching Sustainability Appraisal Report.

Water and the Marine Environment

- 4.3.6 Relevant water environment objectives cover both the offshore and inshore environment and aim to reduce pollution and improve the ecological status (including overall water quality) of water bodies, as well as controlling other operations such as engineering and coastal flood defences. Both the Water Framework Directive and the Marine Strategy Framework Directive set environmental objectives for the marine environment.
- 4.3.7 A number of relevant PPS specifically relate to controlling pollution from ships and off shore activities, and also relate to the dumping of waste. There is a

strong positive framework for improving water quality including coastal areas and designated bathing waters.

Climatic Factors

- 4.3.8 Climate related objectives include targets for the mitigation of greenhouse gas emissions at the international and national levels, including both emission reduction and adaptation measures. The marine environment provides an important resource for achieving Scotland's renewable energy targets and energy development will have associated interactions with most aspects of the marine environment.

Marine Geology and Coastal Processes

- 4.3.9 There is a lack of specific policy protection for soils or sediments within the marine environment, although the Scottish Soil Framework does include coastal areas. Impacts of marine activities which have an onshore component should be recognised in relation to impacts on soils. Marine licensing under the Marine (Scotland) Act covers controls for dredging and disposal activities.

Historic Environment

- 4.3.10 There is an international and national framework for the protection of archaeological and historic features and objects. Objectives include commitments to protecting the historic environment whilst increasing understanding and awareness of its value. Key objectives relate to coastal and offshore designated and non-designated features, including archaeology and wrecks. Legislation now enables for the provision to designate Historic Marine Protection Areas to protect and enhance the most important marine features.

Landscape and Seascape

- 4.3.11 Objectives relating to landscapes and seascapes reflect the broader framework provided by the European Landscape Convention, which emphasises a broad and inclusive approach to landscape protection and enhancement encompassing the value of all landscapes, not only designated areas. The first iteration of the plan for offshore wind energy identified key challenges around this environmental receptor, given the potential visual prominence of large scale wind installations, particularly where they might be located in close proximity to the coast. The diversity and scenic value of coastal seascapes is included as a key theme in the recently updated Natural Heritage Futures series produced by SNH.

5 Environmental Baseline

5.1 Background

5.1.1 The Environmental Assessment (Scotland) Act 2005 Schedule 3 requires that the Environmental Report includes a description of the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the Plan. This section describes the environmental context within which the draft plans will operate and the key strategic issues that this context imposes on the plans. The baseline summary presented below represents the current key issues relating to the SEA topic areas and to be considered in the assessment. More detailed information on specific constraints relating to specific Draft Plan Options within each region (South West, West, North West, North and North East) is set out in greater detail within Appendix B. The headline baseline information relating to each Draft Plan Option is also included in Appendix D.

5.2 Baseline Summaries

Biodiversity, Flora and Fauna

5.2.1 Six broad habitats are found in Scottish waters: intertidal rock, intertidal sediment, subtidal rock, shallow subtidal sediments, shelf subtidal sediments and deep-sea habitats. Scotland's seas support a great number of species between these habitats.

5.2.2 Key pressures to species and habitats include climate change, development, dredging, pollution, marine litter, fishing, invasive non-native species, other coastal and marine users (e.g. oil and gas, aquaculture, recreation), and the vulnerability of marine and coastal species and habitats to these pressures. Species and habitats considered to be vulnerable to these pressures include shoreline and tidal habitats, coral reefs and mudflats, each of which support a wide range of species such as snails, clams, mussels and oysters, bony fish, shellfish, cetaceans (i.e. whales, dolphins and porpoises), elasmobranchs (i.e. sharks, skates and rays), seals, otters and many types of birds.

5.2.3 As such Scotland has a number of Marine and coastal protected sites. There are forty coastal and offshore marine SACs, and one candidate Special Area of Conservation (cSAC), covering several habitat types (including sandbanks, sea caves, estuaries, mudflats, coastal lagoons, shallow inlets and bays and reefs) and several species (including otter, bottlenose dolphin, grey seal and harbour seal, Atlantic salmon and pearl mussel)¹⁹. Beyond Scotland there are a number of other European sites designated for mobile species, and are linked to the presence of major bird migration routes and bird feeding, breeding and roosting areas.

¹⁹ Scottish Government (2011) Scotland's Marine Atlas, Scottish Government pg 72

- 5.2.4 There are also many areas that are of international importance for bird species (seabirds, waders, ducks, geese and swans) including 58 Special Protection Areas (SPAs) that have marine or coastal components²⁰.
- 5.2.5 Scottish Ministers are committed to setting up a network of ecologically coherent MPAs to protect features of conservation importance in both inshore and offshore waters adjacent to Scotland.
- 5.2.6 Sites of Special Scientific Interest (SSSI) underpin international nature conservation designations, such as SACs and SPAs, and will contribute to the development of Scotland's MPA network²¹. Scotland's SSSI network is primarily terrestrial, as its extent is to the mean low water spring tide, but there are 56 in Scotland which have some intertidal and/or seal interests²². The need to protect, and, where possible, improve the status of the numerous internationally and nationally designated conservation sites within Scottish Territorial Waters is a key issue.

Population and Human Health

- 5.2.7 There is an east - west split in the rural characteristics of coastal communities, with the islands, north and west coasts typically having smaller populations and experiencing greater distances to services. Communities on the west coast and islands typically have a greater reliance on marine businesses and related industries as part of their local economy.
- 5.2.8 The waters around Scotland are used for a variety of industrial and recreational activities including salmon and sea trout fisheries, recreational sea angling, sailing, cruising, bathing and recreational tourism. Coastal recreation opportunities make an important contribution to human health as well as coastal economies. Offshore energy generation could interfere with existing recreational activities.
- 5.2.9 The main risks to human health in the marine environment are from accidents as a result of collisions of vessels with each other and with any offshore structures which could impact on the risks of accidents and related mortality rates. Additionally the health benefits of undertaking recreational activities could be compromised if activity is displaced or discontinued.

Water and the Marine Environment

- 5.2.10 Marine water resources support important industries including fishing, oil and gas industry and renewable power generation. In very simple terms the offshore and coastal water circulation is northwards on the west coast (Scottish Coastal Current) and southerly in the North Sea²³.

²⁰ Scotland's Environment (2011) Coastal Waters [online] Available at: http://www.environment.scotland.gov.uk/our_environment/water/coastal_waters.aspx (accessed 13/12/12)

²¹ SNH (2012) How are SSSIs selected and notified? [online] Available at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssisi/sssi-selection/> (accessed 13/12/12)

²² Scottish Government (2011) Scotland's Marine Atlas, Scottish Government pg 72.

²³ Marine Scotland (2012) Regional Locational Guidance [online] Available at: <http://www.scotland.gov.uk/Topics/marine/marineenergy/Planning/> (accessed 04/04/2013)

- 5.2.11 The tidal range varies around the Scottish coastline with a low tidal range at Shetland and off Kintyre and high tidal ranges at the heads of the Firths (e.g. up to 7m in the Solway Firth).
- 5.2.12 Although coastal waters are generally classified as being of good or better status under the Water Framework Directive, poorer quality waters are found in areas such as the Firth of Forth and Firth of Clyde.
- 5.2.13 The key risks to the quality of the water environment are from contamination as a result of marine activities such as the use of anti-fouling paint, pollution from oil spillage and sewage, and pollution of coastal waters resulting from activities on land, in particular from agricultural activities.
- 5.2.14 Polluted waters can have detrimental impacts on habitats and species, on recreational tourism (e.g. bathing) and aquaculture (particularly shellfish), all of which require high water quality.

Climatic Factors

- 5.2.15 In the context of the marine environment, climate change has been predicted to lead to an increase in water temperatures, rise in sea levels, changes in wave heights and changes to our coastlines. Changing ocean acidity, salinity, rising sea temperatures and rising sea levels, as a result of climate change, can impact on marine ecosystems.
- 5.2.16 A number of renewable energy targets have been set in Scotland. The target relevant to this assessment is for renewable sources of energy to generate the equivalent of 100% of Scotland's gross annual electricity consumption by 2020, with an interim target of 50% by 2015.
- 5.2.17 The Scottish Government is committed to adapting to the impacts of climate change that Scotland is already expecting. The natural marine environment is expected to change, and adaptation will be required to minimise impacts and potential loss of species and habitats.

Marine Geology and Coastal Processes

- 5.2.18 In general, the marine sediments around Scotland are sandy or gravelly and originate from deposits during the Quaternary glaciation. Muddy sediments are located principally near-shore or if further offshore in depressions on the sea floor where currents may be relatively weak.
- 5.2.19 Data from the British Geological Society (BGS) demonstrates that Scottish waters display a wide range of seabed habitats, ranging from scoured rock or coarse sediment to muddy gravel or fine sand. However, there is a high degree of variability between the coarseness of the substrate, with some patches of uniformity also identified (e.g. the sandy extents in the central North Sea, muddy sand in the North Sea and rocky outcrops to the west of Lewis). Marine activities can impact on seabed sediments and affect natural processes and their ability to support habitats and species.

- 5.2.20 The bathymetry of Scottish waters shows a sharp distinction between the east and west coasts. The east coast bathymetry presents mostly uniform depths and shallow inclines interspersed with localised trenches while the seabed off Scotland's west coast shelves steeply away from the coast, and deep waters occur relatively close to the land. Appendix B contains further information on spatial bathymetry and seabed characteristics for each of the regions.
- 5.2.21 Much of the Scottish landscape and coastline continues to change through coastal processes such as wave action, sediment movement, erosion and accretion²⁴. There is potential for increased vulnerability of coastal areas from changes in coastal processes related to coastal and marine activities. SSSI designated for their geological importance are located around the coast and can be impacted upon by changes in coastal processes.

Historic Environment

- 5.2.22 A wide range of historic built and archaeological sites can be found on the foreshore and seabed ranging from the remains of ships and aircraft lost at sea, to valued harbours, lighthouses and other structures at the coastal fringe. There is the potential for direct adverse impacts to marine and coastal archaeology from the siting and operation of prospective offshore renewables developments and associated infrastructure activities.
- 5.2.23 It is estimated that there are also 38,000 historic and unprotected sites of interest around Scotland's coast including St. Kilda and the Heart of Neolithic Orkney World Heritage Sites (WHS), numerous scheduled monuments, gardens and designed landscapes, and listed buildings including lighthouses. For these sites, the sea can be an integral part of their setting and a key element in how they are experienced, understood and appreciated. As well as visual effects to their settings, many coastal historic assets are sensitive to impacts from changes in coastal processes and increased erosion exacerbated by offshore development.
- 5.2.24 Many coastal and marine historic environment assets are protected by designations, but there are also gaps in knowledge regarding the location of submerged marine archaeological remains. Extensive coastal and marine areas around the Orkney and Shetland Islands, the East and North West coasts of Lewis, and the coastal regions of North Uist, Benbecula and South Uist have been identified as potentially having submerged archaeology of interest.

Landscape and Seascape

- 5.2.25 There are a large number of coastal landscape designations, some with marine components. For example twenty seven of Scotland's National Scenic Areas (NSAs) are located within or adjacent to coastal areas and include views of transitional or coastal waters. A number of local authorities have also identified local landscape designations. Many of these local designations lie in coastal locations particularly in the Northern and Western Isles, and along the south-

²⁴ SNH (2001) Natural Heritage Futures – Coasts and Seas, [online] Available at: www.snh.gov.uk/docs/A306281.pdf [accessed 04/04/2013]

western, western, north-western and northern coastlines of the Scottish mainland.

- 5.2.26 Areas of 'relative wildness' in Scotland have been identified through a process involving the consideration of the perceived naturalness of the land cover, the ruggedness of the terrain, remoteness from public roads or ferries, and the visible lack of buildings, roads, pylons and other modern artefacts. High levels of wildness are attributed to coastal areas on Scotland's north-west coast and in the Western Isles in particular. Areas of 'core wild land' have also been identified. Some of these have coastal components.
- 5.2.27 The main pressures on Scotland's coastal landscapes and seascapes are from coastal and marine development and the anticipated effects of climate change. Valued coastal landscapes are vulnerable to visual impacts from offshore development as a result of high landscape quality, natural character and wildness. In particular there is potential for cumulative impacts of onshore and offshore developments on landscape and seascape character and scenic value. Changes to coastal processes, specifically coastal erosion and accretion, also have the potential to alter these coastal landscapes and seascapes.

5.3 Likely Future Evolution of the Baseline

- 5.3.1 The Environmental Assessment (Scotland) Act 2005 requires consideration of the likely future evolution of the environment without the plans to assist in the identification of effects. The following section sets out the potential for change in the baseline. It does not specifically take into account the potential effects of other marine projects, as the majority of projects are yet to complete the licensing process. However, it is reasonable to assume some devices promoted outside of the current plans would be constructed, although assumptions would have to be made on the locations of projects. Therefore, whilst planned projects will be brought into the in-combination assessment, detailed later in this report, this section will simply consider changes to the current baseline. It will then seek to think in the broadest terms how the baseline evolution would be affected by some level of marine development.

Biodiversity, Flora and Fauna

- 5.3.2 The impacts of physical changes can be seen across elements of marine ecosystems. The key pressures for biodiversity include climatic factors and more specific man-made pressures (i.e. some fishing activities, offshore development and transport of non-native species). However, many of the trends identified in the environmental baseline are likely to be independent of the plan development process and, to a degree, offshore renewables development.
- 5.3.3 It is considered that changes to marine biodiversity from climate change are already occurring. Some species, such as plankton, fish and some intertidal species, are considered to demonstrate rapid responses to alterations in climate. For example, to the east of Scotland the rate at which the

biogeographic limits of southern intertidal species are extending northwards and eastwards towards the colder North Sea is up to 50 km per decade far exceeding the global average of 6.1 km per decade in terrestrial systems. The MarClim project has concluded that differential rates of range extensions and contractions are likely to result in a short term increase in biodiversity on rocky shores close to the biogeographic boundaries. However, as the climate continues to warm, biodiversity is likely to return to previous levels as northern species ranges retract to be replaced by southern species, resulting in different species compositions²⁵.

- 5.3.4 Recent biodiversity trends vary markedly by habitat and species, and in many cases, by region. In general terms, an overall trend of deterioration has been observed for some marine and coastal habitats, and declines observed for certain species²⁶. For example, shallow and shelf subtidal sediment habitats have been adversely impacted by pressures such as fishing activities affecting large areas of seabed, and localised effects from activities such as aquaculture²⁷. Some benthic Priority Marine Feature (PMF) species, for example sea grass beds and ocean quahog populations, are also considered to have experienced populations declines in recent years, with many more considered to be of scarce and vulnerable status (e.g. blue mussel beds, flame shell beds, maerl beds, etc.)²⁸.
- 5.3.5 Other PMF species, including elasmobranchs (e.g. Basking sharks, Blue shark, Common skate and Spiny dogfish) and harbour seals²⁹, are also considered to have depleted populations with downward trends largely due to man-made pressures, reflected in many cases by their 'vulnerable' or lower status on the International Union for Conservation of Nature (IUCN) Red List³⁰. However, others such as grey seal populations are considered to be in improving condition, having experienced population recoveries in many parts of Scotland, albeit with reductions in pup production in recent years in some areas (e.g. Outer Hebrides and Shetland)³¹.
- 5.3.6 Populations of many seabird and fish species are also experiencing long-term trends of decline³², and in the absence of the plan, are considered likely to continue to do so without intervention. Many species, such as the various cetacean species either based in or frequenting Scottish waters are considered to be in good or moderate condition, albeit with a high degree of uncertainty due largely to deficiencies in data for some species³³.
- 5.3.7 Current pressures such as climatic factors and fishing activities are expected to continue to exert a major influence on future trends in biodiversity, both directly and in-directly. However, the positive trend of increasing ambition for

²⁵ MarClim (undated) Conclusions [online] Available at: <http://www.mba.ac.uk/marclim/index.php?sec=conc> [accessed 15/05/2013]

²⁶ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 5.

²⁷ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 2.

²⁸ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 78 – 96.

²⁹ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 120 – 121.

³⁰ IUCN (2012) The IUCN Red List of Threatened Species [online] Available at: <http://www.iucnredlist.org/> [accessed 17/05/2013]

³¹ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 121.

³² Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 2.

³³ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 128 – 129.

biodiversity protection through mechanisms such as the United Nations Convention of Biological Diversity ("Aichi Targets" for 2020)³⁴, the development of Marine Protected Areas and potential for future expansion of SPA designations, has the potential to increase protection for designated and vulnerable species. This will, in turn, help to promote stronger biodiversity.

- 5.3.8 Even in the absence of the plan, further offshore renewables development would be anticipated in the future, albeit without the spatial context that the strategic level plans provide. As such, there is a degree of uncertainty relating to potential environmental interactions with this future development, and hence uncertainty relating to effects upon the future evolution of the environmental baseline. This SEA explores the potential for such interactions through the consideration of these trends.

Population and Human Health

- 5.3.9 The volume of vessel traffic travelling in or through Scottish waters and the broad routes taken along shipping lanes are primarily driven by commercial factors. The largest sectors responsible for shipping movements are shipping, fishing, recreational, and the oil and gas sectors, and these are largely independent of the plans for marine renewable energy. There are declining trends in Scotland's fishing fleet due in part to economies of scale and financial pressures³⁵. The Scottish tourism industry has ambitions for further growth and coupled with increasing trends for tourism day visits and visits to of outdoor areas in Scotland³⁶ there is a potential for an increase in vessel movement in this sector. Furthermore recent increases in investment in the oil and gas sector may see continued activity and vessel movement³⁷.

- 5.3.10 The continued development of offshore renewables would be anticipated in the future in the absence of the plan, albeit without the spatial context that the strategic level plans provide. Whilst growth in this industry may present an increase in risk of incidents such as collisions and groundings, due to an increase in vessels in some regions of Scottish waters, there is a degree of uncertainty relating to effects on the future evolution of the baseline. This SEA explores the potential for human health interactions associated with the expected growth of the offshore renewables development industry.

Water and the Marine Environment

- 5.3.11 Climate change pressures have played a key role in changing Scotland's marine water quality, with effects such as acidification and increasing sea temperatures having already been demonstrated on Scotland's coastal and marine environments³⁸. Over the last three decades, sea-surface temperatures

³⁴ United Kingdom National Commission for UNESCO (2010) Global deal to protect nature [online] Available at:

http://www.unesco.org.uk/global_deal_to_protect_nature (accessed 13/5/2013)

³⁵ Scottish Government (2010) The Future Of Fisheries Management In Scotland, Report of an Independent Panel [online] Available at: <http://www.scotland.gov.uk/Resource/Doc/329048/0106408.pdf> [accessed 17/05/2013]

³⁶ Visit Scotland (2013) Trends and Statistics, Quarterly Review [online] Available at:

[http://www.visitscotland.org/pdf/Quarterly%20report%20\(2012Q3\).pdf](http://www.visitscotland.org/pdf/Quarterly%20report%20(2012Q3).pdf) [accessed 17/05/2013]

³⁷ Scottish Government (2013) Oil Analysis shows boom years ahead [online] Available at:

<http://www.scotland.gov.uk/News/Releases/2013/03/oil-analysis11032013> [accessed 16/05/2013]

³⁸ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 189.

around the UK coast have also risen by approximately 0.7°C³⁹ following similar trends in the wider North Sea and North Atlantic. At the same time, seas are becoming more acidic, particularly those to the north and west of Scotland⁴⁰. Sea levels around the UK rose by about 1 mm/year in the 20th century (corrected for land movement), although it is estimated that recent increases have been higher than this⁴¹. Projections from the UK Climate Impacts Programme 2009 (UKCIP09) model estimates further rises of between 12 and 76 cm by 2095, with lower probability scenarios suggesting this rise could be even greater⁴².

- 5.3.12 At present, Scotland's coastal and transitional waters are primarily of good or higher classification⁴³. The implementation of programmes, such as River Basin Management Planning (RBMP) and Bathing Water initiatives developed in accordance with the Water Framework and Bathing Waters Directives respectively⁴⁴, have the potential to continue to build on the water quality improvements already made^{45,46} via targeting downgraded waterbodies and changing land and water management practices in both the onshore and offshore environments.
- 5.3.13 These trends are largely independent of the plan and, to a degree, offshore renewables development. With the continued development of offshore renewables that would be anticipated in the future in the absence of the plans, these pressures are unlikely to significantly alter. There could be an increased risk of contamination or pollution events associated with installation and operation of future developments, there is a degree of uncertainty regarding any potential effects on the future evolution of the baseline. This SEA explores the potential for effects on water quality associated with the expected growth of the offshore renewables development industry.

Climatic Factors

- 5.3.14 The UK Climate Change Risk Assessment states that there will be more frequent flooding arising from more frequent and intense rainfall, and increases in the frequency of extreme weather events (i.e. storms and flooding). Associated changes to sea levels, increased wave height and storm surges are predicted, with the potential for serious repercussions for Scotland's marine and

³⁹ UKCIP (2011) Recent Climate Trends [online] Available at: <http://www.ukcip.org.uk/essentials/climate-trends/> [accessed 17/05/2013]

⁴⁰ Scottish Government (2012) Climate Change and Ocean Acidification [online] Available at: <http://www.scotland.gov.uk/Topics/marine/science/atlas/climatechange> [accessed 17/05/2013]

⁴¹ UKCIP (2011) Recent Climate Trends [online] Available at: <http://www.ukcip.org.uk/essentials/climate-trends/> [accessed 17/05/2013]

⁴² Marine Scotland (2011) Scotland's Marine Atlas: Information for The National Marine Plan, pg. 189.

⁴³ Scotland's Environment (2011) Description of Coastal Waters [online] Available at: http://www.environment.scotland.gov.uk/our_environment/water/coastal_waters/description.aspx [accessed 17/05/2013]

⁴⁴ SEPA (2013) Sampling and results [online] Available at: http://www.sepa.org.uk/water/bathing_waters/sampling_and_results.aspx [accessed 10/05/2013]

⁴⁵ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 40 – 41.

⁴⁶ Scotland's Environment (2011) Description of Coastal Waters [online] Available at: http://www.environment.scotland.gov.uk/our_environment/water/coastal_waters/description.aspx [accessed 08/05/2013]

coastal environments, and the water quality, sediment processes and biodiversity they contain⁴⁷.

- 5.3.15 Even in the absence of the plan, further offshore renewables development would be anticipated in the future, albeit without the spatial context that the strategic level plans provide. Whilst increases in renewable energy generation in Scotland are likely to reduce greenhouse gas (GHG) emissions and contribute to adaptation to climate change, it is unlikely to have a significant influence over the effects of climate change at a global level.

Marine Geology and Coastal Processes

- 5.3.16 The environmental baseline, with respect to marine geology and sediments, is ever-changing, even in the absence of human influences. An estimated 12% of Scotland's coastline is subject to erosion⁴⁸, and this is likely to increase in future with likely increases in sea level, storm surges and coastal flooding.
- 5.3.17 While varying markedly by region and habitat type, a general deterioration in marine and coastal habitats has been observed and attributed in part to man-made pressures on benthic habitats (e.g. some fishing activities). Reductions in hazardous contamination of water in Scotland's coastal and near-shore marine areas has been observed over time, and are now considered to be low, having been subject to controls⁴⁹.
- 5.3.18 Even in the absence of the plan, further offshore renewables development would be anticipated in the future, albeit without the spatial context that the strategic level plans provide. Future development of any marine infrastructure may present an additional source of impacts to the seabed and to coastal processes, due to installation activities and presence on the seabed. Loss of benthic habitat within the footprint of any development and increased risk of contamination or pollution events during installation are the potential risks. This SEA explores the potential for effects associated with the expected growth of the offshore renewables development industry.

Historic Environment

- 5.3.19 While far less is known about Scotland's marine cultural heritage than about sites on land, the development of new detection methods and mapping activities are improving the study of submerged and offshore sites. Such techniques and technologies are likely to further aid the discovery of new archaeological or historic sites in the future, both on land and in the marine and coastal environments.
- 5.3.20 Historic sites have become under increasing pressure in recent times. Impacts ranging from structural effects on coastal buildings and erosional effects identified have been identified by coastal monitoring programmes such as

⁴⁷ DEFRA (2012) UK Climate Change Risk Assessment (CCRA) Available at:

<http://www.defra.gov.uk/environment/climate/government/risk-assessment/#report> [accessed 17/05/2013]

⁴⁸ Marine Climate Change impacts Annual Report Card 2010-2011 <http://www.mccip.org.uk/media/7562/mccip-report-2010-2011.pdf> (accessed 04/04/2013)

⁴⁹ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 47.

Shorewatch managed by Scottish Coastal Archaeology and the Problem of Erosion (SCAPE)⁵⁰. These pressures are likely to remain a major influence on the historic environment in the foreseeable future, and may be potentially exacerbated with the predicted effects of climate change (i.e. sea level rise, increased intensity of weather events, erosion and risk of flooding, etc.).

