Planning Scotland's Seas

Developing the Socio-Economic Evidence Base for Offshore Renewable Sectoral Marine Plans in Scottish Waters

Final Report

Summary

Introduction

The Scottish Government (SG) has set a range of challenging targets for renewable energy which recognise the potential to take advantage of the extensive offshore renewable energy resources (offshore wind, wave and tidal power) available in Scottish waters and include meeting at least 30% of its total energy demand from renewable sources by 2020. To assist in meeting these targets, SG has adopted a process of sectoral marine planning to identify potential locations where commercial scale offshore renewable energy could be developed.

A series of Draft Plan Option areas for future offshore wind, wave and tidal energy development have been developed by Marine Scotland which are now subject to a 'Sustainability Appraisal' involving:

- Strategic Environmental Assessment (SEA);
- Habitats Regulations Appraisal (HRA); and
- Socio-economic Assessment.

Together, these assessments will take account of strategic social, economic and environmental considerations as well as assessing the potential effects of the Draft Plan Options of species and habitats protected by European legislation (Natura 2000).

The study reported here provides a high level socio-economic appraisal of the potential costs and benefits to activities[1] that may arise as a result of offshore wind, wave or tidal development within the Draft Plan Options as part of possible future Scottish Government plans for offshore wind, wave and tidal energy. The socio-economic assessment will contribute to informing Scottish Ministers' decisions on the content of these future energy plans.

Aims and Objectives

The aims of this study were:

- To ascertain the extent to which activities already take place in areas identified as potential plan options for offshore renewables (offshore wind, wave and tidal);
- To explore how those activities may be affected by the development of offshore renewables in the plan option areas; and
- To estimate the potential economic and social consequences arising from any potential interactions.

1 For the purpose of this study 'Activities' are defined as being those that take place in marine waters, or on the immediate foreshore.

In the context of this project, 'social impacts' are defined as distributional impacts i.e. the impact of the sets of plan options on different groups in Scotland. This includes impacts on specific locations (including individual settlements, where feasible within the scope of the project and data availability) and on specific groups within Scotland's population (including but not limited to different age groups, genders, minority groups, and parts of Scotland's income distribution).

In order to achieve these aims, the following objectives have been addressed under this study:

- Identify activities (those taking place in marine waters or on the immediate foreshore) that currently make use of or are currently projected to make use of the marine space identified as potential plan options for offshore renewables;
- Establish the intensity and value of activities taking place in plan option areas, using spatial mapping where appropriate, whilst identifying any spatial variations in intensity of use across areas;
- Establish whether and how these activities might be affected by development of offshore renewables in plan options; and
- Estimate the potential economic and social costs and benefits associated with offshore renewables being developed in the areas identified, including:
    - The potential costs associated with the impacts of the plan options on other marine activities;
    - The potential benefits associated with the impacts of the plan options on other marine activities;
    - The potential social impacts, both positive and negative, associated with the plan options;
    - The potential distribution of costs and benefits between marine activities, and between the offshore renewable energy regions.

The scope of the study has been limited to considering the costs and benefits to activities associated with potential future offshore renewables development proposed within offshore wind, wave or tidal development plans. It does not consider the potential benefits to the offshore renewables industry or to wider society associated with such development. Furthermore, while the study has sought to estimate both potential benefits and costs to relevant activities, it should be noted that supply chain benefits (such as benefits to the ports sector associated with manufacturing or operation and maintenance facilities to support offshore renewables) are excluded from the assessment owing to particular methodological challenges in seeking to assess these. These benefits will be taken into account by Scottish ministers in making decisions on offshore energy plans.

The study has been overseen by a Project Steering Group (PSG) comprising officials from within SG supported by guidance and advice from the Project Advisory Group (PAG), which comprised representatives of key stakeholder groups.

Methodology

The methodology to inform the assessment has built on previous work to assess the socio-economic impacts of offshore renewables including ABPmer et al, 2011; ABPmer & RPA, 2012a; ABPmer & RPA, 2012b and previous EIAs for offshore renewables, and has followed wider guidance on impact assessment (Scottish Government Guidance on Business and Regulatory Impact Assessment[2], Better Regulation Executive guidance on impact assessment[3] and the Green Book methodology (HM Treasury, 2003).

Development of Scenarios

The Draft Plan Option areas for offshore wind, wave and tidal development identify potential broad locations within which future arrays might be located. However, in order to provide a sufficient basis to carry out a quantitative socio-economic assessment, it was necessary to make assumptions about the potential scale (potential installed capacity), nature (the types of technologies) and timing of possible development within these Draft Plan Option areas and the location of power export cable routes. Given the inherent uncertainty in seeking to predict the scale and timing of development, a number of scenarios were developed, primarily relating to different possible scales of development within the Draft Plan Option areas, so that these uncertainties could be explored. The impacts of these scenarios were then compared against the 'do nothing' option in seeking to estimate the costs and benefits associated with offshore wind, wave and tidal development within the Draft Plan Option areas.

Three scenarios (termed 'Low Case', 'Central Case' and 'High Case') have been applied within the study relating to different scales of possible future offshore wind, wave and tidal development within the Draft Plan Option areas in the period 2020 to 2030 as follows (in terms of additional capacity beyond existing lease agreements):

- Offshore wind
  - Low Case: 3GW installed capacity
  - Central Case: 7GW installed capacity
  - High Case: 15GW installed capacity
- Wave
  - Low Case: 0.5GW installed capacity
  - Central Case: 1.25GW installed capacity
  - High Case: 2.5GW installed capacity
- Tidal
  - Low Case: 0.5GW installed capacity
  - Central Case: 1.25GW installed capacity
  - High Case: 2.5GW installed capacity

2 http://www.scotland.gov.uk/Topics/Business-Industry/support/better-regulation/partial-ssessments/BRIAGuidance/BRIAGuidance

3 http://www.bis.gov.uk/policies/better-regulation/policy/scrutinising-new-regulations/preparing-impact-assessments

The potential installed capacities were then broadly assigned to individual Draft Plan Option areas *pro rata* to the size of each area.

The timing of possible development within individual Draft Plan Option areas is particularly uncertain. For the purposes of this study, the assumption was made that the draft Plans will look to enable development within the period 2020 to 2030. Given the uncertainty surrounding the precise timing of development, it was further assumed that all construction will commence in 2023 and that all developments will become operational in 2025. While this is a simplification, for impact assessment purposes it is likely to provide a broadly similar assessment of costs and benefits to an assumption that evenly distributes development over the period 2020 to 2030. A sensitivity test was also carried out to explore how costs and benefits might vary with different assumptions on the phasing of development.

Establishing a Baseline

The following socio-economic activities have been considered within the assessment:

- Aquaculture (finfish and shellfish);
- Aviation;
- Carbon Capture and Storage;
- Coast Protection and Flood Defence;
- Commercial Fisheries (including salmon and sea trout);
- Energy Generation (this will need to cover interactions between different offshore energy devices);
- Military Interests;
- Oil and Gas (including exploration, production, interconnectors, gas storage);
- Ports and Harbours;
- Power Interconnectors (including offshore transmission networks);
- Recreational Boating;
- Shipping;
- Social Impacts;
- Telecom Cables;
- Tourism (including heritage assets);
- Waste Disposal (dredge material); and
- Water Sports (including sea angling, surfing and windsurfing, sea kayaking, small sail boat activities and scuba diving and).

Baseline information for the study has largely been drawn from ABPmer & RPA (2012a) which collated baseline information on a wide range of marine activities that may potentially interact with offshore renewables development in Scottish Waters. Some additional baseline information was also obtained, including:

- Additional fisheries data provided by Marine Scotland including provisional outputs from the Scotmap project for inshore fisheries (vessels <15m);

- Information on shipping density around the Scottish coast for 2008 (provided by the Maritime & Coastguard Agency); and
- Information on helicopter main routes (from National Air Traffic Services)

Baseline information has been presented for a consistent base year (2012) and projected forward for the period of the assessment, taking account of available information on current and future trends.

Approach to Quantification of Economic and Social Impacts

The potential for offshore wind, wave and tidal development arrays and export cables to give rise to socio-economic impacts on other activities depends on the nature and scale of interactions between them. The approach adopted therefore sought to define the potential interactions and to identify those interactions which have the potential to give rise to significant socio-economic impacts drawing on relevant previous studies and taking account of specific factors relevant to each Draft Plan Option area. Where potentially significant socio-economic impacts were identified, more detailed methods for quantifying these impacts were applied taking account of information availability (see Appendix B). Where it was not possible to prepare quantitative assessments, relevant impacts were described qualitatively.

Social impacts have primarily been identified based on a distributional analysis. Based on the quantification of economic impacts and baseline data, the study has determined which of these impacts of the sets of plan options will fall on different groups in Scotland. This has included consideration of impacts on specific locations (including individual settlements, where data availability allows) and on specific groups within Scotland's population (including, for example, different age groups, genders, minority groups, and parts of Scotland's income distribution). The approach adopted has been consistent with that put forward by the GES / GSR Social Impacts Taskforce, which is based on the 'capitals approach' of ensuring that stocks of social capital are maintained over time. The key areas of social impact identified by the Task Force include:

- Access to services;
- Crime;
- Culture and Heritage;
- Education;
- Employment;
- Environment; and
- Health.

For the purpose of this study, the combined impact of potential offshore wind, wave and tidal development within the Draft Plan Option areas has also been considered at both regional and national levels. The study has generally adopted an additive approach to assessing combined impacts associated with multiple offshore renewables development locations and multiple offshore renewables technologies within a region and nationally, unless the impacts were predicted to be particularly concentrated and intense at a local or regional level, in which case specific consultation with the relevant sectoral interests was undertaken to seek to evaluate the combined effect using expert judgement.

Estimation of Costs and Benefits

The costs and benefits associated with the impacts identified under Section 2.4.6 have been estimated for the three scenarios compared to the 'do nothing' option. This includes:

- The potential costs (negative impacts) associated with the plan options on other activities;
- The potential benefits associated with the impacts of the plan options on other activities; and
- The potential distribution of costs and benefits between activities, between different locations and regions and between different social groups.

The assessment period used within the study ran from 2014 (the base year) until 10 years after all development became operational (i.e. 2035), a period of 22 years. In line with the indicative programme, construction was assumed to start in 2022 and economic impacts were therefore assumed to ramp up between 2023 and 2025 (one-third of full impact in 2023, two-thirds in 2024 and full impacts from 2025).

Where it was possible to develop quantified estimates for impacts, these were converted to Present Values using a 3.5% discount rate in line with Treasury Green Book guidance, summing the discounted values over the assessment period. In addition, impacts on Gross Value Added (GVA) and employment were estimated for the commercial fisheries sector.

Assessment Outcomes

Assessments for Offshore Wind, Wave and Tidal Energy Development

Table S1 to S3 present quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind, wave and tidal development within Draft Plan Option areas for each Scottish Offshore Renewable Energy Region (SORER) and nationally.

Table S1. National PV Costs (and GVA impacts for fisheries) in £millions for Offshore Wind (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	Central	High
Carbon Capture & Storage	NE	1.85	4.32	9.27
	Total PV	**1.85**	**4.32**	**9.27**
Commercial Fisheries	SW	0.05	0.06	0.13
	W	0.13	0.31	0.67
	NW	0.11	0.27	0.58
	N	0.74	1.8	3.9
	NE	0.18	0.43	0.92
	Total (GVA)	**1.21**	**2.87**	**6.2**
Recreational boating	SW	**0.05**	0.06	0.10
	NE	**-**	0.66	0.81
	Total PV	**0.05**	**0.72**	**0.91**
Shipping	SW	**4.87**	5.08	5.98
	W	**-**	3.80	7.88
	NW	**-**	1.45	2.90
	N	**-**	7.11	14.22
	NE	**-**	48.57	98.61
	Total PV	**4.87**	**66.01**	**129.59**
Tourism	SW	**-**	0.03	0.33
	W	**-**	0.01	0.06
	N	**-**	0.22	0.59
	Total PV	**-**	**0.26**	**0.98**
Water Sports - Sea Angling	N	**-**	**-**	0.47
	Total PV	**-**	**-**	**0.47**
Total PV Costs		**6.77**	**71.31**	**141.22**
Total GVA Impacts (Commercial Fisheries)		**1.21**	**2.87**	**6.20**

Table S2. National PV Costs (and GVA impacts for fisheries) in £millions for Wave Energy (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	Central	High
Commercial Fisheries	W	0.01	0.01	0.03
	NW	0.03	0.09	0.18
	N	0.03	0.08	0.17
	Total (GVA)	**0.07**	**0.18**	**0.38**
Water Sports - Sea Angling	N	-	-	0.10
	Total PV	-	-	**0.10**
Total PV Costs		-	-	**0.10**
Total GVA Impacts (Commercial Fisheries)		**0.07**	**0.18**	**0.38**

Table S3. National PV Costs (and GVA impacts for fisheries) in £millions for Tidal Energy (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	Central	High
Commercial Fisheries	SW	0.01	0.03	0.06
	W	0.02	0.05	0.1
	N	0.06	0.13	0.25
	Total (GVA)	**0.09**	**0.21**	**0.41**
Recreational boating	SW	-	-	0.06
	Total PV	-	-	**0.06**
Shipping	SW	-	-	1.07
	W	-	-	1.89
	N	-	-	9.33
	Total PV	-	-	**12.29**
Sea Angling (Water sports)	N	-	-	0.35
	Total PV	-	-	**0.35**
Total PV Costs		**-**	**-**	**12.70**
Total GVA Impacts (Commercial Fisheries)		**0.09**	**0.21**	**0.41**

For all offshore renewables technologies, the estimated cost impacts increase with increasing scale of development. The impact of offshore wind development is estimated to impose much greater cost impacts on other activities compared to wave or tidal development. This is largely on account of the potentially much larger footprint for offshore wind development compared to the other technologies. Overall offshore wind accounts for up to 93% of total estimated costs across the scenarios.

The main contributing factor to these cost impacts relates to impacts on the shipping sector (assessed as around £130m PV out of a total of £141m PV under the high scenario for offshore wind). Approximately £98m PV of this cost arises in NE SORER - OWNE1 and OWNE2 - with a further £14m PV cost associated with potential development in North SORER – OWN1 and OWN2.

Significant impacts are identified for the commercial fishing sector, as a result of the potential for loss of landings from within offshore renewables arrays, particularly in relation to offshore wind Draft Plan Option areas, for which impacts range from £1.21m to £6.20m PV (GVA) across the scenarios. Around 80-90% of the assessed impacts to the commercial fisheries sector relate to potential offshore wind development depending on the scenario. Potential impacts in the North SORER Draft Plan Option areas for offshore wind OWN1 and OWN2 account for around 55% of the total estimated costs. There is also potential for arrays within the Draft Plan Option areas, particularly offshore wind arrays, to disrupt steaming routes to fishing grounds, primarily for areas in the West, North-West, North and North-East SORERs. Some export cable routes may also affect fishing opportunities in some SORERs but it has not been possible to quantify these impacts.

Some potential impacts on recreational boating have been identified associated with additional fuel costs linked to increased steaming distances to navigate around offshore wind and tidal arrays. The largest estimated impacts occur for potential development in offshore wind Draft Plan Option areas in the North SORER (OWN1 and OWN2) and North East SORER (OWNE1 and OWNE2). Stakeholders have expressed concerns about the potential impact of cumulative offshore renewables development along the east and west coasts in deterring sailors from sailing along these coasts. This has the potential to affect revenues for the recreational boating supply chain (for example reduced revenue from berthing fees for marina operators) but it has not been possible to quantify these impacts.

The assessment identifies relatively minor potential cost impacts to recreational angling and tourism. Potential costs to the CCS sector arise based on possible future development of a CCS pipeline from the Firth of Forth up to St Fergus and relate to additional costs that would be incurred to construct cable crossings over offshore wind export cables from OWNE1 in NE SORER. Given the uncertainties surrounding possible future CCS development, these cost estimates should be considered speculative at this stage.

Although there are possibly some negative impacts on some social groups (particularly special interest groups, such as recreational boaters, sea kayakers and sea anglers), these will be most noticeable at the local level. Tourism impacts may also occur due to changes in the landscape and seascape, but again these will be at a very localised scale. At the national scale, there are numerous alternative locations for these activities to take place, such that the overall impacts are negligible.

Impacts on employment due to reduced turnover are again only likely to be noticeable at the local level, and are mainly associated with commercial fisheries. The maximum impact is in North region, with 9 to 10 direct and indirect jobs potentially affected per year with much lower estimated impacts on employment in other SORERs. This is against a national total of 4,996 fishermen in 2011[4]. At the national scale, the number of jobs affected (including both direct and indirect) is, therefore, negligible. As a result, knock-on effects due to downturns in local economies are unlikely. Therefore, at the national scale impacts would not be noticeable, although the impact at local level for communities that are heavily dependent on fisheries (e.g. Orkney and the Shetland Islands) will be greater. At the national scale, therefore, the number of jobs affected (including both direct and indirect) is expected to be negligible.

Combined Assessment

The combined assessment has taken account of the impacts of potential offshore wind, wave and tidal development within Draft Plan Option areas both at regional and national level. The starting point for each assessment has been to sum the estimated impacts for offshore wind, wave and tidal development (as appropriate) and then to discuss the extent to which combined impacts may be more or less than the summed estimates.

4 Marine Scotland (2012): Scottish Sea Fisheries Statistics 2011, September 2012, downloaded from the Scottish Government website: www.scotland.gov.uk.

Table S4 presents a summary of discounted costs for offshore wind, wave and tidal Draft Plan Option areas in all SORERs for those activities for which quantified cost estimates have been made.

Table S4. Discounted PV costs (GVA for fisheries) in £millions for all technologies (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Carbon Capture and Storage	Costs of additional cable crossings	1.85	4.32	9.27
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	1.37	3.26	6.99
Recreational boating	Additional fuel costs	0.05	0.72	0.97
Shipping	Additional fuel costs	4.87	66.02	141.87
Tourism	Reduction in expenditure	-	0.26	1.00
Water Sports - Sea Angling	Reduction in expenditure	-	-	0.92
Total PV Costs		**6.77**	**71.32**	**154.03**
Total GVA Impacts (Commercial Fisheries)		**1.37**	**3.26**	**6.99**

While there are uncertainties surrounding the cost estimates for tourism, recreational boating and sea angling and not all potential impacts to these sectors have been quantified, the scale of impacts identified in this study does not suggest that there will be significant regional or national impacts associated with combined offshore wind, wave or tidal development within the Draft Plan Option areas. There is concern within the recreational boating sector that multiple developments along the east and west coasts of Scotland have the potential to deter recreational sailors travelling along these routes. This could affect expenditure in recreational boating supply chains in affected areas and could deter some future investments in marina capacity should the potential impacts be realised.

At a national level, the combined impact of the commercial fisheries sector in terms of impacts to annual GVA as a result of potential reductions in landings is estimated to be less than 1% of total annual GVA from the commercial fisheries sector and thus insignificant in a national context. At a regional scale, it is estimated that the greatest potential impacts will occur in the North Region. No significant impacts for the fish processing sector have been identified either regionally or nationally, given the relatively small scale of potential impact to fish landings. Impacts may also occur to the commercial fisheries sector as a result of disruption to steaming routes to fishing grounds as a result of the location of offshore renewables arrays but it has not been possible to quantify these impacts. It is possible that export cable routes may also affect fishing opportunities in some locations, but it has not been possible to quantify these impacts.

The combined cost impacts to shipping interests are potentially significant both in absolute terms (maximum annual cost impact of around £13.0m) and relative terms, although no specific figure is available for the value of shipping to the Scottish economy. For the tidal and wave sites, spatial planning should largely avoid significant impacts on commercial shipping and ferry routes, however reduced sea area availability for navigation will increase the density of traffic in other areas. This will have an increase in the potential encounter rate, and therefore an increase in marine risk. Given that many commercial vessels may be on passage around the coast of Scotland, there is potential for combined impact from multiple Draft Plan Option areas to be more significant than the sum of the impacts for individual technologies/Regions.

A number of potential impacts have been identified for competing offshore renewables technologies, both in relation to competition for space and cable land falls. The combined impact of these interactions is uncertain. It is possible that more commercially viable technologies such as offshore wind could out-compete wave and tidal developments and reduce opportunities for these technologies, although offshore renewables developers will be encouraged to co-operate on issues such as cable landfall.

The social impacts are not expected to be noticeable at the national level. The potential impacts on employment, access to services, health, culture and heritage and the environment could be locally noticeable, with the largest impacts likely to be associated with commercial fisheries, and on marinas if boat users choose to visit other areas of the coast or move their boats to marinas away from the search areas. In most cases, these impacts are also expected to be small and very localised and relate mainly to the knock-on effects of changes to jobs (either number or quality of employment). There are no significant impacts expected in terms of access to services, crime or education. Impacts on culture and heritage, environment and health are limited to loss of traditional fishing grounds, emissions to the environment (most of which will be offshore) and worry associated with increased costs or increased navigation risks.

Discussion and Conclusions

The socio-economic assessment provides a broad overview of indicative cost impacts to other activities associated with potential offshore wind, wave and tidal development within the Draft Plan Option areas. The estimated costs impacts (PV) ranged from £6.8m (Low Scenario: 3GW offshore wind; 0.5GW wave; 0.5GW tidal) to £154m (High Scenario: 15GW offshore wind; 2.5GW wave; 2.5GW tidal). In addition estimated GVA impacts to the commercial fisheries sector ranged from £1.4m to £7.0m PV across the scenarios.

The quantified potential cost impacts to commercial shipping accounted for around 70-90% of total quantified costs depending on scenario. Most of the quantified potential cost impacts relate to either reductions in revenues (for example, reduced tourism or recreational angling expenditure) or increased fuel costs (shipping and recreational boating). Some potential one-off costs have been identified for the CCS sector associated with the need to construct additional cable crossings where a possible future pipeline crossed future offshore wind farm export cables in the North East SORER. The commercial fisheries costs relate to estimated impacts to GVA as a result of potential reductions in fish landings.

For the majority of activities, no significant cost impacts were identified under any of the scenarios including aquaculture, energy generation, oil and gas, ports and harbours, power interconnectors, telecom cables, waste disposal and the majority of water sports. However, for some sectors, some uncertainty remained concerning potential impacts.

Most of the potential social impacts identified are limited to localised effects associated with potential impacts to the commercial fisheries sector but these are generally expected to be small. There may be some impacts on recreational boaters, sea kayakers and sea anglers that could require them to change the location of their activities. This could affect marinas, boat charters, boat maintenance businesses, etc. with knock-on employment effects. However, the impacts on one marina are likely to be compensated by benefits for others. As a result, the overall impacts should balance out. The social issue then depends on whether the benefits move from areas that are more (or less) deprived such that they could have a distributional effect. However, the magnitude of the impacts is unlikely to be significant enough to result in closure of a marina (or associated businesses) such that the distributional effects should be limited. It is unlikely that any specific disadvantaged groups or minorities would be affected to a greater extent than average.

No significant benefits to activities could be quantified in this study, although it is noted that a number of activities such as ports & harbours, shipping and tourism would benefit from the development of the supply chain associated with expenditure on offshore renewables development, but this was out with the scope of the study.

By far the majority of impacts are associated with potential development within offshore wind Draft Plan Option areas, with much lower levels of impact associated with potential development within wave or tidal Draft Plan Option areas. This reflects the much greater spatial footprint and visual presence of offshore wind arrays compared to wave and tidal arrays. The combined impacts of offshore wind, wave and tidal development have therefore been assessed as being broadly similar to the impacts of offshore wind on its own, given that offshore wind accounts for the majority of overall impact.

Knock-on effects on GVA and employment are generally estimated to be insignificant, with few of the costs exceeding the 5% of turnover threshold used as the minimum value for estimating these impacts[5]. The only sector that exceeds the 5% threshold is commercial fishing and then only in North and West regions (low and central scenarios), and North, North East, West and North West regions (high scenario). In all cases, this is associated with wind, although the threshold is

5 The assumption is that costs of less than 5% of turnover could be absorbed without causing knock-on effects on GVA or employment.

exceeded in North region for tidal (high scenario). The main estimated impacts on GVA and employment are as follows:

- Type I (direct and indirect) to Type II (direct, indirect and induced) effect on GVA:
  - North: £6.9 to £7.5 million (£6.7 to £7.3 million (PV) wind and £0.13 to £0.14 million tidal);
  - North East: £1.0 to £1.1 million (PV);
  - West: £1.0 to £1.1 million (PV); and
  - North West: £1.0 to £1.1 million (PV).
- Type 1 (direct and indirect) to Type II (direct, indirect and induced) effect on employment:
  - North: 9.4 to 10.4 jobs (9.2 to 10.4 jobs wind and 0.2 to 0.2 jobs tidal);
  - North East: 1.4 to 1.5 jobs;
  - West: 1.4 to 1.6 jobs; and
  - North West: 1.4 to 1.5 jobs.

This shows that the most significant effects are likely to be in North region, but these are still relatively minor. There might be localised effects that are greater in impact than the numbers suggest, for example, if crofters in North region are affected more significantly than full-time fishermen or if most of the impacts fall onto fishermen from the same harbours, or where impacts fall on areas that are heavily dependent on fisheries.

Study Limitations

There is currently a high level of uncertainty surrounding the location and intensity of possible future offshore renewables development within the Draft Plan Option areas. The study has sought to use assumptions about the density and location of development within the Draft Plan Option areas to inform the scenarios to address this, for example, it is assumed that the notional installed capacities for offshore wind, wave and tidal development identified in the scenarios are apportioned pro rata across the Draft Plan Option areas in proportion to the size of each Draft Plan Option area. In reality it is likely that development will be more intensive in some Draft Plan Option areas than in others leading to variable levels of socio-economic impact within each Draft Plan Option area.

The timing of any development within the Draft Plan Option areas is also uncertain. In this study we have made a simplistic assumption that all development starts in 2023 and is completed by 2025. However, should development proceed within the Draft Plan Option areas this is likely to be staggered in the period 2018 to 2030. While the study assumption is likely to give PV estimates that reflect a national average of development spread over the period 2018 to 2030, it is possible that cost impacts could vary at regional level should development proceed earlier or later than assumed in this assessment. A sensitivity analysis undertaken on the timing of development indicated that if all developments became operational five years earlier (i.e. by 2020) this would increase cost/GVA impacts by around 19% (based on an assessment period ending ten years after full operation (i.e. 2030). Conversely, a delay of five years would reduce cost/GVA impacts by around 16% (based on an assessment period ending ten years after full operation (i.e. 2040)).

The nature and scale of socio-economic impacts is particularly dependent on the precise locations in which offshore renewables development may occur within individual Draft Plan Option areas. This study has assumed that spatial planning within Draft Plan Option areas can be used effectively to minimise socio-economic impacts, particularly where the density of development occupies less than 5% of a Draft Plan Option area. However, within individual Draft Plan Option areas it is possible that other constraints may limit flexibility in choice of the location for offshore renewables development, resulting in higher levels of socio-economic assessment.

Uncertainties in the location and nature of future activity in the marine environment also contribute to uncertainty in the estimation of costs and benefits. For example, potential CCS impacts are based on assumptions about a possible future requirement for a new CCS pipeline sometime in the 2020’s. Similar uncertainties relate to future trends in ongoing activities such as commercial fishing (assumed landings values remain constant over the assessment period) and tourism (revenues assumed to be constant in real terms). Such assessments are therefore based on a significant degree of speculation about future levels of activity and are thus inherently uncertain.

There is also some uncertainty concerning the nature and scale of socio-economic impacts associated with offshore renewables development. This reflects uncertainty surrounding the details of the technologies to be deployed, the lack of scientific understanding relating to the impacts of novel technologies, and the lack of scientific understanding of some specific environmental pressures and impact pathways (e.g. the scale of collision mortality and the effects of electromagnetic fields). The study has sought to accommodate these uncertainties in the assessment where possible, for example in relation to the differential impacts of tidal turbine foundation design on navigation interests. However, some uncertainty remains concerning some aspects of the impacts of offshore renewables and it is important that such issues are managed through the process of plan implementation by ensuring that newly acquired evidence on impacts is used to refine the plans.

It has not been possible to quantify social impacts, other than access to employment where multipliers have been used. Other impacts have been assessed qualitatively, which can result in homogenisation of impacts although it does mean that all impacts are considered throughout the assessment. The social impacts are generally assessed as knock-on impacts from the direct effects on activities. This means that areas such as employment, environment and health have been included to a greater extent than the much more indirect effects on crime or education. Again, these indirect effects may become more evident in a specific local assessment.

The combined assessment poses particular challenges owing to the complexity of such assessments and the limited scientific understanding of impacts. Within this study, combined effects (the combined impact of potential offshore wind, wave and tidal development within the Draft Plan Option areas) have generally been assessed as the sum of the individual impacts of offshore wind, wave and tidal development. This has been based on the generally minor contribution to overall assessed impacts arising from wave and tidal development and the modest overall scale of impacts.

Abbreviations

%	per cent
£	pound(s)
ABPmer	ABP Marine Environmental Research
CAA	Civil Aviation Authority
CCS	Carbon Capture and Storage
CFP	Common Fisheries Policy
DIO	Defence Infrastructure Organisation
EIA	Environmental Impact Assessment
GES	Government Economic Service
GHG	Greenhouse Gas
GSR	Government Social Research
GVA	Gross Value Added
GW	Gigawatt(s)
IMO	International Maritime Organisation
I-O	Input-Output
k	thousand
km	kilometre(s)
km^2	square kilometre(s)
m	metre(s)
m	million
MPA	Marine Protected Area
MaRS	Marine Resource System
MSY	Maximum Sustainable Yield
MW	Megawatt(s)
N	North
NATS	National Air Traffic Service
NE	North East
nm	nautical mile(s)
NW	North West
O&M	Operations and Maintenance
OECD	Organisation for Economic Co-operation and Development
OfTW	Offshore Transmission Work
p.a.	per annum
PV	Present Value
PAG	Project Advisory Group
PSG	Project Steering Group
RPI	Retail Prices Index
RPA	Risk & Policy Analysts
RYA	Royal Yachting Association
SG	Scottish Government
SORER	Scottish Offshore Renewable Energy Region
SSE	Scottish and Southern Energy
SIC	Standard Industrial Classification
SW	South West
UK	United Kingdom

VMS	Vessel Monitoring System
W	West
WOMS	West Orkney Middle South
WOS	West Orkney South

Developing the Socio-Economic Evidence Base for Offshore Renewable Sectoral Marine Plans in Scottish Waters
Final Report

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1. Introduction

1.1 Background

The Scottish Government (SG) has set a range of challenging targets for renewable energy which recognise the potential to take advantage of the extensive offshore renewable energy resources (wind, wave and tidal power) available in Scottish waters and include meeting at least 30% of its total energy demand from renewable sources by 2020. To assist in meeting these targets, SG has adopted a process of sectoral marine planning to identify potential locations where commercial scale offshore renewable energy could be developed.

In March 2011, the SG published *Blue Seas Green Energy – A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters.* The Plan contained 6 short-term options and a further 25 medium-term areas of search within Scottish Territorial Waters (0-12 nautical miles (nm)). The Plan is subject to a 2 year review process, during which the Scottish Government will seek to identify further areas for the development of offshore wind energy in Scotland.

In 2007, a Strategic Environmental Assessment (SEA) of marine renewables was published, which provided an assessment of the impact that both wave and tidal devices could have on the marine environment. Since then, Marine Scotland has undertaken marine planning exercises in support of the development of projects competing for the Saltire Prize and the projects identified within the Pentland Firth and Orkney Waters strategic leasing area

The SG will review the 2007 SEA of wave and tidal energy and develop Sectoral Marine Plans for wave and tidal energy in Scottish waters. It is the intention that finalised Plans for all three technologies will be adopted in late 2013.

Plan Development Process

Scoping exercises were undertaken by Marine Scotland Science to identify areas of constraint and opportunity using the Crown Estate Marine Resource System (MaRS). The output of this stage was the identification of strategic search areas where development could take place with respect to offshore wind, wave and tidal energy.

Building upon the scoping reports for offshore wind, wave and tidal energy, Marine Scotland undertook a series of initial events in August-September 2012, to raise awareness of the planning process. Early views and ideas were also sought on Draft Initial Plan Frameworks and the Draft Regional

Locational Guidance documents[6] which provide further information on the planning process and further detailed environmental, socio-economic and planning related information in relation to the Draft Plan Option areas.

Following this consultation, the Draft Plan Options were revised, taking into account information within the Draft Regional Locational Guidance documents and comments made during the pre-consultation period in 2012. The revised areas are now subject to a 'Sustainability Appraisal' involving:

- Strategic Environmental Assessment (SEA);
- Habitats Regulations Appraisal (HRA); and
- Socio-economic Assessment.

Together, these assessments will take account of strategic social, economic and environmental considerations as well as assessing the potential effects of the Draft Plan Options of species and habitats protected by European legislation (Natura 2000).

Socio-economic Assessment

The purpose of the study is to prepare a high level socio-economic appraisal of the potential costs and benefits to activities[7] that may arise as a result of offshore wind, wave or tidal development within the Draft Plan Options as part of possible future SG plans for offshore wind, wave and tidal energy. The socio-economic assessment will contribute to informing Scottish Ministers' decisions on the content of these future energy plans.

1.2 Aims and Objectives

The aims of this study are to:

- Ascertain the extent to which activities already take place in areas identified as potential plan options for offshore renewables (offshore wind, wave and tidal);
- To explore how those activities may be affected by the development of offshore renewables in the plan option areas; and
- To estimate the potential economic and social consequences arising from any potential interactions.

In the context of this project, 'social impacts' are defined as distributional impacts i.e. the impact of the sets of plan options on different groups in Scotland. This includes impacts on specific locations (including individual settlements, where feasible within the scope of the project and data

6 http://www.scotland.gov.uk/Topics/marine/marineenergy/Planning

7 For the purpose of this study 'Activities' are defined as being those that take place in marine waters, or on the immediate foreshore.

availability) and on specific groups within Scotland's population (including but not limited to different age groups, genders, minority groups, and parts of Scotland's income distribution).

In order to achieve these aims, the following objectives have been addressed under this study:

- Identify activities (those taking place in marine waters or on the immediate foreshore) that currently make use of or are currently projected to make use of the marine space identified as potential plan options for offshore renewables;
- Establish the intensity and value of activities taking place in plan option areas, using spatial mapping where appropriate, whilst identifying any spatial variations in intensity of use across areas;
- Establish whether and how these activities might be affected by development of offshore renewables in plan options; and
- Estimate the potential economic and social costs and benefits associated with offshore renewables being developed in the areas identified, including:
    - The potential costs associated with the impacts of the plan options on other marine activities;
    - The potential benefits associated with the impacts of the plan options on other marine activities;
    - The potential social impacts, both positive and negative, associated with the plan options;
    - The potential distribution of costs and benefits between marine activities, and between the offshore renewable energy regions.

The scope of the study has been limited to considering the costs and benefits to activities associated with potential future offshore renewables development proposed within offshore wind, wave or tidal development plans. It does not consider the potential benefits to the offshore renewables industry or to wider society associated with such development. Furthermore, while the study has sought to estimate both potential benefits and costs to relevant activities, it should be noted that supply chain benefits (such as benefits to the ports sector associated with manufacturing or operation and maintenance facilities to support offshore renewables) are excluded from the assessment owing to particular methodological challenges in seeking to assess these. These benefits will be taken into account by Scottish ministers in making decisions on offshore energy plans.

The study has been overseen by a Project Steering Group (PSG) comprising officials from within SG supported by guidance and advice from the Project Advisory Group (PAG), which comprised representatives of key stakeholder groups (Appendix A).

1.3 Structure of Report

This report is structured as follows:

- Section 1: Introduction – this section;
- Section 2: Methodology;
- Section 3: Outcome of Scoping Exercise:;
- Sections 4 to 8: Regional Assessments for Offshore Wind, Wave and Tidal Draft Plan Option Areas;
- Section 9: National Assessments for Offshore Wind, Wave and Tidal Draft Plan Option Areas;
- Section 10: Combined Assessment; and
- Section 11: Discussion and Conclusions.

2. Methodology

2.1 Introduction

The methodology to inform the assessment has built on previous work to assess the socio-economic impacts of offshore renewables including ABPmer et al, 2011; ABPmer & RPA, 2012a; ABPmer & RPA, 2012b and previous EIAs for offshore renewables, and follows wider guidance on impact assessment (Scottish Government guidance on Business and Regulatory Impact Assessment[8], Better Regulation Executive guidance on impact assessment[9] and the Green Book methodology (HM Treasury, 2003).

The methodology described below covers:

- The approach to defining scenarios;
- Establishing a baseline against which impacts can be assessed;
- Approach to quantification of socio-economic impacts; and
- Estimating costs and benefits in terms of impacts on Gross Value Added (GVA) and employment.

2.2 Approach to Development of Scenarios

The Draft Plan Option areas for offshore wind, wave and tidal development identify potential broad locations within which future arrays might be located. However, in order to provide a sufficient basis to carry out a quantitative socio-economic impact assessment, it was necessary to make assumptions about the potential scale (potential installed capacity), nature (the types of technologies) and timing of possible development within these Draft Plan

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8 http://www.scotland.gov.uk/Topics/Business-Industry/support/better-regulation/partial-ssessments/BRIAGuidance/BRIAGuidance

9 http://www.bis.gov.uk/policies/better-regulation/policy/scrutinising-new-regulations/preparing-impact-assessments

Option areas. Possible socio-economic impacts associated with array export cables, have also been taken into account.