- 5.3.21 The recent increasing trend in visitor numbers to historic sites is likely to continue, although access to many submerged sites are likely to remain limited to relatively few people⁵¹. While further increases in visitor pressures may adversely affect some terrestrial coastal heritage sites. Sites such as Skara-Brae in the Heart of Neolithic Orkney WHS will, however, continue to be actively managed through the adoption of individual site management plans and government and agency commitments, to minimise the risk of impacts from visitor disturbance and erosion.
- 5.3.22 It is reasonable to assume continued development of offshore renewables even in the absence of the plans. Whilst offshore development may present an additional risk to historic sites in localised areas of the seabed and coastline due to their placement and presence on the seabed and in the water column, there is a degree of uncertainty in the effect on the future evolution of the baseline. This SEA explores the potential for effects associated with the expected growth of the offshore renewables development industry.

Landscape and Seascape

- 5.3.23 Whilst the use of Scotland's coastal and marine areas has progressively changed over time, the emergence of new industries, such as marine tourism, finfish and shellfish aquaculture, alongside more established industries (e.g. commercial fishing and shipping), may result in changes to seascape and the number of people potentially affected by change within the marine environment. As such, there is a degree of uncertainty in accurately predicting the extent of such development in the future, and any associated effects on the future evolution of the baseline.
- 5.3.24 There is a potential for cumulative landscape/seascape effects from coastal and marine development, and continued industrial and urban expansion. Seascape changes from closing some North Sea oil and gas installations and the development of new fields is likely, although onshore impacts are minimal.
- 5.3.25 Any changes to landscapes and seascapes from marine development promoted outside of these plans, could impact on other marine users, particularly in the tourism and recreation sectors. This SEA explores the potential for effects associated with the expected growth of the offshore renewables development industry.

⁵⁰ SCAPE (undated) Shorewatch [online] Available at: <http://www.scapetrust.org/html/shorewatch.html> [accessed 20/05/2013]

⁵¹ Scottish Government (2011) Scotland's Marine Atlas, Information for the national marine plan, Scottish Government pg. 158.

6 Environmental Assessment

6.1 Background

- 6.1.1 The Environmental Assessment (Scotland) Act 2005 Schedule 3 requires an assessment of the plans and the reasonable alternatives. The detailed assessment of alternatives is set out in Appendices C and D and summarised below.
- 6.1.2 The first stage of the SEAs was an assessment of current technologies for wind, wave and tidal devices. The assessment has been drawn from a number of existing sources of information including:
- The Environmental Report from the SEA of “Blue Seas, Green Energy: The Plan for Offshore Wind Energy in Scottish Territorial Waters”⁵²;
 - The Environmental Report from the SEA of Scottish Marine Renewables⁵³;
 - Environmental Impact Assessment (EIA) and other project level environmental assessment and monitoring of offshore renewable energy projects, as set out in Appendix C^{54 55 56 57 58 59};
 - The draft report of the review of the Potential Impacts of Wave and Tidal Energy development on Scotland’s Marine Environment⁶⁰; and
 - Other relevant specialist reports and documents^{61 62 63 64 65 66 67}.

⁵² Halcrow (2007) The Plan for Offshore Wind Energy in Scottish Territorial Waters, Environmental Report: Volume 1, Prepared for the Scottish Executive [online] Available at: <http://www.scotland.gov.uk/Resource/Doc/312161/0098588.pdf> [accessed 27/03/2013]

⁵³ Faber Maunsell (2007) Scottish Marine Renewables SEA: Environmental Report, Prepared for the Scottish Executive, March 2007.

⁵⁴ Talisman Energy (UK) LTD (2005) Environmental Statement Beatrice Demonstrator Project [online] Available at: <http://www.beatricewind.co.uk/downloads/statement.asp> [accessed 25/03/2013]

⁵⁵ EMU (2012) Neart na Gaoithe Offshore Wind Farm Environmental Statement, Prepared for Mainstream Renewable Power [online] Available at: <http://mainstream-downloads.opendebate.co.uk/downloads/Contents-Pages.pdf> [accessed 25/03/2013]

⁵⁶ Aberdeen Wind Offshore Wind Farm Limited (2011) European Offshore Wind Deployment Centre: Non-Technical Summary, July 2011 [online] Available at: http://www.vattenfall.co.uk/en/file/EOWDC-consent-vol1.pdf_18476566.pdf [accessed 26/03/2013]

⁵⁷ E-on (2008) Offshore Environmental Statement, April 2008 [online] Available at: <http://www.eon-uk.com/generation/1309.aspx> [accessed 26/03/2013]

⁵⁸ E-on (2008) Onshore Cable Route Environmental Statement, April 2008 [online] Available at: <http://www.eon-uk.com/generation/1309.aspx> [accessed 26/03/2013]

⁵⁹ E-on (2009) Onshore Substation and Cable Spur Environmental Statement, November 2009 [online] Available at: <http://www.eon-uk.com/generation/1309.aspx> [accessed 26/03/2013]

⁶⁰ Aquatera (2012) A review of the Potential Impacts of Wave and Tidal Energy development on Scotland’s Marine Environment, Prepared for Marine Scotland, draft Report Issued 9 March 2012

⁶¹ OSPAR Commission (2004) Biodiversity Series: Environmental Impacts to marine species and habitats of dredging for navigational purposes [online] Available at: http://www.ospar.org/documents/dbase/publications/p00208_environmental%20impacts%20to%20marine%20species.pdf [accessed 28/03/2013]

⁶² McCluskie, A.E., Langston R.H.W. and Wilkinson N.I. (undated) Birds and wave & tidal stream energy: an ecological review, RSPB Research Report No. 42 [online] Available at: http://www.rspb.org.uk/Images/mccluskie_langston_wilkinson_2012_tcm9-307966.pdf [accessed 28/03/2013]

⁶³ Argonne National Laboratory (2011) Visual resource Analysis: Offshore Wind Turbine Visibility and Visual Impact Threshold Distances [online] Available at: <http://visualimpact.anl.gov/offshorevitd/> [accessed 22/03/2013]

⁶⁴ E.On UK (2013) Foundation Types [online] Available at: <http://www.eon-uk.com/generation/3947.aspx> [accessed 02/03/2013];

⁶⁵ ARUP, Costain, Hochtief (undated) Gravity Base Foundations; Scharf R. and Siems M. (2013) Monopile foundations for offshore wind turbines – solutions for greater water depths, Steel Construction 6 (2013), No. 1, DOI: 10.1002/stco.201300010, pp. 47 – 53 [online] Available at: <http://onlinelibrary.wiley.com/doi/10.1002/stco.201300010/pdf> [accessed 27/03/2013];

⁶⁶ DW (2013) Scientists race to develop floating wind farms [online] Available at: <http://www.dw.de/scientists-race-to-develop-floating-wind-farms/a-16540081> [accessed 02/03/2013].

⁶⁷ Fjordr Marine and Historic Environment Consulting (2013) Historic Environment Guidance for Wave and Tidal Energy (*Draft*) [online] Available at: www.fjordr.com/uploads/3/0/0/2/3002891/historic_environment_guidance_for_wave_and_tidal_energy_-_consultation_draft_150213.pdf [accessed 03/04/2013]

6.2 Assessment of Wind Technologies

6.2.1 The technologies considered under wind technology covered:

1. Gravity-base foundation devices;
2. Monopile or multi-pile foundation devices;
3. Tripod or steel jacket foundation devices;
4. Mono or multi-caisson foundation devices; and
5. Floating wind turbines.

6.2.2 Appendix D provides more detail on the technologies included in the assessment and the references of the information sources used in this review.

Biodiversity, Flora and Fauna

6.2.3 Each of the technologies reviewed have the potential for a similar range of effects on biodiversity, flora and fauna. Underwater noise and vibration is associated with the installation of all devices, although in particular those involving piling and fixing to the seabed. This could affect marine fauna including seals, otters, cetaceans, basking sharks and fish, however, the exact effects of noise and vibration are relatively unknown. The assessment identified the potential for some species to be curious and attracted to noise sources while the noise might directly impact on the health e.g. hearing of other species in the vicinity of works.

6.2.4 Additionally underwater noise and vibration alongside other noise sources (such as those associated with vessel movement), vibration, visual and light intensity changes (associated with installation and operation of devices), water quality changes and habitat disturbance, have the potential for displacement or disturbance of marine fauna and seabirds that forage in these areas; in particular diving birds who would be affected by both surface and underwater noise.

6.2.5 Aside from noise impacts, there are other potential sources of injury and even mortality risks associated with the technologies. In particular, risk of injury to seals, cetaceans and elasmobranchs from collision. Although this risk may be reduced with floating devices that require anchoring only. Furthermore, there is a risk to seabirds and some migratory birds from bird-strike with turbine blades. Precise effects depend on the location of migratory paths and foraging grounds. Diving birds could also collide with support devices and infrastructure.

6.2.6 Cabling and grid connection infrastructure have the potential for EMF impacts that could impact on elasmobranchs and fish. Cabling infrastructure, alongside mooring infrastructure, device arrays, and construction vessels and equipment, have also been considered to have the potential for cumulative impacts as barriers to movement of mammals, cetaceans and migratory fish.

- 6.2.7 All of the technologies will result in a degree of loss of benthic habitat as a result of installation. The degree of impact may vary between technologies, as a result of differing surface areas of disturbance required for piling installation, mooring and gravity anchors, and from the placement of gravity based foundations on the seabed. The latter will have a larger area of contact with the seabed than other technologies.
- 6.2.8 In addition to loss of seabed habitat there are other impacts associated with gravity based foundations as a result of sourcing of fill material or dredged material for use. Potential effects include impacts to marine fauna from dredging activities, loss of habitat at the source of material, changes to water hydrology and turbidity, and potential release of contaminated materials from dredged material in less contaminated areas. Potential impacts for marine fauna and flora also include disturbance and physical injury from dredging operations.
- 6.2.9 Some benthic habitats are particularly sensitive to sediment dispersion and deposition that can arise from both the construction phase of works and from dredging and release activities associated with gravity based devices. Shellfish growing waters such as those in Argyll, Islay and Kintyre which are located in regions containing areas of search are particularly sensitive to this type of impact.
- 6.2.10 Many of the construction and decommissioning effects associated with the technologies may be temporary and reversible. For example, eventual removal of structures, such as gravity base and turbines, may reduce collision risks and enable rehabilitation of the seabed. However, some impacts on biodiversity as a result of the construction and operation of wind farms could be permanent if they were to significantly impact on the viable population of a species. Aside from mortality from collision, other impacts on population numbers, such as change to prey species, could also be permanent.
- 6.2.11 Previous assessments have identified the potential for the creation of artificial habitats for marine organisms as a result of new structures in the water. This may be aided by potential reductions in commercial fishing (e.g. trawling) in areas where wind technology is located. These benefits could last for the life time of the project, or potentially longer depending on the decommissioning scheme.

Population and Human Health

- 6.2.12 The review has identified that all of the technologies will have the same potential effects on population and human health. There is potential for noise and shadow flicker effects, which can cause nuisance and irritation to people who live or travel through areas. The significance of effects will depend on the proximity of wind farms to the shore line and its inhabitants and users, and the location of turbines in relation to the sun, particularly when low in the sky. Impacts on mobile sea users could be magnified if they are in closer proximity

to the turbines. Effects can only however be reasonably established at the project design stage.

- 6.2.13 Other impacts on marine users (e.g. fishing, recreational, shipping, aquaculture) to consider are the potential displacement of activities, collision risk with turbine structures, and visual impacts associated with the presence of the turbines. These effects will be reversible and will reduce upon decommissioning
- 6.2.14 The SEA for “*Blue Seas, Green Energy*” identified benefits for the Scottish population, which is projected to increase, as a result of the provision of a new renewable energy supply.
- 6.2.15 Information from previous environmental assessments has identified potential conflicts with shipping navigation, although it has been noted that this may be managed through the involvement of the Maritime and Coastguard Agency (MCA) to ensure that there are no hazards to shipping.
- 6.2.16 Potential for commercial impacts on the fishing and shipping industries have been identified, as a result of the loss of access to fishing areas, reduced catches relating to potential displacement of fish populations, and collision risk.
- 6.2.17 All of the technologies will require the installation of new transmission infrastructure to connect devices to the grid, such as cables on the seabed, and terrestrial infrastructure. The potential impacts of this infrastructure are likely to be site and development specific. In addition there may be a requirement for upgrading of nearby port and harbour infrastructure to install and maintain turbines. Specific effects on ports and harbours from required upgrading are assessed in more detail within the SEA of the National Renewable Infrastructure Plan (NRIP)⁶⁸.

Water and the Marine Environment

- 6.2.18 Potential for significant effects on water and the marine environment are, in general, related to the installation of turbine foundations and structures. Changes to turbidity, seabed disturbance from placement of gravity-based devices and from piling activities, contamination from installation equipment and maintenance vessels, could all impact on local water quality. Changes in water quality will have associated impacts on local marine biodiversity where species are dependent on existing water conditions. In addition, when using gravity based devices, the potential for cross-contamination from the use of dredged material as ballast, as well as the process of dredging itself, could result in changes to water quality.
- 6.2.19 The SEA for “*Blue Seas, Green Energy*” also raised the potential for impacts to the ability of fish species to spawn, respire and feed, and on shellfish growing waters in the vicinity of wind farm sites. The significance of these effects will depend on the proximity of devices to these waters.

⁶⁸ Scottish Enterprise, Highlands and Islands Enterprise (2010) National Renewable Infrastructure Plan: Stage 2: Environmental Report [online] Available at: <http://www.hie.co.uk/growth-sectors/energy/n-rip.html> (04/04/2012)

- 6.2.20 As the majority of effects are likely during phases of disturbance, e.g. during construction and decommissioning, it is considered that effects on water and the marine environment are likely to be temporary and may be reversible. However, implications for species that depend on water quality could have greater significance and permanence.

Climatic Factors

- 6.2.21 The technologies themselves will involve the use of energy in their construction, transportation and maintenance. However, as noted within the SEA for “*Blue Seas, Green Energy*”, wind farms will contribute to the decarbonisation of electricity generation through their long-term operation which will be beneficial for climatic factors.
- 6.2.22 Devices have the potential to result in some changes to wave energy dissipation and to coastal processes. Depending on location these effects could exacerbate existing vulnerability of coasts to climatic change by altering wave energy patterns whilst in some circumstances reducing wave energy could contribute to the protection of coastlines susceptible to erosion.

Marine Geology and Coastal Processes

- 6.2.23 For all of the technologies there are potential adverse impacts to the seabed that would result from the preparation of the seabed, including some dredging, and in the placement of technology. Technologies that involve piling operations may affect a smaller area of the seabed than gravity based technology or suction caisson, but will still involve a degree of adverse effects. Impacts on the seabed may result from changes to turbidity, sediment disturbance, loss of geology, release of contaminated materials bonded to sediments.
- 6.2.24 Additionally, all of the technologies have been identified as capable of potential alteration of sediment dynamics and tidal flows and fluxes as a result of turbine masts and support structures, including anchors, in the water column. As set out in 6.2.22 these can interact with existing pressures on vulnerable coastlines. Impacts such as scouring, deposition and abrasion, particularly in the placement of mooring lines, may also occur due to the foundation structures present at the seabed. However, it is assumed that scour protection would be used for such foundation structures and this may alleviate such risks.
- 6.2.25 The significance of effects is dependent on the type of receiving environment and it is likely that associated scour protection with the technologies would provide some mitigation. The SEA for “*Blue Seas, Green Energy*” considered that impacts from construction and decommissioning works are likely to be temporary and are thought to be reversible. However, impacts from seabed preparation works are likely to be more permanent.
- 6.2.26 Gravity based wind devices require material to fill the shell around these and anchor them to the seabed. Aside from the placement of technologies, there is potential for impacts at the source of the fill material, either from areas dredged or from terrestrial sites of extraction. Potential impacts at the source could

include loss of substrata or habitat if taken from undisturbed areas. Dredging has the potential for a range of effects including the release of contaminated materials bonded to dredged sediments, and cross-contamination from source areas to wind farm sites, particularly if material is sourced from shipping lanes or harbours. The hydrodynamics and water flows at the source location could be altered by the removal of sediments and increased turbidity from sediment disturbance during dredging operations could reduce water quality.

Historic Environment

- 6.2.27 There is potential for impacts from all of the technologies designated and non-designated historic features, including wrecks, and other submerged archaeology. These impacts could result from construction of the technologies and from potential scouring, siltation and deposition around assets located in the vicinity of devices or arrays. However, adverse effects are likely to be avoided through careful siting of individual device foundations and arrays, although this may be more difficult for larger gravity bases or arrays of bases.
- 6.2.28 Wind technologies, specifically masts, turbines and supporting infrastructure, could impact on the setting of historic features, including WHS, coastal listed buildings, and scheduled monuments. The magnitude of visual effects on the historic environment will depend on how the setting of the feature is defined and will be strongly related to the visibility of the device and structure. Impacts will differ between views from the terrestrial and marine environments.
- 6.2.29 Guidance⁶⁹ also notes that development could enhance the significance of heritage assets, or at least make their significance more apparent. This can arise through better understanding or knowledge of the marine historic environment as a result of investigation works which lead to the discovery of features.

Landscape and Seascape

- 6.2.30 Wind turbines and their supporting infrastructure, depending on their location, may impact on views to and from areas designated for their landscape and seascape value. In general, greater impacts are likely for near-shore devices than those located further offshore (e.g. beyond 15k m). However devices that are further offshore can still be highly visible to commercial and recreational sea users.
- 6.2.31 Field observations of offshore wind turbines in the United Kingdom have revealed that the facilities may be visible at distances of up to 26 miles (42 km). However, visibility as a feature of visual attention distances will reduce to approximately 10 miles (16 km). Elevation will also be a factor on the visibility of wind turbines from the marine environment.

⁶⁹ Fjordr Marine and Historic Environment Consulting (2013) Historic Environment Guidance for Wave and Tidal Energy (*Draft*) [online] Available at: www.fjordr.com/uploads/3/0/0/2/3002891/historic_environment_guidance_for_wave_and_tidal_energy_-_consultation_draft_150213.pdf [accessed 03/04/2013]

6.2.32 There are potential onshore impacts from supporting grid infrastructure and interconnectors with terrestrial grid, although these will likely depend on siting and surroundings. Additionally there could be landscape impacts at the source of excavated terrestrial fill material if this is used as ballast in gravity-based foundations.

6.3 Assessment of Wave Technologies

6.3.1 The technologies considered under wave technology covered:

1. Point absorbers and Rotating Mass Devices;
2. Attenuators and Bulge Wave Devices;
3. Oscillating wave surge converters;
4. Submerged pressure differential devices;
5. Oscillating water column devices (offshore and shoreline); and
6. Overtopping devices (offshore and shoreline).

6.3.2 Appendix D provides more detail on the technologies included in the assessment and the references of the information sources used in this review.

Biodiversity, Flora and Fauna

6.3.3 Studies have identified that wave technologies can have a broad range of effects on flora and fauna. These effects could potentially be exacerbated for some devices (1, 2, 5, 6), as a result of bird aggregation utilising above water elements, particularly if located in foraging waters.

6.3.4 Noise effects, both under and above water, are potentially associated with all of the technologies. Noise from some devices may be fairly slight in the operation phase. Noise effects result from construction and installation works (e.g. associated with anchoring), from machinery housing in floating or subsurface structures, and from vessels may occur. Potential effects associated with noise include behavioural impacts to seals and otters (typically located near the shoreline) and cetaceans and elasmobranchs (located offshore) which might avoid locations where development is occurring during installation and operation. Basking sharks avoiding structures or installations and servicing vessel activities, is a concern because it could result in displacement of foraging activities or courtship behaviour. Additionally, there are potential impacts on seabirds, in particular birds within coastal breeding sites, if located close to devices, or in foraging sites located offshore where underwater noise could affect diving birds.

6.3.5 Research demonstrates that there is a significant amount of uncertainty regarding the level of disturbance likely to occur to all species as effects will be site-specific, and will depend on the noise levels generated by the technologies. Moreover, the importance for birds of being able to hear underwater, threshold levels and the likelihood of any impacts, are also unknown. However, it is

reasonable to assume that, for some species, there is the potential for disturbance which is serious enough to cause displacement and a reduction in foraging success.

- 6.3.6 Further displacement of marine fauna, particularly seals, otters and birds, can be associated with impacts on shoreline habitats caused by the installation of shoreline devices (5 and 6). The impact of this is likely to be site-specific and will be dependent on the availability of alternative habitats, siting options, and the activities displaced.
- 6.3.7 The physical presence of new structures in the water column may disrupt movements or migration of marine fauna, particularly where there are groups of devices present. Given the mobility of species, any impacts are likely to be site specific. There is uncertainty about movements and migration routes (e.g. basking sharks) and patterns of movement of other species (e.g. seals, otters). There is also uncertainty about whether devices and their moorings will be perceived by fauna as barriers to movement, and, if they are, whether species will simply alter their movement accordingly. Available research shows that near-shore devices (5 and 6) may restrict movement more than offshore because there are greater alternatives for movement around devices offshore (1 to 4).
- 6.3.8 Aside from noise effects, birds may also be displaced by visual disturbance if surface-piercing components are present, with potential for greater impacts if devices are located near-shore and close to coastal breeding and moulting sites, or offshore near foraging areas. The previous Marine Renewables SEA considered that, in such instances, some birds in flight may use similar avoidance tactics to those employed when encountering other natural and man-made obstructions by taking alternative flight routes. In these cases some effects may only be temporary as birds become accustomed to the presence of the devices.
- 6.3.9 Potential for collisions between marine fauna and devices and their moorings has been identified, particularly where devices have moving parts. However, this will be largely dependent on the size and design of the device, the location of the device, its proximity to receptors such as seal haul out zones, and the response of the marine fauna involved. Avoidance is a likely response for many species, in some circumstances, with a low collision risk. However, if collision were to occur, impacts could result in injuries to some larger species (seals, otters, cetaceans, and elasmobranchs).
- 6.3.10 Collision with, or entanglement in, mooring lines associated with offshore devices is also considered possible, particularly for larger species (such as Minke whales which are more prone to entanglement than other odontocetes). Effects will be most likely where complex arrays of devices are present with multiple mooring lines (e.g. likely 3-point mooring systems). It is not presently known whether the effects of entanglement would be significant, although it is noted that if it did occur, it may result in serious injury or fatality.

- 6.3.11 Whilst there is potential for collision risk for diving birds with wave devices, it is considered minimal as devices are generally placed on the water surface.
- 6.3.12 Some of the technologies (1 and 5) have been found to have the potential for impacts arising from shock waves or pressure waves which occur when large waves hit the side of surface-piercing structures which have high profiles above the water surface. The magnitude of any impacts and their effects on these species is not yet known; however, the potential for impacts to seals, cetaceans, otter and elasmobranchs such as basking shark has been identified.
- 6.3.13 There is the potential for EMF impacts from underwater cabling and grid connections that could impact on marine mammals and, in particular, fish. Further information is required to determine the potential susceptibility of marine fauna and likely effects associated with this issue.
- 6.3.14 Research and assessment of wave technologies has identified a range of potential impacts on benthic habitats. Appendix C provides details of potential effects on specific species and habitats (including maerl beds, tidal swept channels, horse mussel beds, blue mussel beds). The presence of these devices in the water column and their seabed moorings, have the potential to contribute to habitat changes. The presence and type of mooring used for devices (gravity/deadweight anchor, gravity base structure, rock anchors, etc.) and the presence of structures on the seabed, are the main impacts to benthic habitats.
- 6.3.15 Impacts to seabed habitats from the devices are likely to result from changes to wave energy dissipation, tidal flows and flux changes and deposition, due in large to the presence of structures in the water column.
- 6.3.16 Other impacts, such as scouring, deposition, abrasion, smothering and siltation, and the potential for loss of habitat from placement of anchors on the seabed and mooring lines in the water column have also been identified. These may also occur due to wave and coastal process changes and during installation of devices. Associated effects include the introduction of variations and shifts in grain size of sediments, which can alter habitat character and species distribution.
- 6.3.17 Finally, other potential effects include: shading or smothering of benthic areas with sediments and the presence of the device itself; changes in species distribution via interference with filter feeders; inhibiting their respiration and reproduction; and secondary impacts such as reducing food sources for other species supported by these habitats. These may collectively lead to wider changes in ecosystem composition. In some instances, this may also result in changes to sediment movement which can, in turn, result in changes in coastal character and profile which has the potential for a range of adverse impacts for habitats. Secondary impacts may include changes to species distribution, and potentially reducing food sources for other species supported by these habitats.

Population and Human Health

- 6.3.18 Above water components are likely to be visible to larger vessels, particularly for certain technologies (5, 6). As such potential for vessel collisions with above water components or components at shallow depths in the water column has been identified and is considered to have the potential for serious injury, particularly in periods of low light. However, navigational warnings (e.g. marker buoys, navigational aids, lighting) will likely be required on such devices for navigational purposes reducing the risk of significant effects. Potential for a greater significance of effects for small recreational craft has been considered, particularly where sea conditions could make devices that sit on the surface of the sea difficult to see from a distance.
- 6.3.19 The displacement of shipping, both commercial and recreational, from wave sites as a result of restricting access, could increase the potential risk of collision by limiting the space for vessels. Shallow water devices may in particular reduce the space available for some recreational boating.