Given the inherent uncertainty in seeking to predict the scale and timing of development, a number of scenarios were developed, primarily relating to different possible scales of development within the Draft Plan Option areas, so that these uncertainties could be explored. The impacts of these scenarios were then compared against the ‘do nothing’ option in seeking to estimate the costs and benefits associated with offshore wind, wave and tidal development within the Draft Plan Option areas.

2.2.1 Developing Scenarios Relating to the Potential Scale of Future Development

There are currently few long-term projections for potential future offshore wind, wave and tidal development beyond 2020, which is the period in which development within the Draft Plan Option areas might be expected to largely occur[10].

Within Scottish Territorial Waters, there is potential development to install up to 4.4GW capacity of offshore wind in five short-term option sites (Argyll Array, Beatrice, Inch Cape, Islay, Neart na Gaoithe), together with a further 4.8GW capacity within two Round 3 sites (Moray and Firth of Forth). Scottish Government (2012) provides projections for ‘offshore and onshore’ wind of 13,000 MW installed capacity by 2020 and 16,500 MW installed capacity by 2030.

Agreements for lease have been issued for around 2GW of installed capacity for wave and tidal technology, mostly associated with The Crown Estate leasing round for Pentland Firth and Orkney Waters with additional capacity in the Western Isles and Shetland. Existing projections for wave and tidal development in UK waters to 2020 variously identify potential deployments of 1-2GW (Entec, 2009); 1-2GW (DECC, 2010); and 200-300MW (DECC cited in House of Commons Energy and Climate Change Select Committee, February, 2012). Scottish Government (2012) estimates some 700MW of wave and tidal capacity will be installed in Scottish waters by 2020, rising to 1,770 MW by 2030.

Based on the above estimates, three scenarios (termed ‘Low Case’, ‘Central Case’ and ‘High Case’) have been developed for the purposes of this study relating to different scales of possible future offshore wind, wave and tidal development within the Draft Plan Option areas in the period 2020 to 2030 as follows (in terms of additional capacity beyond existing lease agreements):

- Offshore wind

10 For example, Marine Scotland, 2011 assumes that deployment of offshore wind within medium term sites for Scottish Territorial Waters occurs up to 2030.

  - Low Case: 3GW installed capacity
  - Central Case: 7GW installed capacity
  - High Case: 15GW installed capacity
- Wave
  - Low Case: 0.5GW installed capacity
  - Central Case: 1.25GW installed capacity
  - High Case: 2.5GW installed capacity
- Tidal
  - Low Case: 0.5GW installed capacity
  - Central Case: 1.25GW installed capacity
  - High Case: 2.5GW installed capacity

The potential installed capacities were assigned to individual Draft Plan Option areas using the following rules and as shown in Table 1:

- Areas already subject to ‘Agreement for Lease’ located within the Draft Plan Option areas were removed from the analysis (reducing the available Draft Plan Option areas);
- The ‘target’ installed capacities for offshore wind, wave and tidal development under the 3 scenarios were then applied pro rata to the size of the Draft Plan Option area to achieve the same percentage occupancy (proportion of Draft Plan Option area occupied by arrays) across each Draft Plan Option area based on the following assumptions:
  - 7.6MW installed offshore wind capacity occupies 1km^2 (based on BOWL, 2012)
  - 25MW installed wave capacity occupies 1km^2 (AEA Technology and Hartley Anderson 2011)
  - 25MW installed tidal stream capacity occupies 1km^2 (AEA Technology and Hartley Anderson 2011)
- These allocations were then adjusted where necessary to ensure that the following minimum sizes for arrays were met in each Draft Plan Option area:
  - Offshore wind - 100MW;
  - Wave – 30MW; and
  - Tidal - 30MW.

Table 1. Indicative Occupancy of Draft Option Plan Areas

Scenario	Offshore Wind (%)	Wave (%)	Tidal (%)
Low Case	4.8 - 26.5	0.2 - 0.6	0.8 - 2.5
Central Case	11.6 - 26.5	0.5 - 0.6	2.6
High Case	25.1 - 26.5	1	5.1

It is recognised that the scale of development within individual Draft Plan Option areas may vary and is unlikely to be proportional to the size of area in every (or even any) case. However, for the purposes of this assessment, it is important that realistic scales of development are considered in each Draft Plan Option area. Based on the Scottish Government (2012) projections for the period 2020 to 2030, the aggregate levels of offshore wind, wave and tidal development required to deliver these projections would be broadly similar to the Low Case scenario. However, it is helpful to consider higher levels of potential development, particularly given that the scales of actual development within individual Draft Plan Option areas are likely to vary. Thus, the higher scenarios, while they may be unrealistic in aggregate, help to identify possible capacity constraints and how different scales of development within Draft Plan Option areas might give rise to differing levels of socio-economic impact. It should be noted that although SG provided direction, the scenarios used are hypothetical and are not a formal commitment or statement of policy.

2.2.2 Consideration of Possible Future Technologies

There is currently significant uncertainty concerning the nature of possible future offshore wind, wave and tidal technologies that will be deployed and the methods of their construction. In particular, the development of wave and tidal technologies is at an early stage and it remains unclear which technologies might be taken forward to full scale deployment. Similarly, construction methods for offshore wind developments may change over time.

The precise nature of the technologies to be deployed and their construction methods has the potential to affect the nature and scale of impacts, including socio-economic impacts. However, it is not appropriate to make detailed assumptions about project level technologies and construction methods in this plan level assessment. It has therefore been assumed for the purposes of this study that the socio-economic impacts associated with offshore wind, wave and tidal development will not vary significantly as a result of different technology choices for exploiting wind, wave and tidal resources. While this is recognised as an oversimplification, it is noted that many of the potentially most significant socio-economic impacts arise as a result of competition for sea space and this is not expected to vary significantly as a function of technology choice. This issue has been addressed in the assessment of interactions between wave and tidal devices and commercial navigation (see Appendix B).

In addition, while some socio-economic impacts may arise as a consequence of environmental impacts (which may vary to an extent depending on the technology) it will be a general requirement of the EIA and HRA processes to minimise such impacts to acceptable levels (where necessary underpinned by licence conditions). On this basis, residual environmental impacts should not be of sufficient magnitude to give rise to significant socio-economic impacts.

See section 2.4 for more information on how uncertainty concerning potential impacts has been taken into account in the assessment.

2.2.3 Developing an Indicative Programme

The timing of possible development within individual Draft Plan Option areas is particularly uncertain. The assumption has been that the draft Plans will look to enable development within the period 2020 to 2030. Assuming Plan adoption in late 2013/early 2014, it is possible that consenting could be completed in some Areas within 4 years with construction in these areas starting as early as 2018, and for those schemes to become operational by 2020. However, given that the draft Plans are seeking to facilitate development within the period 2020 to 2030 and given the uncertainty surrounding the precise timing of development, it has been assumed for the purposes of this assessment that all construction will commence in 2023 and that all developments will become operational in 2025. While this is a simplification, for impact assessment purposes it is likely to provide a broadly similar assessment of costs and benefits to an assumption that evenly distributes development over the period 2020 to 2030. Separate commentary has been provided in the discussion of the results concerning how costs and benefits might vary with different assumptions on the phasing of development.

2.2.4 Taking Account of Cable Routes

There is currently a high level of uncertainty concerning the possible location and number of export cables associated with potential development within the proposed Draft Plan Option areas. These requirements will depend on the scale and location of development within the Draft Plan Option areas and the future development of grid connection points (both onshore and offshore). Some information is available from National Grid (2011) on potential and planned land-side grid connections. However, it is still challenging to predict the precise routes for export cable corridors. Given these uncertainties, the approach adopted in this study has generally been to identify all areas inshore of the Draft Plan Option areas as potential export cable route corridors unless there is a clear cable landfall point indicated by current and/or planned grid connection points (see Figures 1 to 3). The same export cable route corridors have been identified for each of the three scenarios as these would not be expected to vary significantly as a result of changing the intensity of development within each Draft Plan Option area.

2.3 Establishing a Baseline

ABPmer & RPA (2012a) collated baseline information on a wide range of marine activities that may potentially interact with offshore renewables development in Scottish Waters, including:

- Aquaculture (finfish and shellfish);

- Aviation;
- Carbon Capture and Storage;
- Coast Protection and Flood Defence;
- Commercial Fisheries (including salmon and sea trout);
- Energy Generation (this will need to cover interactions between different offshore energy devices);
- Military Interests;
- Oil and Gas (including exploration, production, interconnectors, gas storage);
- Ports and Harbours;
- Power Interconnectors (including offshore transmission networks);
- Recreational Boating;
- Shipping;
- Social Impacts;
- Telecom Cables;
- Tourism (including heritage assets);
- Waste Disposal (dredge material); and
- Water Sports (including sea angling, surfing and windsurfing, sea kayaking, small sail boat activities and scuba diving and).

This study has provided the main baseline information on which the assessment has drawn. In addition, information has been obtained from a number of additional sources where available, including:

- Additional fisheries data provided by Marine Scotland including provisional outputs from the Scotmap project for inshore fisheries (vessels <15m);
- Information on shipping density around the Scottish coast for 2008 (provided by the Maritime & Coastguard Agency); and
- Information on helicopter main routes (from National Air Traffic Services)

Some additional baseline information was also obtained through consultation with relevant stakeholders, for example, additional information on recreational boating activity. A series of tables in Appendix B summarise the baseline information sources on which the assessment has drawn (largely based on ABPmer & RPA, 2012a).

The baseline information presented in ABPmer & RPA (2012a) relates to a base year of between 2008 and 2010. Where necessary, this information has been rolled forward to 2012 to provide a consistent base year for the study using Treasury's GDP deflator and taking account of any projected trends in the levels of activity identified in ABPmer & RPA (2012a). The baseline information was then further adjusted beyond the base year through the period of study to take account of any projected trends in the levels of activity to create a future baseline. Further details are provided in the sector specific methodologies in Appendix B. Where relevant the baseline data series have been presented in the relevant sectoral assessments in Appendix C.

2.4 Approach to Quantification of Economic and Social Impacts

2.4.1 Introduction

The potential for offshore wind, wave and tidal development arrays and export cables to give rise to socio-economic impacts on other activities depends on the nature and scale of interactions between them. The approach adopted here has therefore been to seek to define the potential interactions and to identify those interactions which have the potential to give rise to significant socio-economic impacts drawing on relevant previous studies and taking account of specific factors relevant to each Draft Plan Option area. Where potentially significant socio-economic impacts are identified, methods for quantifying these impacts have been applied taking account of information availability (Appendix B).

To identify the potential for significant socio-economic impacts to occur, a simple scoping process was undertaken which takes account of:

- Whether the activity occurs within the relevant offshore energy region;
- Whether the activity overlaps spatially with one or more Draft Plan Option areas or cable corridors within the relevant offshore energy region;
- Where the activity occurs within the relevant offshore energy region but does not overlap spatially with a Draft Plan Option area, but there is potential for far-field effects i.e. introduction of human pressures in the marine environment that have the potential to affect other activities beyond the footprint of the Draft Plan Option area or export cable route[11]; and
- The likely scope to avoid a significant interaction through spatial planning of the location of arrays within a Draft Plan Option area[12].

Where one or more potentially significant interactions was identified, further consideration was given to the potential impact pathways by which socio-economic impacts may arise and the extent to which any or all of the relevant pathways required assessment (see column 4 of tables in Appendix B). Where relevant pathways were considered to be present, these were scoped into the assessment.

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11 For the purposes of this study, the potential for far field effects from arrays has been assumed to be present in respect of the following receptors: impacts to coastline, radar interference, underwater communication interference, impacts to landscape/seascape (affecting tourism and water sports receptors), impacts to aquaculture, ecotourism impacts and impacts arising from changes to underwater noise. A potential for far field impacts arising from these impact pathways has been assumed to occur when the activity is located within 5 or 10km of Draft Plan Option area boundaries (depending on the receptor – see Appendix B for details of methodology applied for each sectoral activity).

12 Where the projected area occupied by arrays under a given scenario was <5% of the total Draft Plan Option area, consideration was given to the likely potential to avoid a significant interaction with an activity.

Where potential impacts will need to be mitigated up-front by the developer as a condition of consent, it has been assumed that the residual impacts will not give rise to significant socio-economic impacts. The mitigation costs to be met by the developer have not been included in the costs presented in the assessments described within this study. For example, in the case of potential impacts to aviation radar, these will need to be mitigated by the developer and therefore significant impacts to the aviation sector will be avoided and so are not quantified within this assessment.

Similarly, where potential socio-economic impacts are consequential on potential environmental impacts, it has been assumed that mitigation will be required for such impacts as a condition of consent and the residual environmental impacts will not give rise to significant socio-economic impacts. It is recognised that this is a simplification and that in some cases the likelihood of significant environmental impacts occurring is not well understood, for example in relation to collision risk between mobile species and tidal stream generators or the impacts of electromagnetic fields on electro- and magneto-sensitive species. The potential limitations of this assumption are discussed further in relation to individual methodologies in Appendix B and in the discussion of the results (Section 11). However, particularly in relation to the Habitats Directive, there is a requirement for competent authorities to have a high level of certainty when making decisions relating to possible impacts on features associated with Natura 2000 sites. The processes in place to manage these risks to environmental receptors will provide a high level of assurance that significant effects in the marine environment are avoided, and thus that significant effects to related socio-economic interests are also avoided.

2.4.2 Economic Impacts of Arrays

A series of tables have been prepared for each offshore energy region for each offshore renewable technology documenting the outcome of the scoping process for the assessment of arrays and identifying activities for which potentially significant socio-economic impact pathways exist and which therefore need to be assessed in more detail (see tables in Appendix C).

Where the potential for significant socio-economic impact on an activity has been identified through the scoping process through one or more impact pathways, a more detailed consideration of the potential impacts has been undertaken using the assessment methods described in Appendix B for each sectoral activity. The assessment methods draw upon similar previous assessments (ABPmer et al, 2011, ABPmer & RPA 2012a; 2012b), Environmental Statements for offshore wind (e.g. Beatrice Offshore Wind Limited, 2012), wave (e.g. Meygen, 2012) and tidal development, existing good practice guidance (e.g. UKFEN 2012) and consultation with stakeholders.

Where possible the assessment methods have sought to quantify costs and benefits. Where insufficient information was available to derive a monetised estimate, quantitative or qualitative assessments have been provided. Consultation was also undertaken with relevant stakeholders on the basis for the estimates and the underlying assumptions.

2.4.3 Economic Impacts of Cable Routes

A series of tables have been prepared for each offshore energy region documenting the outcome of the scoping process for the assessment of export cable routes and identifying activities for which potentially significant socio-economic impact pathways exist and which therefore need to be assessed in more detail (see tables in Appendix C). Given the very high level of uncertainty concerning potential export cable routes, only relatively broad indicative Draft Plan Option areas have been identified and it is considered inappropriate to seek to develop monetised or quantitative estimates of impacts. In order to assess the potential for interaction between possible cable routes and socio-economic activities, all those activities that spatially overlap with the possible cable corridor have been identified and screened for possible significant interaction with export cables in line with the methodologies identified in Appendix B. Where there is potential for an interaction to arise that may have significant socio-economic consequences, these have largely been highlighted qualitatively within the assessment.

2.4.4 Social Impacts

For the purposes of this study social impacts have primarily been identified based on a distributional analysis. The assessment of distributional impacts is routinely performed as part of standard impact assessment, identifying who bears the costs and who accrues the benefits. Based on the quantification of economic impacts and baseline data, the study has determined which of these impacts of the sets of plan options will fall on different groups in Scotland. This has included consideration of impacts on specific locations (including individual settlements, where data availability allows) and on specific groups within Scotland’s population (including, for example, different age groups, genders, minority groups, and parts of Scotland’s income distribution). The extent to which this was possible has depended on the availability of data, for example on the gender and age breakdown of the workforce in affected sectors and income distributions within affected sectors. The study has also identified any particular concentrations of minorities amongst the areas and sectors affected. The assessment has drawn on statistical information from the Scottish Government (in particular the Scottish Neighbourhood Statistics), as well as data from previous studies. Additional information on potential social impacts from the previous consultation on short-term and medium term sites for offshore wind development (Marine

Scotland, 2010) has also been used to identify stakeholder concerns about less quantifiable social impacts such as changes to traditional ways of life.

Social impacts have been described and quantified where possible, with the basis for the analysis clearly set out. This approach has been consistent with that put forward by the GES / GSR Social Impacts Taskforce, which is based on the 'capitals approach' of ensuring that stocks of social capital are maintained over time. The key areas of social impact identified by the Task Force include:

- Access to services;
- Crime;
- Culture and Heritage;
- Education;
- Employment;
- Environment; and
- Health.

In order to assess the impacts of interactions with the sectors, the study has sought to clearly define what is (and is not) covered under each of the areas of social impact. Table 2 provides an indication of the definitions used for each area. The definitions provided in Table 2 are, to the extent possible, related to the need to ensure that stocks of capital (produced, human, social and natural) are maintained so that the potential for wellbeing is non-declining over time (Defra, 2011). Here the emphasis is on whether the scenarios being assessed would result in change in the level of access to the goods and services in question and/or whether the experience associated with that good and service changes.

Change in access can be thought of as factors that can be estimated in quantitative terms, for example, as increased time to access services or projected changes in areas of particular habitats. Whether the change is positive or negative is determined by the direction of change from the baseline. The impacts may be the same in quantitative terms across all groups, but the magnitude of impacts may be different. This is because some groups may be more vulnerable and, hence, be more significantly impacted by the change than others. For example, the influx of additional workers may result in increased demand on doctor's surgeries. Thus, the average time required to obtain an appointment to see a doctor may increase. This can be estimated as additional hours or days. However, this quantified measure alone does not reflect that some groups within society may be more significantly affected than others. For example, those in poor health could be affected more significantly than those in good health.

Table 2. Definition of areas of social impact

Key area	Access	Experience
Access to services	Change in opportunity to use services or time to access services	Change in quality of service provided or received
Crime	Change in opportunity for criminal activities	Change in level of crime (perceived or actual)
Culture and heritage	Change in opportunity to access culture and heritage Change in existence of culture/heritage, or knowledge of it (especially loss) Change in number of visits to cultural/heritage sites	Change in quality of cultural or heritage through change in context, quality of visits
Education	Change in opportunity to access education services	Change in quality of education services
Employment	Change in employment opportunities	Change in quality of employment opportunities
Environment	Change in opportunity to access environment Change in existence of environment, or knowledge of it (especially change in habitats) Change in number of visits to environmental sites	Change in quality of environment through change in quality of habitats, species supported or change in quality of visits
Health	Change in level of disease or symptoms (physical and mental health)	Change in self-assessed quality of health

Changes in experience are more subjective and so cannot be easily estimated in qualitative terms. Instead, they have to be assessed in terms of how the change might be perceived by different groups. This approach assumes that individuals within a particular group will have the same (or very similar) subjective response to the change. Continuing the example above, the appointments to see the doctor may be shorter such that those in poor health perceive that they are receiving a worse service than before the additional demand was placed on the surgery. This highlights that it is very important that the groups used within the assessment are appropriate to avoid under-estimating the negative impacts or benefits from interactions.

Table 3 presents the list of groups that has been considered in the assessment of social impacts and these have been used across all of the key areas.

Table 3. Initial list of groups who may be affected

Key area	Groups distinguished by					
	Location	Age	Gender	Income	Minority	Other
Access to services Crime Culture and heritage Education Employment Environment Health	▪ Datazone ▪ Local Authority ▪ Region ▪ Rural datazones[13] ▪ Urban datazones[13]	▪ Children ▪ Working age ▪ Pensionable age	▪ Male ▪ Female	▪ 10% most deprived ▪ 10% most affluent ▪ Remaining 80%[14]	▪ Crofters ▪ 10% most deprived ▪ 10% most affluent ▪ Ethnic minorities ▪ Religion ▪ Sexual orientation	▪ With disability or long-term sick ▪ Special Interest Groups

It is also important to establish exactly what needs to be covered. Table 4 presents an initial definition of the type of services that will be considered for each key area, drawing on the baseline data from ABPmer & RPA (2012a).

Table 4. Definition of services included under each key area

Key area	Services	Potential data sources
Access to services	Household spaces Percentage of dwellings failing Scottish Housing Quality Standard Deprivation for housing Affordability of housing Mean house sale prices Time required to drive to GP, post office, primary school, supermarket, petrol station Percentage of population in fuel poverty	Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics
Crime	Perceptions of neighbourhood Crime rate per 10000 population Clear up rates Reconvictions	Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics
Culture and heritage	Crofting Proportion of population attending a cultural even in previous 12 months	Scottish Government; Hillam (2007) Scottish National Statistics
Education	Deprivation for education, skills and training Proportion of population with/without qualifications Percentage receiving job-related training Access to training facilities (colleges) Pupil: teacher ratio Percentage of schools in satisfactory or good condition	Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics
Employment	Gross weekly earnings Deprivation for income Employment by industry sectors Turnover of social economy Businesses surviving for longer than three years Number of people in poverty	Scottish National Statistics Scottish National Statistics Office for National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics
Environment	Overall rank of deprivation Energy consumption per person	Scottish National Statistics Scottish National Statistics
Health	Self-assessed health rating	Scottish National Statistics

13 Based on Scottish Government Urban/Rural Classification (6-fold) and Scottish Neighbourhood Statistics by datazone.

14 The impact of developments will probably be greater on less affluent sailors who generally have smaller, less powerful boats without all electronic aids and who rely on skill and good seamanship.

Key area	Services	Potential data sources
	Deprivation for health Mean weekly consumption of alcohol Smoking rates Level of physical activity	Scottish National Statistics Scottish National Statistics Scottish National Statistics Scottish National Statistics

(Source: based on ABPmer & RPA, 2012a)

The social assessment is summarised into three tables:

1. The identification of social impacts and their significance: this table considers each of the direct effects predicted to occur on each sector and identifies area of social impacts that could be caused as a result. Where the impacts are expected to be noticeable (i.e. if the overall costs to a sector in any region are less than 5% of the turnover for that sector (or reduction in GVA for commercial fisheries), see also Section 2.5), Present Value (PV) costs have been identified. Otherwise, the impacts are given in qualitative terms only, taking account of any mitigation that might be available. The significance of the social impacts is assessed in terms of both access and experience, with the following definitions used:

- x x x: significant negative effect. This is defined as where it is probable that an impact is sufficiently significant so as to be noticed;
- x x: possible negative effect. This is defined as where it is possible that an impact is sufficiently significant so as to be noticed;
- x: minimal negative effect, if any. This is defined as where it is probable than an impact is unlikely to be sufficiently significant so as to be noticeable, but that some possibility exists that a negative impact could occur; and
- 0: no noticeable effect expected.

2. Distributional analysis (location, age and gender): each of the social impacts described in the first table is then considered for its likely distributional consequences. The ratings defined in the first table are used as the basis for the assessment. Where the impact is expected to be larger on a particular group than average, the rating is increased. So, for example, loss of traditional fishing grounds assigned an ‘x’ in the first table is then considered against where and who might be affected by that impact. Where impacts are more likely to occur in rural areas because that is where the fishing ports are mainly located, the impact is increased to ‘xx’. Likewise, where an impact is less than average for a particular group, the rating is reduced. Where a change to the average impact is made, the tables include a brief reason describing why the change has been made.

3. Distributional analysis (income and social groups): the approach used in the third table is the same as the second but here focusing on impacts across different income groups and particular social groups: crofters, ethnic minorities, those with disability or who are long-term sick, special interest groups and other (those not picked up elsewhere). Again, the ratings from the first table are used as the basis for the assessment, with ratings increased to

reflect that a particular group is likely to be impacted more significantly. The extent of the increase (i.e. from x to xx, or xx to xxx) is used to reflect how concentrated the impact would be on a particular group and, hence, how noticeable it is likely to be to them.

2.4.5 Combined Impact of Offshore Wind, Wave and Tidal Energy Plans

For the purpose of this study, the combined impact of potential offshore wind, wave and tidal development within the Draft Plan Option areas has been considered at both regional and national levels.

In general, at low levels of offshore wind, wave and tidal development, the socio-economic impacts of additional levels of development are likely to be additive. In contrast, more intense offshore wind, wave and tidal development, occupying a significant proportion of local, regional or national sea space may give rise to synergistic impacts. For example, above a certain threshold of impact, it may no longer be economic to continue with an activity and the whole of the activity may be lost. However, there is little if any evidence that indicates what the relevant thresholds might be, above which impacts may become synergistic.

Given these constraints, the study has generally adopted an additive approach to assessing combined impacts associated with multiple offshore renewables development locations and multiple offshore renewables technologies within a region and nationally, unless the impacts are predicted to be particularly concentrated and intense at a local or regional level, in which case specific consultation with the relevant sectoral interests has been undertaken to seek to evaluate the combined effect using expert judgement.

The approach to estimating the combined social effects and distributional impacts has been based on assigning a significance rating to impacts on different groups from changes to access and experiences from the interactions associated with each sector. The number of each rating assigned has been summed to give an indication of not just the number of impacts, but also their likely overall cumulative significance for each group and each key area. The approach has followed the principles of the additive approach used across other sectoral interests, while retaining information on the range of significance of social impacts in a semi-quantitative manner. The following ratings have been applied:

- Very significant: almost all people in this location/group are likely to be affected;
- Significant: the most vulnerable people are likely to be affected;
- Slightly significant: some people or those who are more vulnerable are likely to be affected; and
- Not very significant: few people or those who are least vulnerable are likely to be affected.

Where necessary, consultation was undertaken with relevant sectoral interests to modify the initial assessments of impacts.

2.4.6 Documentation of Impacts

The assessment of impacts has been documented in a series of tables for each Scottish Offshore Renewable Energy Region (SORER) for which Draft Plan Option areas have been identified in this planning round and for each offshore renewables technology (offshore wind, wave and tidal) estimating the potentially significant socio-economic impacts (positive and negative) for each sector for each Draft Plan Option area and identifying the nature and duration of those impacts (i.e. one-off costs or ongoing costs) (see Sections 4 to 8 and Appendix C).

2.5 Estimation of Costs and Benefits

The costs and benefits associated with the impacts identified under Section 2.4.6 have been estimated for the three scenarios compared to the 'do nothing' option. This includes:

- The potential costs (negative impacts) associated with the plan options on other activities;
- The potential benefits associated with the impacts of the plan options on other activities; and
- The potential distribution of costs and benefits between activities, between different locations and regions and between different social groups.

The assessment has been prepared in accordance with Scottish Business and Regulatory Impact Assessment guidance, Better Regulation Executive guidance on impact assessment and the Green Book methodology (HM Treasury, 2003) for economic assessment.

The Treasury Green Book notes that 'Costs and benefits considered should normally be extended to cover the period of the useful lifetime of the assets encompassed by the options under consideration'. However, this could create an extremely long assessment period as the asset life of an offshore wind farm could be 40 years, assuming repowering after 20 years. Given that the purpose of the study is to estimate costs and benefits to socio-economic activities excluding the supply chain, it is considered more appropriate to use a shorter assessment period of 10 years post-construction. As identified in Section 2.2.3, for the purposes of this study, it is assumed that construction will commence in 2023 and that all development will be operational by 2025. The assessment period therefore ran from 2014 (the base year) until 10 years after all development became operational (i.e. 2035), a period of 22 years. In line with the indicative programme, construction was assumed to start in 2022 and economic impacts were therefore assumed to ramp up between 2023 and 2025 (one-third of full impact in 2023, two-thirds in 2024 and full impacts from 2025).

Where it was possible to develop quantified estimates for impacts, these have been converted to PV using a 3.5% discount rate in line with Treasury Green Book guidance and summing the discounted values over the assessment period.

A slightly different approach is taken for commercial fisheries to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used to convert PV assessment of impacts on the value of landings to GVA, based on the average GVA % across all Scottish fleet segments. This 39% factor has been used with the projected change in value of landings to estimate the change in GVA.

Where appropriate, knock-on impacts on GVA and employment have also been estimated using the PV damage estimates (or GVA reduction for commercial fisheries). To minimise the risk of meaningless or misleading assessments of the impacts on GVA and employment, the impacts are only quantified where the overall costs to a sector in any region are more than 5% of the turnover for that sector (or reduction in GVA for commercial fisheries). In most cases, the sector turnover has been based on the industry group from the UK Standard Industrial Classification of Economic Activities 2007 classes. The result of this 5% threshold is that the only knock-on impacts on GVA and employment that are identified as being significant are those for commercial fisheries.

The knock-on effects on GVA for commercial fisheries have been estimated using the Type I and Type II GVA multipliers. The 2007 Scottish Input-Output multipliers have been applied as these were the most recent available at the time of the report. Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment. Knock-on employment impacts are based on the value of landings and use the Type I and Type II employment effects.

Increases in fuel costs (such as for shipping) are unlikely to relate in any change in GVA or employment so use of multipliers to these costs could be misleading. It needs to be acknowledged however that since the 5% threshold is an average applied to a sector as a whole, it does not provide for cases where a small number of businesses may be disproportionately affected (e.g. when their turnover is below industry average). The knock-on effects on different types of business (e.g. micro-enterprises, small and medium companies especially in terms of the fishing fleet) are discussed in the qualitative social analysis.

The total impact on GVA has been estimated as the sum over the 13 year period (3 years construction and 10 years post-construction). The total impact on employment has been estimated as the average (mean) number of jobs affected over the 13 year period. This is because it is likely that it would be the same jobs that are affected, year-on-year, such that a total would be misleading.

There are concerns over the likely robustness of the multipliers for fisheries and aquaculture. Further investigation of possible alternative multipliers (e.g. taken from those for England or for the UK as a whole) has been undertaken. It is not always possible to find detailed information specific to sea fishing. However, three different sources of multipliers have been identified in addition to the Scotland Input-Output Multipliers:

- Study undertaken by the University of Strathclyde in 2002[15]: this study presents employment effects, employment multipliers and output multipliers for sea fishing and fish processing for Scotland and the UK. The study also provides specific multipliers for demersal, shellfish and pelagic fisheries and are based on input-output tables from 1998;
- UK Input-Output Tables for 2005, downloaded from the Office for National Statistics: these provide multipliers at the national scale for fishing (but this is not specifically defined as sea fishing); and
- OECD statistics for the UK covering agriculture, hunting, forestry and fishing for mid-2000s: these provide data that can be used to calculate high level multipliers not specifically related to sea fishing. These data were accessed at http://stats.oecd.org (STAN I-O inverse matrix).

Table 5 compares the multipliers from these sources. The table includes multipliers from 2005 and 1998 for Scotland for better comparison with the other sources of multipliers. The table shows that the Scotland multipliers are consistently lower in terms of employment effect, except for the 1998 employment effect, which is higher than that calculated by the University of Strathclyde. The comparisons are complicated by the different sectors that are included, especially for those from the OECD which include agriculture, hunting and forestry alongside fishing.

The implications of Table 6 are that the employment effect for Scotland would be expected to be lower than that for the UK as a whole (as suggested by the University of Strathclyde study), but the employment effect from the 1998

15 University of Strathclyde (2002): Input-Output multiplier study of the UK and Scottish fish catching and fish processing sectors, Final Report, October 2002: http://www.seafish.org/media/Publications/io_study_economics.pdf

Scotland tables is higher than the University of Strathclyde study. As a result, any adjustment to the 2007 employment effect (for example based on the change between 1998 and 2007 from the Scotland tables) would be a reduction of around 55% in the University of Strathclyde employment effect, or to 9.85. Neither the University of Strathclyde nor the UK input-output tables give GVA multipliers such that it is difficult to draw conclusions for this multiplier. However, the output multipliers do tend to be higher than from the Scotland I-O tables suggesting these may under-estimate the output effects.

Table 5. Multipliers for comparison with the Scottish 2007 multipliers (Type I)

Source and sector	Output multiplier	Employment effect	Employment multiplier	GVA multiplier
Scottish I-O tables 2007 for sea fishing	1.42	11.80	1.32	1.30
Scottish I-O tables 2005 for sea fishing	1.43	10.72	1.49	1.37
Scottish I-O tables 1998 for sea fishing	1.33	21.42	1.25	1.31
University of Strathclyde (2002) for sea fishing in Scotland (1998 I-O tables)	2.13	17.9	1.80	Not given
University of Strathclyde (2002) for sea fishing in UK (1998 I-O tables)	3.47	24.7	2.24	Not given
UK 2005 Input-Output tables for fishing	1.90	Not given	3.92	Not given
OECD for UK (agriculture, hunting, forestry, fishing) (mid-2000s)	2.34	22.5	2.34	Not given
Notes: the table only shows the Type I multipliers as these were more widely available than the Type II multipliers; both Type I and Type II multipliers are used in this study to assess the social impacts				

Table 6. Allocation of expenditure types to industry groups

Cost Type	Industry Group	Justification
Fisheries	Sea fishing	Specific code available
Aquaculture	Fish farming	Specific code available
Navigation	Water transport	Includes sea and coastal water transport
Aviation	Air transport	Includes scheduled and non-scheduled air transport
Recreational Angling	Recreational services	Includes sporting activities
Recreational Boating	Recreational services	Includes sporting activities
Surfing and windsurfing	Recreational services	Includes sporting activities
Tourism	Hotels, catering & pubs etc	Includes accommodation, restaurants and bars
Wave and tidal energy	Research & development	Includes research and experimental design on engineering
Cables	Telecommunications	Specific code available (this also includes maintenance of the network)

The assessments have been presented in a series of fully documented Excel spreadsheets to ensure transparency and facilitate audit by Marine Scotland as necessary. The spreadsheets include qualitative and quantitative data that underlie the calculations, along with any assumptions that have been made.

2.6 Consultation

The study has been overseen by a Project Steering Group (PSG) within Scottish Government to provide guidance and advice on the methodology and presentation of outputs. The study has also benefitted from advice from a wider Project Advisory Group (PAG) (Appendix A) on the development of the methodology and discussion of the draft outputs. In addition, specific consultation has been undertaken with a wider range of stakeholders (see list in Appendix D) to identify additional information sources and to inform assumptions used in the assessment.

At the start of the project an initial email letter (Appendix E) was sent to all wider stakeholders informing them of the purpose of the study and how and when they might become involved. Further engagement with these stakeholders was undertaken as relevant and necessary throughout the course of the study.

3. Outcome of Scoping Assessment

A scoping exercise was carried out for each activity, the details are provided in Appendices B and C, where the criteria used were based on specific assumptions. These assumptions were used in order that a documented trail of the outcome of the scoping could be provided. A number of figures are provided in Appendix B to illustrate the distribution of activities in relation to Draft Plan Option areas to support the scoping assessment.

The scoping exercise has taken account of the scale of potential development within Draft Plan Option areas and the nature and scale of potential interactions with activities for the different offshore renewables technologies.

A summary of the scoping exercise outputs is provided in Tables 7 and 8 for wind and tide respectively. For wave development, all activities except for commercial fishing, energy generation and military interests (all of which occur in all Draft Plan Option areas), and carbon capture and storage in the North Region were scoped out.

In addition due to the uncertainty of where export cable routes would be located a qualitative assessment of the interactions with activities was also carried out.

Table 7. Activities Scoped in by Site for Offshore Wind

Site	Activity																																			
	Aviation			Carbon Capture and Storage			Commercial Fisheries			*Energy Generation*			Military Interests			Oil and Gas			Ports and *Harbours*			Power Interconnectors			Recreational Boating			Shipping			Tourism			*Water Sports*		
	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H
OWN1							✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
OWN2	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓				✓	✓	✓		✓	✓				✓	✓	✓
OWNE1	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓
OWNE2	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓
OWSW1	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
OWSW2	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
OWW1	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓			✓	✓	✓	✓
OWW2	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓				✓	✓	✓
OWW3	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓					✓	✓	✓	✓	✓
OWNW1							✓	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓				✓	✓	✓

L = Low C=Central H = High Scenario

Table 8. Activities Scoped in by Site for Tide

Site	Activity																										
	Carbon Capture and Storage			Commercial Fisheries			Energy Generation			Military Interests			Oil and Gas			Ports and Harbours			Recreational Boating			Shipping			Water Sports		
	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H	L	C	H
TN1			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓			✓	✓	✓	✓
TN2				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓			✓	✓	✓	✓
TN3				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓				✓	✓	✓
TN4			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓			✓	✓	✓	✓
TN5				✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓			✓	✓	✓	✓
TN6				✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓			✓	✓	✓	✓
TN7				✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓			✓	✓	✓	✓
TSW1				✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓			✓	✓	✓	✓
TW1				✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓			✓	✓	✓	✓
TW2				✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓			✓	✓	✓	✓

L= Low C = Central H=High Scenario

4. Assessment for Offshore Wind, Wave and Tidal Draft Plan Option Areas – South West Region

4.1 Offshore Wind

4.1.1 Quantification of Potentially Significant Impacts

Table 9 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind development within Draft Plan Option areas OWSW1 and OWSW2. Quantified cost estimates have been developed for commercial fisheries, recreational boating, shipping and tourism. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further detail can be found in Appendix C.

Table 9. Present value (PV) costs (and GVA for fisheries) in £millions for Offshore Wind in South West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.05	0.06	0.13
Recreational boating	Additional fuel costs	0.05	0.06	0.10
Shipping	Additional fuel costs	4.87	5.08	5.98
Tourism	Reduction in expenditure	-	0.03	0.33
Total costs		**4.97**	**5.23**	**6.54**

Commercial Fisheries

The commercial fisheries assessment considered the worst-case impact of total loss of fishing grounds from the potential offshore wind development in the South-West Region. This was quantified as the value of fish landings from the proportion of the Draft Plan Option areas likely to be developed under each scenario. For OWSW1 and OWSW2 Draft Plan Option areas this area was calculated as being 8.5% and 26.5% (low scenario), 11.6% and 26.5% (central scenario) and 25.1% and 26.5% (high scenario) respectively. The total impact on commercial fisheries from offshore wind development in the South-West region was £0.05m GVA for the low scenario, rising to £0.13m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to the over-10m sector, and mainly on dredgers and potters that are active in the region, targeting shellfish.