Water and the Marine Environment

- 6.3.20 All of the wave devices reviewed have the potential to result in impacts as a result of local changes in water turbulence. Changes to hydrological dynamics, tidal flows and fluxes, water turbidity and water turbulence, vibration, dissipation of wave energy and wave period could result from the presence of devices and their support structures.
- 6.3.21 Water turbidity and vibration might, in particular, be associated with the construction and installation phase. Impacts as listed above will remain during operation and there may be additional contamination risks associated with leakage from vessels or equipment.
- 6.3.22 Impacts on the water environment are closely linked to impacts on the seabed and marine geology, and, in turn, to impacts on biodiversity.

Climatic Factors

- 6.3.23 The technologies themselves will involve the use of energy in their construction, transportation and maintenance. However, wave energy will contribute to reducing greenhouse gases as part of energy generation and displacement of energy generated from non-renewable sources.
- 6.3.24 Devices have the potential to result in changes to wave energy dissipation and to coastal processes. Depending on location these effects could exacerbate existing vulnerability of coasts to climatic change by altering wave energy patterns whilst, in some circumstances, actually contribute to the protection of coastlines susceptible to erosion by reducing the energy of wave impacts.

Marine Geology and Coastal Processes

- 6.3.25 The 2007 Marine Renewables SEA identified the potential for impacts on important coastal geological features including geological SSSI and Geological

Conservation Review sites (GCRs). Furthermore, it identified changes in coastal processes due to energy extraction.

- 6.3.26 The research reviewed discusses the potential for local changes in water turbulence due to the presence of groups of wave devices, and the presence of support structures in offshore and near-shore areas. There is potential for increased scouring and changes to coastal processes, such as sediment dynamics, wave dissipation and tidal fluxes during operation, and for seabed disturbance and abrasion of marine geology during installation of mooring systems and subsea cabling.
- 6.3.27 Changes to sediment dynamics, both offshore and in shallow waters, has the potential, in particular, to impact on benthic habitats and as a result will affect biodiversity.

Historic Environment

- 6.3.28 Wave energy technologies could pose a risk to submerged features of archaeological interest, although the greatest risk is most likely to be for unknown remains. The moorings that anchor the devices (including lengthy mooring chains), and the means to construct these (e.g. piling and seabed preparation), could have direct impacts on features of interest by directly disturbing them. Furthermore, associated grid cables and the anchors of supporting vessels also have the potential to affect historic features located on the seabed.
- 6.3.29 Wave technologies, in particular those with elements that sit on top of and above the water, could also have effects on the setting of historic features during both construction and operation. The significance of these effects will depend greatly on the setting of the historic feature, including views to and from it, and the visibility of technologies in any given location.
- 6.3.30 Mooring of devices can be associated with changes to sediment and seabed processes, as a result of deposition, siltation or abrasion from offshore support structures, scouring, and changes in sediment dynamics. Changes in the movement of sediment can cause adverse effects on historic features from increased exposure. However, guidance on the historic marine environment also identifies that, in some circumstances, where devices reduce wave energy reaching shore there could be benefits, in terms of reduced erosion of coastal heritage features.
- 6.3.31 In general, adverse effects of the devices can be avoided through careful siting of individual device supports and moorings, although this may be more difficult for larger gravity bases or for larger arrays.

Landscape and Seascape

- 6.3.32 Landscape and visual effects may vary between technologies depending on the presence of surface-piercing structures, marker buoys and lights for navigation. These features all have the potential to impact on the aesthetic character of the

coastline, particularly if located near-shore and in large numbers. Submerged and oscillating devices may have fewer impacts than attenuator devices which sit on top of the water, but this will depend on location of devices and receptors, and the quality of the receiving environment. Near shore devices tend to have a greater amount of infrastructure below water and would have reduced visibility, although part of the device infrastructure may be above the surface.

- 6.3.33 The SEA for marine renewable energy identified that eight out of the ten seascape types are of high sensitivity to point structures such as the surface-piercing structures on certain devices, with the potential for effects occurring at 0 – 10 km from coastline. Moderate effects may also occur at distances over 10km.
- 6.3.34 There are potential onshore impacts from supporting grid infrastructure and interconnectors with terrestrial grid, although these will likely depend on siting and surroundings.

6.4 Assessment of Tidal Technologies

6.4.1 The tidal technologies considered covered:

1. Horizontal Axis Turbines;
2. Vertical Axis Turbines;
3. Reciprocating Hydrofoils; and
4. Emerging Technologies.

6.4.2 Appendix C provides more detail on the technologies included in the assessment and the references of the information sources used in this review.

Biodiversity, Flora and Fauna

- 6.4.3 There are a number of potential effects on species and habitats as a result of tidal power devices. Noise effects are associated with all of the technologies and can have impacts for marine fauna. During installation of devices there is potential for noise from drilling and piling, from machinery housing and from vessels. There may be the potential for behavioural impacts to marine fauna (seals, cetaceans, otter, basking sharks), although effects will be site specific and dependant on the presence of species and noise levels generated. Basking sharks avoiding structures or installations and servicing vessel activities, may lead to the displacement of foraging activities or courtship behaviour.
- 6.4.4 There is potential for noise impacts from generators within devices or their support structures. This may impact on birds, in particular diving birds within coastal breeding sites if these are located close to devices or those in foraging sites located offshore, where underwater noise could affect them. Effects on birds and other marine fauna may include displacement, avoidance, and reduction in foraging success. Some displacement effects are considered to be temporary as species become accustomed to changes in noise.

- 6.4.5 Research has found that, although noise has been identified as potentially damaging, there is uncertainty around the magnitude of impact. Noise levels within devices are likely to be low and constant and the high energy environments required for tidal energy are likely to have high levels of background noise.
- 6.4.6 The presence of new structures in the water column can disrupt movements or migration of marine fauna, particularly where devices are grouped. Currently the precise migration routes for species such as basking shark and patterns of movement of other fauna (e.g. Atlantic salmon, seals) are not well defined. Therefore, given the mobility of these species, any impacts are likely to be site specific. There is uncertainty about whether devices will impact directly on species or whether they will simply alter their movement accordingly, particularly with fauna which have been able to gain familiarity with the devices.
- 6.4.7 Bird species could also be displaced by devices with components which extend above the waterline and interfere with their flight paths, although with this technology effects are considered of very minor significance. The potential for impacts of this kind is greater where technologies are located near-shore and close to coastal breeding and moulting sites, or offshore near foraging areas. The 2007 Marine Renewables SEA considered that, in such instances, some birds in flight may operate in a broadly similar way and use similar avoidance tactics to those employed when encountering other natural and man-made obstructions by taking alternative flight routes. In these cases some effects may only be temporary as birds become accustomed to the presence of devices.
- 6.4.8 Potential for collisions between marine fauna and particularly the moving parts of devices, and potentially their moorings has been identified. However, this will be largely dependent on the size and design of the device, the location of the device and its proximity to receptors such as seal haul out zones, and the response of the marine fauna involved. Avoidance is a likely response for many species, and collision risk could be low. However, if collision were to occur, impacts could result in injuries to some larger species (seals, otters, cetaceans, and elasmobranchs).
- 6.4.9 There is potential for collision of diving birds with devices within the water column. Collisions could be fatal for some marine birds, which can dive to depths of up to 60m from the water surface (e.g. common guillemots, long-tailed ducks). This is likely to be of particular concern with the moving blades present on horizontal and vertical axis turbines, and potentially less of a concern with reciprocating hydrofoils where blades are likely to be slower moving.
- 6.4.10 Horizontal and vertical axis turbines have the potential to result in shock waves rebounding from surface piercing features. The magnitude of any impacts and the effects on these species is not yet known, although it is expected to be of a minor significance. The potential for impacts to seals, cetaceans, otter and elasmobranchs has been identified in the research.

- 6.4.11 During periods where hydrofoil devices might not be turning (shutdown periods or slack water) there may be potential for fish aggregation in the vicinity of devices. Research has identified that there may, therefore, be a potential risk of physical injury to some species during periods of start-up (i.e. when the blades start moving), where aggregation has occurred.
- 6.4.12 There is the potential for EMF impacts on marine mammals and in particular fish from underwater cabling and grid connections. Further information is required to determine the susceptibility of marine fauna and likely effects associated with this issue.
- 6.4.13 Research and assessment of tidal technologies (included in Appendix C) has identified a range of potential impacts on benthic habitats including maerl beds, tidal swept channels, horse mussel beds, blue mussel beds and other filter feeders. Tidal devices in general can impact on seabed habitats as a result of installation, and from limited changes in tidal flows, fluxes and turbulence due to the presence of these devices and associated structures in the water column.
- 6.4.14 Other impacts, such as scouring, deposition, abrasion, smothering and siltation, and the potential for loss of habitat from placement of device mooring and anchors (e.g. gravity anchors, or rock anchors) on the seabed and in the water column, have also been identified. Subsea cables can also have these impacts. These effects may also occur due to wave and coastal process changes, as well as during installation of devices. Associated effects include the introduction of variations and shifts in grain size of sediments, which can alter habitat character and species distribution. These effects can impact on a range of species and habitats including the species referred to above.
- 6.4.15 Other effects include: shading or smothering of benthic areas from sediments or from the presence of the device itself; changes in species distribution via interference with filter feeders inhibiting their respiration and reproduction; and secondary impacts such as reducing food sources for other species supported by these habitats. These impacts may collectively lead to wider changes in ecosystem composition. In some instances, this may also result in changes to sediment movement which can result in changes to coastal character and profile and this has the potential for a range of adverse impacts on habitats. Secondary impacts may include changes to species distribution, and potentially reducing food sources for other species supported by these habitats.

Population and Human Health

- 6.4.16 The presence of tidal devices in the water column could interfere with the navigation of recreational or commercial shipping and lead to an increased risk of collision and serious injury.
- 6.4.17 Navigational warnings (e.g. marker buoys, navigational aids, lighting) are likely to be required on such devices and access restrictions for shipping, recreational sailing and other water sports can reduce this risk. However, the displacement

of shipping as a result of restricting access to areas where devices are located could increase the potential risk of collision.

- 6.4.18 The research suggests some measures to prevent adverse effects including; siting devices away from areas spatially constrained or with high vessel densities, and siting devices in open water. Using device types that are fully submerged and allow shipping to pass over the top of them could also reduce effects, but guidance would need to be sought on a case-by-case basis on the level of clearance required.

Water and the Marine Environment

- 6.4.19 Devices have the potential to result in a range of impacts from local changes in water quality during installation and from the presence of devices in the water column which could alter water turbulence and change tidal flows and fluxes. Water quality impacts could arise as a result of changes to sediment dynamics, scouring, deposition, smothering and changes to water turbulence. These may be associated with the installation and presence of support cables and structures on the seabed. Additional contamination risks might be associated with leakage from vessels or equipment during installation and operation.

Climatic Factors

- 6.4.20 The devices themselves will involve the use of energy in their construction, transportation and maintenance. However, tidal energy will contribute to reducing greenhouse gases as part of energy generation and displacement of energy generated from non-renewable sources.
- 6.4.21 Devices have the potential to result in changes to wave energy dissipation and to coastal processes. Depending on location these effects could exacerbate existing vulnerability of coasts to climatic change by altering wave energy patterns whilst, in some circumstances, actually contribute to the protection of coastlines susceptible to erosion by energy and turbidity within the coastal zone.

Marine Geology and Coastal Processes

- 6.4.22 The 2007 Marine Renewables SEA identified the potential for impacts on important coastal geological features including geological SSSI and GCRs. Furthermore, it identified changes in coastal processes due to energy extraction.
- 6.4.23 The research reviewed discusses potential for local changes in water turbulence due to the presence of groups of tidal devices, and support structures, including anchoring and moorings. There is potential for increased scouring and changes to coastal processes, such as sediment dynamics, wave dissipation and tidal fluxes during operation and for seabed disturbance and abrasion of marine geology during installation of mooring systems and subsea cabling.

- 6.4.24 Changes to sediment dynamics, both offshore and in shallow waters, has the potential to impact on benthic habitats and, as a result, on biodiversity.

Historic Environment

- 6.4.25 Tidal devices can impact on submerged features of historic interest, such as wreck sites, although the greatest risk is to unknown archaeological remains. Moorings that anchor the devices and the means to construct these (e.g. piling and seabed preparation), can have direct impacts on features of interest e.g. from disturbance caused by lengthy mooring chains dragging on the seabed. Furthermore, associated grid cables and the anchors of supporting vessels also have the potential to historic features located on the seabed.
- 6.4.26 There may also be impacts on the setting of historic features from elements of devices that sit above the water surface. However, effects are likely to be less significant than for wind or wave devices that sit above the water level. The significance of these effects on the historic environment will depend greatly on the setting of the feature in question, views to and from it, and the visibility of technologies in any given location.
- 6.4.27 Mooring of devices can result in changes to sediment and seabed processes from deposition, siltation or abrasion from offshore support structures, scouring, and changes in sediment dynamics. Changes in the movement of sediment can cause adverse effects on historic features. However, guidance on the historic marine environment identifies that, in some circumstances, where devices reduce wave energy reaching the shore, there could be benefits in terms of reduced erosion of coastal heritage features.
- 6.4.28 In general, adverse effects from devices can be avoided through careful siting of individual device supports and moorings, although this may be more difficult for larger arrays.

Landscape and Seascape

- 6.4.29 Landscape and visual effects of the devices will depend on the presence of surface-piercing structures, marker buoys and lights for navigation. These features all have the potential to impact on the aesthetic character of the coastline, particularly if located near-shore and in large numbers. As predominantly submerged devices, the significance of impacts of tidal technology may be lower than for other technologies, although this will depend on their location and the characteristics of the receiving environment. The greatest effects are likely to result from the process of constructing and locating devices where supporting vessels and structures would be visible.
- 6.4.30 The SEA for marine renewable energy identified that eight out of the ten seascape types are of high sensitivity to point structures, such as the surface-piercing structures on certain devices, with the potential for effects occurring at 0-10km from coastline. Moderate effects may also occur at distances over 10km.

6.5 Assessment of Transmission Infrastructure

6.5.1 The infrastructure considered covered:

1. Offshore Transmission Infrastructure Components;
2. Subsea Transmission Cables;
3. Landfall and Transition Pit;
4. Onshore Transmission Infrastructure Components;
5. Overhead Lines;
6. Onshore AC Substations; and
7. Onshore DC/AC Converter Stations.

6.5.2 While offshore renewable development will require transmission infrastructure and connections to grid infrastructure, the design and placement of such infrastructure is likely to be location and development-specific. Each offshore energy project will have its own unique characteristics which will drive the specific connection requirements, and as such, there is a degree of uncertainty into requirements at this stage. It is expected that these considerations will form a key part of the project level design process.

6.5.3 The Crown Estate has prepared a reference document⁷⁰ outlining the types of transmission infrastructure that may be developed for connecting offshore energy generation sites. The document discusses infrastructure components and presents a range of environmental and socio-economic considerations likely to be associated with this infrastructure.

6.5.4 Appendix C provides more detail on the infrastructure included in the assessment and reference to the information sources used in this review.

Biodiversity, Flora and Fauna

6.5.5 There is the potential for a range of effects on species and habitats as a result of the installation and presence of transmission infrastructure in both the onshore and offshore environments. For large offshore transmission infrastructure components such as substations, similar effects are likely to that associated with other renewables infrastructure, particularly wind devices. Such impacts may include: underwater and above water noise during installation and operation (e.g. piling, placement of gravity base foundations, vessel noise), benthic effects (e.g. scouring, shading, smothering, etc.), and collision risk, particularly for marine mammals, elasmobranchs and diving birds with submerged structures (e.g. steel jackets, monopiles and mooring cables).

6.5.6 While there is the potential for serious injury or fatality associated with some effects, particularly collisions, potential behavioural and displacement impacts for marine fauna have also been identified. There is also the potential for

⁷⁰ The Crown Estate (2013) Transmission infrastructure associated with connecting offshore generation [online] Available at: <http://www.transmissioninfrastructure-offshoregen.co.uk/> (accessed 10/04/2013)

benthic and EMF effects from the placement and presence of operational of subsea cabling.

- 6.5.7 In many cases, these impacts are likely to be location dependent. For example, the potential for displacement and collision impacts is likely to be greater for infrastructure located in proximity to sensitive or important areas, such as coastal bird breeding and moulting sites, seabird foraging sites and seal haul out areas. In some areas, these displacement effects may be temporary as species become accustomed to change (i.e. as the presence of infrastructure and operational noise). Adaptation may also occur, with the presence of stationary infrastructure with above water components such as an offshore substation potentially resulting in the aggregation of fish species around its support structure and foundations, and predator species such as diving birds aggregating on its above water structure.
- 6.5.8 In many instances, transmission infrastructure (e.g. offshore substations for wind developments) is likely to be located in close proximity to other visible offshore infrastructure (e.g. wind turbines). In such cases, the potential for additional impact risk above that of other offshore renewables infrastructure may be minimal.
- 6.5.9 Disturbance effects such as construction noise, vibration and dust generation are likely for all onshore and landfall works. In most cases, these impacts and any associated disturbance to fauna is likely to be temporary. However, the presence of larger infrastructure such as substation sites, may involve loss of habitat, and also contribute to long-term operational disturbance effects through the continued generation of operational noise and vibration. As for the offshore environment, the scale and nature of such impacts are likely to be location dependent.

Population and Human Health

- 6.5.10 The presence of offshore transmission infrastructure, particularly AC and AC/DC substations in the water column or mounted on surface-piercing structures, could interfere with the navigation of recreational or commercial shipping and lead to an increased risk of collision and serious injury. For the most part, this infrastructure is likely to be located near to other offshore renewable infrastructure, and could likely be considered in the context of a wider development, particularly for wind and wave energy devices.
- 6.5.11 In many instances, navigational warnings (e.g. marker buoys, navigational aids, lighting) are likely to be required, and access restrictions for shipping, recreational sailing and other water sports can reduce this risk. The displacement of other marine users or restricting access during construction and/or operation could also increase the potential risk of collision in other areas. However, the potential displacement effects for submerged infrastructure, such as subsea transmission cables, are likely to be temporary.

- 6.5.12 Construction impacts such as dust generation, noise and vibration, and disruption effects (e.g. traffic) are likely to be a consequence of the installation of onshore infrastructure, although there is also the potential for additional impacts during operation. However, any such impacts will likely depend on the type and size of infrastructure, ranging from minor displacement of other land users for sub-surface or overhead cables, to operational noise associated with substations and converter stations.

Water and the Marine Environment

- 6.5.13 The potential for significant effects on water and the marine environment is likely to be limited to the installation of infrastructure and subsea cables. Localised changes to turbidity and seabed disturbance from placement of offshore infrastructure components (i.e. transmission infrastructure mounted on gravity-base, steel jacket or monopiles), habitat loss from placement of subsea cables, and contamination from installation equipment and maintenance vessels could all impact on local water quality. Changes in water quality will have associated impacts on local marine biodiversity where species are dependent on existing water conditions.
- 6.5.14 Potential impacts such as sedimentation, increased turbidity and contamination of watercourses from construction works has also been identified with the installation of onshore infrastructure. In many cases, these impacts may only be temporary and reversible, although the potential for longer term effects associated with permanent infrastructure such as substations and converter stations have also been identified (e.g. flood risk). In many instances, such impacts could be controlled through the adoption of appropriate sediment and erosion controls and site management practices.

Climatic Factors

- 6.5.15 While the installation of transmission infrastructure will involve the use of energy in their construction, transportation, installation and maintenance, it will support the contribution of offshore renewables to the decarbonisation of electricity generation, and through supporting their long-term operation, be beneficial for climatic factors.
- 6.5.16 Depending on their location, offshore and coastal infrastructure may have the potential to exacerbate the effects of climate change, including contributing to coastal erosion by altering wave energy patterns and coastal processes, and destabilising the coastline at landfall sites.

Marine Geology and Coastal Processes

- 6.5.17 While potential impacts likely vary for onshore and offshore infrastructure, impacts from the construction phase is considered more likely for both than during the operational phase. Impacts such as scour from seabed foundation installation during construction and operation (e.g. piling for offshore structures, gravity-based foundations) and sediment disturbance from seabed excavations (e.g. subsea cables) may occur during installation works offshore, while

alteration to coastline stability and coastal processes may be associated with the installation of infrastructure such as transition pits and transmission cabling at landfall sites.

- 6.5.18 Potential impacts including disturbance and degradation of soil resources, land contamination from leaks and spills, and displacement of existing land use (e.g. agricultural production) may occur during onshore construction works, particularly for larger sites such as converter stations and substations.

Historic Environment

- 6.5.19 There is the potential for offshore works to impact on both designated historic features, such as wrecks and coastal monuments, and other submerged non-designated, and potentially unknown, archaeological assets. These impacts could result from construction works in the installation of transmission infrastructure, and from potential operational impacts such as scouring, siltation and deposition around assets located in the vicinity of such infrastructure.
- 6.5.20 Onshore infrastructure, particularly larger substations, converter stations and overhead power lines, have the potential to impact on the setting of historic features (e.g. World Heritage Sites, coastal listed buildings, scheduled monuments). However, the magnitude of any visual effect on the historic environment will largely depend on how the setting of the feature is defined, and how visible this infrastructure is.
- 6.5.21 In general, adverse effects may be avoided through careful siting of onshore and offshore infrastructure, although this may be more difficult for larger components, such as gravity bases, in the marine environment. It is considered that historic setting issues associated with the development of onshore structures is also likely to be a consideration in existing planning processes.

Landscape and Seascape

- 6.5.22 Offshore infrastructure with above water components has the potential to impact on views to and from areas designated for their landscape and seascape value. While in general, greater impacts are likely for near-shore infrastructure than those located further offshore. Devices that are sited further offshore can be highly visible to commercial and recreational sea users. However, in many instances, transmission infrastructure such as offshore substations for wind developments will be located in close proximity to other visible offshore infrastructure (e.g. wind turbines). In such cases, the potential for additional adverse visual impact above that of nearby visible offshore renewables infrastructure is likely to be minimal.
- 6.5.23 There is the potential for onshore impacts from supporting infrastructure and interconnectors with terrestrial grid (e.g. substations and overhead cables), although these will largely depend on siting and surroundings.

6.5.24 There are potential onshore impacts from supporting grid infrastructure and interconnectors with terrestrial grid, although these will likely depend on siting and surroundings.

6.6 Assessment of the Draft Plan Options

- 6.6.1 Each of the Draft Plan Options has been assessed in turn against the SEA topics and environmental receptors, and full details of the assessment are presented in Appendix D. The assessments have demonstrated that whilst gaps within the evidence baseline are being closed through on-going research at this strategic level, difficulties remain in apportioning the precise significance of effects. This is in part due to the fact that renewable design parameters (e.g. device type, size, number of devices, etc.) will be determined at the project level. Furthermore, there are changing marine and coastal designations, and a large number of mobile environmental receptors (e.g. seabirds, cetaceans, elasmobranchs, etc.). These factors underline the requirement for detailed assessment through the project level EIA process.
- 6.6.2 In view of these constraints, Tables 6.1 – 6.3 set out a risk-based summary of the potential effects documented in the Draft Plan Options assessment (Appendix D) on the key receptors identified in the baseline (Appendix B) for wind, wave and tidal devices. Risks are assessed in line with the approach presented in Table 3.1.
- 6.6.3 This risk-based process considered relevant spatial data, such as the presence of designated areas or priority marine species in proximity to option areas (e.g. Salmon river SACs, SPAs, Basking shark ‘hotspots’, NSAs, world heritage sites, etc.) and seabed habitat data (e.g. bathymetry and survey data) amongst others, and linking this with available information on technology types and previous project-level studies undertaken for existing renewables projects (e.g. EIAs and monitoring) to gauge the potential risks for these topic areas and features for each Draft Plan Option.
- 6.6.4 Several difficulties were encountered in undertaking this assessment, largely relating to uncertainties in data (e.g. species distributions) and potential for effects associated with specific renewables technologies. This was of particular note for wave and tidal technologies which remain in the early stages of development and testing. The consideration of several Draft Plan Options was another difficulty, specifically those occupying large areas or set along large sections of varying coastline where the likelihood of effects has the potential to vary markedly within the option area itself (e.g. one end of Draft Plan Option being close to a designation whilst another end is not).
- 6.6.5 For example, there are large differences in seabed composition within WNW1 ranging from coarse sediments to rocky substrate creating significant differences in potential seabed impacts, and the potential for coastal impacts is likely to vary greatly for wave devices installed within the eastern (near-shore) portion of the option area, compared to devices in the western (off-shore)

portion. In these circumstances a precautionary approach was undertaken and a higher level of risk was recorded.