Recreational Boating
The potential overlap of recreational boating within OWSW1 and OWSW2 in the South West SORER will occur in the central and high scenarios where up to three medium RYA cruising routes will be impacted. The estimated cost impact on recreational boating based on additional fuel costs associated with route deviations ranges from £0.05m PV in the low scenario to £0.10m PV in the high scenario.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. There are no ferry routes within the Draft Plan Option areas within the South West SORER. The costs impacts are estimated to be £4.87m PV for the low scenario increasing to £5.98m PV for the high scenario.

Tourism
The shoreward boundary of both OWSW1 and OWSW2 Draft Plan Option areas are within 10km of land and the visual impact has been assessed on a conservative basis as having some minor potential to affect tourism expenditure within the affected area. For the low scenario it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to tourism. For the central and high scenarios, it has been assumed that land areas within 10 and 13km of the Draft Plan Option areas respectively will experience some reduction in tourism expenditure, based on impact factors derived from Riddington et al (2008). The estimated cost impacts are estimated to be £0.03m in the central scenario and £0.33m PV in the high scenario.

It has not been possible to estimate the impact of the potential landside works that might be associated with development within the Draft Plan Option areas (operation and maintenance activity, onshore substations), as the locations of these activities are not yet known.

4.1.2 Other Costs not Quantified

Aviation
The OWSW1 and OWSW2 Draft Plan Option areas are within the line of sight of at least one of the primary surveillance radar used or operated by NATS who has advised that depending on the size, numbers and relative proximity of the turbines within the proposed developments, there is the potential for interference with any of the scenarios. The costs of mitigation measures would be borne by the developer.

Commercial Fisheries

Based on information from VMS 'steaming' pings, the main fishing navigation routes in the South-West Region do not overlap with the Draft Plan Option areas, however there is some steaming that overlaps with wind area OWSW1. It is expected that impacts could be largely mitigated through careful location of devices, although there may be some deviation required particularly under the high scenario. No specific interactions with export cables have been identified owing to a lack of information on the precise location of inshore fishing activity. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK. Where fishing vessels' effort is displaced to new areas, rather than lost (as assumed in the worst-case impact assessed quantitatively), there may be impacts in terms of conflict with other fishing vessels, environmental impacts in targeting new areas, longer steaming times and increased fuel costs, changes in costs and earnings, gear development and adaptation costs, and additional quota costs.

Energy Generation

There is a significant degree of overlap between Draft Plan Option areas OWSW1 and TSW1 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests

There is a potential overlap between OWSW2 Draft Plan Option area and with the cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Recreational boating

The potential impact of future offshore wind development within the Draft Plan Option areas on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports

Scuba diving is carried out in the potential locations of the cable routes from both OWSW1 and OWSW2 Draft Plan Option areas. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. While recreational angling is an important activity within the South-West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with offshore wind development within the Draft Plan Option areas is assessed as negligible.

Social Impacts

Each of the above effects could have social impacts. Table 10 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, while others are likely to be minimal, for example, on recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 11 and 12 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on recreational boating may be more noticeable on settlements with a harbour or marina, or on boat users, although they are still likely to be small. For most groups, though, the impacts are only minimal and are unlikely to result in noticeable effects.

Table 10. Identification of the social impacts and their significance

Offshore Wind (South West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0. 05 Central: £0.06 High: £0.13		x Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)		Impacts should be minimised through careful location of devices	Potentially 0	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear, increasing costs and reducing number of jobs) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Recreational boating	Additional fuel costs	Health (reduction in recreational opportunities) Employment (impacts on boating services if boat owners choose to relocate their boating activities to elsewhere) Environment (change in opportunity for access)	Low: £0.05 Central: £0.06 High: £0.10	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities				
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: £4.87 Central: £5.08 High: £5.98	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
Tourism	Reduction in expenditure	Culture and heritage (may affect cultural interpretation of coastline and seascapes) Employment (negative impacts on numbers of	Low: none Central: £0.03 High: £0.33	Spatial planning used to locate arrays to minimise impacts, but maybe some impacts on	0	x

Offshore Wind (South West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
		tourists affecting income of tourism businesses) Health (impacts may affect recreational trips taken by locals, affecting their health)		medium and high scenarios in OWSW1 and OWSW2		
Water sports	Spatial overlap between cable routes and water sports activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere) Environment (change in opportunity for access)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings**: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected						

Table 11. Distributional analysis (location, age and gender)

Sector	**Impact**	**Location**			**Age**			**Gender**	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	x	xx	xx Ayr, Campbeltown	x	x	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Ayr, Campbeltown	x	x	x	x	xx Processors more likely to be female
Recreational boating	Additional fuel costs	0	x	x	0 Not relevant in SW	x	x	x	x
	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Wigtown, Kirkcudbright, Whitehaven could be particularly affected	0 Not relevant in SW	x	x	x	x
Tourism	Reduction in expenditure	0	x	No specific settlements affected	0 Not relevant in SW	x	x	x	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected.									

Table 12. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Commercial fisheries	Value of potentially lost landings	x	x	x	0 Not relevant in SW	x	0 Unlikely to be employed in fisheries	xx Dredgers and potters	xx Vessels >10m length x Vessels <10m in length
	Consequential impacts to fish processors	x	x	x	0 Not relevant in SW	x	0	x	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	x	x	0 Not relevant in SW	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	0 Not relevant in SW	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase
Tourism	Reduction in expenditure	x	x	x	x	x	x	x	No other specific group identified
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

4.2 Tidal

4.2.1 Quantification of Potentially Significant Impacts

Table 13 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by tidal within Draft Plan Option area TSW1. Quantified cost estimates have been developed for commercial fisheries, recreational boating and shipping. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further detail can be found in Appendix C.

Table 13. Present Value (PV) costs (and GVA for fisheries) in £millions for Tidal Energy in South West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.01	0.03	0.06
Recreational boating	Additional fuel costs	-	-	0.06
Shipping	Additional fuel costs	-	-	1.07
Total costs		**0.01**	**0.03**	**1.19**

Commercial Fisheries
For TSW1 Draft Plan Option area, the area to be developed was calculated as 0.8% (low scenario), 2.6% (central scenario) and 5.1% (high scenario). The total impact on commercial fisheries from tidal energy development in the South-West region was assessed as £0.01m GVA for the low scenario, rising to £0.06m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to the over-10m sector, and mainly on dredgers and potters that are active in the region, targeting shellfish.

Recreational Boating
The potential overlap of recreational boating within TSW1 in the South West SORER occurs in high scenario where up to five high RYA cruising routes will be impacted. The estimated cost impact on recreational boating based on additional fuel costs associated with route deviations is £0.06m PV.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes.
The assessment has considered the additional fuel costs associated with route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. No cost impacts are identified for the low and central scenarios. The costs under the high scenario are estimated to be £1.07m PV.

4.2.2 Other Costs not Quantified

Commercial Fisheries
Based on information from VMS 'steaming' pings, the main fishing navigation routes in the South-West Region do not overlap with the Draft Plan Option areas. There is some steaming that overlaps with TSW1, but due to the small proportion of the area that would be occupied with tidal devices, impacts are expected to be avoidable. No significant interactions with cables were identified, in particular because it is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK.

Energy Generation
There is a significant degree of overlap between Draft Plan Option areas TSW1 and OWSW1 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition in the transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is potential for the TSW1 Draft Plan Option area to interfere with underwater communications, however at the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Recreational Boating
The potential impact of future tidal energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Sea kayaking and scuba diving occur with the TSW1 Draft Plan Option area while scuba diving also overlaps with the route corridor between this Draft Plan Option area and the potential landfall. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. While recreational angling is an important activity within the South-West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling

interests should occur. Therefore the cost to water sports activities associated with tidal developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts

Each of the above effects could have social impacts. Table 14 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover), and environment and health, in relation to sea kayaking. In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although as shown in Table 14 there may be some minimal impacts, for example, on recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 15 and 16 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, there are possible impacts on sea kayakers where devices are located in popular kayaking areas. The impacts for recreational boaters may also be slightly more significant on settlements with a harbour or marina, should boat users choose to relocate. For most groups, though, the impacts are only slightly significant and are unlikely to result in any noticeable effects.

Table 14. Identification of the social impacts and their significance

Tidal (South West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.01 Central: £0.03 High: £0.06		x Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)		Impacts should be minimised through careful location of devices	Potentially 0	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for space and transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Recreational boating	Additional fuel costs	Health (reduction in recreational opportunities) Employment (impacts on boating services if boat owners choose to relocate their boating activities to elsewhere) Environment (change in opportunity for access)	Low: none Central: none High: £0.06	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities				
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: none High: £1.07	Devices should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
Water sports	Spatial overlap between Draft Plan Option areas and water	Health (reduction in recreational opportunities) Environment (change in opportunity for access)	Impacts not quantified		xx	xx

Tidal (South West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
	sport activity (sea kayaking)					
	Spatial overlap between cable routes and water sports activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere) Environment (change in opportunity for access)	Impacts not quantified	Unlikely that devices or cables will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings:** x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected						

Table 15. Distributional analysis (location, age and gender)

Sector	**Impact**	**Location**			**Age**			**Gender**	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	x	xx	xx Ayr, Campbeltown	x	x	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Ayr, Campbeltown	x	x	x	x	xx Processors more likely to be female
Recreational boating	Additional fuel costs	0	x	x	0 Not relevant in SW	x	x	x	x
	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Wigtown, Kirkcudbright, Whitehaven could be particularly affected	0 Not relevant in SW	x	x	x	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	0 Not relevant in SW	x	x	x	x
Impacts: x x x : significant negative effect, x x : possible negative effects, x: minimal negative effect, if any, 0: no noticeable effect expected									

Table 16. Distributional analysis (income and social groups)

Sector	**Impact**	**Income**			**Social groups**				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Commercial fisheries	Value of potentially lost landings	x	x	x	0 Not relevant in SW	x	0 Unlikely to be employed in fisheries	xx Dredgers and potters	xx Vessels >10m length x Vessels <10m in length
	Consequential impacts to fish processors	x	x	x	0 Not relevant in SW	x	0	x	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	x	x	0 Not relevant in SW	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	0 Not relevant in SW	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	x	x	x	0 Not relevant in SW	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified
Impacts: x x x : significant negative effect, x x : possible negative effects, x: minimal negative effect, if any, 0: no noticeable effect expected									

5. Assessment for Offshore Wind, Wave and Tidal Draft Plan Option Areas – West Region

5.1 Offshore Wind

5.1.1 Quantification of Potentially Significant Impacts

Table 17 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind development within Draft Plan Option areas OWW1, OWW2 and OWW3. Quantified cost estimates have been developed for commercial fisheries, recreational boating, shipping and tourism. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 17. Present value (PV) costs (and GVA for fisheries) in £millions for Offshore Wind in the West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.13	0.31	0.67
Shipping	Additional fuel costs	-	3.80	7.88
Tourism	Reduction in expenditure	-	0.01	0.06
Total costs		**0.13**	**4.12**	**8.61**

Commercial Fisheries

For OWW1, OWW2 and OWW3 Draft Plan Option areas, the area that would be occupied by arrays was calculated as being 4.8%, 11.6% and 25.1% for the low, central and high scenarios respectively. The total impact on commercial fisheries from offshore wind development in the West Region was £0.13m GVA for the low scenario, rising to £0.67m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to potters and *Nephrops* trawlers.

Shipping

The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area.

There are no ferry routes within the Draft Plan Option areas within the West SORER. No cost impacts are identified for the low scenario. The costs impacts are estimated to be £3.80m PV for the central and £7.88m PV for the high scenarios respectively.

Tourism
The shoreward boundary of the OWW3 Draft Plan Option area is within 10km of land and the visual impact has been assessed on a conservative basis as having some minor potential to affect tourism expenditure within the affected area. For the low scenario it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to tourism. For the central and high scenarios, it has been assumed that land areas within 10 and 13km of the Draft Plan Option areas respectively will experience some reduction in tourism expenditure, based on impact factors derived from Riddington et al (2008). The estimated cost impacts are estimated to be £0.01m in the central scenario and £0.06m PV in the high scenario.

It has not been possible to estimate the impact of the potential landside works that might be associated with development within the Draft Plan Option areas (operation and maintenance activity, onshore substations), as the location of such activity is not known.

5.1.2 Other Costs not Quantified

Aviation
The OWW1, OWW2 and OWW3 Draft Plan Option areas are within the line of sight of at least one of the primary surveillance radar used or operated by NATS, and in addition OWW2 also falls within 15nm of the safeguarding zone around the secondary surveillance radar around the nearest airport. NATS has advised that depending on the size, numbers and relative proximity of the turbines within the proposed developments, there is the potential for interference with any of the scenarios. The costs of mitigation measures would be borne by the developer.

Commercial Fisheries
OWW1 and OWW3 Draft Plan Option areas overlap with moderate concentrations of steaming pings. There may be some deviation of navigation required to avoid wind arrays in OWW1 and OWW3, particularly under the high scenario, in which 25% of the areas area expected to be occupied by arrays. This implies a cost to the fishing industry in terms of steaming time and increased fuel costs to reach fishing grounds, and additional impacts on fishing time available for those vessels limited by days-at-sea regulations. This is most likely to affect vessels from Oban port, where 55 under-15m vessels and 14 over-15m vessels are based (MMO, 2013). No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of

Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4). Where fishing vessels' effort is displaced to new areas, rather than lost (as assumed in the worst-case impact assessed quantitatively), there may be impacts in terms of conflict with other fishing vessels, environmental impacts in targeting new areas, longer steaming times and increased fuel costs, changes in costs and earnings, gear development and adaptation costs, and additional quota costs.

Energy Generation
There is a significant degree of overlap between Draft Plan Option areas OWW1, OWW3 and WW1 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition in the transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all Draft Plan Option areas and with all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Ports and Harbours
The main identified impact to ports and harbours associated with offshore wind development within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Recreational boating
The potential impact of future offshore wind development within the Draft Plan Option areas on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Scuba diving is carried out in the potential locations of the cable routes from both OWSW1 and OWSW2 Draft Plan Option areas. Most of the diving activities are associated with areas of interest and in particular wrecks and

where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. While recreational angling is an important activity within the South-West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with offshore wind development within the Draft Plan Option areas is assessed as negligible

Social Impacts
Each of the above effects could have social impacts. Table 18 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover), the environment (mainly due to increased emissions or changes in environmental quality), and culture and heritage (related to changes in seascape). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although there may be minimal impacts on recreational boaters and tourists/visitors to the coast.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 19 and 20 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on recreational boating may be more significant on settlements with a harbour or marina, or on boat users. For most groups, though, the impacts are minimal and are unlikely to result in noticeable effects.

Table 18. Identification of the social impacts and their significance

Offshore Wind (West)						
Sector	Direct effects	Area of social impact affected	Costs (PV £ million or GVA for fisheries)	Mitigation	Significance of social impact	
					Access	Experience
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.13 Central: £0.31 High: £0.67		xxx Low: 0.20 to 0.22 jobs affected Central: 0.5 jobs affected High: 1.4 to 1.5 jobs affected	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions from deviation to avoid arrays)	Impacts not quantified	Careful location of devices may help to avoid impacts, but some deviation likely in OWW1 and OWW3	xx	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)	Impacts not quantified	Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for space and for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Recreational boating	Additional fuel costs	Access to recreational opportunities	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: £3.80 High: £7.88	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0

Offshore Wind (West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
	Displacement of anchorage areas	Access to services (if ferry routes are changed) Environment (increased emissions)	Impacts not quantified	Arrays should seek to be sited to avoid hindering ferry services	Potentially 0	Potentially 0
Tourism	Reduction in expenditure	Culture and heritage (may affect cultural interpretation of coastline and seascapes) Employment (negative impacts on numbers of tourists affecting income of tourism businesses) Health (impacts may affect recreational trips taken by locals, affecting their health)	Low: none Central: £0.01 High: £0.06	Spatial planning used to locate arrays to minimise impacts, but maybe some impacts on medium and high scenarios in OWW3 for land within 10km (but area of impact is very small)	x	x
Water sports	Spatial overlap between cable routes and water sports activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0

Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce
Definition of ratings: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

Table 19. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Commercial fisheries	Value of potentially lost landings	0	xxx More significant for OWW1	xxx Oban, Mallaig, Stornoway	x	xxx	x	xxx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	xxx More significant for OWW1 and OWW3	xxx Oban, Mallaig, Stornoway	x	xxx	x	xxx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	xx	xx Oban, Mallaig, Stornoway	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	x Oban, Dunstaffnage marinas could be affected if number of boaters reduces (but others could benefit)	0	x	x	x	x
Tourism	Reduction in expenditure	0	x	No specific settlements affected	x	x	x	x	x

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

Table 20. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Value of potentially lost landings	xxx	xxx	xx	xxx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xxx Potters	xxx *Nephrops* trawlers
	Obstruction of navigation routes	xxx	xxx	xx	xxx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xxx Potters	xxx *Nephrops* trawlers
	Consequential impacts to fish processors	xx	xx	x	x	xx	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	xx May be more likely to have smaller boats	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase
Tourism	Reduction in expenditure	x	x	x	x	x	x	x	No other specific group identified
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

5.2 Wave

5.2.1 Quantification of Potentially Significant Impacts

Table 20 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by wave development within Draft Plan Option areas WW1, WW2 and WW3. Quantified cost estimates have been developed for commercial fisheries only. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 21. Present value (PV) costs (and GVA for fisheries) in £millions for Wave Energy in the West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.01	0.01	0.03
Total costs		**0.01**	**0.01**	**0.03**

Commercial Fisheries
For WW3 and WW4 Draft Plan Option areas, the area that would be occupied by arrays was calculated as being from 0.59% for WW3 in the low scenario to 0.95% in the high scenario. The total impact on commercial fisheries from wave energy development in the West Region was relatively small — £0.01m GVA for the low scenario, rising to £0.03m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to potters and *Nephrops* trawlers.

5.2.2 Other Costs not Quantified

Commercial Fisheries
WW4 overlaps with moderate concentrations of steaming pings, indicating overlap with fishing navigation routes. As less than 1% of the Draft Plan Option area would be occupied by arrays under the high scenario, careful location of devices is expected to be able to avoid impacts for this wave area. No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4).

Energy Generation
There is a significant degree of overlap between Draft Plan Option areas WW1 and OWW1 and OWW3 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition in the transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all Draft Plan Option areas and with all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Recreational Boating
The potential impact of future wave energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Sea kayaking activities overlap with all wave Draft Plan Option areas in the West Region. In addition scuba diving overlaps with area WW2 and with the potential cable routes of all three Draft Plan Option areas. None of the Draft Plan Option areas are considered to be in the top ten sites for sea kayaking and as sea kayaks are highly manoeuvrable, wave devices are unlikely to physically displace this activity. Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so economic and social impacts are assessed as negligible. Most of the scuba diving activities are associated with areas of interest and in particular wrecks and where these are known it is unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of wave devices are assessed as negligible. While recreational angling is an important activity within the West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities

associated with wave developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts
Each of the above effects could have social impacts. Table 22 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, such that the only noticeable effects are expected to be on fisheries.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 23 and 24 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts may be greater on sea kayakers as they could be directly affected however even here the impacts are unlikely to be significant.

Table 22. Identification of the social impacts and their significance

Wave (West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.01 Central: £0.01 High: £0.03		x Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)	Impacts not quantified	Impacts should be minimised through careful location of devices	Potentially 0	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)	Impacts not quantified	Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
	Loss of traditional fishing grounds	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.024 Central: £0.035 High: £0.068		x Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
Energy generation	Competition for space and transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Ports and harbours	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0
Shipping	Displacement of anchorage areas	Access to services (if ferry routes are changed) Environment (increased emissions)	Impacts not quantified	Devices should seek to be sited to avoid hindering ferry services	Potentially 0	Potentially 0

Wave (West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
				Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality		
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking and scuba diving)	Health (reduction in recreational opportunities) Environment (change in opportunity for access)	Impacts not quantified	Unlikely that devices or cables will be placed close to dive sites, such that impacts should be minimised	xx (sea kayaking)	xx (sea kayaking)
	Spatial overlap between cable routes and water sports activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere) Environment (change in opportunity for access)	Impacts not quantified	Unlikely that devices or cables will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings:** x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected						

Table 23. Distributional analysis (location, age and gender)

Sector	**Impact**	**Location**			**Age**			**Gender**	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	0	x	x Oban, Mallaig, Stornoway	x	x	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Oban, Mallaig, Stornoway	x	x	x	x	xx Processors more likely to be female
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 24. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Value of potentially lost landings	x	x	x	x Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	x Potters	x *Nephrops* trawlers
	Consequential impacts to fish processors	x	x	x	x	x	0	x	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	x	x	x	x	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

5.3 Tidal

5.3.1 Quantification of Potentially Significant Impacts

Table 24 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by tidal development within Draft Plan Option areas TW1 and TW2. Quantified cost estimates have been developed for commercial fisheries, recreational boating and shipping. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 25. Present value (PV) costs (and GVA for fisheries) in £millions for Tidal Energy in the West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.02	0.05	0.1
Shipping	Additional fuel costs	-	-	1.89
Total Costs		**0.02**	**0.05**	**1.99**

Commercial Fisheries
For TW1 and TW2 Draft Plan Option areas this area was calculated as being 0.8% and 0.9% respectively for the low scenario, 2.6% for the central scenario and 5.1% for the high scenario and accounted for a total impact on commercial fisheries of £0.02m GVA for the low scenario rising to £0.1m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to potters and *Nephrops* trawlers, and to a lesser extent, dredgers.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. It is considered that spatial planning will seek to locate tidal developments to minimise interactions, which is especially important where ferry services provide lifeline connections to island communities. There is one ferry route within the Draft Plan Option area between Campbeltown and Ballycastle. The costs impacts for route deviation are estimated to be £1.89m PV for the high scenario, with no costs being associated with the low and central scenarios.

5.3.2 Other Costs not Quantified

Commercial Fisheries
Tidal area TW2, off the south west tip of the Mull of Kintyre, overlaps with a significant navigation route for vessels steaming around this area. Coupled with the strong currents experienced in this location, this may pose a potential navigation hazard. This is most likely to affect vessels from Ayr (44 under-15m vessels and 26 over-15m vessels are registered here as their home port) and Campbeltown (59 under-15m vessels and 13 over-15m vessels) (MMO, 2013). No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK.

Energy Generation
Energy generation from differing forms of technology will lead to competition in the transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all Draft Plan Option areas and with all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Ports and Harbours
There is the potential for tidal development within all Draft Plan Option areas to interact with all the ports and harbours within the West SORER. There is spatial overlap between and the maintained navigation channels and the high scenario at site TW1, and similarly with cable routes from TW1 and TW2 and all the Region's ports and harbours.. In addition there is the potential for reduced port development opportunities to occur with the presence of the Draft Plan Option area TW2 under the high scenario. However the assessment has identified that due to the scale of the development within under any scenario within the Draft Plan Option areas it would be possible to avoid conflict with port access routes and channels through careful planning.

Recreational Boating
The potential impact of future tidal energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage

planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Sea kayaking occurs within TW1 and TW2 Draft Plan Option areas while scuba diving also overlaps with the route corridor between these Draft Plan Option areas and the potential landfall together with surfing and windsurfing in TW2. None of the Draft Plan Option areas are considered to be in the top ten sites for sea kayaking and as sea kayaks are highly manoeuvrable, wave devices are unlikely to physically displace this activity. Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so impacts are assessed as negligible.

Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Most of the impacts will result during the construction of the cable routing and will be short lived, any changes in climate regime will also impact on the suitability of these areas to sea kayaking and surfing however any changes are considered to be insignificant and therefore costs associated with the impacts of tidal energy are assessed as negligible.

While recreational angling is an important activity within the West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with tidal developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts
Each of the above effects could have social impacts. Table 26 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although as shown in Table 28 there may be some minimal impacts on recreational boating and sea kayaking.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 27 and 28 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on recreational boating may be more significant on settlements with a harbour or marina, while special interest groups such as sea kayakers may also see an impact. For most groups, though, the impacts will be minimal at worst.

Table 26. Identification of the social impacts and their significance

Tidal (West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.02 Central: £0.05 High: £0.01		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions) Health (increased navigation risks)		Impacts should be minimised through careful location of devices, but some navigation risks may remain in poor weather	xx	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Ports and harbours	Obstruction of maintained navigation channel(s)	Access to services (if number of ferry services were to be reduced or routes were changed) Employment (reduction in jobs associated with ports)	Impacts not quantified	Devices should seek to avoid navigation channels through spatial planning	Potentially 0	Potentially 0
	Reduced development opportunities	Access to services (if number of ferry services were to be reduced or routes were changed) Employment (reduction in jobs associated with ports due to loss of investment)	Impacts not quantified	Devices should seek to minimise impacts on ferries through spatial planning	Potentially 0	Potentially 0
	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0

Tidal (West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities	Impacts not quantified		x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: none High: £1.89	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
	Reduced turnaround times due to increased steaming times for vessel routes	Access to services (if number of ferry services were to be reduced) Employment (reduction in jobs associated with ferries)				
	Displacement of anchorage areas	Access to services (if ferry routes are changed) Environment (increased emissions)	Impacts not quantified	Arrays should seek to be sited to avoid hindering access to anchorages	Potentially 0	Potentially 0
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	Health (reduction in recreational opportunities) Environment (change in opportunity for access)	Impacts not quantified		x	x
	Spatial overlap between cable routes and water sports activity (surfing and windsurfing, and scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere) Environment (change in opportunity for access)	Impacts not quantified	Unlikely that devices or cables will be placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings:** x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected						

Table 27. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	0	xx	xx Oban, Mallaig, Stornoway	x	xx	x	xx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	xx	xx Oban, Mallaig, Stornoway	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Oban, Mallaig, Stornoway	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	x Oban, Dunstaffnage marinas could be affected if number of boaters reduces (but others could benefit)	0	x	x	x	x
Water sports	Spatial overlap between Draft Plan Option areas and water sports activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

Table 28. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Commercial fisheries	Loss of traditional fishing grounds	x	x	x	xx Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	xx Potters	xx *Nephrops* trawlers
	Obstruction of navigation routes	x	x	x	xx Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	xx Potters	xx *Nephrops* trawlers
	Consequential impacts to fish processors	x	x	x	x	x	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	xx Where employed in this area	xx	xx	xx May be more likely to have smaller boats	xx	xxx Could affect ability to support trips for disabled/ sick	xxx Could mean they need to relocate to maintain services	xxx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely reduce activity if navigation risks increase
Water sports	Spatial overlap between Draft Plan Option areas and water sports activity (sea kayaking)	x	x	x	x	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

6. Assessment for Offshore Wind, Wave and Tidal Draft Plan Option Areas – North West

6.1 Offshore Wind

6.1.1 Quantification of Potentially Significant Impacts

Table 28 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind development within Draft Plan Option area OWNW1. Quantified cost estimates have been developed for commercial fisheries, recreational boating and shipping. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 29. Present value (PV) costs (and GVA for fisheries) in £millions for Offshore Wind in the North West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.11	0.27	0.58
Shipping	Additional fuel costs	-	1.45	2.90
Total costs		**0.11**	**1.72**	**3.48**

Commercial Fisheries
For OWNW1 Draft Plan Option area, the area that would be occupied by arrays was calculated as being 4.8%, 11.6% and 25.1% for the low, central and high scenarios respectively. The total impact on commercial fisheries from offshore wind development in the North-West Region was £0.11m GVA for the low scenario, rising to £0.58m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to the pelagic sector, targeting herring and mackerel, and to a lesser extent accrue to potters and demersal (whitefish) trawlers. The over-15m sector is most affected.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with the route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. There are no ferry routes within the Draft Plan Option areas within the North West SORER. The costs impacts are estimated to be £1.45m PV for the

central scenario increasing to £2.90m PV for the high scenario. There are no costs associated with the low scenario.

6.1.2 Other Costs not Quantified

Commercial Fisheries

Wind area OWNW1 overlaps with significant navigation routes from the north-west coast of Scotland heading east and north-east. Development of this area could impact on navigation routes and result in deviation being necessary, particularly under the high scenario, in which 25% of the area is expected to be occupied by arrays. This implies a cost to the fishing industry in terms of steaming time and increased fuel costs to reach fishing grounds, and additional impacts on fishing time available for those vessels limited by days-at-sea regulations. This is most likely to affect vessels from Stornoway (63 under-15m vessels and 17 over-15m vessels are registered here as their home port), Lochinver (9 under-15m vessels and 1 over-15m vessels), Kinlochbervie (9 under-15m vessels and 4 over-15m vessels) and possibly Ullapool (30 under-15m vessels and 11 over-15m vessels) (MMO, 2013). No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4). Where fishing vessels' effort is displaced to new areas, rather than lost (as assumed in the worst-case impact assessed quantitatively), there may be impacts in terms of conflict with other fishing vessels, environmental impacts in targeting new areas, longer steaming times and increased fuel costs, changes in costs and earnings, gear development and adaptation costs, and additional quota costs.

Energy Generation

Energy generation from differing forms of technology will also lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests

There is a potential overlap between OWNW1 Draft Plan Option area and the proposed cable route and military practice and exercise areas. In addition OWNW1 has the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Recreational boating
The potential impact of future offshore wind tidal energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Water sports activities such as scuba diving, windsurfing and surfing occur in the North West Region, where they are mainly carried out within the potential cable route areas from OWNW1 Draft Plan Option area and landfall. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are assessed as negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes should be undertaken to avoid changes in the shoreline and to the location of the arrays to prevent significant changes to the local wave climate. However, the impact of these restrictions or changes in wave quality due to cables is assessed as negligible. While recreational angling is an important activity within the North West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with offshore wind developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts
Each of the above effects could have social impacts. Table 30 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although as shown in Table 30, there may be some minimal impacts on recreational boating.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 31 and 32 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on recreational boating may be more significant on settlements with a harbour or marina, or on boat users. For most groups, though, the impacts are at worst minimal and in many cases are unlikely to be noticeable.

Table 30. Identification of the social impacts and their significance

Offshore Wind (North West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.11 Central: £0.27 High: £0.58		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold on low and central High: 1.4 to 1.5jobs affected	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions) Health (increased navigation routes)	Impacts not quantified	Impacts should be minimised through careful location of devices, but some risks may remain especially in high scenario	x	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)	Impacts not quantified	Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: £1.45 High: £2.90	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
Water sports	Spatial overlap between cable routes and water	Health (reduction in recreational opportunities) Employment (impacts on services if boat	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts	Potentially 0	Potentially 0

Offshore Wind (North West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
	sports activity (surfing and windsurfing, and scuba diving)	owners choose to relocate their water sports activities to elsewhere)		should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period		
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings:** x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect						

Table 31. Distributional analysis (location, age and gender)

Sector	**Impact**	**Location**			**Age**			**Gender**	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	0	xx	xx Kinlochbervie, Lochinver, Ullapool	x	xx	x	xx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	x	x Kinlochbervie, Lochinver, Ullapool	0	x	0	x Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Kinlochbervie, Lochinver, Ullapool	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	x Pontoon facilities, e.g. at Kinlochbervie could be affected if number of boaters reduces (but others could benefit)	0	x	x	x	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 32. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Commercial fisheries	Value of potentially lost landings	x	x	x	xx Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	xx Pelagic sector x Potters, demersal trawls	xx Vessels >15m (herring) x Vessels <15m
	Obstruction of navigation routes	x	x	x	xx Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	xx Pelagic sector x Potters, demersal trawls	xx Vessels >15m (herring) x Vessels <15m
	Consequential impacts to fish processors	x	x	x	x	x	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	xx May be more likely to have smaller boats	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

6.2 Wave

6.2.1 Quantification of Potentially Significant Impacts

Table 32 presents quantified estimates impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by wave development within Draft Plan Option areas WNW1 and WW4. Quantified cost estimates have been developed for commercial fisheries only. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 33. Present value (PV) costs (and GVA for fisheries) in £millions for Wave Energy in the North West Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.03	0.09	0.18
Total costs		**0.03**	**0.09**	**0.18**

Commercial Fisheries
For WNW1 Draft Plan Option area, the area that would be occupied by arrays was calculated as being 0.17%, 0.47% and 0.95% for the low, central and high scenarios respectively. The total impact on commercial fisheries from wave energy development in the North-West Region was £0.03m GVA for the low scenario, rising to £0.18m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to the over-15m pelagic trawl sector, targeting mackerel.

6.2.2 Other Costs not Quantified

Commercial Fisheries
Wave area WNW1 overlaps with the navigation routes heading east from the northern coast of the Isle of Lewis, but impacts on navigation routes are expected to be avoidable through location of devices, given that less than 1% of the area would be occupied with wave devices even under the high scenario. No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK.

Energy Generation
Energy generation from differing forms of technology will also lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all Draft Plan Option areas and with all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Ports and Harbours
The main identified impact to ports and harbours associated with wave developments within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Recreational Boating
The potential impact of future wave energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Surfing and windsurfing occur within the area of WNW1 where the impacts to seascape and setting could reduce the number of surfs using the area however as the wave devices would only be up to a maximum of 10m above sea level these structures are expected to cause a minimal disruption to this activity.

Sea kayaking is undertaken in all wave Draft Plan Option areas while scuba diving is known to take place at WNW1, however this is not considered to be in the top ten sites for sea kayaking and as sea kayaks are highly manoeuvrable, wave devices are unlikely to physically displace this activity. Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so impacts are assessed as negligible. Scuba diving also occurs within WNW1 and is mainly associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are assessed as negligible.

Windsurfing and surfing and scuba diving are also undertaken within the potential cable route areas between the Draft Plan Option areas and landfall. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of wave development in the Draft Plan Option areas are assessed as negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes is required to avoid changes in the shoreline and to the location of the arrays to prevent significant changes to the local wave climate. However the impact of these restrictions or changes in wave quality due to cables is assessed as negligible. While recreational angling is an important activity within the North West Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with wave developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts
Each of the above effects could have social impacts. Table 34 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts such as on health could largely be mitigated, such that there are unlikely to be any noticeable impacts. The only exception may be during construction for surfers and windsurfers, but this would be minimal and only for a short-time.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 35 and 36 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. The only noticeable impacts are likely to be on commercial fisheries.

Table 34. Identification of the social impacts and their significance

Wave (North West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.03 Central: £0.09 High: £0.18		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold	
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)		Impacts should be minimised through careful location of devices	Potentially 0	
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	
Energy generation	Competition for space and transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
Shipping	Obstruction of transiting vessel/ferry routes; increased steaming distances/time	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Impacts not quantified	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
	Spatial overlap between cable	Health (reduction in recreational opportunities)	Impacts not quantified	Unlikely that arrays will be	Potentially 0	Potentially 0

Wave (North West)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
	routes and water sports activity	Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)		placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period		
Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce **Definition of ratings:** x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect						

Table 35. Distributional analysis (location, age and gender)

Sector	**Impact**	**Location**			**Age**			**Gender**	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pension-able age**	**Male**	**Female**
Commercial fisheries	Value of potentially lost landings	0	xx	xx Kinlochbervie, Lochinver, Ullapool	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Kinlochbervie, Lochinver, Ullapool	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	x Pontoon facilities, e.g. at Kinlochbervie could be affected if number of boaters reduces (but others could benefit)	0	x	x	x	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 36. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Loss of traditional fishing grounds	x	x	x	xx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xx Pelagic sector x Potters, demersal trawls	xx Vessels >15m mackerel) x Vessels <15m
	Consequential impacts to fish processors	x	x	x	x	x	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	xx May be more likely to have smaller boats	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

7. Assessment for Offshore Wind, Wave and Tidal Draft Plan Option Areas – North Region

7.1 Offshore Wind

7.1.1 Quantification of Potentially Significant Impacts

Table 36 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind development within Draft Plan Option areas OWN1 and OWN2. Quantified cost estimates have been developed for angling, commercial fisheries, recreational boating, shipping and tourism. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 37. Present value (PV) costs (and GVA for fisheries) in £millions for Offshore Wind in the North Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.74	1.8	3.9
Shipping	Additional fuel costs	-	7.11	14.22
Tourism	Reduction in expenditure	-	0.22	0.59
Water sports - Sea Angling	Reduction in expenditure	-	-	0.47
Total costs		**0.74**	**9.13**	**19.18**

Commercial Fisheries
For OWN1 and OWN2 Draft Plan Option areas, the area that would be occupied by arrays was calculated as being 4.8%, 11.6% and 25.1% for the low, central and high scenarios respectively. The total impact on commercial fisheries from offshore wind development in the North Region was £0.74m GVA for the low scenario rising to £1.8m GVA and £3.9 GVA for the central and high scenarios respectively (over the whole assessment period, discounted), providing the highest value of impact of any of the regions. These impacts mainly accrue to the pelagic trawlers (predominantly impacting on mackerel catches), demersal whitefish trawlers, and potters. The over-15m sector is most affected, but impacts on under-10m vessels are also significant. ScotMap data do not cover OWN2, but indicate that for OWN1, the estimate is likely to be an over-estimate, as the majority of earnings from the

relevant ICES rectangles come from closer inshore and between the islands (Figure B4.2).