Table 6.1: Risk Based Summary for Offshore Wind

Zone	SEA Topic	Feature	Impact Risk
OFSW1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Low
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
	Landscape and Seascape	Visibility	High
		Landscape Character Change and Wild Land	Medium
OFSW2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Low
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low

Zone	SEA Topic	Feature	Impact Risk
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	High
		Landscape Character Change and Wild Land	Medium
	OWW1	Biodiversity, Flora and Fauna	Birds
Elasmobranchs			Medium
Cetaceans			Medium
Seals			Medium
Fish			Low
Benthic Habitats			Low
Population and Human Health		Vessel Collision	Low
		Displacement of Recreational Activities	Medium
Water and the Marine Environment		Water Quality	Low
Climatic Factors		Interaction with Coastal Change	Medium
Marine Geology and Coastal Processes		Seabed Disturbance	Medium
		Sediment Dynamics	Low
Historic Environment		Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
Landscape and Seascape		Visibility	High

Zone	SEA Topic	Feature	Impact Risk
		Landscape Character Change and Wild Land	Medium
OWW2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	High
		Cetaceans	High
		Seals	Medium
		Fish	Low
		Benthic Habitats	Medium
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
	Landscape and Seascape	Visibility	High
		Landscape Character Change and Wild Land	Medium
OWW3	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Medium

Zone	SEA Topic	Feature	Impact Risk	
	Water and the Marine Environment	Water Quality	Low	
	Climatic Factors	Interaction with Coastal Change	Low	
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium	
		Sediment Dynamics	Low	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
	Landscape and Seascape	Visibility	High	
		Landscape Character Change and Wild Land	Medium	
	OWNW1	Biodiversity, Flora and Fauna	Birds	Medium
			Elasmobranchs	Medium
Cetaceans			Medium	
Seals			Medium	
Fish			Low	
Benthic Habitats			Low	
Population and Human Health		Vessel Collision	Low	
		Displacement of Recreational Activities	Low	
Water and the Marine Environment		Water Quality	Low	
Climatic Factors		Interaction with Coastal Change	Low	
Marine Geology and Coastal Processes		Seabed Disturbance	Medium	
		Sediment Dynamics	Low	
Historic Environment		Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
Landscape and Seascape		Visibility	Medium	
		Landscape Character Change and Wild Land	Medium	

Zone	SEA Topic	Feature	Impact Risk
OWN1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Low
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Medium
		Impacts on Setting of Historic Environment	High
	Landscape and Seascape	Visibility	High
		Landscape Character Change and Wild Land	Medium
OWN2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Low
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low

Zone	SEA Topic	Feature	Impact Risk	
	Climatic Factors	Interaction with Coastal Change	Low	
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium	
		Sediment Dynamics	Low	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Medium	
	Landscape and Seascape	Visibility	High	
		Landscape Character Change and Wild Land	Medium	
	OWNE1	Biodiversity, Flora and Fauna	Birds	Medium
			Elasmobranchs	Low
			Cetaceans	Medium
Seals			Medium	
Fish			Low	
Benthic Habitats			Low	
Population and Human Health		Vessel Collision	Low	
		Displacement of Recreational Activities	Low	
Water and the Marine Environment		Water Quality	Low	
Climatic Factors		Interaction with Coastal Change	Low	
Marine Geology and Coastal Processes		Seabed Disturbance	Medium	
		Sediment Dynamics	Low	
Historic Environment		Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
Landscape and Seascape		Visibility	High	
		Landscape Character Change and Wild Land	Low	
OWNE2		Biodiversity, Flora and Fauna	Birds	Medium

Zone	SEA Topic	Feature	Impact Risk
		Elasmobranchs	Low
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Low
	Marine Geology and Coastal Processes	Seabed Disturbance	Medium
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	High
		Landscape Character Change and Wild Land	Low

6.6.6 Table 6.1 identifies that visibility of offshore wind devices is likely to be a key issue, and the potential for associated impacts to landscapes and seascapes for options near to valued coastlines (of which there are several across the regions), and similarly in some key locations effects on the setting of historic features in coastal areas (e.g. in proximity to the Heart of Neolithic Orkney WHS) are also likely to be important considerations for developments within some of the Draft Plan Options.

6.6.7 Potential impacts to biodiversity were also identified, particularly for seabirds in terms of collision and displacement risk, and for marine fauna during construction works. Higher risks to mobile species such as Basking sharks and Common skate, were identified in the Western region (e.g. near to OWW2) where it is known that these priority marine species are frequent visitors. However, several of the other Draft Plan Options also carry some risk of interaction between technologies and elasmobranchs, birds, cetaceans and seals. The risks for many mobile species would arise from collision and

displacement risk, although for many species the precise interactions with new technology are still to be ascertained, and might only be so at the project level.

- 6.6.8 The potential for seabed disturbance during turbine and foundation installation works was identified, particularly for devices with large footprints (e.g. gravity-based, jacket, etc.). Displacement of recreational activities, either during construction or operational phases, may also be relevant for some option areas (in particular those within the South West and West regions).
- 6.6.9 While short-term construction impacts, such as potential for water pollution incidents, were identified in this assessment these were largely considered to be of lower risk in the context of wind energy. They might occur, but given reasonable assumptions on mitigation available during construction these might be avoided or minimised.

Table 6.2: Risk Based Summary for Wave

Zone	SEA Topic	Feature	Impact Risk
WW1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Low

Zone	SEA Topic	Feature	Impact Risk
WW2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	High
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Medium
WW3	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	High
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low

Zone	SEA Topic	Feature	Impact Risk	
	Climatic Factors	Interaction with Coastal Change	Medium	
	Marine Geology and Coastal Processes	Seabed Disturbance	Low	
		Sediment Dynamics	Low	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Medium	
	Landscape and Seascape	Visibility	Medium	
		Landscape Character Change and Wild Land	Medium	
	WW4	Biodiversity, Flora and Fauna	Birds	Medium
Elasmobranchs			Medium	
Cetaceans			Medium	
Seals			Medium	
Fish			Low	
Benthic Habitats			Low	
Population and Human Health		Vessel Collision	Medium	
		Displacement of Recreational Activities	Medium	
Water and the Marine Environment		Water Quality	Low	
Climatic Factors		Interaction with Coastal Change	Medium	
Marine Geology and Coastal Processes		Seabed Disturbance	Low	
		Sediment Dynamics	Low	
Historic Environment		Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
Landscape and Seascape		Visibility	Medium	
		Landscape Character Change and Wild Land	Medium	
WNW1		Biodiversity, Flora and Fauna	Birds	Medium

Zone	SEA Topic	Feature	Impact Risk
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	High
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Medium
WN1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium

Zone	SEA Topic	Feature	Impact Risk
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Medium
WN2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	High
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Medium
WN3	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium

Zone	SEA Topic	Feature	Impact Risk
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Medium
		Displacement of Recreational Activities	Medium
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Low
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Medium
	Landscape and Seascape	Visibility	Medium
		Landscape Character Change and Wild Land	Medium

6.6.10 The visibility of wave devices was not identified to be as significant an issue as for wind largely, due largely to their lower profile above the water surface. However, the potential for impacts to landscape, seascape and the setting of features of the historic environment remains a key consideration for many options, particularly near-shore Draft Plan Options such as those in the Inner Hebrides, the North Sutherland Coast and around Orkney (i.e. near to Orkney WHS). However, whilst risk of effects is considered, the type of device constructed (e.g. near surface technology) may have impacts of only minor significance. This is expected to be a lower risk for options located further offshore (e.g. the north west portion of WNW1).

6.6.11 Potential risks to biodiversity were identified for wave devices in all areas, with some options presenting risks to different species than others. For example, elasmobranchs were considered to be of greater risk for devices in Draft Plan Options located in the Inner Hebrides Islands where the presence of some species is more established, whilst other mobile marine mammal species such as some cetaceans and seals were likely to be of relevance across the whole of Scotland's coastline. Potential risks for diving birds were identified in all

locations, particularly those option areas in the Western and Northern Isles known to support protected bird populations.

- 6.6.12 The potential for interactions between wave devices and coastal change was identified at most option areas, but was considered likely to be of greater risk for areas of the coast that may be susceptible to erosion or accretion (e.g. parts of Orkney and the Western Isles).
- 6.6.13 In general terms, construction works impacts such as seabed disturbance were not considered likely to be as significant as that associated with offshore wind devices, and were considered to be of a lower risk. Whilst some effects will occur, wave devices may in general require a smaller footprint and requirement for works on the seabed as other devices may, such as gravity based wind devices.

Table 6.3: Risk Based Summary for Tidal

Zone	SEA Topic	Feature	Impact Risk
TSW1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	High
		Cetaceans	Medium
		Seals	Medium
		Fish	Medium
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Medium
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Low
		Landscape Character Change and Wild Land	Low

Zone	SEA Topic	Feature	Impact Risk
TW1	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	High
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Low
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Medium
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Low
		Landscape Character Change and Wild Land	Low
TW2	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Low
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low

Zone	SEA Topic	Feature	Impact Risk	
	Climatic Factors	Interaction with Coastal Change	Low	
	Marine Geology and Coastal Processes	Seabed Disturbance	Low	
		Sediment Dynamics	Medium	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
	Landscape and Seascape	Visibility	Low	
		Landscape Character Change and Wild Land	Low	
	TN1	Biodiversity, Flora and Fauna	Birds	Medium
			Elasmobranchs	Medium
			Cetaceans	Medium
Seals			Medium	
Fish			Low	
Benthic Habitats			Low	
Population and Human Health		Vessel Collision	Low	
		Displacement of Recreational Activities	Low	
Water and the Marine Environment		Water Quality	Low	
Climatic Factors		Interaction with Coastal Change	Medium	
Marine Geology and Coastal Processes		Seabed Disturbance	Low	
		Sediment Dynamics	Medium	
Historic Environment		Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
Landscape and Seascape		Visibility	Low	
		Landscape Character Change and Wild Land	Low	
TN2		Biodiversity, Flora and Fauna	Birds	Medium

Zone	SEA Topic	Feature	Impact Risk
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Medium
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Medium
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Low
		Landscape Character Change and Wild Land	Low
TN3	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Medium
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium

Zone	SEA Topic	Feature	Impact Risk	
	Marine Geology and Coastal Processes	Seabed Disturbance	Low	
		Sediment Dynamics	Medium	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
	Landscape and Seascape	Visibility	Low	
		Landscape Character Change and Wild Land	Low	
TN4	Biodiversity, Flora and Fauna	Birds	Medium	
		Elasmobranchs	Medium	
		Cetaceans	Medium	
		Seals	Medium	
		Fish	Medium	
		Benthic Habitats	Low	
	Population and Human Health	Vessel Collision	Low	
		Displacement of Recreational Activities	Low	
	Water and the Marine Environment	Water Quality	Low	
	Climatic Factors	Interaction with Coastal Change	Medium	
	Marine Geology and Coastal Processes	Seabed Disturbance	Low	
		Sediment Dynamics	Medium	
	Historic Environment	Historic Coastal and Marine Assets	Low	
		Impacts on Setting of Historic Environment	Low	
	Landscape and Seascape	Visibility	Low	
		Landscape Character Change and Wild Land	Low	
	TN5	Biodiversity, Flora and Fauna	Birds	Medium
			Elasmobranchs	Medium

Zone	SEA Topic	Feature	Impact Risk
		Cetaceans	Medium
		Seals	Medium
		Fish	Medium
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low
		Sediment Dynamics	Medium
	Historic Environment	Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Low
		Landscape Character Change and Wild Land	Low
TN6	Biodiversity, Flora and Fauna	Birds	Medium
		Elasmobranchs	Medium
		Cetaceans	Medium
		Seals	Medium
		Fish	Medium
		Benthic Habitats	Low
	Population and Human Health	Vessel Collision	Low
		Displacement of Recreational Activities	Low
	Water and the Marine Environment	Water Quality	Low
	Climatic Factors	Interaction with Coastal Change	Medium
	Marine Geology and Coastal Processes	Seabed Disturbance	Low

Zone	SEA Topic	Feature	Impact Risk
	Historic Environment	Sediment Dynamics	Medium
		Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
	Landscape and Seascape	Visibility	Low
		Landscape Character Change and Wild Land	Low
	TN7	Biodiversity, Flora and Fauna	Birds
Elasmobranchs			Medium
Cetaceans			Medium
Seals			Medium
Fish			Medium
Benthic Habitats			Low
Population and Human Health		Vessel Collision	Low
		Displacement of Recreational Activities	Low
Water and the Marine Environment		Water Quality	Low
Climatic Factors		Interaction with Coastal Change	Low
Marine Geology and Coastal Processes		Seabed Disturbance	Low
		Sediment Dynamics	Medium
Historic Environment		Historic Coastal and Marine Assets	Low
		Impacts on Setting of Historic Environment	Low
Landscape and Seascape		Visibility	Low
		Landscape Character Change and Wild Land	Low

6.6.14 Based on the fact that devices and the majority of their infrastructure will be below surface, the visibility of tidal devices is unlikely to be an issue.

6.6.15 Potential risks to biodiversity were identified for tidal devices in all areas, for both diving birds and marine fauna as a result of collision or entanglement. Some option areas were identified as having different levels of risk to certain

species based upon the known patterns of distribution of these around Scotland's coastline. As with wave energy, elasmobranchs were considered to be of particular interest for tidal devices in Draft Plan Options located in the Inner Hebrides Islands and Solway Firth (e.g. TW1 and TSW1), whilst other mobile marine mammal species, such as cetaceans and seals, were likely to be of relevance around most of Scotland's coastline.

- 6.6.16 Potential risks to fish species, such as Atlantic salmon and Sea trout amongst others, were also considered relevant to most Draft Plan Options, particularly those located near to designated sites such as the River Bladnoch in the Solway Firth. Risks to diving birds were identified for all tidal devices. These were considered to be of particular interest for option areas located in areas known to support important bird populations (e.g. Western and Northern Isles, Solway Firth).
- 6.6.17 The potential for interactions between tidal devices and coastal change was broadly identified in Table 6.3, and was considered to be of particular relevance for option areas located near to those coastal areas that may be susceptible to erosion or accretion (e.g. Luce Bay, parts of Orkney and Shetland).
- 6.6.18 In general terms, the risks of effects associated with construction works, such as seabed disturbance during installation, were considered to be of a lower risk than that associated with other technologies (e.g. offshore wind devices). Whilst some effects will occur, tidal devices may in general require a smaller footprint and requirement for works on the seabed as other devices may, such as gravity based wind devices.

6.7 Cumulative and In-Combination Effects

- 6.7.1 The following section discusses the cumulative assessment on a regional basis and concludes with the overarching effects of the plans. The cumulative assessment considers the potential for development within multiple Draft Plan Options in each region. It then considers the potential effects of other potential renewables development, such as those included in the Blue Seas, Green Energy SEA and other assessments, in combination with the current plans. Figure 6.1 illustrates the distribution of current and potential projects for consideration. Additionally where relevant the effects of other coastal renewables activity have been considered and published, namely the effects identified in the SEA of the NRIP for wind energy.

Scottish Offshore Renewable Energy Developments (as of June 2013)

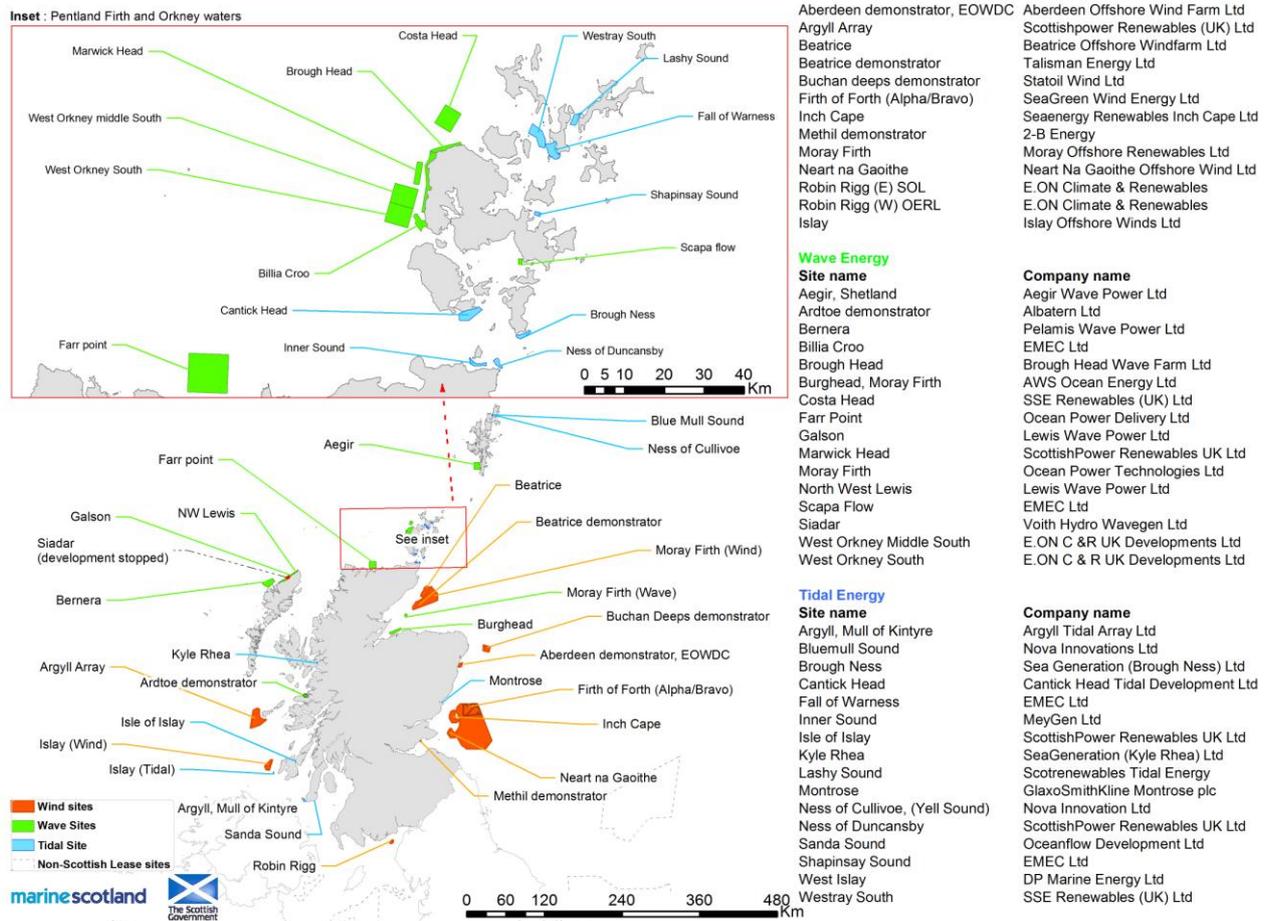


Figure 6.1: Draft Plan Options and Potential Developments

North East

- 6.7.2 The two wind options within the north east region are located between existing proposals for wind development within the firth of forth and Moray Firth. These proposed developments cover large portions of the sea off the east of Scotland. Existing EIAs identify a number of potential effects on a range of environmental receptors and work is continuing to help to determine the significance of effects. Therefore whether the high, low or medium scenarios for occupancy will result in additional significant effects is difficult to predict, although there is likely to be an increased risk of these. If significant effects can be appropriately reduced through project mitigation, development of the high scenario for wind energy in the Draft Plan Options could be favoured.
- 6.7.3 There are a range of potential cumulative effects of development within the Draft Plan Options. Impacts on biodiversity flora and fauna have been raised, in particular potential collision of seabirds with wind turbines. Birds are known to travel along the east coast from the Firth of Forth, Firth of Tay and Moray Firth and flight patterns might cross both wind sites in the North East region as well as other planned projects.
- 6.7.4 There are a number of factors that would influence the significance of effects, not least the species of bird and the height above water at which it flies the

vulnerability of its population and the design of technologies, such as turbine height. Project level HRA and EIA should help to indicate the potential significance of effects and hence the level of density of development that could be undertaken within the Draft Plan Options. If project assessment cannot avoid significant effects on protected species it is recommended that Draft Plan Options could be revisited and/or lower growth scenarios favoured.

- 6.7.5 Similarly, the potential collision risks and impacts of construction on mobile cetaceans and seals will require consideration. Future plan iterations can use the results of project level EIA to indicate the potential level of acceptable development within the Draft Plan Options. In particular effects on the population of bottlenose dolphins attached to the Moray Firth SAC, and common seals from the Firth of Tay and Eden Estuary SAC are considered to be important concerns. If project level assessments and monitoring demonstrate minimal effects there is potential for a higher level of occupancy within the Draft Plan Options.
- 6.7.6 Disturbance to terrestrial habitat for seabirds and areas used as seals haul outs, as a result of increased shipping and port activities promoted through the NRIP could add further pressures. Ports included in the NRIP include several within the Firth of Forth, Forth of Tay and Moray Firth, Aberdeen and the Aberdeenshire coast.
- 6.7.7 There are potential effects for landscape and seascape. Development in both of the Draft Plan Options will result in some degree of visibility from the Aberdeenshire coast. On one hand it could be considered that the higher the level of occupancy of the Draft Plan Option the greater the impact on the seascape, however equally it could also be considered that effects are related simply to a change in the appearance of the coastline and a higher occupancy can minimise effects elsewhere. The latter might imply greater significance of effects in the region, especially alongside the potential development of the projects proposed in the Moray Firth and Firth of Forth. This would create potentially large developments along much of the east coast. However, given the large number of commercial vessels already using the seas in this area it might be considered that there is an existing working seascape and the receiving environment may be considered to have greater resilience than other sections of the coastline. Furthermore, this section of coastline might be considered to have fewer areas of high landscape value and wilderness than some other Draft Plan Options.
- 6.7.8 Large scale development of wind energy through the Draft Plan Options and sites in the Moray Firth and Firth of Forth will have interactions with commercial and recreational boating and shipping. Increased port activity associated with the NRIP could also increase the volume of commercial traffic. Residual impacts for displacement of some recreational activities may result, although these may not be significant if displacement can avoid cessation of activities. Appropriate exclusion zones around the technologies will assist in reducing collision risk.

- 6.7.9 Impacts on the historic environment, particularly damage to marine archaeology, could increase with density of development within the region, with the high occupancy scenario and planned development. There are some valued receptors within the area including listed lighthouses however cumulative impacts on their setting are not considered to be significant.
- 6.7.10 Development of renewable energy along the coastline, from Draft Plan Options and other renewable development could interact with existing sediment and coastal processes. There may also be an interaction with marine water quality from the potential release of seabed contaminants. However, contamination effects would occur during construction of developments where mitigation to limit effects is likely to be available. Furthermore, it is anticipated that development would be staggered, and as a result the significance of cumulative effects is considered minimal. There may be some dredging activities associated with NRIP development, as well as continuing dredging activities undertaken in the Firth of Forth. Dredging for fill material for any gravity based devices could magnify any existing issues associated with dredging, although the volumes of material needed may be substantially below existing levels of dredging. Furthermore, there may be opportunities for coordinated activity between required port dredging and renewables filling to reduce potential dumping and discharge of sediment.

North

- 6.7.11 The draft plans for the north region contain two wind, two wave and seven tidal sites. The region already has a number of tidal and wave projects at various stages of the planning and licencing process, in particular in the Orkney Isles including at the European Marine Energy Centre (EMEC). Renewables projects in the region have been subject to a number of continuing assessments. The published EIAs for tidal energy at Inner Sound in the Pentland Firth and for wave energy (oyster device) at Billia Croo (EMEC) on the west coast of Orkney help to give an indication of what type of effects may arise in combination with the predicted effects of the Draft Plan Options. Project level work on a number of other proposed projects in the region could assist with determining the significance of potential effects.
- 6.7.12 The low, medium and high scenarios for occupancy differ quite markedly between the technologies and it is difficult to accurately predict the precise cumulative effects of the future mix of technologies. In part this is due to the assumption of the plans and this assessment that co-location of technologies is not currently favoured. Therefore where plan options overlap it is difficult to determine if one technology would be developed or smaller plan options that do not overlap might emerge. However, for wave and tidal the occupancy scenarios demonstrate that a relatively small part of the total area of draft (approximately 5% for tidal and 1% for wind) may be developed. The scenarios for wind could see larger proportions of occupancy in the two Draft Plan Options, however as there are not existing wind projects in this area the in

combination effects associated with wind power only may be more limited in this region.

- 6.7.13 Furthermore, it is considered that many of the potential effects identified in this assessment might be appropriately reduced through project level mitigation, such as for construction and maintenance. However, the following paragraphs set out some of the potential cumulative effects.
- 6.7.14 Impacts on marine fauna are varied, due in part to the fact that all types of device could be developed in the region. Firstly there is potential for collision of some species of seabirds with wind turbines if both Draft Plan Options for wind are developed, although as stated previously OWN1 may not necessarily be developed if wave power is favoured in this location. Seabirds are highly mobile and may travel across many of the regions protected habitats and areas beyond the region, such as the Moray Firth and west coast.
- 6.7.15 There are a number of factors that would influence the significance of effects, not least the species of bird and the height above water at which it flies the vulnerability of its population and the design of technologies, such as turbine height. Whilst there is potential interaction with seabirds across the whole of Scotland, the region may have fewer projects than others and potentially bird strike from wind energy may have fewer cumulative effects than other regions. However, given the number of important sites for seabirds the size of the populations of that could be affected are high. Project level HRA and EIA should help to indicate the potential significance of effects on species and hence the level of density of development that could be undertaken within the Draft Plan Options. If project assessment cannot avoid significant effects on protected species it is recommended that Draft Plan Options could be revisited and/or lower growth scenarios favoured.
- 6.7.16 Given the number of tidal and wave developments set out within the plan options and currently in project planning phase there are potential cumulative effects for diving seabirds, fish and marine mammals as a result of collision, barriers to movement and potentially displacement. Diving seabirds and birds that fly above the water surface are present across the region. Cetaceans (including Bottlenose dolphin, Minke whale and Orcas), seals (including Harbour seals that are features of the Sanday SAC), elasmobranchs and fish, are all present in the waters surrounding Shetland, Orkney and the Sutherland coast.
- 6.7.17 The potential collision risks and impacts of construction on these species will be considered as part of project level assessment (EIA and HRA) and this can help indicate the potential level of acceptable development within the Draft Plan Options as part of a plan review process. If project level assessments and monitoring demonstrate the potential for effects, in particular on specific species or designated areas, then the number of Draft Plan Options, specifically for tidal energy, may need to be subject to review or lower scenarios of occupancy, in order to minimise effects.

- 6.7.18 Given the number of potential development sites in the north region the cumulative effects of noise, from construction activities and from vessels associated with developments, has been considered. Existing project level assessments indicated that noise is likely to be below levels at which lethal injury to species would result. Noise mitigation through promoting slow vessel speeds would reduce noise levels during construction and operation. Furthermore, it is highly likely that projects within Draft Plan Options would be phased as they go through the licensing process, and as a result cumulative effects of construction may not result in significant effects.
- 6.7.19 There are locations within the region for which development associated with the NRIP may occur. It is possible that such development could increase noise and disturbance at port locations, and also vessel movements within the area. Therefore further impacts on marine Fauna from increasing the potential for collision and disturbance effects.
- 6.7.20 If several of the Draft Plan Options are developed, alongside the emerging projects, there may be substantial amount of cables required to transmit the energy generated by the devices. Impacts on fish and elasmobranchs from EMF could therefore arise, although research has not been conclusive on the precise impacts. Therefore it is difficult to determine if cumulative effects would be significant.
- 6.7.21 The consideration of potential cumulative impacts on landscape and seascape are relatively complex. The region has a number of valued and important landscape receptors that could be affected by change, including NSAs, and that developments should demonstrate are not significantly affected. Whilst the Draft Plan Options might result in a number of renewable energy developments, it may only be the wind Draft Plan Options that would lead to significant effects and in particular OWN1, which is closer to the shore and sensitive receptors than OWN2. Whilst the high growth scenario for wind could be considered to have a higher degree of effect it could also be considered that these are related simply to a change in the appearance of the coastline and a higher occupancy could minimise effects elsewhere. Cumulative impacts of onshore and offshore wind farms should also be considered during project planning and where possible locations of devices within the Draft Plan Options should seek to minimise landscape effects.
- 6.7.22 Tidal developments may have some element of above water infrastructure but the majority of the device will be below the water surface and as a result visual impact limited. Similarly near shore wave devices can also have large parts of their infrastructure below the water surface, and even above water devices may have more limited effects if constructed further from the coast. Therefore cumulative effects on landscape and seascape for tidal and wave developments could be limited to effects of construction. However, as previously stated it is likely development between Draft Plan Options could be phased which would reduce cumulative effects.

- 6.7.23 The north region contains a number of features of historic importance, not least the Heart of Neolithic Orkney WHS, for which the impacts on setting should be considered. Similarly to the reasons set out above, impacts on setting might be lower for tidal and near shore wave developments than wind. Cumulative effects on the setting of important features of the historic environment will be a key consideration when planning for projects, particularly those that might follow development in other Draft Plan Options.
- 6.7.24 Furthermore, given the number of Draft Plan Options there is the potential for cumulative impacts on marine archaeology, both known and unknown. Draft Plan Options located within the Orkney archipelago and in near coast areas are particularly identified as potentially containing submerged archaeology. This would also increase further under the higher level growth scenarios with more devices.
- 6.7.25 The regions seas are busy with vessel traffic, both commercial and recreational. Increased port activity associated with the NRIP could also increase the volume of commercial traffic. Development of renewables within the Draft Plan Options in combination with the existing planned sites, and furthermore under the higher occupancy scenario, could result in some increased collision risk. Exclusion zones around the technologies will assist in reducing this risk. There may also be some residual impacts for displacement of recreational activities, and potentially cessation in some locations.
- 6.7.26 Development of renewable energy along the coastline, from Draft Plan Options and other renewable development, could interact with existing sediment and coastal processes. In particular tidal and wave devices could result in some cumulative effects in terms of alteration to hydrological and sedimentation processes. However, precise impacts can only be established at the project level with an appropriate level of assessment.
- 6.7.27 There may be some dredging activities associated with any NRIP development in the region. Dredging for fill material for any gravity based devices could magnify any existing issues associated with removal and movement of seabed material, although the volumes of material needed may be substantially below existing levels. Furthermore, there may be opportunities for coordinated activity between required port dredging and renewables filling to reduce potential dumping and discharge of sediment.
- 6.7.28 There may also be an interaction with marine water quality from the potential release of seabed contaminants. However, contamination effects are most likely to occur during construction of developments where mitigation to limit effects is likely to be available. Furthermore, it is anticipated that development would be staggered, and as a result the significance of cumulative effects is considered minimal.

North West

- 6.7.29 The North West Region includes one draft wind plan option at the north of the Minch and one large draft wave plan option to the north and west of the Isle of Lewis. However given the scenarios for occupancy wave development within this large Draft Plan Option is likely to be confined to a much smaller area if projects are licenced within the area.
- 6.7.30 Current wave projects are also in the planning phase and are located along the north west coast of Lewis. The EIA of the North West Lewis wave project set out potential effects of the development and provides a measure for the significance of effects within the region. Furthermore it demonstrates that many effects can be appropriately reduced through project level mitigation.
- 6.7.31 The SEA of the wind energy NRIP assessed development at Kishorn and Arnish. These locations are a considerable distance from the Draft Plan Options and are considered likely to have minimal cumulative effects.
- 6.7.32 There are potential cumulative effects for highly mobile seabirds with the regions Draft Plan Options and others outside the region. However, within the region cumulative effects may demonstrate a slightly different pattern of effect. Cumulative collision risk for some species in the region could in some cases be reasonably low. For example some diving birds that fly well below the blades of wind devices might not be affected by development within both Draft Plan Options, and non-diving seabirds may only be affected by one technology depending on the height at which they fly. There is potential for some species to be affected by both technologies and these effects would need exploration through project level EIA and HRA. If project assessment assessments cannot avoid significant effects on protected species it is recommended that Draft Plan Options could be revisited through plan review, and/or lower growth scenarios favoured.
- 6.7.33 Cumulative effects on mobile species including, fish, elasmobranchs, cetaceans and seals as a result of collision, noise and displacement are considerations for development within the Draft Plan Options, as a result of anchoring of devices and potentially some devices in the water column. The results of project level assessment (EIA and HRA) can help to indicate the potential level of acceptable development scenario within the Draft Plan Options. This SEA baseline and the existing EIA for North West Lewis have indicated that there are likely to be a range of mobile species to be found within the area. However the EIA has indicated that the significance of potential effects was considered to be low for the proposed wind development. Project level assessments for new development within the Draft Plan Options will need to review and verify this conclusion as part of their own assessment.
- 6.7.34 The region has a number of valued and designated areas of landscape and seascape quality and areas of wildness value. Both OOWNW1 and WNW1 may only be visible from the north of the Isle of Lewis. However, the likelihood for wave devices and infrastructure to potentially have minor significant effects,

particularly for near shore devices, must steer any consideration of cumulative effects to be of a low significance.

- 6.7.35 The region contains features of historic interest including the St Kilda World Heritage area. However given the location of the Draft Plan Options and key features of the historic environment, cumulative impacts on the setting of historic assets are considered minimal. Cumulative effects on marine archaeology, both known and unknown could result from both options, in terms of the potential for total loss or damage. However it is considered these can be mitigated at the project level by undertaking appropriate site surveys and avoidance of infrastructure where assets are identified.
- 6.7.36 Given the region has major shipping channels (e.g. shipping off the north west coast of Lewis to the North Minch) as well as established recreational sailing routes (e.g. St Kilda to Lewis), there is a likely increase in the navigational and collision risks to shipping and marine traffic from development in both Draft Plan Options. However, it is considered that the mitigation suggested would reduce this.
- 6.7.37 Development of renewable energy along the coastline, from Draft Plan Options and other renewable development could interact with existing sediment and coastal processes. In particular wave devices above the surface or within the water column could result in some cumulative effects in terms of alteration to hydrological and sedimentation processes. However, the precise impacts can only be realistically established at the project level.
- 6.7.38 There may also be an interaction with marine water quality from the potential release of seabed contaminants. However, contamination effects are most likely to occur during construction of developments where mitigation to limit effects is likely to be available.

West

- 6.7.39 The three wind, four wave and two tidal Draft Plan Options within the West region cover substantial sections of the sea off the west coast of Scotland. Given the current scenarios for occupancy, development within these Draft Plan Option areas are likely to be confined to a much smaller portion of these waters. A number of wind and tidal sites are currently planned for this region, with several already located within the Draft Plan Option areas. Data collected in planning for these projects, sets out the potential effects of these developments and provides a measure for the significance of effects at these locations.
- 6.7.40 Several option areas overlap with MPA search areas (OWW2, TW2, WW2 and WW3), and the progression of the MPA designation process that runs in parallel to this assessment, will be an important consideration in the selection of sites for renewables development in these areas.
- 6.7.41 There is the potential for cumulative impacts for both seabirds and diving birds in the region, particularly for Draft Plan Options near to areas of known

importance to birds, such as Islay and Tiree. Of particular note is the potential for increased collision and displacement risk for seabirds associated with multiple arrays of operating wind turbines, and similar risks for diving birds associated with groups of wave and tidal devices.

- 6.7.42 Some bird species may be affected by several technologies. For example, species that fly at turbine height and dive for prey have the potential to be affected by wind, wave and tidal technologies, while others may fly below turbine height and may only be affected during diving activities. The potential for these effects should be further explored through project level EIA and HRA. If at project level it is ascertained that significant effects on protected species cannot be avoided, it is recommended that Draft Plan Options could be revisited as part of plan review, and/or lower growth scenarios favoured.
- 6.7.43 The potential for cumulative effects, such as the creation of barriers to movement, collision risk and impacts of renewable devices on mobile fauna (e.g. elasmobranchs, cetaceans, seals), will need consideration for any development within the Draft Plan Options. The SEA identified the importance of waters within the West Region for a range of mobile species, particularly for Basking sharks, Common skate and seals. Basking sharks and migrating cetaceans are known to frequent the North Channel and the Sea of the Hebrides and this suggests that in combination potential wave (particularly near shore) and tidal energy development in these coastal waters may increase risks for these species. Project level assessments for new developments within the Draft Plan Options should be able to investigate these potential issues further.
- 6.7.44 The potential for collision risks and impacts of construction activities on marine fauna of these Draft Plan Options will also require consideration. Undertaking concurrent construction works for separate renewables projects within close proximity may exacerbate disturbance issues, particularly in the vicinity of Tiree, Mull and Islay, and those in proximity to the many seal haul out areas located across the region. These effects may be coupled with disturbance in other areas as a result of increased shipping and port activities during construction and maintenance periods. For example, vessel traffic accessing NRIP sites could add further pressures for sensitive species in these locations.
- 6.7.45 The landscapes and seascapes of the region are renowned for their scenic quality and character, with several areas also recognised for wildness value. However, given that a large number of commercial vessels already using waters, particularly between the Minches, the west of the Outer Hebrides and the North Channel, it might be considered that there is to a degree in these locations a working seascape and thus the receiving environment may be considered to have some resilience to change.
- 6.7.46 Wind and near-shore wave devices are likely to be the most visible to coastal receptors. The potential for massing of offshore wind and wave infrastructure in particular in areas to the west of Islay (e.g. OWW1, WW1, TW1 and for proposed developments such as West Islay Wind and Tidal sites) and west of Tiree (e.g. OWW2, WW3 and Argyll Array) will require further consideration. In

many instances, the placement of devices further from these coastlines (e.g. in the western portion of WW1) could reduce their visual effect.

- 6.7.47 The region contains features of historic interest, including designated coastal sites such as Skerryvore Lighthouse in Tiree and Iona Abbey, and the potential for cumulative impacts on the setting of historic sites has been identified. For example, the placement of wind turbines in the Argyll Wind Array and nearby Draft Plan Options OWW1 and OWW2 may have the potential to occupy much of the seascape west of Skerryvore Lighthouse, particularly under a high occupancy scenario. The potential for such effects will be a key consideration for any project level EIA. Cumulative effects on marine archaeology, both known and unknown may also result from development within the Draft Plan Option. In general, the potential for impacts to marine archaeology would increase with greater offshore development. However, it is considered these can be mitigated at the project level by undertaking appropriate site surveys and avoidance of infrastructure where assets are identified.
- 6.7.48 Given the presence of recreational boating and shipping channels in the region, particularly between islands in the Inner and Outer Hebrides, in the Sea of the Hebrides and in the North Channel to the south, there is a likely to be a cumulative increase in navigational risk to shipping and marine traffic. Increased port activity associated with the NRIP could also increase the volume of commercial traffic in other parts of Scotland. However, it is considered that adoption of mitigation measures would be likely to reduce this risk.
- 6.7.49 There is the potential for cumulative effects to displace recreational sailing, water sports and cruising from current routes. However, it is anticipated that under the occupancy scenarios for wind and wave, effects on these activities are likely to be low. Individual projects could result in some issues for navigation through near shore areas and project level assessment should include consultation with recreational groups.
- 6.7.50 There is the potential for significant interactions with existing sediment and coastal processes, particularly for wave and tidal sites such as those off the west coast of Islay, Mull and Tiree. However, the precise impacts may only be able to be established at the project level.
- 6.7.51 While there may be interactions with marine water quality from the potential release of seabed contaminants during installation works, project level investigation and mitigation may limit such effects. As development in this area would likely be staggered, the significance of cumulative effects is considered minimal.

South West

- 6.7.52 The South West region contains one draft wind and one draft tidal plan option to the south of Luce Bay, and a second draft wind option located further east within the Solway Firth, near to an existing offshore wind energy array at Robin Rigg. While these option areas cover large areas of water within the Solway

Firth, particularly the overlapping wind and tidal energy areas immediately south of Luce Bay, development within this area is likely to be much smaller under the proposed occupancy scenarios.

- 6.7.53 It is expected that EIA and continuing monitoring work for the Robin Rigg Wind Array may assist in the identification of potential effects from further wind energy developments in its vicinity, and also aid their consideration in other future developments within the Firth. The SEA of the wind energy NRIP assessed several sites in the West Region, including those at Campbelltown/ Machrihanish and Hunterston. However, these locations are considerable distances from the Draft Plan Options and as such, are not considered likely to have significant effects.
- 6.7.54 The potential for cumulative impacts such as the collision of seabirds and diving birds with wind and tidal devices has been identified. Developments in the overlapping wind and tidal Draft Plan Options located near to Luce Bay (OSW1 and TSW1), known for its importance to birds, are likely to require further investigation at the project level. Together, operational wind and tidal devices could pose a risk to both seabirds and diving birds through risk of collision, both above and below the water. However, the nature of any risk will likely vary for different species, and the potential for species to be affected by both technologies would need exploration through the project level HRA in combination test. If project assessments show that significant effects on protected species cannot be avoided, it is recommended that Draft Plan Options could be revisited and/or lower growth scenarios favoured.
- 6.7.55 The potential for impacts such as the creation of barriers to movement, collision and impacts associated with construction activities for mobile marine fauna (e.g. Atlantic salmon, Lamprey, Cetaceans and elasmobranchs) will also require further exploration in project level EIA and HRA. In particular, potential barrier, collision effects and noise on important fish populations such as Atlantic salmon and Sea trout, and for Basking sharks frequently sighted near Luce Bay, will need consideration at the project level for tidal developments. Simultaneous construction works in close proximity within these areas, particularly those near to Luce Bay, could exacerbate disturbance issues in this area. However, it is expected that any development construction would be phased.
- 6.7.56 Wind energy development within the Firth will result in some degree of visibility from the Solway coast, much of which is recognised for its landscape and seascape value. However, the two Draft Plan Options are located some distance apart, and there are likely to be few parts of the Solway coastline where both are visible. Due to their proximity, developments within OWSW2 and the existing array at Robin Rigg are both likely to be visible from parts of the Solway and Cumbrian coasts. However, any cumulative impacts are best considered in detail at the project level.
- 6.7.57 The potential for interactions between offshore and onshore wind developments has also been identified, particularly in valued coastal areas with views to the

eastern portion of the Solway Firth, from both Scotland and neighbouring Cumbria. However, any such cumulative impact is likely to depend on local topography and lines-of-sight which will require consideration at the project level.

- 6.7.58 The potential for impacts to the historic environment, particularly damage to marine archaeology, would be likely to increase with greater density of development within the region. The richness of the Dumfries and Galloway coastline for historic features has been established, and the potential for cumulative impacts on the setting of features from offshore development has been identified. Cumulative impacts on the setting of features are again likely to depend on local topography and lines-of-sight, which would be best considered at the project level. Undertaking project level site surveys should enable avoidance of historic features and may also contribute to the discovery of previously unidentified submerged archaeology in the region
- 6.7.59 Given the importance of the Solway Firth for recreational boating and fishing, and its location near commercial shipping traffic lanes in the North Channel to the west, there is a likely to be a cumulative increase in the navigational risk to shipping and marine traffic. However, it is considered that the mitigation suggested for individual assessments would reduce this. While the adoption of exclusion zones around the technologies will likely assist in reducing collision risk, their presence may have the potential to displace some recreational and fishing activities in the region.
- 6.7.60 Increased port activity associated with the NRIP could also increase the volume of commercial traffic in the vicinity of those sites, and in the Solway Firth, Irish Sea and the North Channel, particularly during the construction of offshore renewables in this region. However, it is considered that adoption of mitigation measures would reduce the potential for impacts.
- 6.7.61 There is the potential for significant interactions with existing sediment and coastal processes, particularly for tidal sites located south of Luce Bay, which could adversely affect important and potentially vulnerable sites such as the Luce Bay Sands SAC. The significance of effects will need to be established at the project level.
- 6.7.62 There may also be interactions with marine water quality from the potential release of seabed contaminants during installation works. However, as project level mitigation to limit effects is likely to be available, and that development in this area would likely be staggered, the significance of cumulative effects is considered minimal.

6.8 Summary of Overarching Plan Effects

- 6.8.1 The following table sets out a summary assessment of the wind, wave and tidal plans against the SEA objectives that were set out within the Scoping Phase of the assessment. This final assessment assists in drawing together the headline

issues and provides an additional means to view the contribution to, or impact on, the environmental objectives drawn from the relevant policy context.

Table 6.4: Assessment of the Plans against SEA Objectives

SEA Objectives	Conclusions of the assessment
Biodiversity, Flora and Fauna	
<p>To safeguard marine and coastal ecosystems, and their interactions.</p>	<ul style="list-style-type: none"> • The assessments have highlighted the potential for effects on marine and coastal biodiversity, and the uncertainty relating to the significance of such effects. • There are potential interactions between fauna (including priority marine features) and renewables technologies, including seabirds (largely wind devices), diving birds (largely wave and tidal devices) and mobile marine mammals and fish (potential risks for wind and wave, but in particular tidal devices). • A number of designated areas could be affected with potential interactions between their designated features and devices. Project level assessment must determine the significance of these relationships. • There are potential for interactions between localised change to hydrogeological, sediment and coastal processes and benthic habitats that will require consideration in more detail through project level assessment. • Potential for some infrastructure to result in an ‘artificial reef’ effect and for some colonisation by benthic communities. • Given that the assessments have identifies a degree of uncertainty surrounding potential effects it is recommended that further project level assessment and research can seek to close these data gaps.
<p>To avoid adverse effects on the integrity of Natura sites (NB: this will be established through the parallel HRA work).</p>	<ul style="list-style-type: none"> • The assessment highlighted relevant sites within the Natura network, including those that overlap with the Draft Plan Options. • The HRA looks in greater depth at the Draft Plan Options that may have potential interactions with Natura sites, and outlines requirement for further project level HRA to assess these interactions.
Population and Human Health	
<p>To avoid adversely affecting recreational users.</p>	<ul style="list-style-type: none"> • The assessments of the plans have identified the potential for displacement of recreational activities in some areas where such activity is undertaken. • Displacement effects may be more significant in areas where near shore development may take place, and recreational use might be at its densest. Therefore effects are most likely to result from near shore wave development or tidal where recreational vehicles cannot pass above these. However, given the potential scenarios of occupancy for wind and tidal options the significance of impacts is considered low. • Given wind devices might be located further offshore, even with exclusion zones for recreational vessels opportunities for movement around offshore wind farms, should not result in significant adverse effects. • Given the occupancy scenarios and uncertainty of the precise location of future development within the Draft Plan Options the exact significance of effects can only be fully ascertained at the project level and it is recommended that consultation be undertaken with stakeholder groups during the planning phase.
<p>To avoid adverse effects on human health and safety.</p>	<ul style="list-style-type: none"> • The assessment identified the potential for collision and pollution risks associated with construction activities and the presence of devices and infrastructure in the water. • It is concluded that there is adequate mitigation measures, in the form of exclusion zones and demarcation and construction methods to avoid significant adverse risks to human health.

SEA Objectives	Conclusions of the assessment
Water and the Marine Environment	
To avoid pollution of the coastal and marine water environment.	<ul style="list-style-type: none"> • The assessment identified the potential for water contamination from construction activities, particularly for turbidity associated with the placement of foundations and anchoring, and potentially from dredging for fill material for gravity based devices. These activities might result in disturbance of contaminated sediments and the discharge of pollutants from vessels. • Mitigation is available at the construction phase and through seabed contamination surveys.
To maintain or work towards good ecological status.	<ul style="list-style-type: none"> • The assessment found that water quality impacts are likely to be localised and temporary. • It is not anticipated that effects on good ecological status of water would be significantly affected particularly as project mitigation measures should help to reduce potential risks to ecological status.
Climatic Factors	
To reduce greenhouse gas emissions from the energy sector.	<ul style="list-style-type: none"> • The assessment considered that offshore renewables will help to decarbonise Scotland's energy sector through replacing energy generation from non-renewable sources. • While it was identified that energy will be expended in construction and maintenance of infrastructure, long-term benefits in GHG reductions are likely.
To ensure that adaptation to climate change impacts are taken into account, e.g. through consideration of resilience, changing environmental sensitivity	<ul style="list-style-type: none"> • The assessment identified dynamic and vulnerable coastal areas and considers the potential for coastal impacts from offshore renewables, particularly wave and tidal technologies. • It was recommended that project level assessment also consider the effects of climate change when considering the potential for long-term effects of developments on the coastline.
Marine Geology and Coastal Processes	
To avoid exacerbating coastal erosion.	<ul style="list-style-type: none"> • The assessment found that there is the potential for changes to wave period from renewables devices, particularly the presence of wave technologies. • There is potential for some changing patterns of hydrological change associated with tidal devices, however effects may be localised and significance will depend on local coastal processes and the location of devices. • The likely effect of wind devices in terms of coastal erosion were considered to be lower. Although some devices may interact with wave patterns at the site, distance from the near shore may see the significance of effects diminish. • It was recommended that projects consider potential impacts such as altered hydrodynamics and changes to coastal processes when considering the potential for long-term effects of developments.
To maintain integrity of coastal processes	<ul style="list-style-type: none"> • The potential for impacts to wave period and hydrodynamics by wave and tidal devices in particular has been identified. • The assessment identified uncertainty in the significance of such impacts, and recommended the use of site specific modelling at the project level.
To maintain and protect the character and integrity of the seabed	<ul style="list-style-type: none"> • The assessment identified potential impacts to seabed sediments and habitats from construction activities and operating infrastructure (e.g. gravity base, anchors, piling, etc.). It is considered that seabed surveys undertaken at the project level should reduce potential impacts. • There is some potential for beneficial changes, for example as a result of reef effects, although this is obviously uncertain before development is undertaken.