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with the route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. There are two ferry routes within OWN2 namely Lerwick to Hanstholm and Aberdeen to Lerwick. The costs impacts are estimated to be £7.11m PV for the central scenario increasing to £14.22m PV for the high scenario. There are no costs associated with the low scenario.

Tourism
The shoreward boundaries of OWN1 and OWN2 Draft Plan Option areas are within 10km of land and the visual impact has been assessed on a conservative basis as having some minor potential to affect tourism expenditure within the affected area . For the low scenario it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to tourism. Most of the impacts for the central and high scenarios will be associated with OWN1 (Orkney) where 7.56% of the VisitScotland Area is within the Zone of Influence (10 and 13km of land), while the OWN2 Draft Plan Option area (Shetland) this value is only 0.001% based on impact factors derived from Riddington et al (2008) resulting in an estimate of £0.59m PV for the high scenario.

It has not been possible to estimate the impact of the potential landside works that might be associated with development within the Draft Plan Option areas (operation and maintenance activity, onshore substations), as the locations of these activities are not yet known.

Water Sports - Sea Angling
Under the high scenario, around 1.3% of the area fished by boat based sea anglers within the North Region could be subject to offshore renewables development. The cost impact is based on the estimated potential reduction in expenditure in the Region as a result of loss of access to fishing grounds within offshore wind Draft Plan Option areas within 6nm of the territorial baseline. For the low and central scenarios it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to angling. For the high scenario, the cost impact is estimated to be £0.47m PV.

7.1.2 Other Costs not Quantified

Aviation
There is the potential for overlaps between the siting for offshore wind turbines and helicopter routes for the OWN2 Draft Plan Option area, however

where these occupy less than 5% of the area, as in the low scenario, it has been assumed that spatial planning will avoid any significant impacts to the industry. Impacts are potentially more significant for the central and high scenarios however it is difficult to quantify the costs associated with changes to routeing as a result of the turbine locations. Helicopter services businesses were not able to respond within the timescales of this assessment. Impacts are anticipated on radar systems, affecting both primary and secondary surveillance radar and possibly navigation aids, and these will need to be addressed at site level. The costs of mitigation measures would be borne by the developer.

In addition OWN2 falls within 15nm of the safeguarding zone around the secondary surveillance radar around the nearest airport, and the site intersects with the suggested 17km CAA consultation around airports. NATS has advised that depending on the size, numbers and relative proximity of the turbines within the proposed developments, there is the potential for interference with any of the scenarios. The costs of mitigation measures would be borne by the developer.

Carbon Capture and Storage
Draft Plan Option area OWN2 lies inshore and overlaps possible carbon and storage sites and in addition the cable corridors have the potential to overlap or lie inshore of potential storage areas. However arrays for the low scenario occupy <5% of the Draft Plan Option area and it has been assumed that spatial planning can be used to avoid significant impacts under this scenario. Under the central and high scenarios placement of the array and more particularly any deviation in the pipeline routeing could potentially introduce significant cost to the industry, should there be a requirement to install pipelines to offshore storage areas. However, there are currently no plans for such developments within the region, nor are such developments considered likely within the time scales of the assessment owing to the distance from major carbon emission sources.

Commercial Fisheries
Wind areas OWN1 and OWN2 both overlap significant navigation routes, and up to 25% of the areas would be occupied by arrays in the high scenario. This may be expected to impact on navigation routes, particularly for OWN2, whereas location of devices in the northern part of OWN1 may avoid interaction with the most significant navigation routes. Nevertheless, some deviation would be expected to be required, implying a cost to the fishing industry in terms of steaming time and increased fuel costs to reach fishing grounds, and additional impacts on fishing time available for those vessels limited by days-at-sea regulations. This is most likely to affect vessels from Scrabster (52 under-15m vessels and 1 over-15m vessel are registered here as their home port) and Kirkwall (63 under-15m vessels and 5 over-15m vessels) for OWN1, and from Lerwick (58 under-15m vessels and 17 over-15m vessels) for OWN2 (MMO, 2013). No significant interactions with cables

were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4). Where fishing vessels' effort is displaced to new areas, rather than lost (as assumed in the worst-case impact assessed quantitatively), there may be impacts in terms of conflict with other fishing vessels, environmental impacts in targeting new areas, longer steaming times and increased fuel costs, changes in costs and earnings, gear development and adaptation costs, and additional quota costs.

Energy Generation
There is a significant degree of overlap between Draft Plan Option areas OWN1 and WN2 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all cable routes and military practice and exercise areas and all Draft Plan Option areas have the potential to interfere with underwater communications. In addition in OWN1 there is the potential for overlap with the Low Priority Military Low Flying Area. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Oil and Gas
No significant interactions between development in the Draft Plan Option areas and oil and gas interests are anticipated Where potential renewable development areas or cable corridors overlap with existing infrastructure, the width of 'corridors' required to enable maintenance activity will need to be determined on a case by case basis. Should offshore wind farm export cables cross over existing oil and gas pipelines or cables, it has been assumed that the costs would be borne by the offshore wind developer. While the oil & gas industry's interests will largely be protected by the relevant cable crossing agreements, it is currently unclear whether all of the industry's liabilities may be covered by such agreements.

Ports and Harbours
The main identified impact to ports and harbours associated with offshore wind developments within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it

would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Recreational Boating

The potential impact of future offshore wind energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports

Surfing and windsurfing occur within the area of OWN1 where the impacts to seascape and setting could reduce the number of surfers using the area however as the wave devices would only be up to a maximum of 10m above sea level these structures are expected to cause a minimal disruption to this activity.

Scuba diving occurs within OWN1 Draft Plan Option area and is mainly associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are negligible.

Windsurfing and surfing and scuba diving are also undertaken within the potential cable route areas between the Draft Plan Option areas and landfall. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes to avoid changes in the shoreline and to the location of the arrays to prevent significant changes to the local wave climate however the economic and social cost these restrictions or changes in wave quality due to cables is negligible.

Social Impacts

Each of the above effects could have social impacts. Table 38 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although there may be some noticeable impacts, such as on sea anglers or recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 39 and 40 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on sea anglers could fall disproportionately onto males (although this will depend on the local make-up of sea anglers). For carbon capture and storage, there could be larger effects for local businesses and people of working age if investment were to go elsewhere due to competition for space. However, these are likely to be similar businesses and employees involved in renewable energy, so the impacts may be negligible. For most groups, though, the impacts are likely to be minimal.

Table 38. Identification of the social impacts and their significance

Offshore Wind (North)						
Sector	Direct effects	Area of social impact affected	Costs (PV £ million or GVA for fisheries)	Mitigation	Significance of social impact	
					Access	Experience
Aviation	Spatial overlap between Draft Plan Option areas and helicopter routes: height obstruction of commercial navigation routes (helicopters)	Employment (reduced turnover) Health (increased risk) Environment (increased emissions)	Impacts not quantified	Spatial planning should avoid any impacts	Potentially 0	Potentially 0
Carbon capture and storage	Draft Plan Option areas overlap or lie inshore of potential storage areas: competition for space Cable corridors overlap or lie inshore of potential storage areas: competition for space	Education (reduced opportunity for research and development of technology) Employment (reduced opportunity for future development) Environment (reduced opportunity for carbon storage)	Impacts not quantified	Spatial planning should avoid any impacts under low scenario. May be significant costs for pipeline routing, which could minimise the attractiveness of the area for investment	x (where investment is reduced)	x (where investment is reduced)
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.74 Central: £1.80 High: £3.90		xxx Low: 0.8 to 0.9 jobs affected Central: 4.2 to 4.6 jobs affected High: 9 to 10 jobs affected	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions) Health (increased navigation risks)	Impacts not quantified	Impacts should be minimised through careful location of devices, although there may be some risks in OWN2 in particular	x	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)	Impacts not quantified	Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for space and transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Oil and gas	Increased competition for space	Employment (increased costs leading to reduced investment)	Impacts not quantified	Potential overlaps need to be taken into account on case-by-case basis	Potentially 0	Potentially 0

Offshore Wind (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Ports and harbours	Reduced development opportunities	Access to services (if number of ferry services were to be reduced or routes were changed) Employment (reduction in jobs associated with ports due to loss of investment)	Impacts not quantified	Devices should seek to minimise impacts on ferries through spatial planning	Potentially 0	Potentially 0
	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: £7.11 High: £14.22	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
	Reduced turnaround times due to increased steaming times for vessel routes	Access to services (if number of ferry services were to be reduced) Employment (reduction in jobs associated with ferries)	Impacts not quantified	Arrays should seek to be sited to avoid hindering ferry services	Potentially 0	Potentially 0
	Displacement of anchorage areas	Access to services (if ferry routes are changed) Environment (increased emissions)	Impacts not quantified	Arrays should seek to be sited to avoid hindering access to anchorages	Potentially 0	Potentially 0
Tourism	Reduction in expenditure	Culture and heritage (may affect cultural interpretation of coastline and seascapes) Employment (negative impacts on numbers of tourists affecting income of tourism businesses) Health (impacts may affect recreational trips taken by locals, affecting their health)	Low: none Central: £0.22 High: £0.59	Spatial planning used to locate arrays to minimise impacts, but maybe some impacts on medium and high scenarios	0	x
Water sports – Sea Angling	Reduction in expenditure	Health (reduction in recreational opportunities) Employment (impacts on services if anglers choose to relocate their sports activities to elsewhere due to loss of fishing grounds)	Low: none Central: none High: £0.47		xx	x
Water sports	Impacts to seascape / setting (surfing and windsurfing)	Culture and heritage (may affect cultural interpretation of coastline and seascapes) Employment (negative impacts on numbers of tourists affecting income of tourism businesses)	Impacts not quantified	Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction	Potentially 0	Potentially 0

Offshore Wind (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
		Health (impacts may affect recreational trips taken by locals, affecting their health)		and are likely to be minimal over that period		
	Spatial overlap between Draft Plan Option areas and water sport activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
	Spatial overlap between cable routes and water sports activity (surfing and windsurfing, scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0

Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce
Definition of ratings: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect

Table 39. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	**Rural**	**Settlement**	**Children**	**Working age**	**Pensionable age**	**Male**	**Female**
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	0	x Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	x Could have impact on employment opportunities if investment goes elsewhere	0	x	x
Commercial fisheries	Value of potentially lost landings	0	xx	xxx Orkney, Scrabster, Shetland	x	xxx	x	xxx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	x	xx Orkney, Scrabster, Shetland	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	xx	xxx Orkney, Scrabster, Shetland	x	xxx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Bressay, Lerwick and Pierowall could be affected	0	x	x	x	x
Tourism	Reduction in expenditure	0	x	No specific settlements affected	x	x	x	x	x
Water sports- Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	xx	xx	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 40. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	xx economic impacts could affect this group more than others	x	x	x Unlikely to be employed in this industry (but may be for extra income)	x	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xx Local businesses that might otherwise have been involved
Commercial fisheries	Value of potentially lost landings	xxx	xxx	xx	xxx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xxx Pelagic, demersal sector xx Shellfish	xxx Vessels >15m xxx Vessels <15m
	Obstruction of navigation routes	x	x	x	xx Where fishing provides additional income	x	0 Unlikely to be employed in fisheries	xx Pelagic, demersal sector x Shellfish	xx Vessels >15m xx Vessels <15m
	Consequential impacts to fish processors	xx	xx	x	x	x	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x Where employed in this area	x	x	0 Unlikely to be employed in this area	x	xx Could affect ability to support trips for disabled/ sick	xx Could mean they need to relocate to maintain services	No other specific group identified
Tourism	Reduction in expenditure	x	x	x	x	x	x	x	No other specific group identified
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	x Level of sea angling activity may be lower for sick	xxx	No other specific group identified

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

7.2 Wave

7.2.1 Quantification of Potentially Significant Impacts

Table 40 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by wave development within Draft Plan Option areas WN1, WN2 and WN3. Quantified cost estimates have been developed for angling and commercial fisheries. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 41. Present value (PV) costs (and GVA for fisheries) in £millions for Wave Energy in the North Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Value of potentially lost landings	0.03	0.08	0.17
Water sports - Sea Angling	Reduction in expenditure	-	-	0.10
Total costs		**0.03**	**0.08**	**0.27**

Commercial Fisheries

The total impact on commercial fisheries from wave energy development in the North Region was £0.03m GVA for the low scenario, rising to £0.17m GVA for the high scenario (over the whole assessment period, discounted). These impacts mainly accrue to the over-15m sector and to demersal (whitefish) trawlers, and to a lesser extent, the pelagic trawlers and potters. Provisional ScotMap data for WN1 and WN2 confirm that there is little under-15m activity in these areas; the data do not cover the WN3 area.

Water Sports - Sea Angling

Under the high scenario, around 1.3% of the area fished by boat based sea anglers within the North Region could be subject to offshore renewables development. The cost impact is based on the estimated potential reduction in expenditure in the Region as a result of loss of access to fishing grounds within wave energy Draft Plan Option areas within 6nm of the territorial baseline. For the low and central scenarios it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to angling. For the high scenario, the cost impact is estimated to be £0.10m PV.

7.2.2 Other Costs not Quantified

Commercial Fisheries
Wave area WN1 overlaps with the navigation route along the north coast of Scotland. Impacts may be avoidable since less than 1% of the area would be occupied by arrays under the high scenario. No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4).

Energy Generation
There is a significant degree of overlap between Draft Plan Option areas WN2 and OWN1 which could result in competition for space between the different technologies. Energy generation from differing forms of technology will also lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Ports and Harbours
The main identified impact to ports and harbours associated with wave developments within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Recreational Boating
The potential impact of future wave energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water Sports
Sea kayaking is undertaken in all wave Ares of Search while scuba diving is known to take place at WN2, however this Draft Plan Option area is not considered to be in the top ten sites for sea kayaking and as they are highly manoeuvrable therefore wave devices are unlikely to physically displace this activity. Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so economic and social impacts are expected to negligible. Scuba diving is mainly associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are negligible.

Windsurfing and surfing and scuba diving are also undertaken within the potential cable route areas between the Draft Plan Option areas and landfall. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes to avoid changes in the shoreline and to the location of the arrays to prevent significant changes to the local wave climate however the economic and social cost these restrictions or changes in wave quality due to cables is negligible.

Social Impacts
Each of the above effects could have social impacts. Table 42 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). There may also be impacts on education (specifically research and development) if opportunities for carbon, capture and storage are minimised (although it is likely that investment would move elsewhere if competition for space was a deciding factor). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although there may be some noticeable impacts, such as on sea anglers, sea kayakers and recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;

- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 43 and 44 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on sea anglers could fall disproportionately onto males (although this will depend on the local make-up of sea anglers). Sea kayakers may also be impacted, although this will depend on sea kayaking routes and the level of overlap between those routes and the location of devices. For carbon capture and storage, there could be larger effects for local businesses and people of working age if investment were to go elsewhere due to competition for space. However, these are likely to be similar businesses and employees involved in renewable energy, so the impacts may be negligible. For most groups, though, the impacts are likely to be minimal.

Table 42. Identification of the social impacts and their significance

Wave (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Carbon capture and storage	Draft Plan Option areas overlap or lie inshore of potential storage areas: competition for space Cable corridors overlap or lie inshore of potential storage areas: competition for space	Education (reduced opportunity for research and development of technology) Employment (reduced opportunity for future development) Environment (reduced opportunity for carbon storage)	Impacts not quantified	Spatial planning should avoid any impacts under low scenario. May be significant costs for pipeline routing, which could minimise the attractiveness of the area for investment	x (where investment is reduced)	x (where investment is reduced)
Commercial Fisheries	Value of potentially lost landing	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.03 Central: £0.08 High: £0.17		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions) Health (increased navigation risks)		Impacts should be minimised through careful location of devices, although there may be some risks in OWN2 in particular	x	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for space and transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Oil and gas	Increased competition for space	Employment (increased costs leading to reduced investment)	Impacts not quantified	Potential overlaps need to be taken into account on case-by-case basis	Potentially 0	Potentially 0
Ports and harbours	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0
Recreational	Increased deterrent to access	Access to recreational opportunities	Impacts not quantified	Passage planning and	x	x

Wave (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
boating	in sites that are already challenging to navigate			awareness, plus the update and circulation of up to date navigational information via charting publications		
Shipping	Displacement of anchorage areas	Access to services (if ferry routes are changed) Environment (increased emissions)	Impacts not quantified	Arrays should seek to be sited to avoid hindering access to anchorages	Potentially 0	Potentially 0
Water sports – Sea Angling	Reduction in expenditure	Health (reduction in recreational opportunities) Employment (impacts on services if anglers choose to relocate their sports activities to elsewhere due to loss of fishing grounds)	Low: none Central: none High: £0.1		xx	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking, and scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	x (sea kayaking)	x (sea kayaking)
	Spatial overlap between cable routes and water sports activity (surfing and windsurfing, scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0

Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce
Definition of ratings: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect

Table 43. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	0	x Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	x Could have impact on employment opportunities if investment goes elsewhere	0	x	x
Commercial fisheries	Value of potentially lost landing	0	xx	xx Orkney, Scrabster, Shetland	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	xx	xx Orkney, Scrabster, Shetland	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	x	0	x	x	x	Increased deterrent to access in sites that are already challenging to navigate
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	xx	xx	xx
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

Table 44. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	xx economic impacts could affect this group more than others	x	x	x Unlikely to be employed in this industry (but may be for extra income)	x	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xx Local businesses that might otherwise have been involved
Commercial fisheries	Value of potentially lost landing	xx	xx	xx	xx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xx Demersal, pelagic sector x Shellfish	xx Vessels <10m xx Vessels <15m
	Consequential impacts to fish processors	xx	xx	x	x	x	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	xx May be more likely to have smaller boats	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	x Level of sea angling activity may be lower for sick	xxx Sea anglers will be most affected	No other specific group identified
Water sports	Spatial overlap between	x	x	x	x	x	x	xx	No other specific

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
	Draft Plan Option areas and water sports activity (sea angling)							Sea kayakers could have to change routes or look for alternatives	group identified
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

7.3 Tidal

7.3.1 Quantification of Potentially Significant Impacts

Table 44 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by tidal development within Draft Plan Option areas TN1, TN2, TN3, TN4, TN5, TN6 and TN7. Quantified cost estimates have been developed for angling, commercial fisheries, recreational boating and shipping. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 45. Present value (PV) costs (and GVA for fisheries) in £millions for Tidal Energy in the North Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	**Description of Measurement**	**Scenarios**		
		Low	**Central**	**High**
Commercial Fisheries	Value of potentially lost landings	0.06	0.13	0.25
Shipping	Additional fuel costs	-	-	9.33
Water Sports -Sea Angling	Reduction in expenditure	-	-	0.35
Total costs		**0.06**	**0.13**	**9.93**

Commercial Fisheries
For the low scenario, the percentage coverage varied between 0.8% for Draft Plan Option areas TN1 and TN4, 1.5% for TN2, 2% for TN3 and TN5, 2.2% for TN7, and 2.5% for TN6. The area to be developed under the central and high scenarios was 2.6% and 5.1% respectively all sites. The total impact on commercial fisheries was £0.06m GVA for the low scenario rising to £0.25m GVA for the high scenario (over the whole assessment period, discounted). These impacts are mainly on shellfisheries (45% of the value of landings affected), on pelagic trawlers targeting mackerel and herring, and on demersal whitefish trawlers. The over-15m sector is most affected, but provisional ScotMap data (see Figure B4.2, Appendix B) show that areas TN1 and TN2 overlap with important fishing grounds for the under-15m sector, and if these areas are taken forward for development, the location of arrays should be planned in close consultation with the fishing industry in order to minimise any potential impacts.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with the route deviation for an average number of shipping

movements based on the shipping density within the Draft Plan Option area. There are a number of ferry routes within the Draft Plan Option areas in this region. These include three Orkney ferries in TN1 and two in TN2, Kirkwall to Lerwick in N2 and N4 and Kirkwall to Stronsay in N2, and Toft to Yell in TN6. The cost impacts are restricted to the high scenario due mainly to the footprint of the arrays where these are estimated to be £9.33m PV.

Water Sports - Sea Angling
Under the high scenario, around 1.3% of the area fished by boat based sea anglers within the North Region could be subject to offshore renewables development. The cost impact is based on the estimated potential reduction in expenditure in the Region as a result of loss of access to fishing grounds within tidal energy Draft Plan Option areas within 6nm of the territorial baseline. For the low and central scenarios it has been assumed that spatial planning can be used to locate arrays within the Draft Plan Option areas so as to avoid impacts to angling. For the high scenario, the cost impact is estimated to be £0.35m PV.

7.3.2 Other Costs not Quantified

Carbon Capture and Storage
Tidal energy Draft Plan Option areas TN1 and TN4 overlap or lie inshore of possible future carbon capture and storage sites. However, there are currently no plans for such developments within the region, nor are such developments considered likely within the time scales of the assessment owing to the distance from major carbon emission sources. Should such developments proceed, the relatively small areas that would be occupied by tidal energy developments within the Draft Plan Option areas would not be expected to significantly compromise future CCS development.

Commercial Fisheries
Tidal area TN1 overlaps with the navigation route along the north coast of Scotland, and TN2 overlaps with the navigation route through Westray Firth. TN5 and TN6 also overlap significant navigation routes around Shetland. This is most likely to affect vessels from Scrabster (52 under-15m vessels and 1 over-15m vessel are registered here as their home port) and Kirkwall (63 under-15m vessels and 5 over-15m vessels) (MMO, 2013). Up to 5.1% of these Draft Plan Option areas would be occupied by arrays under the high scenario; careful consideration of the location of devices may make it possible to avoid the most significant impacts. No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4).

Energy Generation
Energy generation from differing forms of technology will lead to competition for transmission capacity which would affect all Draft Plan Option areas.

Military Interests
There is a potential overlap between all cable routes and military practice and exercise areas. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Oil and Gas
TN1, TN2, TN3 and TN4 Draft Plan Option areas lie inshore the existing hydrocarbon fields. However, no significant interactions are anticipated. Where potential renewable development areas or cable corridors overlap with existing infrastructure, the width of 'corridors' required to enable maintenance activity will need to be determined on a case by case basis. Should offshore wind farm export cables cross over existing oil and gas pipelines or cables, it has been assumed that the costs would be borne by the offshore wind developer. While the oil & gas industry's interests will largely be protected by the relevant cable crossing agreements, it is currently unclear whether all of the industry's liabilities may be covered by such agreements.

Ports and Harbours
The main identified impact to ports and harbours associated with tidal developments within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Recreational Boating
The potential impact of future tidal developments within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water Sports
Sea kayaking occurs within all Draft Plan Option areas while scuba diving also overlaps with the TN3 Draft Plan Option area. None of the Draft Plan Option areas are considered to be in the top ten sites for sea kayaking and as they are highly manoeuvrable therefore wave devices are unlikely to physically displace this activity. Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so

economic and social impacts are expected to negligible. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Most of the impacts will result during the construction of the cable routing and will be short lived, any changes in climate regime will also impact on the suitability of these areas to sea kayaking and surfing however any changes are considered to be insignificant and therefore costs associated with the impacts of tidal energy are negligible.

Windsurfing and surfing are also undertaken within the potential cable route areas between all Draft Plan Option areas and landfall except for TN6 and TN7. Most of the diving activities are associated with areas of interest and in particular wrecks and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes to avoid changes in the shoreline and to the location of the arrays to prevent significant changes to the local wave climate however the economic and social cost these restrictions or changes in wave quality due to cables is negligible.

Social Impacts
Each of the above effects could have social impacts. Table 46 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). There may also be impacts on education (specifically research and development) if opportunities for carbon, capture and storage are minimised (although it is likely that investment would move elsewhere if competition for space was a deciding factor). In most cases, it has not been possible to quantify the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although there may be some noticeable impacts, such as on sea anglers, sea kayakers and recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 47 and 48 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on sea anglers could fall disproportionately onto males (although this will depend on the local make-up of sea anglers). For carbon capture and storage, there could be larger effects for local businesses and people of working age if investment were to go elsewhere due to competition for space. However, these are likely to be similar businesses and employees involved in renewable energy, so the impacts may be negligible. For most groups, though, the impacts are likely to be minimal.

Table 46. Identification of the social impacts and their significance

Tidal (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Carbon capture and storage	Draft Plan Option areas overlap or lie inshore of potential storage areas: competition for space Cable corridors overlap or lie inshore of potential storage areas: competition for space	Education (reduced opportunity for research and development of technology) Employment (reduced opportunity for future development) Environment (reduced opportunity for carbon storage)	Impacts not quantified	Spatial planning should avoid any impacts under low scenario. May be significant costs for pipeline routing, which could minimise the attractiveness of the area for investment	x (where investment is reduced)	x (where investment is reduced)
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.06 Central: £0.13 High: £0.25		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)	Impacts not quantified	Impacts should be minimised through careful location of devices	Potentially 0	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)	Impacts not quantified	Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Oil and gas	Increased competition for space	Employment (increased costs leading to reduced investment)	Impacts not quantified	Potential overlaps need to be taken into account on case-by-case basis	Potentially 0	Potentially 0
Ports and harbours	Obstruction of maintained navigation channel(s)	Access to services (if number of ferry services were to be reduced or routes were changed) Employment (reduction in jobs associated with ports)	Impacts not quantified	Devices should seek to avoid navigation channels through spatial planning	Potentially 0	Potentially 0
	Reduced development opportunities	Access to services (if number of ferry services were to be reduced or routes were changed)	Impacts not quantified	Devices should seek to minimise impacts on ferries through spatial planning	Potentially 0	Potentially 0

Tidal (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
		Employment (reduction in jobs associated with ports due to loss of investment)				
	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0
Recreational boating	Additional fuel costs	Health (reduction in recreational opportunities) Employment (impacts on boating services if boat owners choose to relocate their boating activities to elsewhere)	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities			x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: none High: £9.30	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
	Reduced turnaround times due to increased steaming times for vessel routes	Access to services (if number of ferry services were to be reduced) Employment (reduction in jobs associated with ferries)	Impacts not quantified	Arrays should seek to be sited to avoid hindering ferry services	Potentially 0	Potentially 0
Water sports – Sea Angling	Reduction in expenditure	Health (reduction in recreational opportunities) Employment (impacts on services if anglers choose to relocate their sports activities to elsewhere due to loss of fishing grounds)	Low: none Central: none High: £0.35		xx	x
Water sports	Impacts to seascape / setting (sea kayaking)	Culture and heritage (may affect cultural interpretation of coastline and seascapes) Employment (negative impacts on numbers of tourists affecting income of tourism businesses) Health (impacts may affect recreational trips taken by locals, affecting their health)	Impacts not quantified	Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0
	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	Health (reduction in recreational opportunities) Employment (impacts on services if boat	Impacts not quantified		x	x

Tidal (North)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
		owners choose to relocate their water sports activities to elsewhere)				
	Spatial overlap between cable routes and water sports activity (surfing and windsurfing, scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0

Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce
Definition of ratings: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect

Table 47. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pension-able age	Male	Female
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	0	x Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	x Could have impact on employment opportunities if investment goes elsewhere	0	x	x
Commercial fisheries	Additional fuel costs	0	xx	xx Orkney, Scrabster, Shetland	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Orkney, Scrabster, Shetland	x	x	x	x	xx Processors more likely to be female
Recreational boating	Alterations to informal cruising routes	0	x	x	x	x	x	x	x
	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Pierowall and Kirkwall, plus pontoons could be affected	0	x	x	x	x
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	xx	xx (may be more likely to be involved in sea angling)	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 48. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	xx economic impacts could affect this group more than others	x	x	x Unlikely to be employed in this industry (but may be for extra income)	x	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xx Local businesses that might otherwise have been involved
Commercial fisheries	Additional fuel costs	xx	xx	xx	xx Where fishing provides additional income	xx	0 Unlikely to be employed in fisheries	xx Shellfish x Demersal, pelagic sectors	xx Vessels <15m x Vessels >15m
	Consequential impacts to fish processors	xx	xx	x	x	x	0	x	x
Recreational boating	Alterations to informal cruising routes	0 Unlikely to own boat	x	x	x	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	xx May be more likely to have smaller boats	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	x Level of sea angling activity may be lower for sick	xxx	No other specific group identified
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	x	x	x	x	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

8. Assessment for Offshore Wind, Wave and Tidal Draft Plan Option Areas – North East Region

8.1 Offshore Wind

8.1.1 Quantification of Potentially Significant Impacts

Table 48 presents quantified estimates of impacts (Present Value (PV) costs and GVA (fisheries)) for activities potentially affected by offshore wind development within Draft Plan Option areas OWNE1 and OWNE2. Quantified cost estimates have been developed for carbon capture and storage, commercial fisheries, recreational boating and shipping. Comments are also provided on activities for which quantified cost estimates could not be provided. No significant benefits have been identified for activities. The impacts of each activity highlighted are briefly described below and further the detail can be found in Appendix C.

Table 49. Present value (PV) costs (and GVA for fisheries) in £millions for Offshore Wind in the North East Region (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Carbon Capture and Storage	Additional costs of constructing cable crossings	1.85	4.32	9.27
Commercial Fisheries	Value of potentially lost landings	0.18	0.43	0.92
Recreational boating	Additional fuel costs	-	0.66	0.81
Shipping	Additional fuel costs	-	48.57	98.61
Total costs		2.03	53.98	109.61

Carbon Capture & Storage

Draft Plan Option areas OWNE1 and OWNE2 lie inshore of possible CCS storage sites and should not interact with potential future storage areas. However, the offshore wind farm export cable corridors have the potential to overlap with possible future CCS pipeline routes. This may give rise to additional costs to the CCS sector to construct cable crossings where CCS pipelines traverse offshore wind farm export cables. The costs associated with these cable crossings are estimated to range between £1.85m (PV) for the low scenario to £9.27m (PV) for the high scenario reflecting the increased number of cable crossing associated with higher installed capacities within the Draft Plan Option areas.

Commercial Fisheries
For OWNE1 and OWNE2 Draft Plan Option areas, the area that would be occupied by arrays was calculated as being 4.8%, 11.6% and 25.1% for the low, central and high scenarios respectively. The total impact on commercial fisheries from offshore wind development in the North East Region was £0.18m GVA for the low scenario, rising to £0.43m GVA for the central scenario and £0.92m GVA for the high scenario (over the whole assessment period, discounted. These impacts arise predominantly from OWNE2 and mainly accrue to the over-15m sector, and mainly to dredgers, potters, demersal whitefish trawlers and *Nephrops* trawlers. Provisional ScotMap data indicate that the under-15m sector activity is mainly concentrated closer to the coast than the Draft Plan Option areas, and is therefore unlikely to be affected.

Recreational Boating
The potential overlap of recreational boating within the OWNE1 Draft Plan Option area within the North East SORER will occur in the central and high scenarios where medium cruising routes will be impacted. The presence of offshore wind arrays in all Draft Plan Option areas have the have the potential to deter investment in the region resulting from changing attitudes to navigating in areas with increased hazards i.e. resulting in changes in starting and end points to cruises. The largest costs are associated with the need for craft to deviate and due to the high usage in this area these costs will range from £0.66m PV for the central scenario and £0.81m PV for the high scenario. The relative risk of development sites on recreational boating has been assessed qualitatively, and has concluded that increased risks are apparent, especially for development sites located in sea areas which are already challenging to navigate. This increased risk is mitigated through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications. An additional qualitative assessment was also carried out to identify the Draft Plan Option area for each technology which could influence marina access and the potential for lost revenue through dissuasion of attempting certain passages or holiday routes. This concluded that potential for lost revenue existed from the OWNE1 and OWNE2.

Shipping
The shipping costs have considered the costs to commercial shipping including ferry routes. The assessment has considered the additional fuel costs associated with the route deviation for an average number of shipping movements based on the shipping density within the Draft Plan Option area. There are two ferry routes within the OWNE2 Draft Plan Option area in this region, namely Aberdeen to Kirkwall and Aberdeen to Lerwick. These together with the high density of shipping generally in this region give rise to high cost impacts under the central and high scenarios of £48.57m PV and £96.61m PV respectively.

8.1.2 Other Costs not Quantified

Aviation

There is the potential for overlaps between the siting for offshore wind turbines and helicopter routes for the OWNE2 Draft Plan Option area, however where these occupy less than 5% of the area, as in the low scenario, it has been assumed that spatial planning will avoid any significant impacts to the industry. Impacts are potentially more significant for the central and high scenarios however it is difficult to quantify the costs associated with changes to routeing as a result of the turbine locations. Helicopter services businesses were not able to respond within the timescales of this assessment. Impacts are anticipated on radar systems, affecting both primary and secondary surveillance radar and possibly navigation aids, and these will need to be addressed at site level. The costs of mitigation measures would be borne by the developer.

The OWNE1 and OWNE2 Draft Plan Option areas are within the line of sight of at least one of the primary surveillance radar used or operated by NATS, and in addition these sites fall within 15nm of the safeguarding zone around the secondary surveillance radar around the nearest airport. OWNE1also intersects with the suggested 17km CAA consultation around airports. NATS has advised that depending on the size, numbers and relative proximity of the turbines within the proposed developments, there is the potential for interference with any of the scenarios. The costs of mitigation measures would be borne by the developer.

Commercial Fisheries

Wind area OWNE1 is predominantly outside of the major fishing navigation routes, being located slightly further south, however, wind area OWNE2 is located in the area of the highest concentration of ‘steaming’ pings and major navigation routes. The development of wind arrays in this area would have a significant impact on navigation routes for fishing vessels, and cause a significant number of vessels and of individual fishing trips to have to deviate around any arrays located here. This implies a cost to the fishing industry in terms of increased steaming time and fuel costs to reach fishing grounds, and additional impacts on fishing time available for those vessels limited by days-at-sea regulations. This is most likely to affect vessels from Fraserburgh (52 under-15m vessels and 72 over-15m vessels are registered here as their home port) and Peterhead (42 under-15m vessels and 47 over-15m vessels), two of the most important ports for the Scottish fishing fleet (MMO, 2013). No significant interactions with cables were identified. It is expected that cables would be laid in consultation with the fishing industry, and a Memorandum of Understanding is being developed between the fishing industry and Subsea Cables UK (see Appendix C4.2.4). Where fishing vessels’ effort is displaced to new areas, rather than lost (as assumed in the worst-case impact assessed quantitatively), there may be impacts in terms of conflict with other fishing vessels, environmental impacts in targeting new areas, longer steaming times and increased fuel costs, changes in costs and earnings, gear development and adaptation costs, and additional quota costs.

Energy Generation
There is potential for OWNE1 and OWNE2 to compete for transmission capacity.

Military Interests
There is a potential overlap between OWNE2 Draft Plan Option area and all cable routes with military practice and exercise areas within the North East Region. In addition all Draft Plan Option areas have the potential to interfere with underwater communications. The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

Oil and Gas
No significant interactions between offshore wind development in the Draft Plan Option areas and oil and gas interests are anticipated Where potential renewable development areas or cable corridors overlap with existing infrastructure, the width of ‘corridors’ required to enable maintenance activity will need to be determined on a case by case basis. Should offshore wind farm export cables cross over existing oil & gas pipelines or cables, it has been assumed that the costs would be borne by the offshore wind developer. While the oil & gas industry’s interests will largely be protected by the relevant cable crossing agreements, it is currently unclear whether all of the industry’s liabilities may be covered by such agreements.

Ports and Harbours
The main identified impact to ports and harbours associated with offshore wind developments within the Draft Plan Option areas relates to increases in marine risk, specifically the temporary collision risk while cable laying or maintenance is being carried out. However the assessment considers that it would be possible to avoid conflict with port access routes and channels through careful planning of cable laying and maintenance activities.

Power Interconnectors
The assessment indicates that all current planned/proposed power interconnectors, except the UK-Norway NorthConnect, are likely to be consented prior to the leasing of the OWNE1 and OWNE2 Draft Plan Option areas or cable corridors and hence no interactions with this sector are anticipated for future interconnectors. Although the NorthConnect interconnector route has not been finalised it is believed unlikely to intersect (and therefore need to deviate around) either OWNE1 or OWNE2 indicating that it is unlikely that there will be a significant cost impact to this sector.

Should offshore wind farm export cables cross over existing power interconnector cables, it has been assumed that the costs would be borne by the offshore wind developer. While the power interconnector asset owner/operator will largely be protected by the relevant cable crossing agreements, it is currently unclear whether all of the industry's liabilities may be covered by such agreements.

Recreational Boating
The potential impact of future offshore wind energy development within the Draft Plan Option area on investment in recreational boating supply chains has been assessed qualitatively. It is recognised that development in areas which are already challenging to navigate may deter sailors and reduce expenditure in the Region. The risk can be mitigated to some extent through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications.

Water sports
Water sport activities of scuba diving, windsurfing and surfing in the North East Region, are carried out mainly within the potential cable route areas between OWNE1 and OWNE2 Draft Plan Option areas and landfall. Most of the diving activities are associated with areas of interest and in particular wrecks in OWNE2 and where these are known it is highly unlikely that arrays will be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. Therefore costs associated with the impacts of offshore wind are assessed as negligible. Access restrictions to surfing and wind surfing sites may occur during the construction phase and careful siting of these routes is necessary to avoid changes in the shoreline. Careful siting of the location of arrays is also needed to prevent significant changes to the local wave climate. However, the impact of these restrictions or changes in wave quality due to cables is assessed as negligible.

While recreational angling is an important activity within the North East Region, no significant cost impacts have been identified. It is recognised that there is some uncertainty surrounding the potential environmental impacts of offshore renewables development on fish populations, but it is considered that sufficient management mechanisms are in place to limit such impacts and therefore that no significant socio-economic impacts to recreational angling interests should occur. Therefore the cost to water sports activities associated with offshore wind developments within the Draft Plan Option areas is assessed as negligible.

Social Impacts
Each of the above effects could have social impacts. Table 50 identifies the areas of social impact that could be affected, with main impacts likely to be on employment (as a result of the impact of increased costs or reductions in turnover) and the environment (mainly due to increased emissions or changes in environmental quality). In most cases, it has not been possible to quantify

the impacts, although employment impacts for fisheries are estimated (based on use of multipliers, which are uncertain, see also Section 2.5). Other impacts, such as on access to services, health, and culture and heritage could largely be mitigated, although there may be some noticeable impacts, such as on carbon capture and storage (mainly due to additional costs of rerouting pipelines, such that the social impacts might be minimal) and recreational boaters.

Those impacts identified as being slightly significant or greater are carried forwards for assessment in the distributional analysis. Five different aspects are assessed:

- location;
- age;
- gender;
- income; and
- social group (covering minorities and special interest groups).

Tables 51 and 52 summarise the results of the distributional analysis, showing where impacts are likely to be greater for a particular social group, equal, or lower than the overall impact. For example, impacts on recreational boating could affect marinas near to cable routes. For carbon capture and storage, there could be larger effects for local businesses and people of working age if investment were to go elsewhere due to competition for space. However, these are likely to be similar businesses and employees involved in renewable energy, so the impacts may be negligible. For most groups, though, the impacts are likely to be minimal.

Table 50. Identification of the social impacts and their significance

Offshore Wind (North East)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
Aviation	Spatial overlap between Draft Plan Option areas and helicopter routes: height obstruction of commercial navigation routes (helicopters)	Employment (reduced turnover) Health (increased risk) Environment (increased emissions)	Impacts not quantified	Spatial planning should avoid any impacts	Potentially 0	Potentially 0
Carbon capture and storage	Additional costs of constructing cable crossings Cable corridors overlap or lie inshore of potential storage areas: competition for space	Education (reduced opportunity for research and development of technology) Employment (reduced opportunity for future development) Environment (reduced opportunity for carbon storage)	Low: £1.85 Central: £4.32 High: £9.27	Spatial planning should avoid any impacts under low scenario. May be significant costs for pipeline routing (especially in OWNE2), which could minimise the attractiveness of the area for investment	x (where investment is reduced)	x (where investment is reduced)
Commercial fisheries	Value of potentially lost landings	Employment (reduced turnover) Culture and heritage (impact on traditions) Health (increased risks due to moving to lesser known areas)	Low: £0.18 Central: £0.43 High: £0.92		xx Impacts on jobs not quantified as regional effects do not exceed 5% threshold on low and central High: 1.4 to 1.5 jobs affected	x
	Obstruction of navigation routes	Employment (increased costs) Environment (increased emissions)		Impacts should be minimised through careful location of devices	Potentially 0	Potentially 0
	Fouling of fishing gear on cables or seabed infrastructure	Employment (increased costs to replace gear) Environment (impacts of fouled gear)		Expected that cables would be laid in consultation with the fishing industry	Potentially 0	Potentially 0
	Consequential impacts to fish processors	Employment (reduced turnover) Culture and heritage (loss of connection of places with sea and history of area)	Impacts not quantified		x	0
Energy generation	Competition for transmission capacity	Employment (reduced opportunity for future development) Environment (reduced opportunity for use of renewable energy)	Impacts not quantified	Potential to collaborate rather than compete for grid connection, minimising impacts	Potentially 0	Potentially 0
Oil and gas	Increased competition for space	Employment (increased costs leading to reduced investment)	Impacts not quantified	Potential overlaps need to be taken into account on case-by-	Potentially 0	Potentially 0

Offshore Wind (North East)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
				case basis		
Ports and harbours	Reduced development opportunities	Access to services (if number of ferry services were to be reduced or routes were changed) Employment (reduction in jobs associated with ports due to loss of investment)	Impacts not quantified	Devices should seek to minimise impacts on ferries through spatial planning	Potentially 0	Potentially 0
	Spatial overlap between cable routes and maintained navigation channels: competition for space	Employment (reduced turnover)	Impacts not quantified	Cables routes will need to be located to avoid navigation routes	Potentially 0	Potentially 0
Power interconnectors	Draft Plan Option areas and/or cable routes intersect proposed interconnectors	Employment (increased costs and/or delays result in reduced investment)	Impacts not quantified	Planned/proposed interconnectors are likely to be consented prior to leasing Draft Plan Option areas, hence interactions can be avoided	Potentially 0	Potentially 0
Recreational boating	Additional fuel costs	Health (reduction in recreational opportunities) Employment (impacts on boating services if boat owners choose to relocate their boating activities to elsewhere)	Low: none Central: £0.66 High: £0.81		x	x
	Increased deterrent to access in sites that are already challenging to navigate	Access to recreational opportunities	Impacts not quantified	Passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications	x	x
Shipping	Additional fuel costs	Access to services (increased costs passed onto users, especially ferries) Environment (increased emissions)	Low: none Central: £48.57 High: £98.61	Arrays should seek to be sited to avoid hindering ferry services Additional emissions unlikely to be significant in terms of climate change, and will be offshore so should not affect air quality	Potentially 0	Potentially 0
	Reduced turnaround times due to increased steaming times for vessel routes	Access to services (if number of ferry services were to be reduced) Employment (reduction in jobs associated with ferries)	Impacts not quantified	Arrays should seek to be sited to avoid hindering ferry services	Potentially 0	Potentially 0
Water sports – Sea Angling	Reduction in expenditure	Health (reduction in recreational opportunities) Employment (impacts on services if anglers choose to relocate their sports	Impacts not quantified		xx	x

Offshore Wind (North East)						
Sector	**Direct effects**	**Area of social impact affected**	**Costs (PV £ million or GVA for fisheries)**	**Mitigation**	**Significance of social impact**	
					Access	**Experience**
		activities to elsewhere due to loss of fishing grounds)				
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised	Potentially 0	Potentially 0
	Spatial overlap between cable routes and water sports activity (surfing and windsurfing, and scuba diving)	Health (reduction in recreational opportunities) Employment (impacts on services if boat owners choose to relocate their water sports activities to elsewhere)	Impacts not quantified	Unlikely that arrays will be placed close to dive sites, such that impacts should be minimised. Care needed when siting arrays to minimise impacts on wave climate and avoid changes in the coastline. The only impacts may be during construction and are likely to be minimal over that period	Potentially 0	Potentially 0

Notes: The likely areas of social impact are based on the key areas identified by the GES/GSR Social Impacts Taskforce
Definition of ratings: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected x x x : significant negative effect

Table 51. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	0	x Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	x Could have impact on employment opportunities if investment goes elsewhere	0	x	x
Commercial fisheries	Value of potentially lost landings	0	xx	xx Aberdeen, Buckie, Fraserburgh, Peterhead	x	xx	x	xx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	xx	xxx OWNE2 (Fraserburgh and Peterhead)	x	xxx	x	xxx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	xx	xx Aberdeen, Buckie, Fraserburgh, Peterhead	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Additional fuel costs	0	x	x	x	x	x	x	x
	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Peterhead, Banff and Whitehills marinas could be affected	0	x	x	Increased deterrent to access in sites that are already challengin g to navigate	0
Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected									

Table 52. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Carbon capture and storage	Competition for space: Draft Plan Option areas and/or cable corridors overlap or lie inshore of potential storage areas	xx economic impacts could affect this group more than others	x	x	0 Not relevant in NE	x	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xx Local businesses that might otherwise have been involved
Commercial fisheries	Value of potentially lost landings	xx	xx	xx	0 Not relevant in NE	xx	0 Unlikely to be employed in fisheries	xx Dredgers, potters x Demersal, pelagic sectors, *Nephrops*	xx Vessels >15m xx Vessels <10m x Vessels <15m
	Obstruction of navigation routes	xxx	xxx	xxx	0 Not relevant in NE	xxx	0 Unlikely to be employed in fisheries	xxx Dredgers, potters xxx Demersal, pelagic sectors, *Nephrops*	xxx Vessels >15m xxx Vessels <10m xxx Vessels <15m
	Consequential impacts to fish processors	xx	xx	x	0 Not relevant in NE	x	0	x	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	x	x	0 Not relevant in NE	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	0 Not relevant in NE	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to reduce activity if navigation risks increase

Impacts: x x x : significant negative effect; x x : possible negative effects; x: minimal negative effect, if any; 0: no noticeable effect expected

9. National Assessments for Offshore Wind, Wave and Tidal Draft Plan Option Areas

Tables 53, 54 and 55 provide a summary of the estimated regional impacts for potential offshore wind, wave and tidal development within the Draft Plan Option areas (see Sections 4 to 8 for detail) to provide national estimates of cost impacts. These provide a high level description of how the PV costs (and GVA for fisheries) vary across the different activities.

Table 53. National PV Costs (and GVA for fisheries) in £millions for Offshore Wind (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	**Central**	**High**
Carbon Capture & Storage	NE	1.85	4.32	9.27
	Total	**1.85**	**4.32**	**9.27**
Commercial Fisheries	SW	0.05	0.06	0.13
	W	0.13	0.31	0.67
	NW	0.11	0.27	0.58
	N	0.74	1.8	3.9
	NE	0.18	0.43	0.92
	Total (GVA)	**1.21**	**2.87**	**6.2**
Recreational boating	SW	0.05	0.06	0.10
	NE	-	0.66	0.81
	Total	**0.05**	**0.72**	**0.91**
Shipping	SW	4.87	5.08	5.98
	W	-	3.80	7.88
	NW	-	1.45	2.90
	N	-	7.11	14.22
	NE	-	48.57	98.61
	Total	**4.87**	**66.01**	**129.59**
Tourism	SW	-	0.03	0.33
	W	-	0.01	0.06
	N	-	0.22	0.59
	Total	**-**	**0.26**	**0.98**
Water Sports - Sea Angling	N	**-**	**-**	0.47
	Total	**-**	**-**	**0.47**
Total PV Costs		**6.77**	**71.31**	**141.22**
Total GVA Impacts (Commercial Fisheries)		**1.21**	**2.87**	**6.2**

Table 54. National PV Costs (and GVA for fisheries) in £millions for Wave Energy (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	Central	High
Commercial Fisheries	W	0.01	0.01	0.03
	NW	0.03	0.09	0.18
	N	0.03	0.08	0.17
	Total (GVA)	**0.07**	**0.18**	**0.38**
Water Sports - Sea Angling	N	**-**	**-**	0.10
	Total	**-**	**-**	**0.10**
Total PV Costs		**-**	**-**	**0.10**
Total GVA Impacts (Commercial Fisheries)		**0.07**	**0.18**	**0.38**

Table 55. National PV Costs (and GVA for fisheries) in £millions for Tidal Energy (costs discounted over assessment period, 2012 prices, numbers rounded to nearest £0.01m))

Activity	Region	Scenarios		
		Low	Central	High
Commercial Fisheries	SW	0.01	0.03	0.06
	W	0.02	0.05	0.1
	N	0.06	0.13	0.25
	Total (GVA)	**0.09**	**0.21**	**0.41**
Recreational boating	SW	-	-	0.06
	Total	-	-	**0.06**
Shipping	SW	-	-	1.07
	W	-	-	1.89
	N	-	-	9.33
	Total	-	-	**12.29**
Sea Angling (Water sports)	N	-	-	0.35
	Total	-	-	**0.35**
Total PV Costs		**-**	**-**	**12.70**
Total GVA Impacts (Commercial Fisheries)		**0.09**	**0.21**	**0.41**

For all offshore renewables technologies, the estimated cost impacts increase with increasing scale of development. The impact of offshore wind development is assessed as imposing much greater cost impacts on other activities compared to wave or tidal development. This is largely on account of the potentially much larger footprint for offshore wind development compared to the other technologies. Overall, offshore wind accounts for up to 93% of total estimated costs across the scenarios.

The main contributing factor to these cost impacts relates to impacts on the shipping sector (assessed as around £129m PV out of a total of £157m PV under the high scenario for offshore wind). Approximately £98m PV of this cost arises in NE SORER - OWNE1 and OWNE2 - with a further £14m PV cost associated with potential development in North SORER – OWN1 and OWN2.

Impacts to the commercial fishing sector are also significant. Around 90% of the assessed impacts to commercial fisheries sector relate to potential offshore wind development. Potential impacts in the North SORER at sites OWN1 and OWN2 account for around 63% of the total estimated costs to the commercial fisheries sector.

The assessment identifies relatively minor potential cost impacts to recreational angling and tourism. Potential costs to the CCS sector arise based on possible future development of a CCS pipeline from the Firth of Forth up to St Fergus and relate to additional costs that would be incurred to construct cable crossings over offshore wind export cables from OWNE1 in NE SORER. Given the uncertainties surrounding possible future CCS development, these cost estimates should be considered speculative at this stage.

Some potential impacts on recreational boating have been identified associated with additional fuel costs linked to increased steaming distances to navigate around offshore wind and tidal arrays. The largest estimated impacts occur for potential development in offshore wind Draft Plan Option areas in the North SORER (OWN1 and OWN2) and North East SORER (OWNE1 and OWNE2). Stakeholders have expressed concerns about the potential impact of cumulative offshore renewables development along the east and west coasts in deterring sailors from sailing along these coasts. This is considered further in Section 10.

Although there are possibly some negative impacts on some social groups (particularly special interest groups, such as recreational boaters, sea kayakers and sea anglers), these will be most noticeable at the local level. Tourism impacts may also occur due to changes in the landscape and seascape, but again these will be at a very localised scale. At the national scale, there are numerous alternative locations for these activities to take place, such that the overall impacts are negligible.

Impacts on employment due to reduced turnover are again only likely to be noticeable at the local level, and are mainly associated with commercial fisheries. For offshore wind, the maximum impact is in North region, with 9 to 10 direct and indirect jobs potentially affected per year. This is against a national total of 4,996 fishermen in 2011[16]. At the national scale, the number of jobs affected (including both direct and indirect) is, therefore, negligible. As a result, knock-on effects due to downturns in local economies are unlikely. Therefore, at the national scale impacts would not be noticeable, although the impact at local level for communities that are heavily dependent on fisheries

16 Marine Scotland (2012): Scottish Sea Fisheries Statistics 2011, September 2012, downloaded from the Scottish Government website: www.scotland.gov.uk.

(e.g. Orkney and the Shetland Islands) will be greater. At the national scale, the number of jobs affected (including both direct and indirect) is expected to be negligible.

10. Combined Assessment

10.1 Introduction

This section provides an assessment of the combined impacts of potential offshore wind, wave and tidal development within Draft Plan Option areas both at regional and national level.

The starting point for each assessment has been to sum the estimated impacts for offshore wind, wave and tidal development (as appropriate) and then to discuss the extent to which combined impacts may be more or less than the summed estimates.

10.2 Regional Assessments

10.2.1 South West

Table 56 presents summed discounted costs for offshore wind, wave and tidal Draft Plan Option areas in South West Region for those activities for which quantified cost estimates have been made. Unquantified impacts were also identified for a number of activities including commercial fisheries, energy generation, military interests, water sports and for social impacts.

Table 56. Discounted PV Costs (GVA for fisheries) in £millions for all technologies within South West Region (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	0.06	0.09	0.19
Recreational boating	Additional fuel costs	0.05	0.06	0.16
Shipping	Additional fuel costs	4.87	5.08	7.05
Tourism	Reduction in expenditure	-	0.02	0.33
Total PV Costs		**4.92**	**5.16**	**7.54**
Total GVA Impacts (Commercial Fisheries)		**0.06**	**0.09**	**0.19**

Estimation of potentially significant impacts

The following activities are relevant to more than one Draft Plan Option area and have the potential to experience significant combined impacts within the South West SORER.

Commercial Fisheries
The combined impact of potential wind and tidal development on fish landings is considered to be additive, given the relatively low value of the summed impact. Obstruction to navigation routes for commercial fishing vessels in South West SORER is assessed as relatively minor. Therefore the combined impact is considered to be additive.

Energy Generation
There is some potential for competition between offshore wind and tidal developments for grid connection. However, it is not possible to quantify the cost impact of this interaction. It is possible that grid capacity will expand in response to offshore energy development, thus avoiding significant competition for connectivity and offshore energy developers may co-operate in seeking to secure adequate grid connection.

Recreational Boating
The combined impact of potential wind and tidal development (TSW1 and OWSW1) is considered to be additive, given the value of the summed impact. The combined developments, assuming a high scenario and the interaction with medium RYA cruising routes assessed within this study provide a marginal increase in marine risk for recreational vessels. There is, however, limited commercial vessel usage of this sea area, providing adequate sea room for recreational craft to make safe passage around the combined developments.

Shipping
Most shipping activity within the Region is through traffic transiting from the Isle of Man and English ports along the Cumbrian Coast, Morecambe Bay and Liverpool. The combined assessment has therefore been made at national level.

Tourism
There is no anticipated impact on tourism activity from tidal development. Therefore the combined impact of offshore wind and tidal development is the same as for offshore wind development alone.

Social
Tables 57 and 58 show that most of the impacts are still identified as being possibly negative at worst, suggesting they would not be noticeable for most groups. There are some exceptions, notably commercial fisheries due to loss of traditional fishing grounds and the additional costs incurred in finding and or

moving to new fishing grounds. These impacts may be significant for dredgers and potters. Impacts may also be seen on recreational boat users due to increased difficulty with navigation. This could have knock-on implications for local employment in marinas and boat maintenance businesses if boat owners choose to relocate to other areas. However, these impacts would be very localised. A combination of recreational boating and tourism effects could increase the significance of the impacts for boat-based businesses (for example, if tourists chose to go elsewhere due to seascape changes reducing demand for boat trips). The costs are not expected to be large, though, so the impacts on employment and the local economy of the South West region are likely to be negligible.

Table 57. Combined distributional analysis (location, age and gender) South West

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Commercial fisheries	Value of potentially lost landings	0	xx	xx Ayr, Campbeltown	x	x	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	x Ayr, Cambeltown	x	x	x	x	xx Processors more likely to be female
Recreational boating	Additional fuel costs	0	xx	xx	x	xx	xx	xx	xx
	Increased deterrent to access in sites that are already challenging to navigate	0	xx	xxx Wigtown, Kirkcudbright, Whitehaven could be particularly affected	x	xx	xx	xx	xx
Tourism	Reduction in expenditure	0	x	No specific settlements affected	x	x	x	x	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x

Impacts: x x x : significant negative effect, ,x x : possible negative effects, x: minimal negative effect, if any, 0: no noticeable effect expected
Rules: Any impacts scored x under both wind and tidal are now scored xx
Any impacts scored xx under wind or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

Table 58. Distributional analysis (income and social groups) South West

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Value of potentially lost landings	xx	xx	xx	0 Not relevant in SW	0	0 Unlikely to be employed in fisheries	xxx Dredgers and potters	xxx Vessels >10m length x Vessels <10m in length
	Consequential impacts to fish processors	x	x	x	0 Not relevant in SW	0	0	x	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	xx	xx	0 Not relevant in SW	xx	xx	xxx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	xx Where employed in this area	xx	xx	0 Not relevant in SW	xx	xx Could affect ability to support trips for disabled/ sick	xxx Could mean they need to relocate to maintain level of access for recreational boating	xxx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely reduce activity if navigation risks increase
Tourism	Reduction in expenditure	x	x	x	x	x	x	x	No other specific group identified
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	x	x	x	0 Not relevant in SW	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified

Impacts: x x x : significant negative effect, x x : possible negative effects, x: minimal negative effect, if any, 0: no noticeable effect expected
Rules: Any impacts scored x under both wind and tidal are now scored xx
Any impacts scored xx under wind or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

10.2.2 West

Table 59 presents summed discounted costs for offshore wind, wave and tidal Draft Plan Option areas in West Region for those activities for which quantified cost estimates have been made.

Table 59. Discounted PV Costs (GVA for fisheries) in £millions for all technologies within West Region (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	0.16	0.37	0.80
Shipping	Additional fuel costs	-	3.80	9.77
Tourism	Reduction in expenditure	-	0.01	0.05
Total PV Costs		**-**	**3.81**	**9.82**
Total GVA Impacts (Commercial Fisheries)		**0.16**	**0.37**	**0.80**

Estimation of potentially significant impacts

The following activities are relevant to more than one Draft Plan Option area and have the potential to experience significant combined impacts within the West SORER.

Commercial Fisheries
The combined impact of potential offshore wind, wave and tidal development on fish landings is considered to be additive, given the relatively low value of the summed impact. Obstruction to navigation routes for commercial fishing vessels in West SORER may be significant for some Draft Plan Option areas. Generally these Draft Plan Option areas are well separated and it is therefore unlikely that an individual fishing vessel would be affected by multiple Areas, although offshore wind Area OWW3 and wave Area WW4 overlap significantly and could give rise to combined impacts in the area to the west of Mingulay.

Energy Generation
There is some potential for competition for space and grid connection between offshore wind and wave developments, particularly offshore wind Areas OWW1, OWW2 and OWW3 which overlap with wave Areas WW1, WW3 and WW4. However, it is not possible to quantify the cost impact of this interaction. It is possible that grid capacity will expand in response to offshore energy development, thus avoiding significant competition for connectivity and offshore energy developers may co-operate in seeking to secure adequate grid connection.

Shipping
Most shipping activity within the Region is through traffic. A wider combined assessment has therefore been made at national level.

Tourism
There is no anticipated impact on tourism activity from wave or tidal development. Therefore the combined impact of offshore wind, wave and tidal development is the same as for offshore wind development alone.

Social
Tables 60 and 61 show that most of the impacts for the West region are still identified as being possibly negative at worst, suggesting they would not be noticeable for most groups. There are some exceptions, notably commercial fisheries due to loss of traditional fishing grounds and the additional costs incurred in finding/moving to new fishing grounds. These impacts may be significant for potters and *Nephrops* trawlers. Crofters could also be disproportionately affected if they are involved in these type of fishing activities to supplement their incomes. There may also be issues with navigation routes, especially in TW2.

Of the other groups, recreational boat users and could reduce their activities or potentially relocate their activities if navigation becomes more difficult. This may be more significant for people with smaller boats that have fewer navigational aids, with the potential for knock-on implications for income to marinas and boat maintenance businesses. However, these impacts would be very localised. A combination of recreational boating and tourism effects could increase the significance of the impacts for boat-based businesses (for example, if tourists chose to go elsewhere due to seascape changes reducing demand for boat trips). The costs are not expected to be large, though, so the impacts on employment and the local economy of the West region are likely to be negligible.

Table 60. Distributional analysis (location, age and gender) West

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Commercial fisheries	Value of potentially lost landings	0	xxx More significant for OWW1	xxx Oban, Mallaig, Stornoway	x	xxx	x	xxx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	xxx More significant for OWW1 and OWW3	xxx Oban, Mallaig, Stornoway	x	xxx	x	xxx Fishermen more likely to be male	x
	Consequential impacts to fish processors	xx	xx	xx Oban, Mallaig, Stornoway	x	xx	x	xx	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	xx	xx Oban, Dunstaffnage marinas could be affected if number of boaters reduces (but others could benefit)	0	xx	xx	xx	xx
Tourism	Reduction in expenditure	0	x	No specific settlements affected	x	x	x	x	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	xx	No specific settlements affected	xx	xx	xx	xx	xx

Impacts: x x x : significant negative effect,
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: Any impacts scored x under both wind and tidal are now scored xx
Any impacts scored xx under wind or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

Table 61. Distributional analysis (income and social groups) West

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Value of potentially lost landings	xxx	xxx	xx	xxx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	xxx Potters	xxx *Nephrops* trawlers
	Obstruction of navigation routes	xxx	xxx	xx	xxx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	xxx Potters	xxx *Nephrops* trawlers
	Consequential impacts to fish processors	xx	xx	xx	xx	0	0	xx	xx
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	xx Where employed in this area	xx	xx	xx Maybe more likely to have smaller boats	xx	xx Could affect ability to support trips for disabled/ sick	xxx Could mean they need to relocate to maintain level of access for recreational boating	xxx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to look for alternative sailing sites if navigation risks increase
Tourism	Reduction in expenditure	x	x	x	x	x	x	x	No other specific group identified
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	xx	xx	xx	xx	xx	xx	xxx Sea kayakers could have to change routes or look for alternatives	No other specific group identified

Impacts: x x x : significant negative effect
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: Any impacts scored x under both wind and tidal are now scored xx
Any impacts scored xx under wind or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

10.2.3 North West

Table 62 presents summed discounted costs for offshore wind and wave Draft Plan Option areas in the North West SORER for those activities for which quantified cost estimates have been made.

Table 62. Discounted PV Costs (GVA for fisheries) in £millions for all technologies within North West Region (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	0.14	0.36	0.76
Shipping	Additional fuel costs	-	1.45	2.90
Total PV Costs		**-**	**1.45**	**2.90**
Total GVA Impacts (Commercial Fisheries)		**0.14**	**0.36**	**0.76**

Estimation of potentially significant impacts

The following activities are relevant to more than one Draft Plan Option area and have the potential to experience significant combined impacts within the North West SORER.

Commercial Fisheries
The combined impact of potential offshore wind and wave development on fish landings is considered to be additive, given the relatively low value of the summed impact. Obstruction to navigation routes for commercial fishing vessels in North West SORER may occur in relation to offshore wind Area OWNW1, but interaction with the two wave Areas is expected to be small. Given that the Draft Plan Option areas are well separated, it is therefore unlikely that individual fishing vessel would be affected by multiple Areas.

Energy Generation
There is some potential for competition for grid connection between offshore wind Area NW1 and wave Areas WNW1, WW4. However, it is not possible to quantify the cost impact of this interaction. It is possible that grid capacity will expand in response to offshore energy development, thus avoiding significant competition for connectivity and offshore energy developers may co-operate in seeking to secure adequate grid connection.

Shipping

Most shipping activity within the Region is through traffic. The combined assessment has therefore been made at national level.

Social Impacts

Tables 63 and 64 show that most of the impacts for the North West region are associated with commercial fishing, particularly due to loss of traditional fishing grounds and the additional costs incurred in finding/moving to new fishing grounds or steaming around arrays. These impacts may be significant for the pelagic sector, however this region has the largest impact on fisheries therefore the combined impact on fisheries therefore may be greater. There may also be impacts for recreational boaters, who could reduce or potentially relocate their activities if navigation becomes more difficult. This may be more significant for people with smaller boats that have fewer navigational aids, with the potential for knock-on implications for income to marinas and boat maintenance businesses.

Table 63. Distributional analysis (location, age and gender) North West

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Commercial fisheries	Value of potentially lost landings	0	xxx	xxx Kinlochbervie, Lochinver, Ullapool	x	xxx	x	xxx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	x	x Kinlochbervie, Lochinver, Ullapool	0	x	0	x Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	x	xx Kinlochbervie, Lochinver, Ullapool	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Pontoon facilities, e.g. at Kinlochbervie could be affected if number of boaters reduces (but others could benefit	0	x	x	x	x

Impacts: x x x : significant negative effect , x x : possible negative effects, x: minimal negative effect, if any, 0: no noticeable effect expected
Rules: Any impacts scored x under both wind and wave are now scored xx
Any impacts scored xx under wind or wave, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or wave, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

Table 64. Distributional analysis (income and social groups) North West

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Commercial fisheries	Value of potentially lost landings	x	x	x	xx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	xx Pelagic sector x Potters, demersal trawls	xx Vessels >15m (herring) x Vessels <15m
	Obstruction of navigation routes	x	x	x	xx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	x Pelagic sector 0 Potters, demersal trawls	x Vessels >15m (herring) 0 Vessels <15m
	Consequential impacts to fish processors	x	x	x	x	0	0	x	x
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	x	x	xx May be more likely to have smaller boats	0 Unlikely to be employed in this area	x	xxx Could mean they need to relocate to maintain level of access for recreational boating	xxx Could mean they need to relocate to maintain level of access for recreational boating	No other specific group identified

Impacts: x x x : significant negative effect
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: Any impacts scored x under both wind and wave are now scored xx
Any impacts scored xx under wind or wave, plus x under other technology are now scored xxx
Any impacts scored xxx under wind or wave, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

10.2.4 North

Table 64 presents summed discounted costs for offshore wind, wave and tidal Draft Plan Option areas in the North SORER for those activities for which quantified cost estimates have been made.

Table 65. Discounted PV Costs (GVA for fisheries) in £millions for all technologies within North Region (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	0.83	2.01	4.32
Shipping	Additional fuel costs	-	7.12	23.55
Tourism	Reduction in expenditure	-	0.22	0.59
Water Sports - Sea Angling	Reduction in expenditure	-	-	0.92
Total PV Costs		**-**	**7.34**	**25.06**
Total GVA impacts (Commercial Fisheries)		**0.83**	**2.01**	**4.32**

Estimation of potentially significant impacts

The following activities are relevant to more than one Draft Plan Option area and have the potential to experience significant combined impacts within the North SORER.

Commercial Fisheries
The combined impact of potential offshore wind, wave and tidal development on fish landings is considered to be additive, given the relatively low value of the summed impact. Obstruction to navigation routes for commercial fishing vessels in North SORER may be significant for some Draft Plan Option areas. Offshore wind Area OWN1 and wave Area WN2 both overlap with important steaming routes to the north-west of Orkney. More generally, the concentrations of Areas for offshore wind, wave and tidal energy development around Orkney and Shetland create the potential for combined impacts for fishing vessels working in these areas.

Energy Generation
There is a significant overlap between offshore wind Area OWN1 and wave Area WN2 which could result in competition for space. There may also be competition for grid connection between offshore wind, wave and tidal developments, particularly around Orkney and Shetland. However, it is not possible to quantify the cost impact of this interaction. It is possible that grid capacity will expand in response to offshore energy development, thus avoiding significant competition for connectivity and offshore energy developers may co-operate in seeking to secure adequate grid connection.

Shipping
Most shipping activity within the Region is through traffic along the Pentland Firth, or further offshore passing through the Fair Isle Channel or further north around the top of the Shetland Islands. The combined assessment has therefore been made at national level. The Lerwick to Hanstholm (Denmark) ferry could be affected by OWN2, but there are no other Draft Plan Option areas or existing lease areas giving rise to a combined impact on this route.

Tourism
There is no anticipated impact on tourism activity from wave or tidal development. Therefore the combined impact of offshore wind and tidal development is the same as for offshore wind development alone.

Water Sports - Sea Angling
The combined impact of potential offshore wind, wave and tidal development is considered to be additive, given the relatively low value of the summed impact.

Social Impacts
Tables 66 and 67 show that almost all of the potentially significant cumulative impacts for the North region are associated with commercial fishing, particularly due to loss of traditional fishing grounds and the additional costs incurred in finding/moving to new fishing grounds or steaming around arrays, but inshore fisheries may also suffer significant impacts. These impacts may be most significant for the pelagic and demersal sectors. Crofters could be disproportionately affected if they are involved in these types of fishing activities to supplement their incomes.

Impacts on other groups are mostly identified as being possibly negative at worst, suggesting they would not be noticeable. The main exceptions are impacts on sea anglers and recreational boaters, who could reduce or potentially relocate their activities if navigation becomes more difficult. This may be more significant for people with smaller boats that have fewer navigational aids, with the potential for knock-on implications for income to marinas and boat maintenance businesses. . This could have knock-on implications for local employment in marinas and boat maintenance businesses. However, these impacts would be very localised. A combination of effects on recreational boating, sea angling and tourism could increase the significance of the impacts for boat-based businesses (for example, if tourists and sea anglers chose to go elsewhere reducing demand for boat trips). The costs are not expected to be large, though, so the impacts on employment and the local economy of the North region are likely to be negligible. Impacts on sea angling may be significant for the 10% most deprived proportion of the population (although other groups within the population may be equally affected). However, as with the other impacts, these effects are likely to be localised.

Table 66. Distributional analysis (location, age and gender) North

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Carbon capture and storage	Costs of additional cable crossings	0	xx Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	xx Could have impact on employment opportunities if investment goes elsewhere	0	xx	xx
Commercial fisheries	Value of potentially lost landings	0	xxx	xxx Orkney, Scrabster, Shetland	x	xxx	x	xxx Fishermen more likely to be male	xx
	Obstruction of navigation routes	0	x	xx Orkney, Scrabster, Shetland	x	xx	x	xx Fishermen more likely to be male	x
	Consequential impacts to fish processors	xx	xxx	xxx Orkney, Scrabster, Shetland	x	xxx	x	xx	xxx Processors more likely to be female
Recreational boating	Increased deterrent to access in sites that are already challenging to navigate	0	xx	xxx Pierowall could be affected most, Bressay and Lerwick less so (xx)	0	xx	xx	xx	xx
Tourism	Reduction in expenditure	0	x	No specific settlements affected	x	x	x	x	x
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	xx	xxx May be more likely to be involved in sea angling	x
Water sports	Spatial overlap between Draft Plan Option areas and water sport activity (sea kayaking)	0	x	No specific settlements affected	x	x	x	x	x

Impacts: x x x : significant negative effect
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: Any impacts scored x under all of wind, wave and tidal are now scored xx
Any impacts scored xx under wind, wave or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind, wave or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

Table 67. Distributional analysis (income and social groups) North

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Carbon capture and storage	Costs of additional cable crossings	xxx economic impacts could affect this group more than others	xx	xx	xx Unlikely to be employed in this industry (but may be for extra income)	xx	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xxx Local businesses that might otherwise have been involved
Commercial fisheries	Value of potentially lost landings	xxx	xxx	xxx	xxx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	xxx Pelagic, demersal sector xx Shellfish	xxx Vessels >15m xxx Vessels <15m
	Obstruction of navigation routes	x	x	x	xx Where fishing provides additional income	0	0 Unlikely to be employed in fisheries	xx Pelagic, demersal sector x Shellfish	xx Vessels >15m xx Vessels <15m
	Consequential impacts to fish processors	xxx	xxx	x	x	0	0	xx	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	x	x	x	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	xx Where employed in this area	xx	xx	xxx May be more likely to have smaller boats	xx	xxx Could affect ability to support trips for disabled/ sick	xxx Could mean they need to relocate to maintain level of access for recreational boating	xxx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. They may be more likely to look for alternative sailing sites if navigation risks increase

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Tourism	Reduction in expenditure	x	x	x	X	x	x	x	No other specific group identified
Water sports – Sea Angling	Reduction in expenditure	xxx	xxx	xxx	xxx	xxx	xx Level of sea angling activity may be lower for sick	xxx Sea anglers will be most affected	No other specific group identified
Water sports	Spatial overlap between Draft Plan Option areas and water sports activity (sea kayaking)	x	x	x	x	x	x	xx Sea kayakers could have to change routes or look for alternatives	No other specific group identified

Impacts: x x x : significant negative effect, x x : possible negative effects
x: minimal negative effect, if any, 0: no noticeable effect expected
Rules: Any impacts scored x under all of wind, wave and tidal are now scored xx
Any impacts scored xx under wind, wave or tidal, plus x under other technology are now scored xxx
Any impacts scored xxx under wind, wave or tidal, plus x or xx under other technology are now scored xxx+ (to indicate cumulative impacts may be greater)

10.2.5 North East

No wave or tidal Draft Plan Option areas have been identified in the North East Region. The combined costs are therefore the same as those for offshore wind alone (Table 67).

Table 68. Discounted PV Costs (GVA for fisheries) in £millions for all technologies within North East Region (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Carbon Capture and Storage	Costs of additional cable crossings	1.85	4.32	9.27
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	0.18	0.43	0.92
Recreational boating	Additional fuel costs	-	0.66	0.81
Shipping	Additional fuel costs	-	48.57	98.61
Total PV Costs		**1.85**	**53.55**	**108.69**
Total GVA Impacts (Commercial Fisheries)		**0.18**	**0.43**	**0.92**

Estimation of potentially significant impacts

The following activities are relevant to more than one Draft Plan Option area and have the potential to experience significant combined impacts within the North East SORER.

Carbon Capture & Storage
There are no wave or tidal Draft Plan Option areas in North East Region. The combined impacts are therefore the same as those for offshore wind alone.

Commercial Fisheries
No wave or tidal Draft Plan Option areas are identified in the North East Region. The combined impacts on fish landings are therefore the same as those for offshore wind alone. Obstruction to navigation routes for commercial fishing vessels in North East SORER may occur in relation to OWNE2 for Fraserburgh port, and to a lesser extent in relation to OWNE1 for Peterhead and Aberdeen ports. Therefore the combined impact is likely to be additive.

Energy Generation
There may be some competition for grid connection between the two offshore wind Areas. However, it is not possible to quantify the cost impact of this interaction. It is possible that grid capacity will expand in response to offshore energy development, thus avoiding significant competition for connectivity and offshore energy developers may co-operate in seeking to secure adequate grid connection.

Recreational Boating

There are no wave or tidal Draft Plan Option areas in North East Region. The combined impacts are therefore the same as those for offshore wind alone.

Shipping

Most shipping activity within the Region is through traffic, although there are a number of ferry routes to the islands. The Peterhead-Shetland ferry route passes through offshore wind Draft Plan Option area NE2 and the Peterhead-Orkney route also passes through the edge of this Draft Plan Option area. The methodology used within this study has identified that the high development scenario can be accommodated within the Draft Plan Option area without impinging on the ferry routing. However, to recognise the proximity of development sites and existing ferry services, the effect of reduced sea area availability for navigation provides an increase in marine risk through the potential for ship encounters (a high density of traffic is expected around the development). As no wave or tidal Draft Plan Option areas occur in North East Region, the combined impacts are therefore the same as those for offshore wind alone.