SEA Objectives	Conclusions of the assessment
	<ul style="list-style-type: none"> • Project level monitoring during construction and operation was recommended to demonstrate the scale of potential effects.
Historic Environment	
<p>To protect and, where appropriate, enhance the historic marine environment.</p>	<ul style="list-style-type: none"> • The assessment identified historic marine sites and the setting of valued coastal features of the historic environment as potential receptors to offshore renewables development. • While the potential for adverse impacts to marine archaeology was identified, such effects may be avoided by undertaking site survey works at the project level and furthermore it is considered that survey work may also contribute to the discovery of unknown marine archaeology. • It was recommended that projects demonstrate no significant effects on the setting designated sites giving regard in particular to WHS, designated wrecks and A listed coastal buildings.
<p>To avoid damage to known and unknown coastal and marine archaeology.</p>	<ul style="list-style-type: none"> • While the potential for impacts on marine and coastal archaeology was identified in the assessment, such effects may be avoided through undertaking site survey works at the project level. • It was considered that survey work may also contribute to the discovery of unknown marine and coastal archaeology. • It is recommended that projects demonstrate no significant effects on designated sites (e.g. designated wrecks).
<p>To avoid adverse effects on the character and setting of historic sites and buildings.</p>	<ul style="list-style-type: none"> • The assessment identified the potential for infrastructure, particularly near-shore wind and wave devices, to impact on the setting of coastal receptors. • It identified historic features to avoid at the project level, recommending the avoidance of significant effects on key features of the historic environment in the siting of offshore developments.
Landscape / Seascape	
<p>To avoid where possible, or minimise, adverse effects on landscape/seascape</p>	<ul style="list-style-type: none"> • The assessment acknowledged the likely visibility of renewables devices from coastal receptors, particularly near-shore wind and wave technologies. • Wind devices will be most visible, but also most likely to be located at a distance from the coastline. Wave devices can have a lower visibility (either on the water surface, or within the wave column), and tidal even lower. However, these devices might be constructed closer to shore with surface-piercing elements of the development visible from receptors. • Lighting of devices and exclusion zones may have some visual effects. Effects will diminish for wind devices with distance from shore, wind and tidal arrays are expected to be smaller than those for wind and although potentially nearer the shore effects are also considered unlikely to be significant. • The assessment identified relevant landscape designations and areas of wild land to avoid at the project level, recommending that projects seek to minimise the potential for adverse effects.
<p>To promote the protection of seascape and coastal landscapes</p>	<ul style="list-style-type: none"> • The assessment identified areas of value and highlighted the need to consider these further. • It also identified the importance of wildness in siting offshore developments, and recommended that projects seek to minimise the potential for adverse effects.
<p>To avoid or minimise adverse visual effects</p>	<ul style="list-style-type: none"> • The assessment acknowledged the visibility of renewables devices from coastal receptors, particularly near-shore wind and wave technologies. • It identified that visual effects in some parts of Scotland that have valued landscape value cannot be avoided in some parts of Scotland. However, the SEA does propose that project level assessment will seek to minimise visual effects.

SEA Objectives	Conclusions of the assessment
	<ul style="list-style-type: none"> • Lighting of devices and exclusion zones may have some visual effects. Effects will diminish for wind devices with distance from shore, wind and tidal arrays are expected to be smaller than those for wind and although potentially nearer the shore effects are also considered unlikely to be significant. • The assessment considered that the overall visual effects of offshore development can be reduced if considered appropriately. The location of devices within the Draft Plan Options may help to achieve this and lower levels of occupancy may be required in the most sensitive locations.

7 Recommendations, Mitigation and Monitoring

- 7.1.1 In accordance with Schedule 3 of the Environmental Assessment (Scotland) Act 2005, the measures proposed to manage (by preventing, reducing or offsetting) the significant adverse environmental effects of the alternatives under assessment are to be documented within an environmental report.
- 7.1.2 This section sets out the recommendations of the assessment. Recommendations are discussed in three stages. Firstly the general recommendations for future projects within Draft Plan Options are discussed. These highlight the environmental considerations common to development of devices and discuss the implementation, monitoring and review of the plans. Secondly, there are recommendations for specific Draft Plan Options and regions relating to specific environmental receptors. Both of these stages expand on the recommendations and mitigation identified in the Draft Plan Options assessment set out in Appendix D.
- 7.1.3 A final set of wider recommendations are also considered, setting out recommendations for the marine planning sector to consider to help provide information to enable greater certainty in effects prediction.

7.2 Recommendations for Renewables Projects

Biodiversity, Flora and Fauna

- 7.2.1 As number of Draft Plan Options have specific constraints relating to marine biodiversity and the particular location of the Options, some of which are explored in the next section. However, there are also effects that relate to all Draft Plan Options, and many of these are based on uncertainties relating to the movement of migratory and mobile marine species, and the potential interaction of all species with devices. The following mitigation has been identified:
- Designated sites for species and habitats of nature conservation interest should be avoided, and project level assessment should establish connectivity and potential risk to conservation areas. Impacts on European Protected Species, PMFs and wider biodiversity, including migratory and mobile species, should be identified and considered within the design and application stage of project development. Project level HRA work should assist in the identification of mitigation for protected European sites and species.
 - Impacts on species and habitats in general, including important areas for fish, should be reduced through appropriate project design. This might include measures such as minimising the impact on the seabed and avoiding key spawning areas. Furthermore, effects might be minimised by appropriate construction and operation methods. This might include avoidance of undertaking work in key seasons (e.g. February to June to

minimise impacts to Atlantic salmon), and employing methods to minimise noise and disturbance during construction and maintenance.

- The results of hydrodynamic and sediment modelling, recommended as part of impact identification associated with the movement of water and sediments and potential changes to coastal processes, should also consider the impacts of these changes on biodiversity and individual species of interest. Project level assessment should be required to demonstrate that there will be no significant impact on protected species and habitats (see also recommendations within the water and marine environment and the marine geology and coastal processes topics).
- Further research into potential collision risks, noise and displacement effects is required to better understand potential effects on fish species such as Atlantic salmon and other diadromous fish, cetaceans, seals, elasmobranchs and some bird species. These risks may be most pertinent to the operational phase of tidal developments and some types of wave devices. At present, less is known about effects from these types of devices, and therefore the results of future research and the current research outlined in Section 7.5, should be fed into the assessment process at project level EIA.
- Furthermore, monitoring of projects as they are deployed and tested will be vital to providing greater certainty on impact prediction for subsequent development.

Population and Human Health

7.2.2 The assessment considers the potential increase in collision risk, and the potential displacement of existing recreational activities. Whilst some displacement could be permanent, leading to recreational activities being discontinued, it is likely that most activities could continue in existing or other locations. Given these potential effects the following mitigation has been suggested:

- Some impacts could be reduced through appropriate design and use of navigational aids such as marker buoys and lighting in the vicinity of the infrastructure. Furthermore the mapping of offshore energy developments and their inclusion on navigational charts could reduce collision risk. However, this might not avoid all risks, in particular collision risk between floating wave devices and small craft. Therefore, in some circumstances exclusion zones around wave and wind farms for recreational craft should also be considered. Impacts on small craft from tidal devices are considered to be minimal.
- When bringing forward specific projects, developers could work with the recreation sector to consider how recreational activities might continue within the option boundary. Early consultation can also help to reduce impacts on activities such as important cruising routes.

- There is a potential collision risk for commercial vessels with all technologies, particularly wind and wave but also potentially tidal devices in shallow waters, and as such exclusion zones and mitigation via navigational aids is likely to be required.
- Developments should avoid key shipping routes whilst ensuring that future energy generation is not compromised in its location.

Water and the Marine Environment

7.2.3 The assessment has considered potential impacts to water and the marine environment relating to increased turbidity, releasing contaminants from the seabed, and from potential pollution associated with installation, maintenance and decommissioning of devices. Impacts are largely considered to be localised and temporary in nature. Given these potential effects, the following mitigation has been suggested:

- Pollution risks associated with installation, maintenance and decommissioning of devices should be reduced and limited through building mitigation into construction and operational procedures, and avoiding discharges of harmful material and substances.
- Project level assessment will be required to reduce uncertainty relating to potential changes to hydrodynamics and the associated effects of this, for marine and benthic fauna in particular. It is suggested that hydrodynamic modelling is undertaken at project level to demonstrate the potential effects and consider appropriate mitigation (see recommendations in the biodiversity, flora and fauna, and the climatic factors topics).
- Further assessment work may be required to reduce uncertainty regarding potential impacts on water quality, particularly for shellfish waters. This includes a recommendation for hydrodynamic and water quality modelling as part of project level assessment.

Climatic Factors

7.2.4 The assessment highlights the positive effects of supporting lower carbon energy generation, and no further recommendations or mitigation has been developed relating to this. However, the assessments do identify that in some areas potential changes to hydrodynamics and wave energy could be linked to changes for coastal erosion and accretion, which could interplay with the effects of climate change. Therefore, the following mitigation has been suggested:

- Project level assessment work will be required to reduce uncertainty relating to the potential changes to hydrodynamics and impacts on the coastal environment. The results of hydrodynamic modelling could be considered alongside any tangible impacts reasonably associated with climate change (See recommendations within the biodiversity, flora and fauna topic, and water and marine environment topics).

Marine Geology and Coastal Processes

7.2.5 While the assessment identified the potential for impacts resulting from erosion or deposition from changes to hydrodynamics, uncertainty remains regarding potential impacts associated with offshore development on coastal processes. Once operational, there is the potential for scour effects on the seabed where devices are located, and devices with large footprints (e.g. gravity bases) would have a larger area for scour to occur as a result of impacts on hydrodynamics. Therefore, the greatest impacts may be associated with wind devices, although the potential for localised effects associated with wave and tidal devices will likely remain. Given these potential effects the following mitigation has been suggested:

- Project level assessment work is required for all options to reduce uncertainty regarding potential impacts on coastal processes. It is suggested that sediment dynamic modelling is undertaken at the project level to demonstrate potential effects and consider appropriate mitigation.
- When projects are in the design process, consideration should be given to the location and arrangement of devices in order to minimise and mitigate potential impacts on marine geology and coastal processes, particularly if there are sensitive receptors in proximity (see recommendations within the biodiversity, flora and fauna, and climatic factors topics).
- Device and project design should include the use of scour protection around the base of foundations, particularly gravity-based foundations and monopiles, placed on or into the seabed.

Historic Environment

7.2.6 A number of Draft Plan Options have specific constraints relating to the historic environment associated with their particular location. However, there are also more generic effects relating to potential impacts on the setting of historic features and undesignated marine features, such as some wrecks. The following mitigation has therefore been identified.

- Direct effects on features of the historic environment can be avoided through the appropriate siting of devices away from the location of historic marine features. This might include locating developments away from known and designated wrecks, or as a result of surveys identifying previously unknown archaeological remains.
- Project level assessments should consider the potential impacts on the setting of sites and seek to mitigate accordingly to minimise any such effects.

Landscape and Seascape

7.2.7 Recommendations relating to specific Draft Plan Options and features of interest in their locality are set out in the following section. However, there are some broader recommendations:

- Whilst devices and supporting infrastructure could be visible for all of the technologies, if not in whole then partially, the likely height of wind turbines and thus greater visibility may result in impacts of a greater significance from development within some wind Draft Plan Options. As a result, particular attention to visual effects will be required when considering projects that may come forward.
- Wave devices that sit above the water surface may have greater visual and seascape effects than those that sit in the water column. However, above water devices may be more suitable for locations further offshore and water column devices in near shore locations. In this case, the potential visual impacts in both locations may be reduced.
- Whilst below surface tidal devices may have lower significance of effects this does not mean there will be no effects.
- Given the high quality landscapes and seascapes associated with many of the Draft Plan Options, an assessment of the impacts on landscape and seascape character should form part of project level EIA and significant effects should be avoided if possible, or reduced through appropriate design and construction.
- Development that will affect NSA should avoid adverse effects on the integrity of the area or the qualities for which it has been designated.
- The use of lighting on devices has the potential to create impacts, particularly during the night. However, devices positioned several kilometres offshore may have reduced effects, with wind devices and some wave devices falling into this category. Near shore devices may therefore have a greater impact, particularly where there are sensitive receptors. However, given the likely lower levels of occupancy, the significance of these impacts may be reduced. Project level assessment will be required to consider the implications of device design, array size and location in terms of proximity to sensitive receptors.
- There is the potential for cumulative effects associated with a number of development areas. Primarily, there is the potential for effects from massing of devices with other planned and existing offshore renewable energy developments, the onshore components of the movement of generated energy and existing onshore wind developments. The capacity of landscapes to absorb change should be considered in detail within project level EIA.
- As a result of the above, a full visual impact assessment will be required at the project level to establish the significance of any effects. Visual impacts on key onshore receptors could be limited by appropriate positioning within the Draft Plan Options.

7.3 Regional Recommendations for Draft Plan Options

North East

- 7.3.1 The assessment of Draft Plan Options for wind energy (OWNE1 and OWNE2) in the North East region has identified the potential for interaction with a number of marine mammals and birds, in particular mobile species associated with designated areas along Scotland's eastern coastline. This includes seabirds known to travel between many locations from the Moray Firth to the Firth of Forth. Furthermore, Atlantic salmon and Bottlenose dolphins from the Moray Firth and Grey seals from the Firth of Tay have the potential for interactions with wind devices and their foundations. Project level EIA should include detailed impact assessment on protected species identified as being present in development areas.
- 7.3.2 The area is busy with commercial shipping and ferries, and developments within the Draft Plan Options should demonstrate mitigation measures to avoid any increased risks from collision. It is anticipated that existing mitigation measures are available to do this.
- 7.3.3 Both of the Draft Plan Options overlap with the Southern Trench MPA area of search. However, as an area of search, the boundaries presented for the MPA may not necessarily be those that will represent any future proposed MPA within it. Rather than propose alteration to the boundary of the Draft Plan Options, it is recommended that projects within the Draft Plan Option will need to demonstrate through project level EIA that co-location is possible and development is compatible with the conservation objectives of the MPA. Co-location of devices and MPA designations may not result in significant effects, depending on the interaction between marine features and technologies. The Southern Trench MPA area of search has Minke whale and White-beaked dolphin interest features. As such, collision and displacement risk should be part of this consideration.

North

- 7.3.4 The assessment of Draft Plan Options in the North region has identified the potential for interaction with a number of marine species. For example, Draft Plan Options in the Pentland Firth, Orkney and Shetland has particular bird sensitivities and interests. Developments within Draft Plan Options across Orkney and Shetland will need to consider Grey and Harbour seals with many haul out sites and their presence within SAC designations.
- 7.3.5 Cetaceans and fish species are known to use these northern waters, including several commercial fish species that nurse in these waters (e.g. Mackerel to the north and north west of Shetland). Elasmobranchs, including PMFs such as Basking Sharks, have also been sighted in northern waters.
- 7.3.6 Project level EIA should include a detailed assessment of impacts on PMFs and other important species when assessing potential developments within the Draft Plan Options.

- 7.3.7 The region has a coastline rich with landscape designations and remote and wild areas in the vicinity of several of the Draft Plan Options, including several NSAs located on the mainland and islands. Consideration of these important landscapes and character should form part of project level assessments. In particular, projects within Draft Plan Options WN3 and TN5 should demonstrate no significant adverse effects on the Shetland NSA.
- 7.3.8 The region contains several designated coastal features of importance to the historic environment. The potential for impacts on the setting of these features should be considered through the EIA process and demonstrate that adverse effects are avoided or minimised, not least the Heart of Neolithic Orkney WHS Site. As an international heritage designation, developments in these areas must demonstrate no significant adverse effects on its outstanding universal value. Projects that come forward within Draft Plan Options OWN1, WN2, TN2, and potentially TN3, should consider effects on this important designation through project EIA.
- 7.3.9 The region's seas are busy with commercial and recreational vessels, and activities such as fishing, angling, cruising, sailing, diving and surfing present within the region. Developments should avoid cumulative impacts of displacement on recreational activities and identify through project EIA the means to enable impacts on such activities (and human health) to be minimised.
- 7.3.10 The boundaries of several Draft Plan Options were identified as overlapping with designated nature conservation sites. These include: Draft Plan Options WN1 overlapping with Strathy Point SAC; WN2 overlapping with the Marwick SPA, Stromness Heath and Coast SPA and the Hoy SPA; TN1 overlapping with the North Caithness Cliffs SPA, Hoy SPA and Pentland Firth Island SPA; TN2 overlapping with Rousay SPA; TN3 overlapping with Papa Westray SPA; TN4 overlapping with East Sanday Coast SPA and Ramsar and Sanday SAC; WN3 and TN5 overlapping with the Sumburgh Head SPA; TN6 overlapping with Yell Sounds Coast SAC; TN7 overlapping with the Hermaness, Saxa Vord and Valla Field SPA, and the northern perimeter of OWN2 overlapping with the Pobie Bank cSAC. Whilst the development of wind and wave devices may be possible within these designations, it must be demonstrated through project level HRA that any development does not adversely affect the integrity of the designations. The number of designations illustrates the importance of biodiversity and nature conservation to the region.
- 7.3.11 Additionally, several of the region's Draft Plan Options are also in proximity to or overlapping with proposed MPAs. These include Draft Plan Options OWN1, TN4 and WN2 overlapping with the North West Orkney MPA, with sand eel and geomorphology interest; WN2 and TN3 overlapping with the Papa Westray MPA, proposed for Black guillemot and the Marine Geomorphology of the Scottish Shelf Seabed; and TN2 overlapping with Wyre and Rousay Sounds MPA, proposed for kelp and seaweed communities on sublittoral sediment, maerl beds and marine geomorphology. Collision and displacement risk with

PMFs, and the potential for impacts on the seabed and benthic communities should therefore be considerations when ascertaining the links between development within the Draft Plan Options and the MPAs. Developments within the Draft Plan Options will need to demonstrate through project level EIA that co-location is possible and development is compatible with the conservation objectives of the MPA.

North West

- 7.3.12 As with all of the regions, the Draft Plan Options in the North West have potentially significant interactions with cetaceans, seals, birds, fish and elasmobranchs, and project level assessment should include a detailed impact assessment on protected species.
- 7.3.13 Similarly given the high quality landscapes and seascapes within this region, many of which are identified as wilderness, both on the mainland and on the isle of the Lewis, development within the Draft Plan Options should demonstrate measures to avoid and reduce significant effects. Project level assessment should identify the appropriate locations within Draft Plan Options and distance from the shoreline to minimise and avoid significant seascape and visual effects.
- 7.3.14 Commercial shipping routes are popular in and around the Draft Plan Options, and any impacts on safety from renewables development should be considered in project level EIA.
- 7.3.15 The region has many designated areas and the potential for impacts on these will form an important part of project level EIA and HRA. WNW1 in particular includes the Flannan Isles SPA, overlaps with the proposed Eye Peninsula and Butt of Lewis MPA and its boundaries are in proximity to St Kilda, which is designated as a SPA, SAC and WHS. As an international heritage designation, developments in the areas must demonstrate no significant adverse effects on its outstanding universal value.
- 7.3.16 Whilst the development of wind and wave devices may be possible within these designations, it must be demonstrated through project level HRA that development does not adversely affect the integrity of SPAs and SACs, and project EIA will need to demonstrate that co-location is possible and any development is compatible with the conservation objectives of the MPA.

West

- 7.3.17 The large West region contains several Draft Plan Options and has many valued environmental features. There will be a wide array of interest features including marine mammals, birds, fish, elasmobranchs, heritage and landscape features to consider when undertaking project level assessment within the Draft Plan Options.
- 7.3.18 Within a number of Draft Plan Option area assessments, it has been noted that effects on some aspects of biodiversity and on landscapes could be reduced by

appropriate location of devices within the Draft Plan Option. This should be balanced with project level assessment, available mitigation and technical feasibility. However, opportunities to reduce the scale of potential effects should be sought in subsequent locational project planning.

- 7.3.19 The region contains a number of shellfish waters and although it is considered that mitigation to reduce and avoid impacts on these is available, they will remain a consideration for the scoping of project level EIA.
- 7.3.20 Across the region's mainland and islands there are many valued and important landscapes, both designated (e.g. South Uist Machair and Loch Na Keal NSAs) and undesignated, including those considered to be remote and wild land. Project level EIA should give consideration to these important landscapes and character. This applies to all options but particular landscape value has been considered for Draft Plan Options in proximity to islands and remote peninsulas. The assessment of Draft Plan Option WW2 in particular recommends that projects in this area should only be developed where significant landscape effects are demonstrated to be minimised and avoided, based on the potential for landscape and cultural impacts.
- 7.3.21 The region contains many designated coastal features of importance to the historic environment. The potential for impacts on the setting of these features should be considered through the EIA process and it should be demonstrated that adverse effects are avoided or minimised.
- 7.3.22 Given the volume of mobile species in the area, all of the Draft Plan Options may impact on PMFs and designations. These are important issues to be explored at the project level. However, given the overlap of several Draft Plan Options with SPA, SAC or MPA search locations, boundaries should be kept under review as this consultation progresses.
- 7.3.23 The boundary of OWW2 was identified as overlapping with the Stanton Banks SAC. Furthermore WW4 overlaps with Mingulay and Berneray SPA. Whilst the development of wind and wave devices may be possible within these designations, it must be demonstrated through project level HRA that development does not adversely affect the integrity of the designations.
- 7.3.24 Draft Plan Options OWW2, WW2 and WW3 overlap with the Skye to Mull MPA search area, and Draft Plan Option TW2 has a small overlap with the Clyde Sea Sill MPA. As an area of search, the boundaries presented for the Skye to Mull MPA may not necessarily represent the final proposed MPA, and both MPA are presently at the consultation stage. The Skye to Mull MPA area of search has Basking shark and Minke whale interest features and the Clyde Sea Sill MPA Black guillemot interests. It should be noted that co-location of devices and MPA designations may be possible, depending on the interaction between marine features and devices. Collision and displacement risk will be particular considerations.

- 7.3.25 Development within Draft Plan Option will need to demonstrate through project level EIA that co-location is possible and that the development is compatible with the conservation objectives of the MPA.

South West

- 7.3.26 As with other regions the three Draft Plan Options in the South West region have potentially significant interactions with marine mammals, elasmobranchs, birds and fish, and project level assessment should include detailed impact assessment on protected species. Species such as Basking sharks, Atlantic salmon, Sea lamprey and Harbour porpoise in particular will require consideration.
- 7.3.27 Designated biodiversity sites are important considerations for potential developments within the region, and these should be considered at the project level. It is recommended that modelling and project level work may be required to demonstrate that there will be no significant impacts on Luce Bay SAC habitats, particularly as a result of changes to hydrology and sedimentation from the construction of devices in TSW1 and/or OWSW1. Similarly it is recommended that the assessments of developments in the Draft Plan Options should seek to minimise landscape effects on Luce Bay.
- 7.3.28 A small section of the boundary of Draft Plan Option TSW1 overlaps with the Luce Bay and Sands SAC and Mull of Galloway SAC. The boundary of this Draft Plan Option should be kept under review as consultation progresses. Location of tidal devices within the boundary may be possible if project level HRA can demonstrate development does not adversely affect the integrity of the SACs.

7.4 Wider Recommendations

- 7.4.1 In addition, the assessment has identified wider questions and considerations for improving knowledge of the effects of renewable energy developments in the marine environment.
- 7.4.2 Whilst this assessment provides focus for the potential effects of renewable energy technologies located within the Draft Plan Options, there are wider considerations in terms of the delivery of new development. Connections to the onshore electricity grid and across the marine environment are a major part of delivering commercial scale renewable development, demonstrated by their inclusion as a national development within the Main Issues Report for the National Planning Framework 3 (NPF3)⁷¹. However, grid connections, and the identification of locations for these, do not form part of this plan process and assessment. It is recommended that provisions should be made for the strategic planning of the marine grid in order consider potential effects arising from the provision of grid infrastructure, and that strategic assessment of potential environmental effects is also undertaken.

⁷¹ Scottish Government (2013) National Planning Framework 3 - Main Issues Report and Draft Framework [online] Available at: <http://www.scotland.gov.uk/Publications/2013/04/2377> (accessed 11/6/2013)

- 7.4.3 The assessment process has highlighted difficulties in providing certainty in the prediction of effects. This reflects a number of issues, including uncertainty of the precise type of technology and the foundations and/or anchoring that would be developed in any individual Draft Plan Option, and hence the difficulty in predicting particular effects associated with devices and their receiving environment.
- 7.4.4 Furthermore, there remains uncertainty over the scale and significance of interactions between devices and species. Mobile species including cetaceans, seals, fish, elasmobranchs and birds may all interact with devices and all may be impacted through collision and displacement, which in turn may impact on their populations and patterns of movement.
- 7.4.5 This SEA, where appropriate, has attempted to consider and incorporate information on the effects of emerging projects identified in project level EIA. As many of these assessments are currently live applications with Marine Scotland Licensing Operations Team, the key outputs could not be considered in depth or certainty within this SEA process as they are still to receive regulatory acceptance. Future iterations of plans for offshore renewables would benefit from an understanding of the recorded environmental effects of project deployment.
- 7.4.6 It is therefore recommended that a co-ordinated approach to reviewing approved EIA and project monitoring should be developed. Any such approach would need to produce a framework in which effects prediction and monitoring information can be compiled and presented in order to provide greater certainty on effects, inform future iterations of the plan making process and potentially assist in the Scoping of project EIA. Furthermore, where uncertainty remains, further research within the existing frameworks should be considered and continue to be commissioned. A co-ordinated and collaborative approach should also help to direct future research to areas of value for the plan making and development process.
- 7.4.7 It is further recommended that a steering group is established for the monitoring of this SEA to discuss how this co-ordinated approach may be taken forward. It is anticipated that an established group might oversee the framework to collate monitoring environmental information, potentially input into project level assessment review and review of mitigation, and identify opportunities for research to close gaps in the certainty of impact assessment. The group could include a wide range of representatives but should include expertise for scientific accountability. It is proposed that during the consultation period the membership of the group is considered. Wider stakeholders and consultees are requested to share their thoughts on the potential for the development of a collaborative group.
- 7.4.8 Given existing uncertainties regarding some of the potential effects, it is recommended that further plan iterations may be required, particularly if research indicates environmental effects that are currently unforeseen. The recommendation for a steering group and plan review is in line with the

recommendation in the HRA that a project steering group oversee monitoring review work of initial projects as part of iterative plan review (IPR). An opportunity exists to establish a coordinated approach to meet the recommendations of both this SEA and the HRA.