Social Impacts

As there are no search areas for wave or tidal, the impacts are the same as for wind. These are mainly associated with commercial fishing and recreational boating, with some possible, but limited impacts, associated with carbon capture and storage. Impacts on commercial fisheries may be most noticeable for over 15m vessels, especially dredgers, demersal and *Nephrops* trawlers and potters. At for dredgers and potters, especially those <10m in length or >15m on length. At the regional level, the impacts will be negligible (see Tables 69 and 70).

Table 69. Distributional analysis (location, age and gender)

Sector	Impact	Location			Age			Gender	
		Urban	Rural	Settlement	Children	Working age	Pensionable age	Male	Female
Carbon capture and storage	Costs of additional cable crossings	0	x Could have impact on rural economy if investment goes elsewhere	0 Unlikely to affect specific locations	0	x Could have impact on employment opportunities if investment goes elsewhere	0	x	x
Commercial fisheries	Value of potentially lost landings	0	xx	xx Aberdeen, Buckie, Fraserburgh, Peterhead	x	xx	x	xx Fishermen more likely to be male	x
	Obstruction of navigation routes	0	xx	xxx OWNE2 (Fraserburgh and Peterhead)	x	xxx	x	xxx Fishermen more likely to be male	x
	Consequential impacts to fish processors	x	xx	xx Aberdeen, Buckie, Fraserburgh, Peterhead	x	xx	x	x	xx Processors more likely to be female
Recreational boating	Additional fuel costs	0	x	x	x	x	x	x	x
	Increased deterrent to access in sites that are already challenging to navigate	0	x	xx Peterhead, Banff and Whitehills marinas could be affected	0	x	x	x	x
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	xx	xx	x

Impacts: x x x : significant negative effect
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: No cumulative effects as there are no wave or tidal Draft Plan Option areas. Impacts are the same as for wind

Table 70. Distributional analysis (income and social groups)

Sector	Impact	Income			Social groups				
		10% most deprived	Middle 80%	10% most affluent	Crofters	Ethnic minorities	With disability or long-term sick	Special interest groups	Other
Carbon capture and storage	Costs of additional cable crossings	xx economic impacts could affect this group more than others	x	x	0 Not relevant in NE	x	0 Unlikely to be affected, economic impacts likely to be small	0 None likely to be affected	xx Local businesses that might otherwise have been involved
Commercial fisheries	Value of potentially lost landings	xx	xx	xx	0 Not relevant in NE	0	0 Unlikely to be employed in fisheries	xx Dredgers, potters x Demersal, pelagic sectors, *Nephrops*	xx Vessels >15m xx Vessels <10m x Vessels <15m
	Obstruction of navigation routes	xxx	xxx	xxx	0 Not relevant in NE	0	0 Unlikely to be employed in fisheries	xxx Dredgers, potters xxx Demersal, pelagic sectors, *Nephrops*	xxx Vessels >15m xxx Vessels <10m xxx Vessels <15m
	Consequential impacts to fish processors	xx	xx	x	0 Not relevant in NE	0	0	x	x
Recreational boating	Additional fuel costs	0 Unlikely to own boat	x	x	0 Not relevant in NE	x	x	xx Boat users	No other specific group identified
	Increased deterrent to access in sites that are already challenging to navigate	x	x	x	0 Not relevant in NE	x	x	xx Could mean they need to relocate to maintain level of access for recreational boating	xx Potentially greater impact on less affluent sailors with smaller, less powerful boats without electronic aids. May be more likely to look for alternative sailing sites if navigation risks increase

Sector	Impact	Income			Social groups				
		10% most deprived	**Middle 80%**	**10% most affluent**	**Crofters**	**Ethnic minorities**	**With disability or long-term sick**	**Special interest groups**	**Other**
Water sports – Sea Angling	Reduction in expenditure	xx	xx	xx	xx	xx	x Level of sea angling activity may be lower for sick	xxx Sea anglers will be most affected	No other specific group identified

Impacts: x x x : significant negative effect
x x : possible negative effects
x: minimal negative effect, if any
0: no noticeable effect expected
Rules: No cumulative effects as there are no wave or tidal Draft Plan Option areas. Impacts are the same as for wind

10.3 National Assessment

Table 71 presents summed discounted costs for wind, wave and tidal Draft Plan Option areas in all SORERs for those activities for which quantified cost estimates have been made.

Table 71. Discounted PV Costs (GVA for fisheries) in £millions for all technologies (numbers rounded to nearest £0.01m)

Activity	Description of Measurement	Scenarios		
		Low	Central	High
Carbon Capture and Storage	Costs of additional cable crossings	1.85	4.32	9.27
Commercial Fisheries	Loss of GVA associated with possible reduction in fish landings	1.37	3.26	6.99
Recreational boating	Additional fuel costs	0.05	0.72	0.97
Shipping	Additional fuel costs	4.87	66.02	141.87
Tourism	Reduction in expenditure	-	0.26	1.00
Water Sports - Sea Angling	Reduction in expenditure	-	-	0.92
Total PV Costs		**6.77**	**71.32**	**154.03**
Total GVA Impacts (Commercial Fisheries)		**1.37**	**3.26**	**6.99**

While there are uncertainties surrounding the cost estimates for tourism and sea angling and not all potential impacts to these sectors have been quantified, the scale of impacts identified in this study does not suggest that there will be significant regional or national impacts associated with combined offshore wind, wave or tidal development within the Draft Plan Option areas.

At a national level, the combined impact of the commercial fisheries sector in terms of impacts to GVA as a result of potential reductions in landings is estimated to be less than 1% of total GVA and thus insignificant in a national context. At a regional scale, it is estimated that the greatest potential impacts will occur in North Region. No significant impacts for the fish processing sector have been identified either regionally or nationally, given the relatively small scale of potential impact to fish landings. Impacts may also occur to the commercial fisheries sector as a result of disruption to steaming routes to fishing grounds as a result of the location of offshore renewables arrays but it has not been possible to quantify these impacts. It is possible that export cable routes may also affect fishing opportunities in some locations, but it has not been possible to quantify these impacts.

Cost impacts to shipping interests are potentially more significant both in absolute terms (maximum annual cost impact of around £13.0m) and relative terms, although no specific figure is available for the value of shipping to the Scottish economy. For the tidal and wave sites, spatial planning can largely avoid significant impacts on commercial shipping and ferry routes, however reduced sea area availability for navigation will increase the density of traffic in other areas. This will have an increase in the potential encounter rate, and therefore an increase in marine risk. Changes in shipping patterns around development sites, specifically larger wind farm sites, will also affect greenhouse gas (GHG) emission values for different sea areas. This will depend on the route of the deviation, however it is expected that GHG emission values will be modified by affected routes. It is unlikely that routeing around the north of the Shetland Islands will be affected by development sites, likewise, routeing through the Fair Isle channel is unlikely to be affected. However, vessels transiting along the North East Scottish Coast will be affected by wind farm sites (i.e., OWNE1, OWNE2). Routeing through the Pentland Firth is unlikely to be affected, however the wind farm Draft Plan Option area off Cape Wrath (Sutherland Coast) may modify routeing for vessels bound for the deep water IMO routing land to the West of the Outer Hebrides, or those vessel transiting through the Minch. The Minch and Outer Hebrides vessel routes combine in an area with intense Commercial Traffic use to the West of Tiree, further South off the Isle of Islay, which has potential for multiple impacts on through the combined effect of development sites in this area. Careful site specific selection will be require to position development sites so that they do not interact with establish shipping routes provide access to vessels entering, or leaving the Irish Sea; or transiting to smaller ports within the Inner Isles.

The impact of renewable development sites on recreational boating is recognised as a deterrent (i.e., the prospect of increased danger which affects planned passages) and partly economic where the passage is attempted, but a deviation is encountered to avoid development areas. The effect of decisions not to navigate in these areas will be recognised in income from marina and leisure support facilities, and a long term disincentive for investment. The combined impacts of development within the Draft Plan Option Areas may include:

- Vessels on passage from the Forth to the Caledonian Canal and the west, or to the Northern Isles may be deterred by the cumulative effect of the three wind farms off the Forth, the proposed scheme in Aberdeen Bay and OWNE1 and OWNE2 requiring the increased level of alertness and crewing levels which may dissuade recreational vessels from using this area;
- Similarly, the number and intensity of development sites may act as a deterrent for recreational craft wanting to access the Inner and Outer Hebrides from cruising bases such as the Clyde. The location of development sites around headlands provides added anxiety and complexity for recreational navigation; and
- The numerous development sites around the Orkney Islands may also lead to potential reductions in visiting vessels where it is considered

more difficult and challenging to navigate inshore where renewable development sites are located.

A number of potential impacts have been identified for competing offshore renewables technologies, both in relation to competition for space and cable land falls. The combined impact of these interactions is uncertain. It is possible that more commercially viable technologies such as offshore wind could out-compete wave and tidal developments and reduce opportunities for these technologies, although offshore renewables developers will be encouraged to co-operate on issues such as cable landfall.

Impacts to CCS and Dredge Material Disposal sites only occur in one SORER and national impacts will therefore be no greater than the regional impacts to these activities.

The social impacts are not expected to be noticeable at the national level. The potential impacts on employment, access to services, health, culture and heritage and the environment could be locally noticeable, with the largest impacts likely to be associated with commercial fisheries, and on marinas if boat users choose to visit other areas of the coast or move their boats to marinas away from the search areas. In most cases, these impacts are also expected to be small and very localised and relate mainly to the knock-on effects of changes to jobs (either number or quality of employment). There are no significant impacts expected in terms of access to services, crime or education. Impacts on culture and heritage, environment and health are limited to loss of traditional fishing grounds, emissions to the environment (most of which will be offshore) and worry associated with increased costs or increased navigation risks.

11. Discussion and Conclusions

11.1 Potential Cost Impacts

The socio-economic assessment provides a broad overview of indicative cost impacts to other activities associated with potential offshore wind, wave and tidal development within the Draft Plan Option areas. The Present Value (discounted over the assessment period at 2012 prices) of the quantified costs ranged from £5.4m (Low Scenario: 3GW offshore wind; 0.5GW wave; 0.5GW tidal) to £154m (High Scenario: 15GW offshore wind; 2.5GW wave; 2.5GW tidal).

The quantified potential cost impacts to commercial shipping accounted for around 70-90% of total quantified costs, depending on scenario. Most of the quantified potential cost impacts relate to either reductions in revenues (for example, reduced tourism or recreational angling expenditure) or increased fuel costs (shipping and recreational boating). Some potential one-off costs have been identified for the CCS sector associated with the need to construct additional cable crossings where a possible future pipeline crossed future offshore wind farm export cables in the North East SORER. The commercial fisheries costs relate to estimated impacts to GVA as a result of potential reductions in fish landings.

The relatively higher potential costs to the shipping sector under the Central and High Scenarios reflects the increasing level of constraint on commercial shipping associated with more intense development within offshore wind Draft Plan Option areas, thus reducing the flexibility to locate arrays within portions of the Draft Plan Option areas that have low shipping densities. Thus under Central and High Scenarios, increasing numbers of vessels will be required to deviate from current routes, resulting in significant additional fuel costs. The main impacts relate to OWNE1 (PV cost of £71m), OWNE2 (PV cost of £17m), OWN2 (PV cost of £9m), OWW1 (PV cost of £6m) and OWN1 (PV cost of £5m).

Such route deviations will also potentially give rise to additional cost impacts associated with time delays to passing vessels, but it has not been possible to quantify these impacts. Offshore wind Draft Plan Option area OWNE2 intersects with ferry routes from Peterhead to Shetland and to Orkney, and OWN2 intersects with the ferry route from Lerwick to Hanstholm (in Denmark). The time delays associated with deviating around possible offshore wind development in this Draft Plan Option area could have a particularly detrimental impact on the Shetland services should these routes not be taken into account in the siting of arrays within the Draft Plan Option area.

While potential wave and tidal arrays also have some potential to disrupt existing vessel routes, the much smaller spatial scale of development and the much greater flexibility in locating such development within the Draft Plan

Option areas potentially mean that spatial planning can be used to minimise impacts to the shipping sector from such developments. On this basis, the combined impacts of offshore wind, wave and tidal development on shipping within each SORER are broadly similar to the impact of offshore wind Draft Plan Option areas alone.

For the commercial fisheries sector, the estimated impact for all technologies at national level ranges from PV £1.4m GVA (Low Scenario) to PV £7.0m GVA (High Scenario). Under the High Scenario, the impact represents less than 1% of total annual GVA for the commercial fisheries sector in Scotland. Furthermore, this is considered to be a very conservative estimate, as it assumes that all fishing effort and associated landings within the footprint of offshore wind, wave and tidal arrays is lost, rather than simply displaced. In reality, it is likely that some commercial fishing activity will continue, particularly within offshore wind arrays (which account for around 90% of total impact in this assessment). This level of impact is not considered to have significant implications for the fish processing sector. It has not been possible within this study to quantify the potential impacts of offshore renewables on other aspects of commercial fishing, but there may be impacts from additional steaming distances to fishing grounds, gear development and adaptation costs and quota costs involved in moving to alternative fishing grounds, and cost impacts associated with gear damage associated with interactions with intra-array or export cables.

The combined impacts of offshore wind, wave and tidal development on commercial fishing are considered to be very similar to the impacts of offshore wind on its own, as wave and tidal are estimated to contribute only around 5% each to total commercial fishing impacts.

The quantified recreational boating impacts have been assessed as being relatively minor ranging from £0 p.a. (Low Scenario) up to £0.87m p.a. (High Scenario in 2035) with the PV cost impacts ((discounted over the assessment period at 2012 prices) ranging from £0m (Low Scenario) to £5.8m (High Scenario). The cost estimates relate purely to the potential additional fuel costs associated with diverting around wind or tidal arrays. The cost estimates in relation to offshore wind arrays are considered to be conservative, as it is possible for recreational vessels to transit through offshore wind farms in fair weather conditions. The main factor affecting the range of estimated cost impact is the assumption about the scope for spatial planning of Draft Plan Option areas to minimise disruption to sailing routes. In particular, given that on average wave arrays under the High Scenario will only need to be deployed across less than 1% of the Draft Plan Option area and that such environments only experience light use by recreational sailors, it has been assumed that spatial planning will be able to avoid any impacts associated with the deployment of wave devices. It has not been possible to quantify the impact of development within the Draft Plan Option areas on wider aspects of recreational boating. In particular, there is uncertainty surrounding the effect of multiple offshore energy developments on the attractiveness of sailing around the Scottish coast. In particular, the area off the Mull of Galloway and the Mull of Kintyre are already challenging routes and there is some concern that offshore renewables development in these areas may deter sailors from using this route up the West coast of Scotland. This could lead to a reduction in expenditure in local supply chains. Similarly, multiple offshore wind developments along the East coast may deter recreational sailors travelling along the east coast, although their location relatively far offshore will provide a safe inshore route and thus is likely to limit the combined impact. On this basis, the combined impacts of offshore wind, wave and tidal development on recreational boating may be greater than the sum of the individual impacts, although it is not possible to quantify this potential impact.

Some potential costs may be incurred by the CCS sector in the future, should possible new CCS pipelines be constructed running from the Firth of Forth up to St Fergus. However, these costs are particularly uncertain as they are based on a speculative development path for CCS.

Quantified cost impact estimates for recreational angling and tourism are low, reflecting assumptions about the limited interaction between offshore renewables and these sectors. While there are ongoing concerns about the impact of offshore wind farms on tourism, there is currently no evidence of any offshore wind farm having a significant impact on tourism. Given that the current Draft Plan Option areas for offshore wind are generally all a minimum of 10km offshore, the scope for significant impacts on tourism is considered to be very limited. It has not been possible to quantify potential cost impacts to the tourism sector associated with onshore development (O&M facilities and substations). While such developments have the potential to affect the character and setting of areas of importance to tourism, it is noted that adverse impacts will be controlled through the planning system.

For the majority of activities, no significant cost impacts were identified under any of the scenarios including aquaculture, energy generation, oil and gas, ports and harbours, power interconnectors, telecom cables, waste disposal and the majority of water sports. However, for some sectors, some uncertainty remained concerning potential impacts. For example for oil & gas, power interconnectors and telecom cables, where export cables require to cross existing cables or pipelines, it was assumed that the main costs of constructing the crossings would fall on the offshore renewables developers. While the existing asset owners would seek to protect their interests through cable crossing agreements, it remains uncertain the extent to which all future liabilities might be covered by such agreements. For example should an existing asset owner need to replace their infrastructure, they might need to place this on top of an offshore renewables cable and thus inherit additional liabilities at that point. For energy generation, some uncertainty remains concerning the potential impact of competition for grid connection and cable landfalls between rival developers.

It has not been possible to develop quantified cost estimates for aviation or military interests. There is some potential for impact to helicopter services to offshore oil and gas fields where offshore wind developments may preclude low level flying during adverse weather. This would require helicopters to deviate around arrays, resulting in extended flight distances. While service providers were approached, they were not able to provide any information within the time scales of this study. In the absence of quantified information, the cost impact is considered to be relatively minor as route deviations will only be required in adverse weather conditions. It may be possible to minimise such impacts through careful location of the arrays at project level. Offshore wind development within many of the Draft Plan Option areas will affect radar services around the coast and mitigation measures are likely to be required at project level. It has not been possible to quantify these costs in this study but the costs will be borne by the offshore wind developers and therefore would not fall on the aviation sector.

The MOD has identified that offshore renewables development within the Draft Plan Option areas may have the potential to affect military training exercises and activities but that it is not possible to quantify impacts at this stage. Such potential impacts will therefore need to be addressed at project level.

No significant benefits to activities could be quantified in this study, although it is noted that a number of activities such as ports & harbours, shipping and tourism would benefit from the development of the supply chain, but this was outwith the scope of the study.

Most of the social impacts are limited to localised effects and even these are generally expected to be small. There may be some impacts on recreational boaters, sea kayakers and sea anglers that could require them to change the location of their activities. This could affect marinas, boat charters, boat maintenance businesses, etc. with knock-on employment effects. However, the impacts on one marina are likely to be compensated by benefits for others. As a result, the overall impacts should balance out. The social issue then depends on whether the benefits move from areas that are more (or less) deprived such that they could have a distributional effect or whether sailors in smaller, more traditional boats with fewer navigational aids are affected in terms of access and opportunities for continued activity. The magnitude of the impacts is unlikely to be significant enough to result in closure of a marina (or associated businesses) such that the distributional effects should be limited. If sailors of more traditional craft feel that the additional navigational risks are too great, they could reduce their activity with impacts for their well-being.

Impacts on commercial fisheries may be more significant and could affect groups such as crofters using fishing as a means of supplementing their income. It is difficult to determine which fishermen would be affected, although the greater impacts are predicted in crofting areas, such as Caithness and the Northern Isles (North region) and the Western Isles (West region). The magnitude of impacts may be more significant on vessels greater than 15m in length, but the relative impact may be greater on the under 10 and under 15m sectors particularly in West and North regions while impacts on different gear types vary between regions. As a result, there is no one group that is consistently affected to a greater extent overall.

Knock-on effects on GVA and employment are generally insignificant, with few of the costs exceeding the 5% of turnover threshold used as the minimum value for estimating these impacts[17]. The only sector that exceeds the 5% threshold is commercial fishing and then only in North and West regions (low and central scenarios), and North, North East, West and North West regions (high scenario). In all cases, this is associated with offshore wind. The main estimated impacts on GVA and employment are as follows:

- Type I (direct and indirect) to Type II (direct, indirect and induced) effect on GVA (high scenario):
  - North: £5.4 to £5.9 million;
  - North East: £0.76 to £0.83 million (PV);
  - West: £1.9 o £2.1 million (PV); and
  - North West: £0.75 to £0.82 million (PV).
- Type I (direct and indirect) to Type II (direct, indirect and induced) effect on employment (high scenario):
  - North: 9.2 to 10.2 jobs;
  - North East: 1.4 to 1.5 jobs;
  - West: 1.5 to 1.7 jobs; and
  - North West: 1.3 to 1.5 jobs.

This shows that the most significant effects are likely to be in North region, but these are still relatively minor. There might be localised effects that are greater in impact than the numbers suggest, for example, if crofters in North region are affected more significantly than full-time fishermen or if most of the impacts fall onto fishermen from the same harbours, or where impacts fall on areas that are heavily dependent on fisheries.

11.2 Study Limitations

There is currently a high level of uncertainty surrounding the location and intensity of possible future offshore renewables development within the Draft Plan Option areas. The study has sought to use assumptions about the density and location of development within the Draft Plan Option areas to inform the scenarios to address this, for example, it is assumed that the

17 The assumption is that costs of less than 5% of turnover could be absorbed without causing knock-on effects on GVA or employment.

notional installed capacities for offshore wind, wave and tidal development identified in the scenarios are apportioned pro rata across the Draft Plan Option areas in proportion to the size of each Draft Plan Option area. In reality it is likely that development will be more intensive in some Draft Plan Option areas than in others leading to variable levels of socio-economic impact within each Draft Plan Option area.

The timing of any development within the Draft Plan Option areas is also uncertain. In this study we have made a simplistic assumption that all development starts in 2023 and is completed by 2025. However, should development proceed within the Draft Plan Option areas this is likely to be staggered in the period 2018 to 2030. While the study assumption is likely to give PV estimates that reflect a national average of development spread over the period 2018 to 2030, it is possible that cost impacts could vary at regional level should development proceed earlier or later than assumed in this assessment. A sensitivity analysis undertaken on the timing of development indicated that if all developments became operational five years earlier (i.e. by 2020) this would increase cost/GVA impacts by around 19% (based on an assessment period ending ten years after full operation (i.e. 2030). Conversely, a delay of five years would reduce cost/GVA impacts by around 16% (based on an assessment period ending ten years after full operation (i.e. 2040).

The nature and scale of socio-economic impacts is particularly dependent on the precise locations in which offshore renewables development may occur within individual Draft Plan Option areas. This study has assumed that spatial planning within Draft Plan Option areas can be used effectively to minimise socio-economic impacts, particularly where the density of development occupies less than 5% of an Draft Plan Option area. However, within individual Draft Plan Option areas it is possible that other constraints may limit flexibility in choice of the location for offshore renewables development, resulting in higher levels of socio-economic assessment.

Uncertainties in the location and nature of future activity in the marine environment also contribute to uncertainty in the estimation of costs and benefits. For example, potential CCS impacts are based on assumptions about a possible future requirement for a new CCS pipeline sometime in the 2020's. Similar uncertainties relate to future trends in ongoing activities such as commercial fishing (assumed landings values remain constant over the assessment period) and tourism (revenues assumed to be constant in real terms). Such assessments are therefore based on a significant degree of speculation about future levels of activity and are thus inherently uncertain.

There is also some uncertainty concerning the nature and scale of socio-economic impacts associated with offshore renewables development. This reflects uncertainty surrounding the details of the technologies to be deployed, the lack of scientific understanding relating to the impacts of novel technologies, and the lack of scientific understanding of some specific environmental pressures and impact pathways (e.g. the scale of collision mortality and the effects of electromagnetic fields). The study has sought to accommodate these uncertainties in the assessment where possible, for example in relation to the differential impacts of tidal turbine foundation design on navigation interests. However, some uncertainty remains concerning some aspects of the impacts of offshore renewables and it is important that such issues are managed through the process of plan implementation by ensuring that newly acquired evidence on impacts is used to refine the plans.

Most of the social impacts are likely to be felt at a very local level. The scale of this assessment is generally focused on a regional level such that small scale issues can appear to be insignificant. The study addresses this by considering impacts on specific social groups, including looking for local hotspots (such as marinas) where the impacts may be disproportionate. However, the real significance of the local impacts could only be fully explored through a specific, local assessment, which is beyond the scope of this study. For example, it has not been possible to explore whether a local area might become increasingly deprived if there were impacts on jobs partly because the impacts are generally small but also because the specific locations of the impacts cannot be clearly identified. In addition, the 5% threshold for assessing quantitative impacts may under-estimate effects on certain businesses that may be disproportionately affected as impacts are unlikely to be evenly distributed across a sector.

It has not been possible to quantify social impacts, other than access to employment where multipliers have been used. Other impacts have been assessed qualitatively, which can result in homogenisation of impacts although it does mean that all impacts are considered throughout the assessment. The social impacts are generally assessed as knock-on impacts from the direct effects on activities. This means that areas such as employment, environment and health have been included to a greater extent than the much more indirect effects on crime or education. Again, these indirect effects may become more evident in a specific, local assessment.

The combined assessment poses particular challenges owing to the complexity of such assessments and the limited scientific understanding of impacts. Within this study, combined effects (the combined impact of potential offshore wind, wave and tidal development within the Draft Plan Option areas) have generally been assessed as the sum of the individual impacts of offshore wind, wave and tidal development. This has been based on the generally minor contribution to overall assessed impacts arising from wave and tidal development and the modest overall scale of impacts.

As identified in section 11.1 above, it has not been possible to provide quantified cost estimates for a number of activities owing to a lack of data or because of a lack of time for the relevant sector to respond. However, based on the information available to the study team, the cost impacts to the affected sectors are not considered to be particularly large.

For oil and gas, power interconnectors and telecom cables, other uncertainties about potential cost impacts arise relating to assumptions about potential future liabilities at crossing points. There is currently limited experience of developing and implementing such agreements and thus the extent to which all future liabilities might be taken into account.

The main uncertainty with the GVA and employment effects is associated with the use of multipliers. The multipliers used typically relate to much wider sectors than just the industries that could be affected by the Draft Plan Option areas, so they may under- or over-estimate the impacts. The fisheries multiplier has also been questioned, although a review of other multipliers was inconclusive over if (and how) the multipliers used should be adjusted. The use of a 5% threshold for identifying potentially significant impacts could mean that some locally significant effects are not highlighted. This is because regional data have been used as the basis for assessing whether the impacts exceeded the threshold.

12. References

ABPmer, 2011. Quantifying the Potential Impact of a Marine Conservation Zone (MCZ) Network on the Deployment of Offshore Renewables. Report R1763 to DECC, March 2011.

ABPmer & RPA, 2012a. Socio-economic Baseline Reviews for Offshore Renewables in Scottish Waters. ABP Marine Environmental Research Ltd, Report No. R.1905 to Marine Scotland.

ABPmer & RPA, 2012b. A Socio-economic Methodology and Baseline for Pentland Firth and Orkney Water Round 1 Wave and Tidal Developments. Report to the Crown Estate. ABP Marine Environmental Research Ltd, Report No. R.1826.

ABPmer, SQW and RPA, 2011. Economic Assessment of Short-term Options for Offshore Wind in Scottish Territorial Waters.

Beatrice Offshore Wind Ltd, 2012. Beatrice Offshore Wind Farm Environmental Statement.

DECC, 2010. Marine Energy Action Plan 2010

Defra (2011): A framework for understanding the social impacts of policy and their effects on wellbeing, paper for the Social Impacts Taskforce, Defra evidence and analysis series Paper 3, April 2011, available at: http://www.defra.gov.uk/publications/files/pb13467-social-impacts-wellbeing-110403.pdf.

Energy and Climate Change Select Committee, 2012. The Future of Marine Renewables in the UK, February 2012.

Entec, 2009. Marine Renewable Energy State of the industry report – October 2009.

HM Treasury, 2003. Green Book. http://www.hm-treasury.gov.uk/data_greenbook_index.htm

Marine Scotland, 2010. Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Analysis of Consultation Responses, December 2010.

Marine Scotland, 2011. Blue Seas - Green Energy A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters Part A: The Plan.

Meygen, 2012. Meygen Tidal Energy Project Phase 1 Environmental Statement.

MMO, 2013. The United Kingdom Fishing Vessel List (excluding islands) as at 1 May 2013. Marine Management Organisation Statistics and Analysis Team.

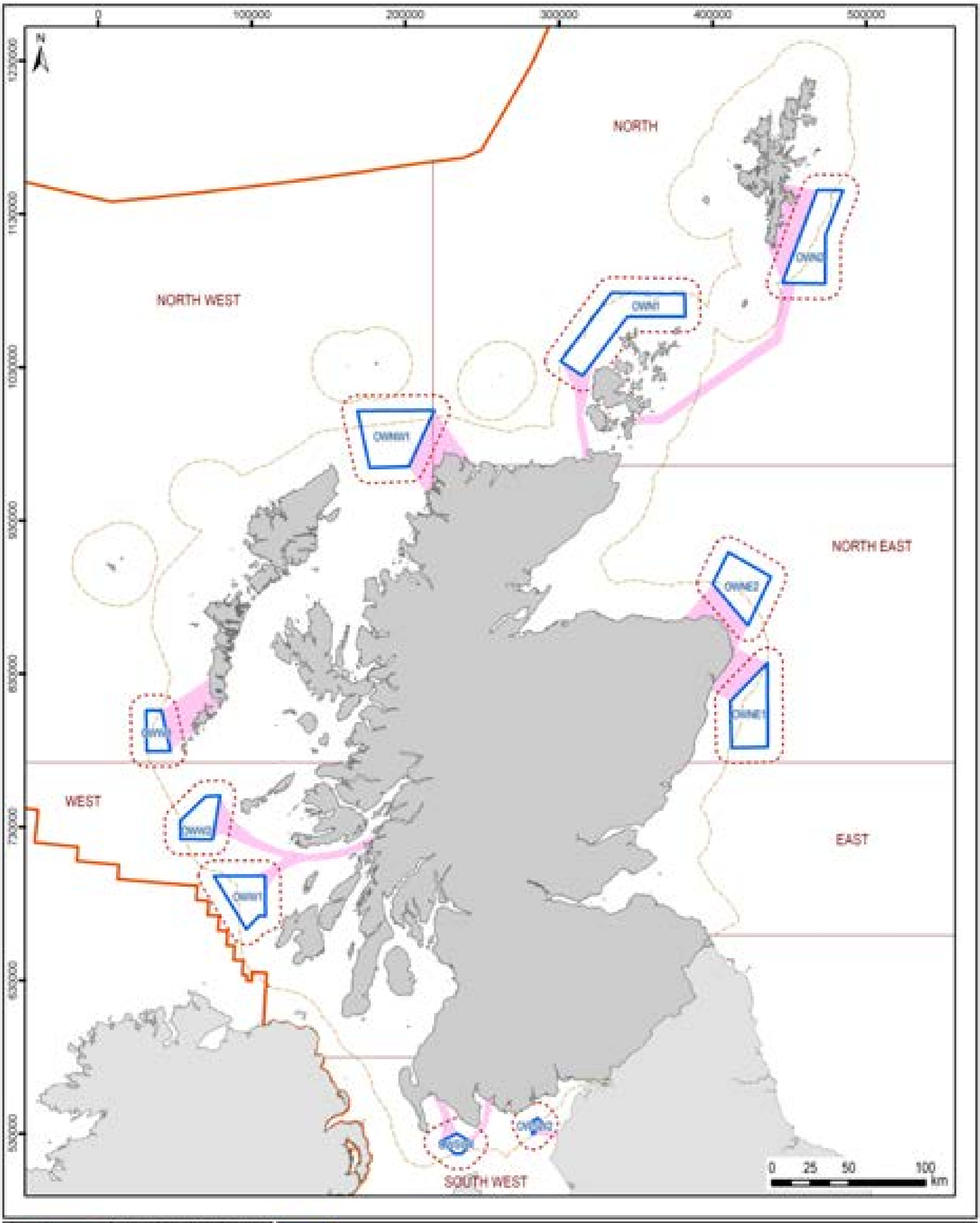
National Grid, 2011. Offshore Development Information Statement (ODIS), September 2011.

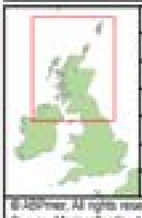
National Statistics (2009): UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007), available from http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/standard-industrial-classification/sic2007---explanatory-notes.pdf.

Scottish Government, 2012. Draft Electricity Generation Policy Statement, available from: http://scotland.gov.uk/Topics/Business-Industry/Energy/EGPS2012/DraftEPGS2012

SNH & JNCC, 2012. Advice to the Scottish Government on the selection of Nature Conservation Marine Protected Areas (MPAs) for the development of the Scottish MPA network. Scottish Natural Heritage Commissioned Report No. 547. Scottish Natural Heritage and the Joint Nature Conservation Committee.