7.5 Current and Ongoing Research

- 7.5.1 The results of the assessment, including the assumptions required to reach these, alongside the limitations and gaps in the evidence base, highlight the need for on-going research and information gathering regarding the marine environment and its interaction with renewable energy devices. Section 3.5 of this report sets out some of the difficulties encountered in undertaking the assessment.
- 7.5.2 Whilst there are existing limitations, in particular relating to baseline data, many areas of uncertainty are also the focus of current or planned research projects promoted through the Scottish Marine Renewables Research Group (SMRRG), and undertaken by organisations including SNH, the Joint Nature Conservation Committee (JNCC), Offshore Wind Developer Groups and the Crown Estate, amongst others.
- 7.5.3 Additionally, a number of related research activities and frameworks are also currently in place including: the Marine Mammal Scientific Support Research Programme managed by the Sea Mammal Research Unit (SMRU) and focused on filling gaps in knowledge between marine mammal distribution and interactions with renewable energy; the Co-ordinated Agenda for Marine, Environment and Rural Affairs Science (CAMERAS) which provides an overall framework for marine science in Scotland; and the Scottish Marine Science Strategy⁷².
- 7.5.4 Marine Scotland's Research Implementation Strategy⁷³, produced to identify research to inform the development of offshore renewable energy, seeks to fill various gaps in current knowledge identified via their ongoing programme of work. It sets out research priorities and lists a wide range of projects being undertaken to fill these gaps, including projects relating to seabirds, marine mammals and migratory fish, amongst others.
- 7.5.5 Within the large array of research activities there are a number of projects that will help to add greater certainty to future assessment and iterations of marine planning. Studies such as the Joint Cetacean Protocol and tagging projects for Atlantic salmon are aimed at delivering greater understanding of species distributions and migratory routes. The monitoring projects for seals, cetaceans and elasmobranchs outlined in the Research Implementation Strategy have similar aims to improve the understanding of mobile species.

⁷² Marine Scotland (2011) Scottish Marine Science Strategy 2010-2015 [online] Available at: <http://www.scotland.gov.uk/Publications/2011/03/02092716/0> [accessed 15/05/2013]

⁷³ Marine Scotland (2012) Development of Offshore Renewable Energy in Scotland's Seas: Research Implementation Strategy [online] Available at: www.scotland.gov.uk/Resource/0040/00401505.doc [accessed 15/05/2013]

- 7.5.6 Aerial survey and modelling projects developed by TCE seek greater understanding of the movements of seabirds, and are complemented by existing Marine Scotland Science and TCE studies looking at displacement and disturbance effects on seabirds from offshore wind energy devices. The outcomes of other projects, such as the FAME project, may also provide further understanding of these issues.
- 7.5.7 Regional studies may also help to supplement the information that might inform future iterations of marine planning. For example research into monitoring seabird behaviour associated with offshore renewable developments in the vicinity of the protected North and East Caithness Cliff SPAs, which provide important habitats for seabirds, will help to inform the wider understanding of individual seabird species interactions with renewable devices. Other regional and project specific studies include bathymetry and habitat studies undertaken for specific renewables developments in the Pentland Forth and Orkney Waters.
- 7.5.8 Many such studies have been specifically developed to fill knowledge gaps in relation to interactions and the identification of effects between species and habitats, and renewables technologies. Planned research projects include: impacts of wave technology on benthic habitats and species, including seaweed; the potential for underwater noise and EMF from wave and tidal devices to affect marine mammals and other biota; the consideration of collision and entanglement risk for marine fauna with submerged renewables infrastructure; and the investigation of collision risk and modelling of device avoidance by diving birds associated with submerged tidal devices.
- 7.5.9 The findings from ongoing and future research programmes and projects, alongside academic studies and monitoring of deployed marine devices, have the potential to inform both the appropriate location of future development and potentially the design of renewables technology. The results of the research programmes are expected to inform future iterations of the plan making process.

7.6 Proposed Monitoring

- 7.6.1 The Environmental Assessment (Scotland) Act 2005, Part 3 (19) requires monitoring of the potential significant effects of the plans. The SEA of 'Blue Seas, Green Energy'⁷⁴ set out initial proposals for monitoring and included the enacted recommendation to commission the Marine Monitoring Network Review⁷⁵. This sought to identify gaps in marine environmental data required to inform offshore wind, wave and tidal energy planning and assessment. The review included: identifying the current capabilities of the existing marine monitoring network in Scotland; examining the suitability of marine monitoring data to report on trend information; and recommendations on changes to the current monitoring network. This project has informed the identification of appropriate programmes to monitor the significant effects of the plans.
- 7.6.2 Initial proposals for the monitoring framework are set out in table below. Consultation on this Environmental Report provides an opportunity to refine the proposals before final measures are set out in the SEA post adoption statement. The views of consultees are now sought on the draft framework.

⁷⁴ Scottish Government (2012) Offshore Wind, Blue Seas – Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters [online] Available at: <http://www.scotland.gov.uk/Topics/marine/marineenergy/wind> [accessed 07/06/2013]

⁷⁵ Scottish Government (2012) Marine Monitoring Network Review [online] Available at: <http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/Themes/networkreview> [accessed 07/06/2013]

Table 7.1: Initial Monitoring Framework

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
Biodiversity, Flora and Fauna	Seabird and diving bird collision and displacement risk.	<p>A number of seabird monitoring programmes are currently being undertaken by several organisations, including those by JNCC and Scottish Association for Marine Science (SAMS), largely targeting taxonomy, migratory routes population, breeding information and population trends. These are complemented by survey and modelling studies undertaken for specific locations, such as that for TCE, characterising seabird use of the PFOW in areas considered for potential renewables development.</p> <p>Research into the connectivity between seabirds and offshore renewables developments is ongoing, and has involved numerous studies undertaken for Marine Scotland and TCE, amongst others. Like previous research to date, this work largely looks at measuring the risk of collision, potential effects on breeding at SPAs, and the likelihood of avoidance of some seabird species with specific technologies, including devices at operating test sites in Scottish waters.</p> <p>Other potential impacts such as the effects of underwater noise are also the subject of current research, including several studies being undertaken by SAMS and TCE.</p>	<p>Further understanding of seabird and diving bird collision risk and likelihood of impacts, particularly relating to emerging wave and tidal technologies.</p> <p>Further understanding of potential displacement effects associated with offshore renewables technologies, particularly emerging wave and tidal technologies.</p> <p>Collision and displacement modelling and monitoring as part of project level EIA for specific renewable technologies may also be beneficial.</p>
	Marine mammal and fish collision and displacement risk.	<p>Most research undertaken to date has targeted species distributions. Continuing cetacean distribution monitoring has been largely based upon sighting and survey information obtained from sources such as specific sightings programmes and by-catch monitoring (e.g. Sea Mammal Research Unit (SMRU), Seawatch, SNH). Similar programmes have been undertaken for seals, including species abundance and behaviour assessments undertaken by SNH in SAC site conditioning surveys, and Grey and Harbour seal population and</p>	<p>Improved understanding of distribution and migratory routes of marine species in Scottish waters, particularly cetaceans, elasmobranchs and migratory fish (e.g. Atlantic salmon).</p> <p>Improved understanding of the potential for collision and displacement impacts for marine fauna, particularly relating to emerging wave and tidal technologies.</p>

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
		<p>behaviour research being undertaken by SMRU.</p> <p>Fish monitoring is undertaken by MSS, with important programmes involving catch, trawler and pelagic surveys amongst others. Programmes such as WFD assessments undertaken by SEPA, also investigate river basin fish abundance and morphology in water bodies.</p> <p>Surveys for other species such as Basking sharks, seals and Marine turtles, are based upon both reported sightings in Scottish waters and targeted surveys. For example, the MCS Basking shark project identified a number of surface feeding 'hotspots', and complements similar Marine Scotland and TCE programmes working towards determining the distribution of these important creatures.</p> <p>Current research programmes are more wide reaching, with several including both encounter rate modelling and cetacean entanglement with renewables devices in their remit. However, there remain significant data gaps and uncertainties in relation to the potential for adverse effects on mammal and fish species from marine renewables technologies.</p>	
	EMF effects on elasmobranchs and fish from submerged transmission infrastructure.	<p>Little evidence into the EMF sensitivity of species such as elasmobranchs and migratory fish has been developed to date.</p> <p>There may be the potential to expand future studies into the population and distribution features of Basking sharks in Scottish waters to include issues such as sensitivity to EMF, disturbance and construction noise.</p>	Research and project monitoring to improve understanding of the potential effects of EMF on marine fauna, particularly Basking sharks and fish species (i.e. Atlantic salmon).
	Impacts to benthic habitats.	SNH currently undertake Site Condition Monitoring of protected areas (e.g. SACs) to detect trends in the condition of threatened marine habitats and benthic species within the national and international site series. These surveys complement targeted benthic survey programmes such as those by Marine Scotland	<p>Targeted monitoring of impacts on benthic habitats at the project level for proposed renewables development.</p> <p>Improved understanding of the potential benthic effects associated with of construction and</p>

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
		<p>looking at seabed disturbance from marine activities (e.g. dredging, trawling, etc.), the Deep Sea Benthic Biodiversity and Northern UK Intertidal Communities Surveys by SAMS, the Marine Biodiversity and Climate Change (MarClim) programme, and WFD operation and surveillance monitoring by SEPA, each with benthic monitoring components.</p> <p>Project level assessments (i.e. HRA and EIA) and ongoing monitoring programmes will have the potential to determine on-site effects of a particular development, and inform future assessments and located in proximity whilst also aiding the understanding of impacts associated with specific renewable technologies.</p>	operation of renewables development, and the extent of adaptation of benthic communities to such works.
	Effects on protected areas and species.	<p>SNH currently undertake Site Condition Monitoring of protected areas (e.g. SACs) to detect trends in the condition of threatened habitats and species within the national and international site series. These surveys are complemented by other surveys such as the Deep Sea Benthic Biodiversity Survey by SAMS, the MarClim programme, and WFD Operation and Surveillance Monitoring by SEPA, which may facilitate the identification of impacts associated with renewables development on designated areas and species.</p> <p>Ongoing project level assessments and monitoring (i.e. HRA and EIA) would add to these overarching programmes. Project monitoring has the potential to provide evidence of effect, if any, from offshore renewables development on nearby protected features.</p>	<p>Targeted monitoring of effects, either beneficial or adverse, of renewables technologies on protected sites and species.</p> <p>Improved understanding of the potential effects on habitats and species due to the construction and operation of renewables developments, and the extent of adaptation of these habitats and species to such works.</p>
Population and Human Health	Displacement of recreational boating.	Royal Yachting Association Scotland (RYAS) currently monitor recreational cruising and sailing activities in Scotland, and complement other studies such as those undertaken by Sailing and Tourism Scotland, which investigate the overall economic benefits of sailing tourism in Scotland.	<p>Continued monitoring of recreational boating activities in Scottish waters.</p> <p>Targeted consideration of displacement at the project level, including socio-economic aspects if</p>

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
		<p>A planned study proposed by Visit Scotland, RYAS and Sea Anglers Conservation Network (SACN) to determine the spatial extent and economic activity on tourist activities such as including sea angling and water sports, has the potential to inform future renewables development.</p> <p>The potential displacement of recreational activities will likely be a consideration in project-level assessment of prospective developments.</p>	appropriate.
	Disruption to commercial shipping.	<p>Maritime transport statistics such as tonnages, vessel numbers utilising Scottish ports and travelling through Scottish waters, and Automatic Identification System (AIS) traffic data is routinely collated by organisations such as the MCA and Lloyds List Intelligence. There may be the opportunity to use this collated data to monitor shipping impacts, and identify potential disruption to shipping routes associated with offshore renewable developments.</p> <p>A planned survey project involving TCE and the MCA amongst others may add to this data and also identify the need for setting priority areas for shipping and renewables.</p>	<p>Continued monitoring of maritime transport figures and traffic routes in Scottish waters.</p> <p>Targeted consideration of shipping displacement at the project level, including socio-economic aspects if appropriate.</p>
	Increase in collision risk associated with development siting.	<p>Marine incident monitoring programmes, such as those run by the Marine Accident Investigation Branch (MAIB), provide detailed data on vessel collisions and groundings within UK waters. While these figures also include fatality information when applicable, other sources such as the National Water Safety Forum, also collate and report on water-related fatality data. While neither provide detail on collision risk, both are likely to be important sources of data to identify and monitor potential changes in incident occurrence that may be associated with collisions with offshore renewables infrastructure and service vessels.</p> <p>The reporting of collision incidents associated with the</p>	Continued monitoring of collision incidents, including project-level reporting of collisions and near-miss events to identify the potential for increased collision occurrence, and potentially identify 'hotspots' for such incidents.

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
		construction and operation of offshore renewables developments in accordance with standard health and safety practices, would likely be beneficial in identifying the likelihood of incidents at the project level.	
Water and the Marine Environment	Water quality impacts from construction and operation of offshore renewables.	<p>Current programmes such as the monitoring and classification of coastal and transitional waters by SEPA, developed to meet Scotland's the requirements of the WFD, are likely to be the primary source of data in relation to water quality. Other more localised programmes, such as monitoring of Bathing Water status and Shellfish Water classification, may also provide some spatial perspective into water quality monitoring. However, they are unlikely to be sufficient to monitor localised impacts from offshore renewables development works.</p> <p>Undertaking ongoing monitoring at the local level will likely add to the existing overarching programmes, with the potential to provide evidence of the likelihood of effects of offshore renewables and construction impacts on local water quality. This may also aid future decision-making and inform future developments in nearby areas.</p>	Monitoring of water pollution incidents during the construction and operation of renewable developments may be beneficial.
Climatic Factors	Contribution of renewable developments to meeting renewable energy targets.	<p>The Scottish Government currently oversees the monitoring of Scotland's renewable energy generation, and assesses performance against current energy generation targets.</p> <p>The contribution of renewable energy technologies to emissions target reductions are monitored and reported.</p>	Monitoring and reporting of electricity generation achieved by renewables developments.
	Contribution to reduction of GHG emissions.	The Scottish Government currently oversees monitoring of Scotland's renewable energy generation, and assesses performance against GHG emissions reduction targets.	Monitoring and reporting of GHG emissions reductions achieved by renewables developments.
Marine Geology and	Seabed disturbance in areas of development	At present, seabed monitoring is largely limited to protected habitats. SNH currently undertakes Site Condition Monitoring of	Improved seabed habitat characterisation and data on the status of seabed habitats would be

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
Coastal Processes	(e.g. scouring, shading, smothering).	<p>protected sites to identify trends in the condition of threatened habitats.</p> <p>Site specific monitoring is also undertaken as part of consent conditions in select areas, for example, seabed monitoring for controlled activities such as aquaculture. Targeted studies, such as those completed for Marine Scotland in the Pentland Firth and Orkney Waters (PFOW), have focused on habitat issues within specific areas considered likely for marine renewables. These studies may be suitable for inclusion as baseline data at the project level for future developments in these areas.</p> <p>The characterisation of seabed habitats is also a component of several other monitoring programmes, including MarClim and SAMS research, although these are largely biodiversity-focused rather than geological.</p> <p>Project level EIA work, and subsequent monitoring, will likely add to these overarching programmes. These may have the potential to inform future developments in the nearby area, and also provide evidence on the likelihood of effects on designated sites from construction and operations of offshore renewables developments.</p>	<p>beneficial.</p> <p>Project-level seabed assessment and monitoring during construction and operation would be beneficial.</p>
	Disturbance of contaminants present in seabed sediments.	<p>Marine Scotland undertakes a regular monitoring programme of sea disposal sites and records are maintained of the material deposited. However, outwith these locations most seabed contamination is likely to be unknown prior to disturbance.</p> <p>Project level EIA work and subsequent project monitoring will likely be the primary source of data on contaminant disturbance and monitoring adverse effects.</p>	<p>Consideration of contamination disturbance and project level assessment and monitoring of the seabed during construction and operation would be beneficial.</p>
	Changes to sediment dynamics and coastal processes from presence	<p>Monitoring at the local level and the development of plans by many local authorities around Scotland, such as Shoreline Management Plans and Local Development Plans, provide the</p>	<p>Continued monitoring of coastal erosion in the vicinity of offshore renewables development may be beneficial in identifying visible impacts.</p>

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
	of devices.	<p>means for local identification of coastal impacts.</p> <p>Project level EIA and ongoing monitoring, may be useful in identifying potential changes and resulting coastal impacts.</p>	<p>Project-level assessment and monitoring of coastal processes during construction and operation would also be beneficial.</p>
	Increase in coastal erosion/accretion due to presence of devices.	<p>Existing climate change monitoring and projection programmes, such as the UK Climate Projections, consider coastal erosion and accretion issues. Monitoring at the local level via programmes, such as the adoption of Shoreline Management Plans by many local authorities around Scotland, provide a means of identification and action against coastal erosion at the local level.</p> <p>Monitoring of individual offshore renewables projects may also identify potential coastal effects.</p>	<p>Continued monitoring of coastal areas, particularly in the vicinity of offshore renewables development, may be beneficial in identifying erosion and accretion effects.</p> <p>Project-level assessment and monitoring of effects such as coastal changes near offshore renewables development, would likely be beneficial.</p>
Historic Environment	Physical damage to marine archaeology and historic assets in coastal areas.	<p>The listing and scheduling of historic assets is carried out by Historic Scotland who also oversee the monitoring of scheduled monuments including those in coastal and marine areas. The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) also carry out threatened buildings studies to enhance their national database of Scotland's Places (Canmore). Coastal monitoring programmes such as the Shorewatch programme co-ordinated by the SCAPE Trust also monitor the condition of a wide range of archaeological sites around Scotland's coastline. In addition, local communities often report damage to sites or monuments and can help to identify local pressures.</p> <p>However, there are significant data gaps in relation to coastal and marine asset monitoring data.</p>	<p>Continued monitoring on coastal assets may be beneficial.</p> <p>Project-level assessment and monitoring of nearby coastal and marine archaeological sites during construction and operation is likely to be beneficial.</p>
	Effects on setting of historic assets in coastal areas.	<p>Changes to the setting of historic sites in the coastal environment are likely to be location-specific. However, previous investigations including those for other renewables developments in close proximity to a proposed development,</p>	<p>Project-level assessment of potential impacts to the setting of historic sites is likely to be required for offshore renewables developments,</p>

SEA Topic	Significant Environmental Effects	Summary of Current Monitoring	Monitoring Required
		<p>may aid in the consideration of setting issues.</p> <p>It is likely that project level EIA will consider the setting of historic assets located in proximity to a prospective development, if any.</p>	<p>particularly for wave and wind technologies.</p>
Landscape and Seascape	Effects on landscape and seascape from offshore renewables developments.	<p>Impacts on landscape and seascape value on an area as a result of offshore development are likely to be location-specific. Broad seascape studies, such as the planned seascape assessment of the PFOW associated with planned renewable activities managed by Marine Scotland and TCE, amongst others, may form a key resource for the consideration of these issues within these areas. Similarly, previous EIA investigations in the vicinity of a development, may aid consideration of such issues.</p> <p>It is likely that project level EIA investigations will consider the potential for landscape/seascape impacts for all prospective developments.</p>	<p>Project level assessment and modelling of potential landscape/seascape impacts may be required for many offshore renewables developments, particularly if located near to recognised scenic areas, and involving wave and wind technologies.</p>

8 Next Steps

8.1 Timescale for the Assessment

8.1.1 This Environmental Report has informed the conclusions of the Sustainability Appraisal Report, and both of these alongside the draft plans are subject to a 16 week statutory consultation period. At the end of the consultation process, the views of stakeholders and the public on the plans and assessment work will be analysed. In light of these comments, the Plans will be reviewed, updated and finalised. If significant changes are made to the Draft Plan Options, the SEA will be reviewed in order to consider whether any further work will be required.

8.1.2 After consultation and analysis has been concluded an SEA Post Adoption Statement will be produced, detailing:

- How sustainability considerations have been integrated into the plans;
- How the sustainability appraisal and technical reports have been taken into account;
- How consultee opinions have been taken into account;
- The reasons for choosing the plan or programme as adopted, in the light of the other reasonable alternatives considered; and
- Measures to be used to monitor the significant effects of the plan.

8.1.3 The production of a Post Adoption Statement fulfils the requirements of the Environmental Assessment (Scotland) Act 2005 and will be available alongside the final plans. At this stage, the plans are anticipated for adoption in early 2014.

8.2 Details of the Consultations

8.2.1 Consultation on the Environmental Report, draft plans, the Sustainability Appraisal, is now open and will run for a period of 16 weeks closing on the 13th November 2013. Consultees are able to view the key documents:

- On the Scottish Government website;
- At the Scottish Government office at Victoria Quay, Edinburgh; and
- At the Scottish Parliament, Edinburgh.

8.2.2 Only written representations to the documents can be considered, however there are three ways consultees will be able to respond:

- Following the 'Consultation Response' button on the consultation web page of the Scottish Government website
<http://www.scotland.gov.uk/consultations>;

- By email to offshorerenewableenergy@scotland.gsi.gov.uk; or
- By post to Offshore Renewables Energy Planning, Marine Scotland, Policy and Planning, Area 1-A (South), Victoria Quay, Edinburgh EH6 6QQ.

8.2.3 Throughout the 16 week consultation period, Marine Scotland will be holding a series of open meetings for stakeholders and members of the public to raise awareness of, and encourage further discussion on the Draft Plans and the Sustainability Appraisal. The locations and timings will be made available on the Scottish Government website.

8.2.4 While Marine Scotland will seek to capture all views expressed during the workshops, formal representations will not be accepted verbally. These will only be accepted in writing, as outlined above.

Stakeholder events

8.2.5 Marine Scotland will engage with key national stakeholders in a series of sectoral workshops, focusing on the key sectoral interests including:

- Environment;
- Shipping and Navigation;
- Ports and Harbours;
- Recreation and tourism;
- Renewables and grid industry; and
- Fishing, fisheries management and aquaculture.

8.2.6 Marine Scotland will contact key stakeholders in the coming months regarding the arrangements for these workshops.

Public events

8.2.7 Marine Scotland will hold a series of open events to engage with members of the public throughout August and September 2013. These will take the form of an afternoon drop in session, followed by an evening presentation to provide more in-depth information for those who are interested in the detailed aspects of the Plans and their assessments. These events will:

- Outline the consultation process and how to provide a response;
- Raise awareness of the Draft Plans that have been developed;
- Set out how the Initial Plan Options, RLG and consultation have been used to identify options for the planning process;
- Explain how we have assessed the economic, social and environmental impact of these options; and
- Outline how the Draft plans will be used.

8.2.8 The events will be advertised nationally (online and in the press) and locally using local press and existing networks and organisations, where possible. Consultees will not be required to sign up in advance or sign in on the day.

8.3 Questions for Consultees

8.3.1 Consultees may find the following questions helpful to provide a focus for their responses:

1. To what extent does the Environmental Report set out an accurate description of the current environmental baseline (Please give details of additional relevant sources)?
2. Do you agree with the predicted environmental effects of the plans as set out in the Environmental Report?
3. Do you agree with the recommendations and proposals for mitigation of the environmental effects set out in the Environmental Report?
4. Are you aware of any additional ongoing research or monitoring that may help to fill gaps in the evidence base, particularly relating to the marine environment and its interactions with renewable energy devices (Please give details of additional relevant sources)?
5. Are you aware of any further environmental information that will help to inform the environmental assessment findings (Please give details of additional relevant sources)?

8.3.2 Responses need not be confined to these questions. More general comments on the Environmental Report and relevant documents are also invited.