Figures





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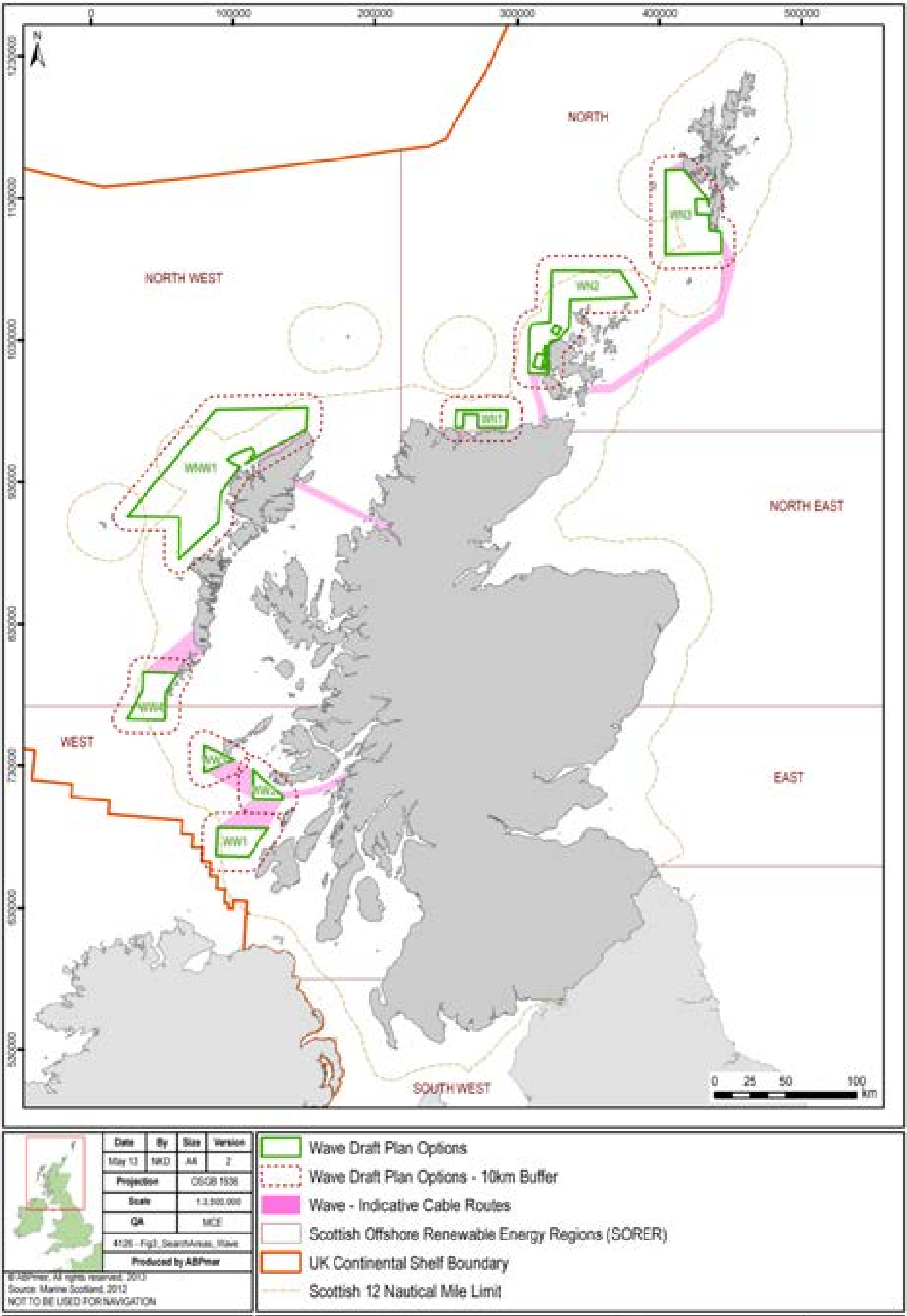
QA		MCE	
#126 - Fig1_SearchAreas_Wind			
Produced by ABPmer			

Source: Marine Scotland, 2012
NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- Offshore Wind Draft Plan Options - 10km Buffer
- Offshore Wind - Indicative Cable Routes
- Scottish Offshore Renewable Energy Regions (SORER)
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

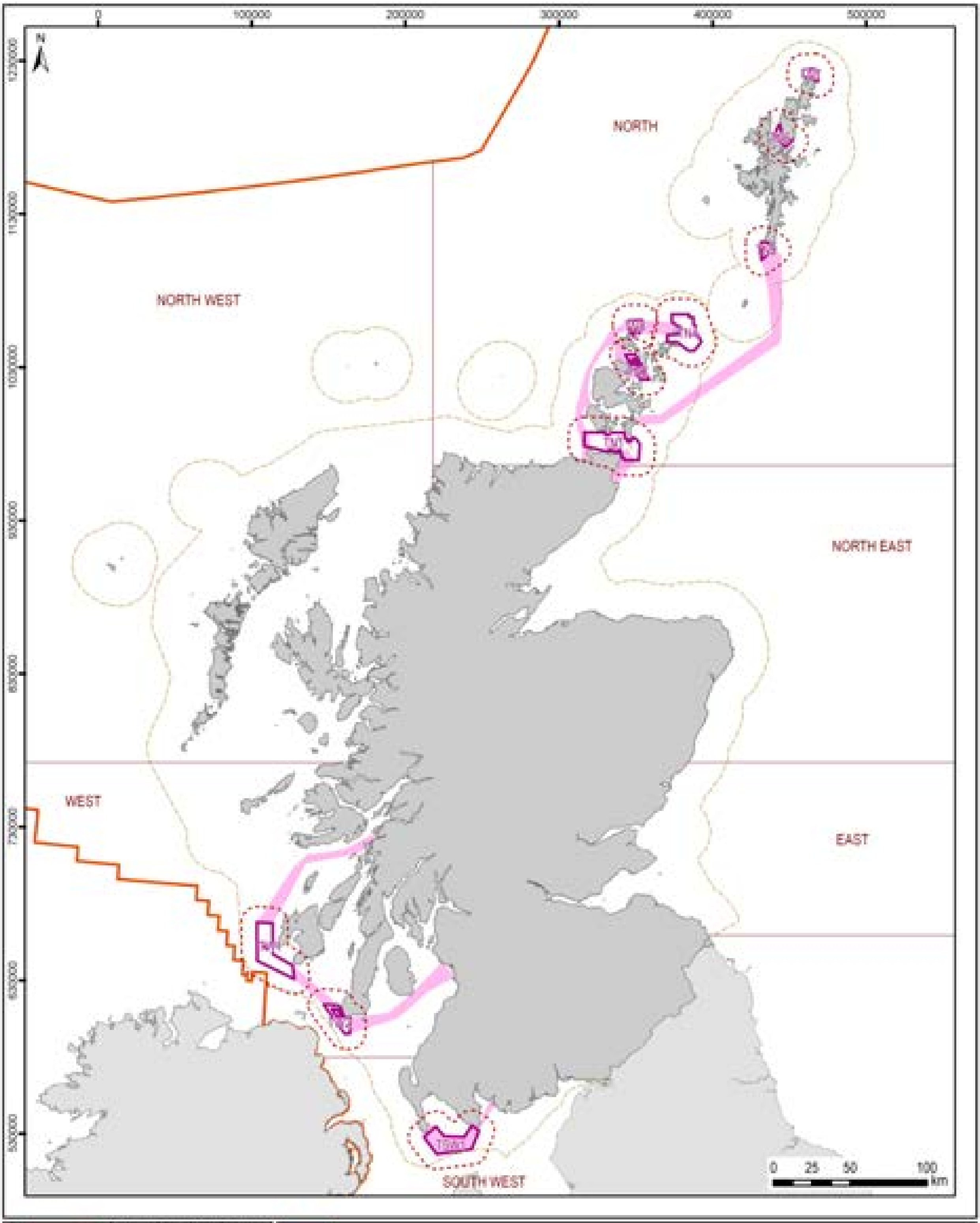
Draft Plan Options for Offshore Wind and Scottish Offshore Renewable Energy Regions

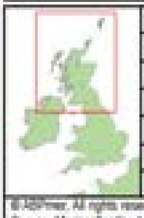
Figure 1



Draft Plan Options for Wave Energy and Scottish Offshore Renewable Energy Regions

Figure 2





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4126 - Fig3_SearchAreas_Tidal			
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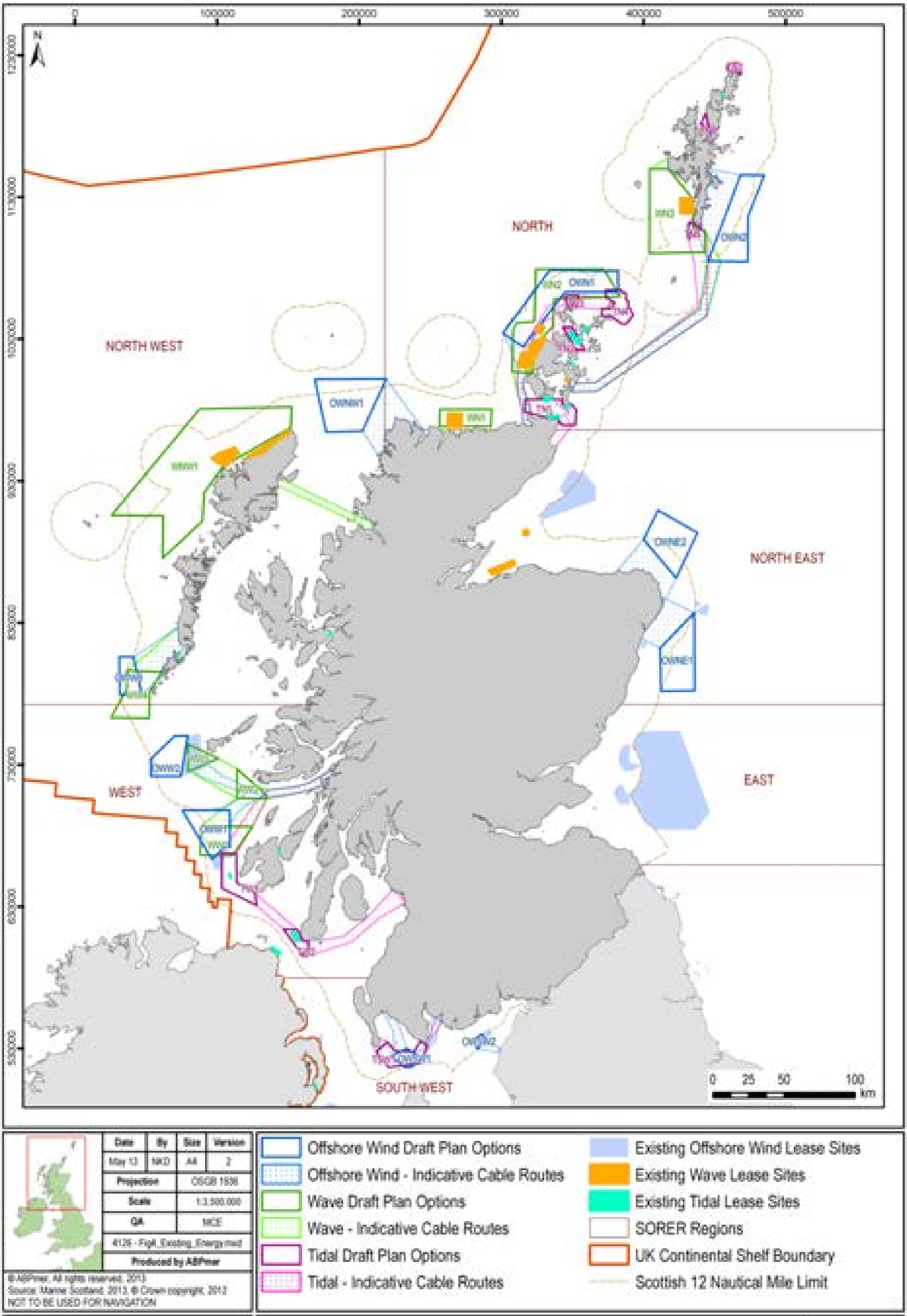
Source: Marine Scotland, 2012
NOT TO BE USED FOR NAVIGATION

- Tidal Draft Plan Options
- Tidal Draft Plan Options - 10km Buffer
- Tidal - Indicative Cable Routes
- Scottish Offshore Renewable Energy Regions (SORER)
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

Draft Plan Options for Tidal Energy and Scottish Offshore Renewable Energy Regions

Figure 3



Existing Offshore Renewable Energy Developments **Figure 4**

Appendices

Appendix A

Members of Project Advisory Group

Appendix A. Members of Project Advisory Group

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Sandra Turnbull	South East Inshore Fishery Group (SEIFG) representing 10mu Association	sandra@sandraturnbull.co.uk
Alistair Sinclair	Scottish Creel Fishermans Federation	ats1@btopenworld.com

* only attended first meeting on behalf of colleague.

Project Steering Group

David Pratt – Marine Scotland
Kevin Brady – Marine Scotland
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Ryan Gunn – SG Energy
Ian Storrie – SG Energy
Lewis Hurley – SG SEA Team

Appendix B

Description of Interactions with Activities and Assessment Methods

Appendix B. Description of Interactions with Activities and Assessment Methods

B1. Aquaculture

B1.1 Overview

Aquaculture relates to the production of marine species such as finfish and shellfish within aquaculture installations including cultivated shellfish beds. Figure B1 shows an overview of aquaculture activity in relation to the Draft Plan Option areas. Information sources used in the assessment are listed in Table B1.1.

Table B1.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Production and turnover 2005-2009	2005-2009	Baxter et al (2011)
Scotland	Scottish shellfish production survey	2010	Marine Scotland (2010)
Scotland	Scottish fish farm production survey	2009	Marine Scotland (2009)
UK	Future trends	2006+	Wilding et al (2006)
Regional	Economic value and trends	2010	Scottish Salmon Producers Organisation (2010)

B1.2 Future Trends

Aquaculture continues to be the world's fastest-growing animal-food-producing sector. In the period 1970-2008, the production of food fish from aquaculture increased at an average annual rate of 8.3 percent and is set to overtake capture fisheries as a source of food fish (FAO, 2010; Commission of the European Communities, 2009). The global demand for seafood, coupled with the need to replace land-based sources suffering from climate change and the current health of the world's wild fish stocks, has seen an increased demand for Scottish production (Baxter et al. 2011).

Despite an overall decrease in rainbow trout production from 2008-2011, the immediate prospects for Scottish finfish aquaculture overall are good. The Scottish Government (2010) predicted that the opportunity for sustainable growth in the next five years for salmon may equate to an ex farm value of £152 million and a potential of 400 new jobs, partly due to an increased worldwide demand due to the collapse of Chilean salmon stocks. The salmon production industry in Scotland has outlined a plan to increase annual production to 210,000 tonnes by 2020, and in 2011 the SSPO reported that 86% of its companies planned to expand their business in the next five years, with 272 new jobs already created in 2011 (SSPO, 2012). A 2010 agreement to open the Chinese markets to Scottish salmon offers opportunity for further expansion of salmon exports. Scottish Development International have pledged to support Scotland's salmon industry in reaching targets set by the Scottish Government to increase salmon exports by 50% by 2017 (SSPO, 2010). The Scottish Government has stated its support for the ambitions of the aquaculture sector to increase production of farmed fish by 50 per cent by 2020 compared to

2009[18]. This target implies fin fish production in the order of 230,000 tonnes, up from 150,000 tonnes in 2009.

Emerging aquaculture species such as tilapia, barramundi, bass and bream may also increase the size of the UK finfish aquaculture market (Defra, 2008). Cod, haddock and halibut farming (which are currently only farmed on a relatively small scale) are also predicted to grow (Pugh, 2008). However, cod farming is now seen as a less attractive option due to recent increases in North Sea cod catch quotas. 'No Catch', Britain's only supplier of sustainable organic cod, based on the Shetland Isles, went into administration in early 2008. Due to a shortage of available investment there is now no commercial cod production and only three halibut producers in Scotland, despite reports from the British Marine Finfish Association that there is potential to increase halibut production. A number of aquaculture businesses are currently considering plans for the production of wrasse as a sea-lice control within salmon farms.

Scotland is well positioned to contribute to continued growth in shellfish aquaculture within the EU, in line with the EU Aquaculture Strategy. In the 2009 European Fisheries Fund awards, grants to the mussel sector were made which could alone lead to a further increase of more than 2,000 tonnes of production (Baxter et al. 2011). A decline in Dutch mussel production may also contribute to an expansion of the Scottish industry, which has the potential to double its production by 2020 to 160,000 tonnes without having a significant impact on overall market supply and avoiding a reduction in the market value (Marine Scotland, 2011).

The Scottish Government has stated its support for the ambitions of the aquaculture sector to increase production of shellfish by 100 per cent by 2020 compared to 2009[19]. This target implies shellfish production in the order of 13,000 tonnes by 2020.

B1.3 Potential for Interaction

Table B1.2 shows potential interaction pathways between aquaculture and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;

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[18] The target, as set out in the Pre Consultation Draft Marine Plan (see here http://www.scotland.gov.uk/Publications/2011/03/21114728/14#a3) are as follows:
By 2020:
- To increase the sustainable production of marine finfish at a rate of 4% per annum to achieve a 50% increase in current production.

[19] The target, as set out in the Pre Consultation Draft Marine Plan (see here http://www.scotland.gov.uk/Publications/2011/03/21114728/14#a3) are as follows:
By 2020:
- To increase the sustainable production of shellfish, mussels especially, by at least 100%.

Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in; and
Column 5: Identifies how the socio-economic impact will be assessed.

Table B1.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Displacement of existing or future aquaculture activity	All arrays, export cables	Reduction in income for aquaculture producers	✓	See Section B1.4
Disturbance or injury to aquaculture species in n production (underwater noise)	All arrays during construction	Reduction in income for aquaculture producers	✓	See Section B1.4

B1.4 Scoping Methodology

B1.4.1 Displacement of Aquaculture Activity

Potential negative impacts on aquaculture may occur through the direct displacement of aquaculture installations. This potential negative effect was considered only likely to occur where Draft Plan Option areas (or associated cable corridors) and aquaculture interest areas directly overlap. Using this assumption:

- Draft Plan Option areas or cable corridors which did not overlap with aquaculture interest areas were scoped out.
- Draft Plan Option areas or cable corridors which did overlap with aquaculture interest areas were considered to require more detailed assessment.

The output of this scoping exercise is presented in Appendix C1.

B1.4.2 Disturbance or Injury to Aquaculture Species in Production (Underwater Noise)

Potential negative impacts on aquaculture may occur through disturbance or injury to aquaculture species in production through underwater noise. Noise associated with installation activities and operation might arise from vessel traffic, turbine movement, possible requirements for bed levelling, driving and drilling of piles, and installation of the power export cable (i.e. ploughing through sediment areas, rock cutting in hard sea beds, bolting to the sea bed and/or directional drilling). There is an increasing understanding of the source noise levels and frequencies associated with marine construction activities from various reports largely associated with offshore wind farms (Nedwell & Howell, 2004; Thomsen et al., 2006). The impacts from pile driving and the use of explosives are of most concern (e.g. IECS, 2007). This is because pile driving generates very high sound pressure levels over a relatively broad frequency range (20Hz - >20kHz). Studies indicate that some exposures will result in changes or damage to sensory structures and hearing capabilities, impacts on other aspects of fish physiology and mortality (Hastings & Popper, 2005). Specifically, noise impacts from pile driving may result in permanent or temporary threshold shifts for species in close proximity to the activity (Thomsen, et al. 2006).

Offshore wind arrays may use large diameter piling and are likely to emit more intense noise than wave or tidal arrays which would be expected to either use much smaller diameter piling or no piling (such as for gravity base or floating structures). Using this assumption:

- Draft Plan Option areas > 5km (Wind) or 2km (Wave and Tidal) from aquaculture interest areas were scoped out of the assessment.
- Draft Plan Option areas < 5km (Wind) or 2km (Wave and Tidal) of aquaculture interest areas were considered to require more detailed assessment.

The output of this scoping exercise is presented in Appendix C1.

B1.5 Assessment Methodology

B1.5.1 Displacement of Aquaculture Activity

An assessment of the potential impact on revenue due to displacement has been based on scale of spatial overlap and information on production (using information on farm activity and size as a proxy for production data which can't be released for individual sites due to commercial confidentiality).

Currently there is still uncertainty surrounding the precise routes which cables will be laid within the indicative corridors. However, given that aquaculture installations only cover small areas, a large degree of overlap occurring between a cable route and aquaculture site is unlikely. In addition, it is assumed that cable routes will generally be able to be modified slightly through spatial planning to avoid aquaculture installations. Displacement of aquaculture sites due to cable routes has therefore not been assessed in more detail as part of this study.

B1.5.2 Disturbance or Injury to Aquaculture Species in Production (Underwater Noise)

The assumption has been made that if an aquaculture site (including a 5km noise buffer for wind and a 2km noise buffer for wave/tidal) only represents a small percentage of a Draft Plan Option area it would easily be possible to locate the arrays at a distance which would not produce noise disturbance to aquaculture species.

B2. Aviation

B2.1 Overview

This sector relates to civil aviation, which comprises scheduled air transport (including all passenger and cargo flights operating on regularly scheduled routes) and general aviation (including all other civil flights, private or commercial). Military aviation is covered separately in the Military Interests baseline. Figure B2 shows an overview of aviation activity in relation to the Draft Plan Option areas. Information sources used in the assessment are listed in Table B2.1.

Table B2.1 Information Sources

Scale	Information Available	Date	Source
Scotland	UK Air Passenger Demand Forecasts	2009+	Department for Transport (2009)
Scotland	Scottish Transport Statistics	2010	Scottish Government

B2.2 Future Trends

The number of air passengers using UK airports is forecast to recover from the recent downturn. In a ‘constrained’ forecast, in which it is assumed that there will be no new runways and only incremental developments to airport terminals to make maximum use of existing runways, numbers of passengers are forecast to rise from 211 million passengers per annum (mppa) in 2010 to 335mppa in 2030 (range 300 - 380 mppa), and to 470mppa in 2050 (range 380 - 515 mppa). These forecasts imply average annual growth in passenger numbers to 2050 of 2.0% (within the range 1.5-2.3%) significantly lower than the 3.7% average seen over the past twenty years (DfT, 2011). Unconstrained forecasts (in which it is assumed there are no airport capacity constraints) show that UK air travel would rise from 211mppa in 2010 to 345mppa in 2030 (central forecast, range 305-400mppa) and 520mppa (central forecast, range 400-700mppa) (DfT, 2011).

Constrained (maximum use) passenger capacity and ATM forecasts for major Scottish airports are shown in Table B2.2.

Table B2.2 Constrained Terminal Passenger and ATM ‘Central’ Forecasts for Major Scottish Airports

Numbers/ Movements	Airport	2010	2020	2030	2040	2050
Terminal passengers (mppa)	Glasgow	7	7	10	12	20
	Edinburgh	9	13	15	20	20
	Aberdeen	3	3	4	5	6
	Prestwick	2	2	2	3	4
	Inverness	<1	1	<1	<1	<1
Air Transport Movements (000’s)	Glasgow	70	55	75	90	140
	Edinburgh	100	170	190	230	180
	Aberdeen	90	90	100	110	120
	Prestwick	15	20	25	25	30
	Inverness	15	30	15	15	15

B2.3 Potential for Interaction

Table B2.3 shows potential interaction pathways between aviation activities and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B2.3 Potential for Interaction

1 Potential Interaction	2 Technology Relevance (Wind, Wave, Tidal)	3 Potential Socio-Economic Consequence	4 Scoped in (✓) or Out (X) of Assessment	5 How the Economic Impact Will be Assessed
Height obstruction of commercial navigation routes (helicopters)	Wind arrays only	Additional track miles for helicopters owing to height obstruction in inclement weather	✓ - where Draft Plan Option areas overlap with existing helicopter routes	Information on main helicopter routes (MHRs) is available from the Aeronautical Information Publication (NATS website). Consultation with specific helicopter operators to discuss any particular issues for individual Draft Plan Option areas and estimate additional track miles where any issue highlighted. See Section B2.4 for detailed methodology.
Interference with radar systems	Wind arrays only	The need to provide radar mitigation for strategic en-route and low level radar interference.	**X –**radar mitigation will be required as a condition of consent if there is a potentially significant effect. And the costs will be borne by the developer rather than the airline industry or regulator. This essentially involves a transfer of the cost to the developer and therefore does not require assessment here.	Economic assessment not required. To inform the Sustainability Appraisal, consultation will be undertaken with (NATS) to identify any issues or objections to developments in each Draft Plan Option areas due to potential interference with radar systems and the scale of any issues associated with individual Draft Plan Option areas will be highlighted.

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-Economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Height obstruction of commercial navigation routes (commercial aircraft)	Wind arrays only	Loss of trade at airports	**X** – developments that compromised air safety on approaches to and from commercial airports would not be granted consent	Economic assessment not required.

B2.4 Scoping Methodology

B2.4.1 Height Obstruction of Commercial Helicopter Navigation Routes

Helicopter Main Routes (HMRs) represent the routes typically flown by helicopters operating to and from offshore destinations and are ‘signposts’ to aid flight safety (i.e. signposting concentrations of helicopter traffic to other air space users). Whilst HMRs have no airspace status and assume the background airspace classification within which they lie, they are used by the Air Navigation Service Provider (ANSP) (i.e. NATS Aberdeen) and helicopter operators for flight planning and management purposes. While compliance with the HMR structure is not compulsory, in the interests of flight safety, civil helicopter pilots are strongly encouraged to plan their flights using HMRs wherever possible. The HMRs do not predict the flow of helicopter traffic (UK Aeronautical Information Package; NATS website).

The Civil Aviation Authority (CAA) has noted that, as a result of needing to lower their operating altitude in inclement meteorological conditions, helicopters may not be able to overfly wind farm developments, and thus would be forced to alter their track to go laterally around the sites, resulting in additional track miles, costs and emissions (Civil Aviation Authority, 2010; cited in ABPmer et al. 2011).

For the purpose of this assessment, this potential negative effect was only considered to be likely where main helicopter routes (MHRs) intersected with a wind Draft Plan Option areas. Using this assumption:

- Draft Plan Option areas which were not intersected by HMRs were scoped out of the assessment; and
- Draft Plan Option areas which were intersected by HMRs were considered to require a quantitative impact assessment.

The results of the scoping exercise are presented in Appendix C2.

For the purposes of this assessment it was assumed that there was no potential for wave and tidal developments to cause any potential negative interaction with civil aviation or helicopter operations. Consultation with relevant civil aviation stakeholders confirmed that, in general, this was a reasonable assumption. However, the following information was provided by the CAA (Kelly Lightowler, CAA, pers. comm. 12 March 2013):

"Wave and tidal developments will have minimal impact on aviation as they often will not extend vertically above the surface of the water. However, during construction and maintenance there may be a requirement for tall structures such as cranes to be temporarily at the site. The CAA would ask that these temporary structures are notified through the means of a Notice to Airmen (NOTAM). To arrange an associated NOTAM, the developer or those responsible for the site at the time should contact the CAA's Airspace Utilisation Section; they will need an accurate location, an accurate maximum height and a completion date".

B2.5 Assessment Methodology

B2.5.1 Height Obstruction to Commercial Helicopter Navigation Routes

Where wind Draft Plan Option areas were identified as potentially obstructing HMRs using the scoping methodology, it was anticipated that the potential cost impact to the aviation industry of this interaction could calculated by estimating the additional track miles required for helicopters to navigate around Draft Plan Option areas of concern during inclement weather for both inbound and outbound routes. This assessment would require generic information on helicopter flight speed (assumed cruising speed; km/h), fuel consumption (kg/hr) and fuel cost (obtained from internet searches or industry consultation). An indicative economic cost of the additional track miles could then be calculated as follows:

additional track miles (km) x cost of fuel used

Given the high number of HMRs in the Northern North Sea the additional track miles would be estimated to represent the largest deviation that would be required around a given Draft Plan Option areas of concern (i.e. a 'worst case' scenario).

To assess the significance of this cost to the sector, the frequency of usage of the HMRs which intersect with wind Draft Plan Option areas, and the frequency of low level flying due to inclement weather would be required and this information was sought through industry consultation.

B2.5.2 Interference With Radar Systems

Mitigation for radar interference will be required as a condition of consent if there is a potentially significant effect. This cost would be transferred to the developer and hence no quantitative assessment of this cost has been undertaken. However, relevant stakeholders were consulted to ascertain whether there were any issues or concerns about any of the wind Draft Plan Option areas, and the scale of any potential issues.

Prior to undertaking this consultation with aviation stakeholders the NATS self assessment maps (NATS, 2013) and the DECC Aviation Safeguarding Data (DECC website), were used to identify Draft Plan Option areas which were likely to cause interference with radar systems and the outputs of this scoping exercise was discussed further with stakeholders.

The outcome of this scoping exercise and stakeholder consultation is provided in Appendix C2.

B3. Carbon Capture and Storage

B3.1 Overview

Carbon capture and storage (CCS) is a carbon abatement technology that will enable fossil fuels to be used with substantially reduced CO_2 emissions. CCS combines three distinct processes: capturing the CO_2 from power stations and other industrial sources, transporting it (usually via pipelines) to storage points, then injection of the CO_2 into deep geological formations (e.g. deep saline formations or depleted Oil and Gas fields) for long term storage. The full chain of CCS technologies (i.e. the process described above) has yet to be demonstrated at a commercial scale within Scotland. However, CCS is an active field of research and development and a growing industry. Figure B3 shows an overview of potential CCS storage sites in relation to the Draft Plan Option areas. Information sources used in the assessment are listed in Table B3.1.

Table B3.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Potential CO_2 storage sites, transport options between sources and storage sites (ship and pipeline)	2009	Scottish Centre for Carbon Storage (2009.)
Scotland	Refined estimate of CO_2 storage capacity in North East Region, estimates of timelines to CCS deployment and employment estimates	2011	Scottish Centre for Carbon Storage (2011)
Scotland	Potential transport options and possible European CCS Network	2011	Scottish Government and Scottish Enterprise (2011)
Scotland	Potential CO_2 storage sites	2011	Baxter et al (2011)
UK	CCS Project Proposals	2012	Carbon Capture and Storage Association (2012)
UK	CCS Commercialisation Programme	2013	DECC (2013)

B3.2 Future Trends

The Scottish Government and Scottish Enterprise (2010) stated that the emerging CCS-based industry in Scotland could support up to an estimated 10,000 new jobs in the next 15-20 years. A more recent study (SCCS, 2011) stated that an appropriately skilled and trained workforce, in addition to that already engaged in the engineering and offshore industries, will be an essential component of the new CCS industry in the UK and estimated that CCS could create 13,000 jobs in Scotland (and 14,000 elsewhere in the UK) by 2020 and increase in the following years (SCCS, 2011). This study also estimated that the UK plc share of the worldwide CCS business is potentially worth over £10 billion per year from around 2025, with the added value in the UK worth between £5-9.5 billion per year (SCCS, 2011).

CCS on fossil fuel power generation may have an important role in helping to meet Scotland's climate change targets of an 80% reduction in greenhouse gas (GHG) emissions by 2050. The Scottish Government and Scottish Enterprise (2010) state that in order to make significant progress towards Scotland's climate change targets the electricity generation sector needs to be decarbonised by 2030. To meet this target Scotland must have one or more demonstrator projects operational by 2015 to ensure that CCS is available on a commercial scale from 2020 and be widespread in the sector by 2030 (including the retrofitting of CCS to existing plants). However, challenges to this emerging sector include demonstrating that CCS is economically and technically feasible, that CCS is permanent (proposed sites must be investigated and evaluated to demonstrate they are suitable for secure storage of CO2 for thousands of years) and whether the technology can be developed within a timescale that enables utilisation of the existing Oil and Gas infrastructure (platforms and pipelines) before decommissioning occurs (Baxter et al, 2011). Potential storage sites may increase as further hydrocarbon fields or saline aquifers suitable for CO2 storage may yet be discovered (SCCS, 2009).

B3.3 Potential for Interaction

Table B3.2 shows potential interaction pathways between carbon capture and storage and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B3.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Competition for space.	All arrays, export cables	Sterilization of potential storage areas/obstruction of potential pipeline routes	✓– where Draft Plan Option areas overlap or lie inshore of potential storage areas	See Section B3.4

B3.4 Scoping Methodology

B3.4.1 Competition for Space

For the purpose of this assessment, this potential negative effect was only considered to be likely where Draft Plan Option areas or export cable corridors overlap or lie inshore of identified deep geological formations (saline aquifers or depleted oil and gas fields). Using this assumption:

- Draft Plan Option areas and/or cable corridors which do not overlap or lie inshore of identified geological formations were scoped out of the assessment;
- Draft Plan Option areas and/or cable corridors which do overlap or lie inshore of identified geological formations were considered to require a quantitative impact assessment;
- Draft Plan Option areas which do lie inshore of identified geological formations but occupy only a small percentage of the Draft Plan Option areas were also scoped out of the assessment as it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts. The parameters for scoping out include:
  - Wind: <5% of Draft Plan Option areas
  - Wave: <5% of Draft Plan Option areas
  - Tidal: <5% of Draft Plan Option areas
- The results of the scoping exercise are presented in Appendix C3.

B3.5 Assessment Methodology

B3.5.1 Competition for Space

The Carbon Capture and Storage Association (CCSA) and the Office of Carbon Capture and Storage (OCCS) were consulted to determine their views on the potential socio-economic impacts of the identified wind, wave and tidal Draft Plan Option areas on CCS development.

There is currently a high level of uncertainty about the future location and scale of carbon capture and storage activity in UK seas, in particular, commercial viability is still to be demonstrated. There are a large number of potential storage sites in Scottish seas, and through the DECC CCS Commercialisation Competition two sites in Scotland have been shortlisted. These are the Peterhead project (storing in the Goldeneye field) as well as the Captain Project (storing in the Aspen formation within the Captain sandstone). The details of these projects, including any future infrastructure developments, were reviewed along with Government plans and policies which might influence the development of CCS in the longer term.

Future CCS requirements and potential developments in Scotland were also reviewed. The storage capacity of the Captain Sandstone formation in the North Sea is estimated to be more than 360million tonnes of CO_2, even when applying the most stringent, geologically least favourable conditions. There is the potential for an additional 1200 million tonnes storage capacity with significant investment. Therefore, it is predicted that the Captain Sandstone formation alone could provide a feasible secure store of Scotland's CO_2 emissions from existing industrial point sources for the next 15 to 100 years (SCCS and Scottish Government, 2011). In addition, there is very likely to be sufficient storage to allow import of CO_2 from North East England (SCCS and Scottish Government, 2009). Linking onshore power stations to these offshore storage sites would potentially require significant infrastructure development which has the potential to interact with the Draft Plan Option areas. Where this issue has been identified the cost of re-routing a CCS pipeline and/or the cost of cable/pipeline crossings has been calculated as follows:

The cost of re-routing pipelines was calculated based on the additional distance required for future CCS pipeline routes to deviate around Draft Plan Option areas and/or of export cable corridors of concern

Length of deviation (km) x average cost pipeline laying per km

The average cost per km for pipeline laying was based on standard industry values of £1million per km (as confirmed by CCSA), whilst the length of deviation was estimated under a worst case if the pipeline route had to avoid all Draft Plan Option areas and associated cable corridors.

Similarly, where pipeline laying was considered likely, the additional cost of crossing any cables linking the Draft Plan Option areas to the land was calculated. Assuming 132MW cables will be used to transmit the energy generated the number of cable crossings needed under each scenario was calculated as follows:

Notional installed capacity within relevant Draft Plan Option areas (MW) / 132 (MW)

The standard industry cost of crossings of existing pipelines or cables is between £0.5-1million (ODIS). As a precautionary measure this assessment has assumed that all cable crossings will cost £1million. The total cost of cable crossings was determined as follows:

Number of cable crossings x cost of cable crossing

The assessment has assumed constant prices in real terms based on 2012.

The results of these reviews, consultations and analysis are described in the assessment results Appendix C3.2.

B4. Commercial Fisheries

B4.1 Overview

This sector relates to all commercial fishing activity within Scottish waters and includes the subsequent handling and processing of catches. In this study, commercial fishing activity includes wild salmon and sea trout fisheries.

The main fishing sectors are: pelagic trawl fisheries e.g. for mackerel and herring (based mainly in Shetland and north-east Scotland; demersal trawl fisheries e.g. for whitefish - haddock, cod and monkfish; demersal trawl fisheries for Nephrops; inshore fisheries including smaller Nephrops trawls and Nephrops creels (pots).

The Scottish fisheries sector landed 359,000 tonnes of fish with a value of £501 million in 2011. Pelagic species accounted for 56% of landings by quantity (37% by value), demersal species accounted for 26% by quantity (30% by value) and shellfish accounted for 20% by quantity (33% by value) (Marine Scotland, 2012). The total volume of landings decreased by 2% compared to 2010, but the value increased by 13%, mainly due to higher prices being achieved for pelagic species (herring and mackerel). Other countries' vessels also fish in Scottish waters. These include Norway, France, Spain, Ireland, Denmark, the Netherlands, Germany, Russia and Faroe Islands.

Figures B4.1, B4.2 and B4.3(a-e) show an overview of fishing activity in relation to the Draft Plan Option areas. Information sources used in the assessment are listed in Table B4.1.

Table B4.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Value and weight of landings by port Average effort (kw days) in sea areas by UK vessels (range) Average value of landings from sea areas (range) Average number of days of foreign vessel fishing activity per ICES square (range) Reported annual catches by fishing type (fixed engine, rod and line, net and coble)	2005-2009	Baxter et al (2011)
Scotland	Locations and types of fishing; status of stocks; economic and social aspects of the fisheries	2010	Crawley, D. (2010)
Fishing District	Sea Fisheries Statistics for fishing fleet, employment and catches and landings	2009	Marine Scotland - Science
ICES rectangle	Landings data (weight and value of landings into a UK port by vessel size, nationality and gear type for each species)	2000-2010	Marine Scotland
ICES rectangle	Satellite (VMS) data for UK vessels if available	2006-2010	Marine Monitoring Centre, Marine Scotland
ICES rectangle	Vessel surveillance data by nationality and gear type	2006-2010	Marine Monitoring Centre, Marine Scotland
Statistical Districts	Aggregate catch data for salmon and sea trout fisheries by fishing type	2000-2010	Freshwater Laboratory Field Station, Marine Scotland - Science
Additional data sources: • Dunstone (2008) presents 2004-2008 VMS data by gear type, effort and estimated economic value including Scotland • Pentland Firth and Orkney Waters ScotMap draft outputs			

B4.2 Future Trends

B4.2.1 Fish Catching Activities

The fisheries sector is currently, and is likely to remain, important to many rural areas in Scotland. Fisheries are potentially impacted by both environmental and anthropogenic factors, including:

- Climate change effects (warming seas), which may result in the decline of stocks of cold-water species, such as cod, in waters around the UK as the stocks move northwards. However, new opportunities for warmer-water species may emerge as these species extend northwards into UK seas. Existing more southerly stocks such as red mullet, John Dory and bass may also experience improved productivity in years with higher average sea temperatures (UKMMAS, 2010);
- Anthropogenic effects such as permanent structures, dumping at sea, oil and chemical spills, and the effects of the fisheries themselves, which may impact on the habitats where the fish live; and
- Profitability and political effects, as detailed below.

There are a wide range of factors influencing the financial performance of individual businesses: some are internal to the business (such as strategic decision making, assets and skills), while others are external (and include sectoral competitiveness, the management framework, market conditions and fuel prices). These interact to determine the actual business performance (Scottish Government, 2010).

Landings of fish subject to UK quotas set under the EU Common Fisheries Policy (CFP) generally reflect changes in the quota set, therefore, in the future as species-specific quotas are raised or lowered, this will have an impact on the amount of that species landed. This is difficult to predict and will depend on the recovery and sustainability of individual species as well as the details and implementation of CFP reform in 2013, including the implementation of a discards ban.

Fisheries management will continue to focus on bringing down rates of exploitation to Maximum Sustainable Yield (MSY) targets. The majority of scientifically-assessed stocks continue to be fished at rates well above the levels expected to provide the highest long-term yield (UKMMAS, 2010), therefore, there is increasing downward pressure on the levels of exploitation allowed. It is likely that pressure to reduce discarding will increase, though without allowing overall catch to rise. Management measures will need to reduce bycatch and discards, and be more responsive to changing patterns of fish migration and movement (Baxter et al. 2011).

Reform of the CFP in 2013 may result in significant changes to the aims and objectives of the policy with a consequent effect on management. The outcome of this reform process cannot be predicted with any certainty but it is likely that EU fisheries will be managed on a more regional basis and fishermen may be more directly involved in the management of the fish stocks. (Baxter et al. 2011).

The certification of sustainable fisheries by the Marine Stewardship Council (MSC) may bring marketing advantages in a climate of increasing public and commercial awareness of sustainability issues, and where there is a desire to source fish and shellfish from environmentally-responsible businesses. Currently, there are six Scottish fisheries with MSC certification, although the certification for the mackerel fishery is currently suspended (MSC website):

- Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea haddock - this fishery was certified as sustainable in October 2010. It is located in the North Sea (ICES Sub-Area IVa, b) and contains 192 vessels using seine and trawl methods;
- Scottish Pelagic Sustainability Group Ltd Atlanto Scandian herring - this fishery was certified as sustainable in March 2010. It is located in the ICES Sub-Area I, IIa, IIb, V and XIV and contains 25 vessels from the Scottish RSW pelagic trawl fleet;
- Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring - this fishery was certified as sustainable in July 2008. The Scottish fleet mainly exploits the Buchan sub-stock of herring located in the central and Northern North Sea within the EEZ of the EU and Norway;
- Scottish Pelagic Sustainability Group Ltd (SPSG) western component of North-East Atlantic mackerel – this fishery was certified in January 2009 and includes 21 Scottish-owned and operated large refrigerated seawater pelagic mid-water trawl vessels. The certification was suspended in 2012 due to the failure of countries exploiting the stock to agree on allocation of quotas that do not exceed the TAC set for the stock;
- SPSG West of Scotland herring pelagic trawl – this fishery was certified in April 2012 and includes 28 vessels fishing with pelagic trawl;
- SSMO Shetland inshore brown and velvet crab, lobster and scallop fishery – this fishery was certified in March 2012 and includes creel and pot fisheries for brown crab and velvet crab, and scallop dredge fishery for king scallops, within 6nm of Shetland.

Planned and possible future offshore renewables development in Scottish seas has the potential to affect the distribution of fishing activity and the value of fish landings in the future. A recent socio-economic assessment carried out for potential future offshore wind, wave and tidal energy development (ABPmer & RPA, 2013), estimated possible reductions in landings values of between £3.6m to £19.3m (Present value costs discounted over assessment period (2014 to 2035, 2012 prices). Planned and possible oil and gas development may also interact with commercial fishing activity at some locations, but the spatial footprint of such development is likely to be smaller than for offshore renewables. Decommissioning of oil and gas structures, particularly in the North Sea may create new fishing opportunities over the period of the assessment.