9 Appendix A: Relevant Environmental Protection Objectives

Plan, Programme or Strategy	Objectives	Implications / Comments
Biodiversity, Flora & Fauna		
<i>International</i>		
UN Convention on Biological Diversity (1992)	<p>The three main objectives of the UNCBD are:</p> <ul style="list-style-type: none"> • the conservation of biodiversity; • the sustainable use of biodiversity; and • the sharing of benefits from the use of genetic resources (including by appropriate access to these resources). <p>Article 6 requires that all parties to the Convention develop national biodiversity strategies, plans or programmes, and that they seek to integrate the provisions of these across other policy sectors. Article 7 requires the identification of key resources and their protection. Monitoring of potentially damaging processes and activities should also be undertaken. To establish representative networks of protected areas in the maritime environment by 2012.</p>	This broader framework sets the context within which specific environmental protection objectives have been developed. The principles defined within the Convention should be supported by the plan.
Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979	Aims to conserve terrestrial, marine and avian species through international co-operation.	As with the previous Convention, these conservation objectives should be taken into account in the development of the plan.
Convention on Wetlands of International Importance 1971 (amended 1982/87)	Otherwise known as the Ramsar Convention, this emphasises the special value of wetland, particularly as a key habitat for waterfowl. The Convention resulted in designation of sites for management and conservation.	The plan should uphold commitments to environmental protection.
Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) 1992.	The aim of the OSPAR convention is to prevent and eliminate pollution and to protect the maritime area against the adverse effects of human activities. The Convention led to establishment of a cross-regional commission promoting an ecosystems approach to marine management, including establishment of a network of MPAs. Its five work areas are biodiversity and ecosystems, eutrophication, hazardous substances, offshore industry, and radioactive substances). Climate change is also a key cross-cutting theme. Also includes a Biological Diversity and Ecosystems Strategy.	The ecosystems approach to marine planning should be taken into account within the development of the plan.

Plan, Programme or Strategy	Objectives	Implications / Comments
Agreement on the Conservation of African-Eurasian Migratory Waterbirds 1995 (AEWA)	An independent international treaty developed under the auspices of the UNEP/Convention on Migratory Species. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including species of divers, grebes, cormorants, herons, ducks, swans, geese, waders, gulls, and terns. An action plan addresses issues including: species and habitat conservation, management of human activities, research, monitoring, education and implementation.	The plan should take into account the priority afforded to protect bird species which are present within the Scottish terrestrial, coastal and marine environment.
Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas 1992 (ASCOBANS)	An agreement on the protection of small cetaceans, noting that the migratory nature of dolphins, porpoises and whales means that they can be vulnerable to a range of marine activities and issues.	As noted above, the high priority given to protection of these species should be taken into account in the development of the plan.
UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks 2001	Sets out principles for the conservation and management of specified fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information. The Agreement elaborates on the fundamental principle, established in UNCLOS, that States should co-operate to ensure conservation and promote the objective of the optimum utilisation of fisheries resources both within and beyond the exclusive economic zone.	The plan should avoid conflicting with the aims of conserving and managing fish stocks.
International Plan of Action for the Conservation and Management of Sharks 1999	The objective of the IPOA-SHARKS is to ensure the conservation and management of sharks and their long-term sustainable use. Scotland has over 30 species of sharks, skates and rays recorded in its waters of which 25 are found in coastal waters, of which a high proportion are already or nearly at risk.	The high level of protection afforded to sharks should be taken into account within the plan.
UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks 2001	Sets out principles for the conservation and management of specified fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information. The Agreement elaborates on the fundamental principle, established in UNCLOS that States should co-operate to ensure conservation and promote the objective of the optimum utilisation of fisheries resources both within and beyond the exclusive economic zone.	The plan should avoid conflicting with the aims of conserving and managing fish stocks.
<i>European</i>		
Council Directive 92/43/EEC	Established a commitment to designating networks of sites of ecological	The plan should take into account

Plan, Programme or Strategy	Objectives	Implications / Comments
on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) as Amended by Council Directive 97/147/EC	importance across Europe. These are known as Natura 2000 sites and include SPAs (designated under the Birds Directive – see following paragraph) and SACs.	the potential effects of site development on the network of Natura 2000 sites. Commitments to protecting habitats and species should be upheld within the plan.
Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive)	Protects all wild birds (together with their nests and eggs) and their associated habitats. Commitment to designation of SPAs (included in Natura 2000 sites - see preceding paragraph).	Objectives to protect important species and habitats, including internationally designated sites, should be supported within the plan.
Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979)	Aimed to promote co-operation between European states to protect biodiversity.	The broader framework for environmental protection across Europe should be supported by the plan.
The Pan-European Biological and Landscape Diversity Strategy (1995)	The Strategy aims to reverse the decline of landscape and biological diversity, by promoting innovation and proactive policy making. It supports preceding measures for protecting natural heritage, and aims to supplement this by further promoting a number of action themes relating to different environmental resources. Emphasises the rapid decline of some key characteristics and resources, including traditional human-made landscapes, coastal zones, marine areas, wetlands, mountains and grassland.	The SEA should help to deliver these broader objectives by ensuring that key areas and resources are protected in the plan.
EU Biodiversity Strategy (2011)	The Strategy runs until 2020, and focuses on six priority targets and related measures. These are aimed at: enforcing EU laws protecting birds and habitats; maintaining and improving ecosystems - restoring at least 15% of areas that have been damaged; getting farming and forestry to help improve biodiversity; ensuring sustainable use of fisheries resources by reducing catches to scientifically determined limits by 2015 - 88% of the EU's fish stocks are currently over-exploited or are significantly depleted; combating alien species that invade habitats - and currently threaten 22% of the EU's indigenous species; stepping up the EU's contribution to preventing global biodiversity loss.	The plan should support these objectives by taking into account biodiversity protection and enhancement, within and outwith formally protected areas.
<i>United Kingdom</i>		
Wildlife and Countryside Act 1981	Provides the framework for protection of species other than European Protected Species. Sets out protection objectives for specified birds and wild animals. The Act's various schedules detail the species that are protected	The plan should take into account the particular protection afforded to key terrestrial, coastal and marine

Plan, Programme or Strategy	Objectives	Implications / Comments
	under the Act, including dolphins, porpoises, and numerous birds such as geese and ducks. This was reviewed and updated in December 2008 and it was recommended that several further species of marine fish should be added to the lists attached to the Act, including shark, seahorse and ray species.	species.
The Conservation (Natural Habitats, &c) Regulations 1994	Transposes the requirements for protection of designated sites under the Habitats and Birds Directives, and the framework for protection of European Protected Species. Applies within 12nm. Several marine species are protected by various development consenting regimes covered by the Act. This includes marine turtles, all species of dolphins, porpoise and whale, seals and several types of marine fish (Atlantic salmon, Barbel, etc.).	The plan should take into account the particular protection afforded to key terrestrial, coastal and marine species.
The Offshore Marine Conservation (Natural Habitats, &c) Regulations 2007 (the Offshore Marine Regulations)	The Regulations extend protection to important species and habitats under the Birds and Habitats Directives beyond UK territorial waters (i.e. outside 12 nm). Give protection to marine species, wild birds and habitats, mainly through the creation of offences and site protection mechanisms. Provide the definition of deliberate disturbance applicable to cetaceans, turtles and the Atlantic sturgeon	The plan should recognise and support the protection of important marine species and sites which form part of the Natura 2000 network.
Conserving Biodiversity – the UK Approach (2007)	A framework document for biodiversity identifies six priorities for implementing biodiversity objectives within the integrating framework of an ecosystem approach: <ul style="list-style-type: none"> • protecting the best sites for wildlife; • targeting action on priority species and habitats; • embedding proper consideration of biodiversity and ecosystem services in all relevant sectors of policy and decision-making; • engaging people, and encouraging behaviour change; • developing and interpreting the evidence base; • ensuring that the UK plays a proactive role in influencing the development of Multilateral Environmental Agreements, and contributes fully to their domestic delivery. 	Emphasises an ecosystem approach to managing biodiversity, and recognises the need to allow for the impacts of climate change within the network of marine protected areas.
Conservation of Seals Act 1970	Provides for the protection and conservation of seals in and in adjacent territorial seas. The Habitats Directive and the 1994 Regulations (see above) introduced additional measures for the protection of seals.	Protection of seals should be taken into account in the development of the plan.
<i>Scotland</i>		
Nature Conservation (Scotland) Act 2004	Introduced a ‘duty to further the conservation of biodiversity’ for all public bodies, and sets out more specific provisions within this including for Sites of Special Scientific Interest. Also states a requirement for the preparation of a	Biodiversity protection objectives cover the coast and the immediate offshore environment. The plan

Plan, Programme or Strategy	Objectives	Implications / Comments
	Scottish Biodiversity Strategy, to which all public bodies should pay regard. Applies to 12nm around Scotland and includes protection measures for marine species.	should seek to contribute positively to biodiversity protection objectives.
Scotland's Biodiversity – It's In Your Hands. A strategy for the conservation and enhancement of biodiversity in Scotland (2004)	Sets out Scottish aims relating to biodiversity over 25 year period. Seeks to go beyond a previous emphasis on protecting individual sites to achieve conservation at a broader scale. Aims to halt loss and reverse decline of key species, to raise awareness of biodiversity value at a landscape or ecosystem scale, and to promote knowledge, understanding and involvement amongst people. The Strategy notes the importance and health of Scotland's ecosystems, and summarises key trends.	The plan should note and aim to support recognised ecosystems. Where feasible operations and disturbance should be steered away from the most sensitive parts of the coastal and marine environment as noted in the biodiversity strategy.
A Consultation on the 2020 Challenge for Scotland's Biodiversity (2012)	<p>The consultation paper is focused on desired outcomes for 2020 in response to the European Union's Biodiversity Strategy for 2020 and the 'Aichi Targets' set by the United Nations Convention on Biological Diversity. These call for a step change in efforts to halt the loss of biodiversity and restore the essential services that a healthy natural environment provides. The document aims to:</p> <ul style="list-style-type: none"> • increase the general level of biodiversity on land and in our seas, and support healthy, well-functioning ecosystems; • engage people with the natural world, for the health and well-being benefits that this brings, and empower them to have a say in decisions about their environment; • maximise the benefits for Scotland of a diverse natural environment and the services it provides, contributing to sustainable economic growth. <p>The consultation includes a section on the Marine environment seeking to protect marine and coastal biodiversity and maintain marine productivity.</p> <p>The strategy paper that follows the consultation in summer 2013 will form part of the Scottish Biodiversity Strategy, alongside the 2004 document. This would make it relevant to public bodies' biodiversity duty under the Nature Conservation (Scotland) Act 2004.</p>	The plan should help to maintain and enhance marine and coastal biodiversity
A Fresh Start: The renewed Strategic Framework for Scottish Aquaculture (2009) (SFSA)	The Strategic Framework for Scottish Aquaculture (SFSA) is based on three guiding principles; economic; environmental; and social. It is the main policy instrument to deliver a diverse, competitive but sustainable aquaculture industry in Scotland and provides a set of parameters within which industry can	The aims for the industry and associated environmental protection issues should be taken into account in the development of the plan.

Plan, Programme or Strategy	Objectives	Implications / Comments
	balance socio-economic benefits against environmental impact.	
Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	This Act allows for the Salmon Conservation Regulations to be made where it is considered necessary to do so for the conservation of salmon e.g. relating to fishing in the sea, estuaries or rivers.	The Regulations should be taken into account within the plan, with particular recognition of their potential role in assumed or proposed mitigation of possible environmental effects.
Aquaculture and Fisheries (Scotland) Act 2007	Covers fish farms and shellfish farms, refers to operational issues and covers both freshwater and sea fisheries. Covers payments relating to aquaculture and fisheries.	The plan should take into account operational issues relating to aquaculture as part of its broader context.
Scottish Aquaculture: A Fresh Start: A Consultation on a Renewed Strategic Framework for Scottish Aquaculture (2008)	Consultation updating the existing aquaculture strategy. This includes five main themes: health, improved systems and finance for new developments, reduced escapes, and improved image and marketing.	As above. The updated policy may provide a different emphasis to the established policy as it emerges.
Population and Human Health		
<i>United Kingdom</i>		
Food and Environment Protection Act 1985	Part II protects the marine ecosystem and human health by controlling the deposit of articles or materials or scuttling of vessels in the sea or tidal waters.	The plan should contribute to the protection of health via the marine environment.
<i>Scotland</i>		
Land Reform (Scotland) Act 2003	Set out a new right of responsible access in Scotland, and made provisions for community right to buy. Core paths to be identified in each local authority area and identified in an adopted plan, promoting more widespread functional and recreational walking, cycling and riding and thereby supporting improved levels of physical activity.	Focuses on access to land and inland water bodies. The plan should ensure that developments do not adversely impact on areas or activities of particular interest to recreational users.
Scottish Marine Wildlife Watching Code	Sets out a code of conduct for recreational operators and users when wildlife watching at sea. Aims to minimise disturbance to marine wildlife.	The principles are relevant in setting the broader context for the plan.
Water		
<i>International</i>		
IMO International	Aims to prevent marine pollution from ships and in part from oil rigs and	The plan should be developed

Plan, Programme or Strategy	Objectives	Implications / Comments
Convention for the Prevention of Pollution from Ships 1973 (MARPOL)	production platforms. It includes annexes covering pollution by oil, noxious liquids, harmful substances, sewage, garbage and air pollution. Recent changes focus on reducing the sulphur content and particulate emissions from fuel in the shipping sector.	taking into account the broader protection provided by the convention.
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990	Provides a framework for international co-operation in combating major incidents or threats of marine pollution.	The plan should be developed taking into account the broader protection provided by the convention.
London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (as amended)	Prohibits the dumping of certain hazardous materials, requires a prior special permit for the dumping of a number of other wastes, and a prior general permit for other wastes or materials. It also creates a basis in international law to allow and regulate carbon capture and storage (CCS) in sub-seabed geological formations.	The plan should support the protection of the marine environment from waste.
<i>European</i>		
Water Framework Directive 2000/60/EC	This provides an overarching strategy, including a requirement for EU Member States to ensure that they achieve 'good ecological status' by 2015. RBMPs were defined as the key means of achieving this. While the recent Marine Strategy Directive (MSD) will extend coverage of coastal waters beyond 3nm, Good Chemical Status already applies beyond this limit.	The WFD sets out an overarching framework that aims to ensure that good ecological status is met by 2015.
<i>United Kingdom</i>		
The Merchant Shipping Regulations 2009	Enhances marine protection through stricter regulation of pollution from ships.	Recognises the importance of protecting the water quality of the marine environment.
Merchant Shipping Act 1995	General provisions for merchant shipping, seamen, and safety. Part VI focuses on prevention of pollution, including oil pollution. Sets out responsibilities and liabilities. Also covers international incidents. Other issues include lighthouses, salvage and wrecks.	This contributes to the regulatory context within which the plan should be developed.
Environmental Protection Act 1990	Covers pollution control and waste management. Also covers litter, radioactive substances and genetically modified organisms. Pollution at sea is specifically controlled.	This forms an important regulatory context within which the plan should be developed.
<i>Scotland</i>		
Environmental Liability (Scotland) Regulations 2009	Covers incidents of significant damage to biodiversity, water or land. In accordance with the European Environmental Liability Directive (2004/35/EC), aims to apply the polluter pays principle by requiring restoration in such	This forms an important regulatory context within which the plan should be developed.

Plan, Programme or Strategy	Objectives	Implications / Comments
	instances.	
Water Environment and Water Services (Scotland) Act 2003 (WEWS Act)	Transposes the Water Framework Directive into the Scottish context. Aims to protect the water environment by ensuring a reliable and high quality supply of water, reducing groundwater pollution, and protecting marine and other waters.	The plan should support the protection of the water environment.
The Water Environment (Controlled Activities) (Scotland) Regulations 2011	Sets out the process by which activities that have the potential to affect Scotland's water environment are regulated. Authorisation under the Controlled Activities Regulations (CAR) is required for discharging to waters, disposal of pollutants to land, abstractions, impoundments and engineering works affecting water bodies.	The CAR provides an important tool for mitigating adverse effects on the water environment. This should be taken into account within the plan.
Pollution Prevention and Control (Scotland) Regulations 2000	Implements Directive 96/61/EC (Integrated Pollution Prevention and Control). Regulating industrial and commercial activities which may cause environmental pollution and to prevent and control emissions that are capable of causing any pollution.	The plan should take into account wider pollution prevention measures relating to the water environment.
Scottish Executive Environment Group (2002) Scotland's Bathing Waters A Strategy for Improvement	Aims to reduce water pollution in order to specifically improve bathing water catchments. Measures include changes to agricultural practices to address diffuse pollution, ensuring compliance with controls of industrial discharges, and making more use of Sustainable Urban Drainage Systems (SUDS).	The importance of bathing water quality should be taken into account and supported as far as possible within the plan.
Bathing Waters (Scotland) Regulations 2008	Implements the Bathing Waters Directive (2006/7/EEC) which aims to protect the public and the environment from pollution of waters used for bathing by large numbers of visitors. Achieves this by making information on quality public, and setting standards to be met by 2015.	The importance of protecting water quality in recognised bathing locations should be taken into account and supported by the plan.
Marine (Scotland) Act 2010	Provides a framework aimed at managing the competing demands on Scotland's seas. The main measures include: <ul style="list-style-type: none"> • a new statutory marine planning system to sustainably manage the increasing demands on Scottish waters; • a simpler marine licensing system; • improved marine nature and historic conservation with new powers to protect and manage areas of importance; • improved protection for seals and a new comprehensive licence system to ensure appropriate management when necessary; and • a range of enhanced powers of marine conservation and licensing. 	This forms an important regulatory context within which the plan should be developed.
Flood Risk Management (Scotland) Act 2009	Replaces the Flood Prevention (Scotland) Act 1961, and introduces a more sustainable and modern approach to flood risk management, suited to manage	This forms an important regulatory context within which the plan should

Plan, Programme or Strategy	Objectives	Implications / Comments
	<p>the impact of climate change. Creates a more joined up and coordinated process to manage flood risk at a national and local level. The main measures include:</p> <ul style="list-style-type: none"> • a framework for coordination and cooperation between all organisations involved in flood risk management; • assessment of flood risk and preparation of flood risk management plans; • new responsibilities for SEPA, Scottish Water and local authorities in relation to flood risk management; • a revised, streamlined process for flood protection schemes; • new methods to enable stakeholders and the public to contribute to managing flood risk; and <p>a single enforcement authority for the safe operation of Scotland's reservoirs.</p>	be developed.
Climatic Factors		
<i>United Kingdom</i>		
Electricity Act 1989	Provides the legislative background within which the energy sector functions. Sets out the framework within which applications for marine energy development should seek consent. Related regulations define EIA responsibilities.	The plan should be recognised as fitting within a broader consenting framework, with more detailed applications and environmental assessments being required at the project level.
Energy Act 2004	Covers the civil nuclear industry, sustainability and renewable energy sources. Aims to achieve diversification of supply in favour of renewable sources. Augments the system for determining developments within territorial waters. Provided the Crown Estate with rights to license the generation of renewable energy and grant leases for development sites out to 200nm.	The broad aims and more specific requirements of the legislation should be taken into account within the development of the plan.
<i>Scotland</i>		
Climate Change (Scotland) Act 2009	The Climate Change (Scotland) Act 2009 includes a greenhouse gas emissions reduction target of 80% by 2050 and an interim target of 42% by 2020. Proposals include setting of targets for 2050 and interim periods, requirement for annual reporting, and provisions for meeting targets through additional policies and legislation. The targets include emissions from the aviation and shipping sectors.	The Plan is being developed in order to contribute to these overarching targets. The assessment will explore impacts on climatic factors.

Plan, Programme or Strategy	Objectives	Implications / Comments
Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022 (2011) and Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027 (2013) (the first and draft second climate change report on proposals and policies)	The reports set out the proposals and policies required to meet Scotland's targets for climate change mitigation included in the Act (above). Includes commitments to the development of the renewable energy sector.	The assessment will consider the broader suite of committed action on climate change.
Climate Change Sector Adaptation Action Plan: Marine and Fisheries (2011)	Sets out a number of objectives including raising awareness of climate change to the wider marine stakeholder community (through the Marine Strategy Forum). Also aims to build evidence to support future adaptation action and build further policies that respond to impacts.	The Plan and its assessment should take into account the need to adapt to the impacts of climate change in the future.
Climate Ready Scotland: Scottish Climate Change Adaptation Programme (Consultation Draft) 2013	Currently out to consultation, the Programme addresses the impacts identified for Scotland in the UK Climate Change Risk Assessment (CCRA) published under section 56 of the UK Climate Change Act 2008. It sets out Ministers' objectives in relation to adaptation to climate change, targeting three key themes: the Natural Environment, Buildings and Infrastructure Networks, and Society. It outlines proposals and policies for meeting these objectives, the period within which the proposals and policies will be introduced, and setting out arrangements for wider engagement in meeting these objectives.	The Plan and its assessment should take into account the commitment to adapt to the impacts of climate change.
Marine Geology and Coastal Processes		
<i>Scotland</i>		
Scottish Soil Framework 2009	Provides an overarching policy framework for protection of soils in Scotland, in line with European Directive. Relates largely to the onshore environment, but this includes coastal areas and the principles are applicable more widely.	The plan should consider potential effects on onshore soil resources. Issues will primarily arise in terms of impacts on coastal zones.
Historic Environment		
<i>International</i>		
UNCLOS 1982 was ratified by the UK in 1997	Article 303 stipulates that 'states have the duty to protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose' and provides for coastal states to exert a degree of control over the	The plan should support commitments to protect the offshore historic environment.

Plan, Programme or Strategy	Objectives	Implications / Comments
	archaeological heritage to 24 nautical miles	
<i>United Kingdom</i>		
Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Developers (JNAPC 2008)	The JNAPC Code is voluntary but provides a framework that seabed developers can use in conducting their activities in an archaeologically sensitive manner. A guidance note on protocols to deal with the marine historic environment developed specifically for the offshore renewable energy sector has also been prepared.	The guidance should be taken into account within the plan to identify where mitigation might be assumed or practicable.
Protection of Wrecks Act 1973	The 1973 Act provides protection for designated wrecks and for the designation of dangerous sites.	The plan should take into account effects on protected wrecks.
Ancient Monuments and Archaeological Areas Act 1979	Provides for the protection of archaeological heritage, including the scheduling of 'monuments'. The Act, which is administered by Historic Scotland, primarily deals with terrestrial locations but there is provision to designate submarine sites.	The plan should ensure that, as far as possible, areas with archaeological interest are avoided and / or effects are mitigated.
Protection of Military Remains Act 1986	Identifies scope for protected places and controlled sites, covering vessels. This reflects the status of these sites as war graves.	The plan should take into account the protection afforded to these types of sites.
<i>Scotland</i>		
Scottish Historic Environment Policy (SHEP) (Updated 2011)	Provides the overarching framework for historic environment policy in Scotland, consolidating and replacing the previously separate SHEPs. Aims to promote effective conservation and to enhance enjoyment and understanding of the historic environment, linking it with the Scottish Government's central purpose. The updated SHEP includes provisions to broaden the types of sites which can be designated on the basis of their national importance, arrangements for consultation in advance of designation, and proposals for powers and provisions to allow for site maintenance.	The aims of protecting the historic environment should be taken into account in development of the plan, in particular any designated Historic MPAs.
The Marine Historic Environment Strategy for the protection, management and promotion of marine heritage 2012-15	Historic Scotland's strategy has the vision to protect and, where appropriate, enhancing the most important marine heritage assets in such a way that they can be valued, understood, and enjoyed. The aims of the Strategy are: <ul style="list-style-type: none"> • helping to advance knowledge about marine heritage and make information widely available; • improving stewardship of key marine heritage sites; and • developing wider understanding and enjoyment of marine heritage. 	The plan should take into account the Selection and designation of Historic MPAs.
Landscape and Seascape		
<i>European</i>		

Plan, Programme or Strategy	Objectives	Implications / Comments
Council of Europe, European Landscape Convention 2000	States that landscapes across Europe make an important contribution to quality of life and cultural identity, but that they are being transformed as a result of a number of factors, including town planning, transport and infrastructure and the economy. Requires Member States to develop more comprehensive frameworks to protect and enhance landscapes. Notes that landscape has no boundaries and that people are central to its management. Includes inland water and marine areas in its coverage and emphasises the importance on non-designated landscapes in addition to those which are protected.	It is important that the plan takes into account the quality and character of coastal and marine landscapes/seascapes.
<i>Scotland</i>		
SNH Natural Heritage Futures (Draft) 2008 Update: Coasts and Seas	<p>Provides baseline information and draws attention to particularly important issues, assets and changes. The key objectives are to:</p> <ul style="list-style-type: none"> • improve management, stewardship, awareness and understanding of marine ecosystems; • manage the coast in sympathy with natural processes; • safeguard and enhance the fine scenery and diverse character of coastal seascapes and landscapes; • enhance populations of over-exploited commercial fish species and ensure that fishing is sustainable; • ensure salmon fishing and other forms of aquaculture are environmentally sustainable; • improve the water quality of estuaries and seas; and • promote access to the sea and coast for public enjoyment and recreation. 	The plan should take into account these issues and objectives, including the importance of recognising the integrated character of coastal areas and seascapes.



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ISBN: 978-1-78256-744-8 (web only)

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St Andrew's House
Edinburgh
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Produced for the Scottish Government by APS Group Scotland
DPPAS14473 (07/13)

Published by the Scottish Government, July 2013

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