B4.2.2 Fish Processing Activities

The availability, quality and conservation of fish stocks are major concerns for the processing industry. Landings of pelagic and demersal species have continued to decrease over the last decade, therefore, there is a lower volume of these species available to the processing industry (Brown, 2009). By contrast there is a larger volume of shellfish available to processors. No industry can continue unchanged while its major raw materials become less readily available. Firms engaged in some secondary processes or other diversification, are best placed to achieve financial stability in the near future. The process of rationalisation, which has been witnessed in recent years, will result in fewer bigger firms which are more likely to be geared up for obtaining supplies via direct routes and from overseas.

B4.2.3 Wild Salmon and Sea Trout

Scotland is famous for its wild salmon *Salmo salar* and sea trout *Salmo trutta*. These fish spend several years in rivers, migrate to sea then return as adults to spawn. Marine migrations in salmon are generally more extensive than those of sea trout (Baxter et al. 2011).

All salmon fishing and sea trout fishing rights in Scotland, including in the sea, are private, heritable titles, which may be held separately from any land. They fall into one of three broad categories:

- Fixed engine fisheries - are restricted to the coast and must be set outside estuary limits;
- Net and coble fisheries - generally operate in estuaries and the lower reaches of rivers; and
- Rod and line fisheries - generally operate within rivers and above tidal limits.

There are 45 fishing stations in mainland Scotland: East coast - 22; North coast - 5; and West coast and islands - 18.

Salmon and sea trout fishing takes place within estuaries or on the coast, and no management measures or cost impacts are anticipated for wild salmon and sea trout fisheries as a result of the establishment of potential MPAs in Scottish waters.

B4.3 Potential for Interaction

The potential for interaction between commercial fisheries and offshore renewable development was assessed during the Inception Phase. Whether each potential interaction required detailed assessment or not, and how the economic impact would be assessed, were determined (see Table B4.2). The columns in the table below provide the following information:

Column 1: Describes the potential interaction between the activity and any renewable technology;

Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B4.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Loss of or displacement from traditional fishing grounds	All arrays, export cables	Reduction in landings and income	✓ **(arrays)**	See section B4.4
Displacement from fishing grounds leading to increased conflict over diminishing fishing grounds	All arrays, export cables	Loss of static fishing gear, increased stress, loss of traditional trawling areas	✗	Assessment of loss of traditional fishing grounds takes worst case scenario, assuming that the value of landings from the area would be lost. This assumes effort is not displaced, however, potential displacement effects are assessed qualitatively.
Displacement of fishing vessels leading to changes in fishing patterns including gears used and species targeted	All arrays, export cables	Change in costs and earnings profile of vessels	✗	See above
Disturbance of commercially-important species and disruption or damage to habitats, nursery and spawning grounds	All arrays, export cables	Reduction in landings/Catch per Unit Effort (CPUE)	**X** – assumed that impacts to fish populations will be minimised in accordance with EIA and HRA requirements and that residual impacts will not have significant impact on fishing sector.	Not required.
Obstruction of navigation routes	All arrays, export cables	Increased steaming times for vessels, increased fuel cost	✓ **(arrays)**	Assessment of potential magnitude of impact and scale of deviation. Not possible to monetise, as precise location of arrays within Draft Plan Option areas are uncertain. Small fishing vessels may navigate through arrays in fair weather conditions. Identify as potential qualitative impact.
Fouling of fishing gear on cables or seabed infrastructure	Export cables	Loss of fishing gear, increase in gear costs, loss of fishing time and revenue	✓ **(export cables)**	Assessment of potential frequency of fouling events based on discussions with fishermen's representatives and cables industry, based on possible locations of export cables

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Consequential impacts to fish processors	All arrays, export cables	Loss of profit for fish processors	✓ **(arrays)**	See section B4.4 Assessment of impact of any significant reduction in landings to fish processors (NB import substitution may occur) - Consultation with industry
Spillover benefits of de facto closed areas, refuge for fish and shellfish species, protection of important habitat types (spawning and nursery grounds)	All arrays	Increased landings	**X** – not possible to assess potential benefits in any detail.	Identify as potential qualitative benefit.
Salmon and sea trout fisheries	All arrays	Loss of landings	**× -** netting occurs in estuaries and inshore area, not expected to be affected by Draft Plan Option areas. Environmental impacts avoided through EIA and HRA process	Not required

B4.4 Scoping Methodology

Potential negative impacts on commercial fisheries may occur principally through the loss of (or displacement from) traditional fishing grounds due to the location of wind, wave or tidal devices. For the purposes of this assessment, this potential negative effect was considered to occur for Draft Plan Option areas which overlap with fishing activities of all gear types. Through this process, and due to the widespread nature of fishing activity in the marine environment, all Draft Plan Option areas were scoped in to the fisheries assessment. This assumes a worst-case scenario in terms of the potential impact on the commercial fisheries sector, because in practice there may be potential for some activities (e.g. potting) to continue at some level within lease areas.

The loss of fishing grounds would lead to a reduction in catches/landings and income for affected vessels. This has been quantified as the value of landings derived from the area of the Draft Plan Option area that would be occupied by wind, wave or tidal arrays under the different development scenarios. Because this assessment assumes a worst-case scenario, that all landings from the renewables areas are lost, potential displacement effects are not quantified, but are discussed qualitatively.

Impacts on fisheries may also occur through increased conflict and competition over diminishing fishing grounds, and changes in fishing patterns including gears used and species targeted, as a result of adapting to new fishing grounds. However, these impacts have been scoped out because the worst-case scenario of loss of fishing grounds assumes loss of activity and the value of the activity from the area. As described above, the potential impacts of such displacement are discussed qualitatively.

Arrays may cause obstruction of navigation routes, resulting in increased steaming times for vessels to reach their fishing grounds, increased fuel costs and reduced time available for fishing for those fleets limited by days-at-sea restrictions. Fouling of fishing gear may occur on intra-array and export cables and seabed infrastructure, causing loss of fishing gear, increase in gear costs and loss of fishing time and revenue. This has been assessed qualitatively.

Offshore renewable developments may cause disturbance of commercially-important species and disruption or damage to habitats, nursery and spawning grounds from the arrays and from cables, resulting in a reduction in landings and catch per unit effort (CPUE). The methodology for this assessment assumes that impacts to fish populations will be minimised in accordance with EIA and HRA requirements and that residual impacts will not have a significant impact on the fishing sector. This has therefore been scoped out.

Reductions in landings may cause consequential impacts to fish processors resulting in loss of profit. This may arise from a loss of local landings available for processing, reducing turnover, or increased costs in sourcing additional material from imports or from further afield.

There may or may not be ‘spillover benefits’ of de facto closed areas and protection of habitats for fish and shellfish species, however, it is not possible to assess potential benefits or otherwise in any detail.

Salmon and sea trout fisheries occur mainly in rivers and estuaries, or from fixed engines close to the shore. The Draft Plan Option areas are not located in any of these areas, therefore no interaction is expected and it has been scoped out of the assessment. Salmon and sea trout are protected under Habitats Regulations legislation, which requires that a Habitats Regulations Assessment is conducted for individual wind, wave and tidal developments. This requires that environmental impacts on salmon and sea trout are avoided. Salmon and sea trout fisheries have therefore been scoped out of the assessment.

The output of this scoping exercise is presented in Appendix C4.

B4.5 Assessment Methodology

The assessment methodology presented in this section takes account of the existing best practice guidance relating to assessment of the impacts of developments on commercial fisheries (e.g. UKFEN & Seafish, 2012). This indicates that the level of detail of assessment carried out on financial and economic impacts on the fisheries sector should be proportionate to the study (size, length, resources) and provides guidance on methodologies for assessing impacts.

The methodologies adopted to assess each interaction type are described below.

B4.5.1 Loss of or Displacement from Traditional Fishing Grounds

The potential worst-case impact of loss of fishing grounds from development of offshore renewable sites was quantified in terms of the value of fish landings from the proportion of the Draft Plan Option area that is likely to be developed under each scenario. For example, some Draft Plan Option areas are large, but it is likely that only a small percentage of the overall area would be occupied by wind, wave or tidal arrays, in order to achieve the power output level expected under each scenario. Because the precise location of the arrays within the Draft Plan Option areas is not yet known, this has been treated in a pro-rata manner, proportionate to the area of the Draft Plan Option area expected to be developed under each scenario.

The average value of landings for 2007–2011 attributable to individual ICES rectangles was provided by Marine Scotland, broken down according to:

- Species group (cod; haddock; monkfish; other whitefish; herring; mackerel; other pelagic; nephrops; scallops; other shellfish);
- Vessel length (10m and under; over 10m under 15m; 15m and over; unknown length over 10m);
- Gear type (demersal trawl; nephrops trawl; beam trawl; pelagic trawl; other trawl; gill nets; long lines; dredges; pots; shell fishing by hand; other gear).

These data included landings from under-15m vessels (non-VMS) and over-15m vessels (with VMS), and included both UK vessels landing into UK and non-UK ports, and foreign vessels landing into UK ports. They exclude landings from non-UK vessels into non-UK ports and therefore may underestimate the impact of offshore renewables development on foreign fleets.

The value of landings from each individual Draft Plan Option area was calculated using the proportional area technique (UKFEN & Seafish, 2012). For each ICES rectangle that overlapped with a Draft Plan Option area, the proportion of the ICES rectangle within the Draft Plan Option area was calculated (adjusting as necessary for coastal ICES rectangles that include some areas of land). This proportion was then multiplied by the value of landings from that ICES rectangle to obtain an approximation of the value of landings from the part of the ICES rectangle that overlapped with the Draft Plan Option areas. The values were then summed for all the ICES rectangles that the Draft Plan Option areas overlapped, to obtain the total value of landings attributable to the Draft Plan Option areas. This total value was then multiplied by the proportion of the Draft Plan Option areas expected to be occupied by arrays under the different development scenarios, to obtain an estimate of the value of landings affected by offshore renewables development in each case.

These calculations were broken down by gear type, species type and vessel length, to enable identification of the fleet sectors likely to be most affected by the developments.

It is recognised that this ‘proportional area technique’ can be inaccurate as it assumes the value of landings from an ICES rectangle is evenly distributed across the rectangle, which may not be the case. This method is adequate in this case due to the fact that the precise areas in which arrays will be developed within the Draft Plan Option areas are not yet known, so it is not possible to pinpoint the areas that will be affected. Furthermore, the method reflects the value of landings from both the over-15m vessels and the under-15m vessels, which is not the case for other data sources which are available at higher resolution (e.g. for value of landings based on VMS estimates, which is available for over-15m vessels only).

In order to address this, a qualitative assessment of whether the area of the Draft Plan Option areas represented an area of above or below average landings from within the ICES rectangles involved was carried out. The value of landings based on fishing effort from ICES sub-rectangles (50 sub-rectangles per ICES rectangle, measuring 5.4 km by 11.1 km in the north, to 6.3 km by 11.1 km in the south) (i.e. landings adjusted for fishing effort from VMS data) for the over-15m fleet was overlain on the Draft Plan Option areas. This was used to qualitatively assess, within an ICES rectangle, whether the fishing grounds within the Draft Plan Option areas were more or less important than the fishing grounds outside the Draft Plan Option areas, according to whether the value of landings based on effort distribution was above or below average for the ICES rectangles involved. This provided an indication of whether the quantitative estimate of value of landings affected using the proportional area technique was an over-estimate or an under-estimate for the over-15m fleet. This was also cross-checked against the proportion of the value of landings accounted for by the over-15m fleet. Where this was greater than 85%, the VMS-based estimates were considered to be a good representation of the overall value of landings. Conversely, where the under-15m fleet represented more than 15% of the overall value of landings, VMS-based estimates were not considered to be a good reflection of the overall activity of the fleet. For the under-15m fleet, an interim output of the ScotMap project was used, which provides a spatial indication of the average annual earnings for all gear types at a higher resolution than the ICES rectangle data.

The advantage of this methodology is that the ICES rectangle data incorporate landings from both the over- and under-15m sectors and therefore a consistent data source is used across both fleet sectors. The disadvantage is that the data used for the over-15m fleet are not as spatially resolved as the VMS-based estimates.

To take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies an adjustment is made to convert change in value of landings to GVA. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used to convert PV assessment of impacts on the value of landings to GVA, based on the average GVA % across all Scottish fleet segments. This 39% factor has been used with the projected change in value of landings to estimate the change in GVA.

The knock-on effects on GVA for commercial fisheries have been estimated using the Type I and Type II GVA multipliers. The 2007 Scottish Input-Output multipliers have been applied as these were the most recent available at the time of the report. Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment. Knock-on employment impacts are based on the value of landings and use the Type I and Type II employment effects.

Foreign Vessels

The above data used to assess the value of landings from Draft Plan Option areas do not include the value of landings from non-UK vessels that land their catches outside the UK. Surveillance data were provided to identify which non-UK fleets might be most affected, but these did not differentiate between vessels actively fishing and not fishing. Cefas data layers on effort of non-UK fleets were not available for use in the analysis. It was therefore not possible to assess the potential impact on non-UK fleets.

B4.5.2 Obstruction of Navigation Routes

Data on VMS pings relating to 'steaming' (average speed since last ping equal to or greater than 5 knots) were provided by Marine Scotland. These were plotted in GIS and the Draft Plan Option areas were overlain. This was used to assess whether the Draft Plan Option areas overlap with areas that show a concentration of VMS steaming pings, and therefore may impact on fishing vessels' navigation routes. Consultation with industry also explored the potential disruption of navigation routes and deviation required.

It was not possible to quantify or monetise the impact due to obstruction of navigation routes, as the precise location of arrays within Draft Plan Option areas are uncertain. Furthermore, small fishing vessels may navigate through arrays in fair weather conditions. Additionally, since arrays will only occupy a proportion of the Draft Plan Option areas, it may be possible to locate them in areas that cause least disruption to steaming routes. An indication of the magnitude of impact from obstruction of navigation routes was assessed by identifying the ports with steaming routes affected, and the number of vessels (split by under-15m and over-15m sectors) which are registered at those ports as their home ports on the MMO UK fishing vessel list (MMO, 2013).

Fouling of Fishing Gear on Cables

For export cables, precise routes are too uncertain to provide a quantitative assessment of their impact on the commercial fisheries sector. Furthermore, cables are likely to be buried where possible and therefore impacts on catches should be minimised. This potential impact was described qualitatively through consultation with the industry and identification of likely cable routes.

B4.5.3 Consequential Impacts to Fish Processors

The results of the assessment of impacts on landings from loss of or displacement from traditional fishing grounds were used to assess the regions the significance of the reduction in landings compared to the overall landings of each species group (whitefish, pelagics, shellfish). This presents a worst-case scenario because in reality the impact may be less, as a degree of import substitution may occur to compensate for the loss of landings.

Baseline Value and Future Projections

The potential impact on commercial fisheries within each region between 2014 and 2035 was then calculated as follows:

- The total value of fisheries landings affected in each Draft Plan Option area in the region (£ million) (average for 2007–2011) (calculation method described above) was adjusted for inflation to provide baseline commercial fisheries values at 2012 prices using the GDP deflator. The average value for 2007–2011 was assigned to the mid-point (2009) and adjusted to 2012 prices.
- The value of fisheries landings was projected forwards to 2035 based on a static baseline, and discounted at a rate of 3.5% in line with Treasury Green Book guidance.
- The value of fisheries landings affected was then converted into GVA by applying a fleet-wide GVA multiplier of 39% (GVA as a percentage of fishing income, average for 2007–2011), an average of relevant UK fleet segments fishing in Scottish waters from the Seafish economic indicators 2013.

In order to quantify the potential impact of offshore renewables development on fisheries between 2014 and 2035, future trends should be taken into account. The value of fisheries landings is dependent on a range of interacting factors, including:

- Fishing activity, which changes in response to a number of factors including:
  - Scientific advice and resulting catch limits (quotas);
  - The location of fish;
  - Policy measures such as limits on fishing effort (days spent fishing multiplied by the power of the vessel);
  - Closed areas;
  - Fleet size and composition which may be affected by decommissioning schemes;
  - Profitability including the influence of fuel price and technological developments.

- Policy developments such as the forthcoming Reform of the Common Fisheries Policy and the impact this may have on fishing activity and stock recovery;
- Fish prices and market support measures;
- Climate change effects, which may result in shifts in geographical distribution of stocks;
- Anthropogenic effects such as permanent structures, dumping at sea, oil and chemical spills and the effects of the fisheries themselves, which may impact on the habitats where fish live;
- Profitability and political effects including internal and external factors affecting business performance.

The baseline review (ABPmer & RPA, 2012) did not identify any clear future trends for commercial fisheries. Total fishery landings and employment in the fishing industry have been fairly stable since the mid-2000s. Species-specific quotas may be raised or lowered according to stock status and scientific advice, but this is difficult to predict and a species- and area-specific analysis of this type, which would require bio-economic modelling to predict the response of individual fleet *métiers* and stocks to management measures under the Reformed CFP, is beyond the scope of this study. The Impact Assessment for the Marine Conservation Zones (MCZs) in England also assumed the spatial distribution and value of landings would remain constant over the 20-year timeframe of the assessment, due to the lack of micro-scale forecasts of future activity (Annex H7 of the MCZ Impact Assessment).

B4.5.4 Cumulative Assessment

After the initial analysis, a cumulative assessment was carried out to identify where there might be a concentration of impacts on particular types of fishing or fleet segments in particular areas.

B5. Commercial Shipping

B5.1 Overview

Commercial Shipping provides for the transport of freight and passengers both within Scottish waters and internationally. Shipping routes can be split into two distinct types; transiting vessels passing through Scottish Waters and vessels with either their origin or destination port within Scotland. The movement of vessels is monitored and recorded by the Maritime and Coastguard Agency (MCA) and individual port authorities. Port information is described in Section B9 of this Appendix and there is an intrinsic link between shipping and ports, however the interactions and issues in relation to marine renewable developments are often distinctly different. Information sources used in the assessment are listed in Table B5.1.

Table B5.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Baseline review of data on commercial shipping.	2012	ABPmer (2012)
Scotland	Passenger and vehicle ferry routes in Scotland, from the Scottish Government's Urban/Rural Classification for 2009-2010. Plus, Orkney Ferries and Calmac Ferries routing information added in 2011.	2011	Spatial Data Management Team, Rural Payments Inspections Directorate (RPID), Scottish Government
UK	AIS density grid for one month (January 2008) provided by the Maritime and Coastguard Agency (MCA). The date includes all vessels transmitting during the month period, and represents vessel of 300 Gross Tonnes (GT) and all passenger ships regardless of size passenger. Other vessels will also be included in the dataset such as fishing, leisure, military, police and port craft, where these craft are transmitting AIS information. Each grid is representative of approximately a 5km^2 area. The density grid does not allow distinction by vessel type, not does it provide routing information.	2008 - January	MCA AIS data
UK	Admiralty charted formal anchorages.	2013	UK Admiralty charts
European	Combination bathymetry file of European Marine Observation and Data Network (EMODNET) bathymetry merged with SeaZone data captured in coastal wave models, and General Bathymetric Chart of the Ocean (GEBCO) data which was used to cover areas lying outside the extent of the SeaZone and EMODNET data coverage.	2010	ABPmer, 2010. (R.1684 'Seabed Kinetic Energy - EUseaMAP')

The movement of vessels is monitored by the MCA's network of Automatic Identification System (AIS) receivers and presents the most robust national dataset for defining the spatio-temporal activity of the Shipping sector. AIS transmission is mandatory for all vessels greater than 300 gross tonnes (GT) and for all passenger ships regardless of size. This assessment uses an AIS density grid at 5 km2 mesh size for Scottish waters provided by the MCA (Figure B5). The AIS Density Grid identified cumulative vessel (transit) movements for January 2008.

Whilst the above marine traffic is not considered in this chapter, it should be noted that Section B4 provides an assessment of Fishing and uses Vessel Monitoring System (VMS) data to spatially define activity levels. In addition, recreational boating has been addressed in Section B11 and identifies indicative recreational boating routes.

Whilst this assessment uses a representative set of data to evaluate the socio-economic consequences from individual Draft Plan Option areas, it should be noted that any marine renewable site development would be subject to individual assessment which includes evaluation of shipping and navigational risk. The majority of development site navigational risk assessments would also be underpinned by a marine traffic survey relevant to the baseline marine traffic use. The assessment presented in this section provides a high level socio-economic appraisal based on a number of nationally applicable assumptions.

B5.2 Future Trends

Shipping volumes bear a direct relationship to the global economic market. As markets react to the changing financial situation, shipping lines respond with services to move goods and people. The most notable variable to affect the volume and intensity of shipping into the future will be the technology and innovations used to design future shipping. Ship design seeks for bigger, faster and more economic transhipment of goods and people.

The introduction of bigger ships places expectations that existing ports will increase the depth of water in entrance channels and alongside berths to accommodate changing ship requirements. This implies that investment is necessary in port infrastructure, both in terms of shore side facilities and access to the ports. Channel widths may need to increase to take account of the wider ship beam, which in addition may lead to the requirement for turning circles to be enlarged to take account of greater vessel length. Although all of these pressures have to be taken into account, probably the most significant factor to challenge traditional ports in the context of their ability to accommodate bigger ships is sea access, and in particular vessel draught. New future shipping routes may also lead to shipping increases, especially in respect to the potential for a viable North West passage

In respect of lifeline ferry services, which make up significant proportion of vessel movements within Scottish waters, the Scottish Government have prepared a long-term ferries strategy (2013-2022). The Draft Ferries Plan was published in December 2011 and the consultation period ran until March 2012, with the final Ferries Plan published in December 2012. The plan makes recommendations regarding where investment should be focused to improve connections for island and remote rural communities, improve reliability and journey times, maximising opportunities for employment, business, leisure and tourism and promoting social inclusion (Transport Scotland, 2012).

Planned and possible future offshore renewables development over the assessment period could interact with commercial shipping activity. Such development is likely to preclude passage of commercial vessels through areas occupied by arrays with the potential to increase steaming distances and times on some routes. However, the overall impacts on shipping activity are considered to be relatively minor.

B5.3 Potential for Interaction

Table B5.2 shows potential interaction pathways between commercial shipping and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;

Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B5.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Obstruction of transiting vessel/ferry routes; increased steaming distances/time	All arrays	Increased costs, effect on regular route (ferry) competitiveness, potential for increased insurance costs; and Critical lifeline services become uneconomic leading to service termination.	✓	Assess potential additional steaming distances/times
Reduced ferry turnaround times due to increased steaming times for vessel routes	All arrays	Increased costs	✓	Site-specific consideration with operators
Displacement of anchorage areas	All arrays, export cables	Increased costs	✓ (arrays)	Assess potential additional steaming time/costs for alternative anchorages

B5.4 Scoping Methodology

B5.4.1 Impacts to Shipping Routes and Ferry Routes

The presence of wind, wave and tidal arrays and the construction of their associated export cables may cause obstruction and displacement of shipping routes, leading to increased steaming time and therefore increased cost. This will occur where commercial shipping routes and Draft Plan Option areas and/or cable corridors spatially overlap. Cable corridors affect shipping during the process of laying cables with temporary increases in collision risk and/or a requirement to avoid areas of work to reduce the risk of marine incidents.

As a base assumption, where density of development is less than 5% of the Draft Plan Option area, then it is assessed that avoidance of significant impacts can be achieved through spatial planning. As such, the following scoping methodology was applied for proposed wind, wave and tidal Draft Plan Option areas plus their associated cable corridors.

Offshore Wind:

- Where Draft Plan Option areas are transected by commercial navigation route(s) or ferry routes, the density of traffic has been assessed. If the density of traffic is 5 or more vessel movements per day, the area has been scoped in;
- If the Draft Plan Option area is transacted by an IMO recognised "ship routeing system", the area has been scoped in; and
- If the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under this scenario and the area has been scoped out.

Wave:

- Where Draft Plan Option areas are transected by commercial navigation route(s) or ferry routes, the density of traffic has been assessed. If the density of traffic is 5 or more vessel movements per day, the area has been scoped in;
- If the Draft Plan Option area is transacted by an IMO recognised "ship routeing system", the area has been scoped in; and
- Where the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under these scenarios and the area has been scoped out.

Tidal:

- Where Draft Plan Option areas are transected by commercial navigation route(s) or ferry routes, the density of traffic has been assessed. If the density of traffic is 5 or more vessel movements per day, the area has been scoped in;
- If the Draft Plan Option area is transacted by an IMO recognised "ship routeing system", the area has been scoped in;
- Where Draft Plan Option areas are in waters of depths greater than 75m, the area has been scoped out. This follows the rationale that tidal devices are stationed circa 20m from the bed (to avoid bed turbulence) and have a maximum blade around 10m in diameter, providing a 30m bed-to-blade-tip clearance. Ultra Large Crude Carriers have a maximum draught of around 35m. An Under Keel Clearance allowance of 10m is applied as a maximum working clearance (NOREL NAV SUB Group, 2012); and
- Where the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under this scenario and the area has been scoped out.

B5.4.2 Displacement of Formal and Informal Anchorages

Offshore Wind:
- Where an anchorage is within a Draft Plan Option area, it is scoped in;
- Where a cable corridor crosses an anchorage, it is scoped in; and
- Where the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under this scenario and the area has been scoped out.

Wave:
- Where an anchorage is within a Draft Plan Option area, it is scoped in;
- Where a cable corridor crosses an anchorage, it is scoped in; and
- Where the spatial extent of indicative arrays for a given scenario occupy greater than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under these scenarios and the area has been scoped out.

Tidal:
- Where an anchorage is within a Draft Plan Option area, it is scoped in;
- Where a cable corridor crosses an anchorage, it is scoped in; and
- Where the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under this scenario and the area has been scoped out.

The detailed output of this scoping exercise is presented in Appendix C5.

B5.4.3 Data Limitations

The processed AIS data available as a density grid at the time of completing this assessment has inherent limitations. The available AIS data density grid was produced from one month's AIS data (January 2008). This presents a limitation regarding seasonal traffic variability, especially in routes which reflect tourism (ferry routes) or seasonal transport of goods. However, it is considered that a threshold of 5 transits within one day used as a scoping threshold will have captured broad-scale sea area usage. This assessment can be improved through the use of more recent AIS data. To remove seasonality trends, AIS data should be representative of the whole year.

AIS transmission is only mandatory for all commercial vessels above 300GT and all passenger ships regardless of size. As a result, the following vessel classifications are not accounted for in the AIS data and as such are not considered within this section:

A) Commercial vessels below 300GT;
B) Recreational vessels;

C) Fishing vessels; and
D) Naval vessels whilst on deployment.

B5.5 Assessment Methodology

The assessment methodology presented in this section takes account of stakeholder concerns regarding the interaction of renewal energy (wind, wave and tidal) on the Commercial Shipping sector.

B5.5.1 Impacts to Shipping and Ferry Routes

Vessel routes, identified from AIS intensity maps have been used to evaluate the potential annual volume of traffic (to the scale of the AIS map output) which would have to be deviated around the development scenarios within the Draft Plan Option areas. The development scenarios are based on the low, central and high estimates of the proportion of the Draft Plan Option areas to be developed, which varies for each technology. To carry out an assessment of the effects of each Draft Plan Option area development on shipping and ferry routes, an average density of shipping has been calculated using the AIS mapping for each Draft Plan Option area (this average area includes all vessels within the AIS data-set include ferry traffic). The low/central/high scenario percentage areas of occupancy have been converted into an area of coverage within each Draft Plan Option area. Each percentage of occupancy has then been represented as a square with a 1km buffer round it.

The deviation has been calculated by assuming that vessels will commence their direction change 10km either side of the square identified as the array occupancy. From this methodology, an assessment of deviation in nautical miles has been calculated to arrive at additional steaming distance.

For both the ferry and commercial shipping routes, the difference in distance between the original and modified routes determine the fuel cost, based on an assumed fuel consumption rate of 2,941 litres per hour at a speed of 20 knots. This is based on an average assumed vessel fuel consumption (measured in MT (metric tonnes)) per day of 60MT, at 2.5MT per hour, for a large cargo vessel travelling at 20 knots, where 1MT (1,000 kilograms) equates to 1176.5 litres based on an average diesel fuel density of 0.820 kg/l. The density of diesel varies according to its grade, within this assessment, an average diesel fuel at 15ºC with a density of 0.820 kg/l has been assumed.

For this costing assessment low sulphur fuel has been used, this is the most expensive option but one that will be compulsory from 2015 in Sulphur Emissions Control Areas, the assessment has used a cost of circa $1000 per tonne. Therefore, the unit pence per litre (ppl) used in this assessment was taken to be 56.29 ppl. In addition the use of this fuel for propulsion carries with it an additional duty of 11.14 ppl based on HMRC rates from 2012.

The above vessel fuel rationale has been applied within this assessment however, it must be noted that, a range of variables affect the fuel burned per hour. These include ship type and size, the precise fuel type and grade being used, different engine types, the age and service history of engines, met-ocean effects, the vessel hull hydrodynamic and the wider economic pressures which dictating vessel speed. For example, slow steaming is currently a technique used by Commercial Shipping operators to minimise fuel, as significant cost savings results from sailing at 12 knots instead of 24 knots. This has become a commonly deployed measure for addressing shipping costs in response to recent economic pressures and fluctuating fuel costs.

Using the additional steaming distance and fuel price, the costs associated with the deviation and additional steaming distance was calculated where the additional cost of steaming time was calculated as:

> Current route (distance in nautical miles) compared to additional steaming distance (nautical miles) x fuel costs per nautical mile. The calculation uses an assumed average vessel speed to arrive at fuel consumption per vessel movement. To then infer the annual cost, the journey fuel consumption was multiplied by the average vessel transit count within the Draft Plan Option area in one year. The calculated cost uses 2012 as the baseline year, from which a 2% increase has been applied for future cost projections.
>
> The results of this assessment are presented in Section C5.2 where the described methodology was applied.

B5.5.2 Increase in Marine Risk

Radar interference from offshore wind installations is a known factor with respect to marine safety. This increase in marine risk has been assessed qualitatively with comments regarding possible mitigation measures. Mitigation cost would be transferred to the developer and hence no quantitative assessment of this cost was undertaken. However, relevant stakeholders were consulted to ascertain whether there were any issues or concerns about any of the Draft Plan Option areas, and the scale of any potential issues.

There is also a temporary increase in marine risk along cable corridors whilst cabling is laid. Developers are responsible for ensuring appropriate Navigational Risk Assessments are provided for their marine works, hence no quantitative assessment of this cost has been undertaken.

B5.5.3 Displacement of Formal and Informal Anchorages

The spatial overlap of Draft Plan Option areas and formal anchorages has been evaluated through comparison of Draft Plan Option areas with formal charted anchorage locations. Where these anchorages are used by specific ports, consultation has been carried out to identify relocation options. The impact has been assessed quantitatively through a calculation of change in steaming distance from the port to the relocated anchorage, plus the associated cost with lifting and laying ship mooring buoys (should these be part of the displaced anchorage). The assessment methodology takes the additional cost of steaming time as:

> Current route (distance in nautical miles) compared to additional steaming distance (nautical miles) x fuel costs per nautical mile. The calculation uses an assumed average vessel speed to arrive at fuel consumption.

A qualitative assessment of any other impacts of the use of alternative anchorages has also been carried out (for example; less protected site, greater risk of damage in stormy weather).

Informal anchorages are not available as a data layer from Admiralty Chart producers, and may or may not be marked on charts. Often, an informal anchorage is based on custom and practice with a particular consultee providing evidence of use. Informal anchorages have been evaluated through consultation, and quantified if they are identified through port consultation using the same methodology as formal anchorages.

B6. Energy Generation

B6.1 Overview

This sector is concerned with the generation of energy through harvesting the power of the wind, waves and tide and the transmission of this power through submarine export cables to land. In the future, biofuel production (from seaweed) may occur in offshore areas. However, this concept is still at research stage and therefore has not been considered further in this assessment.

Wind Energy
Wind energy technologies use the energy in wind to generate electricity. Wind energy can be produced anywhere in the world where the wind blows with a strong and consistent force. For large scale sources of wind energy, turbines are usually built close together to form a wind farm that provides grid power.

Wave Energy
Ocean wave energy technologies rely on the motion of waves to generate electricity. They are placed either on the sea surface or on the seabed (to harness near shore surge energy). Energy output is determined by wave height, wave speed, wavelength and water density.

Tidal Energy
Tidal energy is produced through the use of tidal energy generators. These large underwater turbines are placed in areas with high tidal movements, and are designed to capture the kinetic motion of the ebbing and surging of ocean tides in order to produce electricity.

Export Cables
Export cables are needed to bring the energy generated offshore to land to connect with onshore electricity distribution networks.

Figure B6 shows the overlap of the wind, wave and tidal Draft Plan Option areas and their associated cable corridors. Information sources used in the assessment are listed in Table B6.1.

Table B6.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Amount of electricity generated by energy source in Scotland (Scottish Environmental Statistics Online)	2009	Scottish Government Statistics
Scotland	National Renewables Infrastructure Plan	2010	SE & HIE (2010)
Scotland	Blue Seas – Green Energy - A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters	2010	Scottish Government
Scotland	Potential Development Scenarios for Scottish Offshore Wind Supply Chain	2010	Scottish Renewables (2010)
Scotland	Scotland's Offshore Wind Route Map – Developing Scotland's Offshore Wind Industry to 2020	2010	Offshore Wind Industry Group
Scotland	The Offshore Valuation – A valuation of the UK's offshore renewable energy resource	2010	Public Interest Research Centre on behalf of The Offshore Valuation Group (2010)
Scotland	Scottish Offshore Wind: Creating an Industry to Scottish Renewables	2010	IPA Energy + Water Economics (2010)
Scotland	Information and analysis of wave and tidal market in Scotland	2011	Pure Marine Gen Ltd (2011)
Scotland	Draft Electricity Generation Policy Statement 2010	2010	Scottish Government
Scotland	A Low Carbon Economic Strategy for Scotland	2010	Scottish Government
Pentland Firth and Orkney Waters	Supply Chain Demand - PFOW Round 1 Wave and tidal Projects	2011	BVG Associates (2011)
West Coast	Scottish Offshore Renewables Development Sites	2011	Scottish Development International, Highlands and Islands Enterprise, and Scottish Enterprise (2011)
Scotland	Scotland's Renewable Energy Potential: realising the 2020 target	2005	Scottish Executive (2005), Future Generation Group Report
Scotland	Scottish Renewable Energy Generation Capacity	2010	Scottish Renewables
Scotland	Interim Great Britain Seven Year Statement	2004	National Grid (2004)
Scotland	Scottish and Southern Energy plc Annual Report 2011	2011	Scottish and Southern Energy plc (2011)
Scotland	Electricity Generation Policy Statement	2012	Scottish Government (2012)
Scotland	Our Electricity Transmission Network: A Vision for 2020	2012	ENSG (2012)

B6.2 Future Trends

B6.2.1 Electricity Generation

It has been suggested that significant reductions in Scotland's electricity generating capacity would occur as coal and nuclear power stations closed and the importance of renewables grew (Allan et al, 2006). However, in the next few decades, Scotland has the capacity to install offshore renewable generation devices which could produce over 60GW of generating capacity (Scottish Development International et al, 2011). Renewable energy is being promoted as an economic opportunity (Verso Economic, 2011). Indeed, the Scottish Government's target is to meet the equivalent of 100% of gross annual electricity consumption from renewables by 2020.

Based on the offshore wind, wave and tidal developments currently in planning, there is likely to be a significant increase in installed capacity in the period up to and beyond 2020 with potentially up to 9.2GW of offshore wind capacity, 720MW of wave capacity and 1GW of tidal energy capacity.

There are currently no specific targets for offshore renewables development although Scottish Government (2012) provides projections for 'offshore and onshore' wind of 13,000MW installed capacity by 2020 and 16,500MW installed capacity by 2030.

SeaGreen estimate that the first phase of the Firth of Forth Round 3 Offshore Wind Farm (1GW capacity across two wind farms) would inject £315m - £788m to the Scottish economy. Additional ongoing economic benefits would arise over the 25 year operating life of the wind farms. Development of an additional 2.5GW generation capacity in the Firth of Forth Zone would have a further very significant contribution to the Scottish economy.

B6.2.2 Marine Biomass

There is currently no clear development plan for marine biofuels, although a number of trials are underway in Scotland (Black, 2011). The Crown Estate estimates that up to 1.5% of the seabed area could be used for macroalgae cultivation. This could give an annual biogas yield equivalent to around 5% of the natural gas consumed in the UK in 2009 (The Parliamentary Office of Science and Technology, 2011). A number of Scottish initiatives are currently underway to demonstrate the viability of producing biofuels from macroalgae and to facilitate the cost effective exploitation of currently under-utilised seaweed resources, notably the Seaweed Anaerobic Digestion and the BIOMARA programmes (FRM, 2010).

B6.2.3 Transmission Capacity

National Grid's Electricity Ten Year Statement (ETYS) indicates that there is likely to be a need for new infrastructure/reinforcement in many areas of Scotland to ensure that generated power can be transmitted to where it is required, for example, new transmission infrastructure will be necessary to connect power generation around the Western Isles, Orkney and Shetland to the mainland transmission network (National Grid, 2012). Indeed, problems have already occurred in some areas. Within Scotland, wind connection is restricted due to insufficient transmission capacity across the Scottish border, with 16 GW of wind awaiting connection in 2007 (Public Interest Research Centre, 2010). There are also issues with congestion in the power transmission network between the North and the South of the UK (Public Interest Research Centre, 2010). However, plans do exist to increase the capacity of power interconnections from Scotland to both England and Northern Ireland, as well as for a new major interconnector to Norway (Scottish Development International et al, 2011). In addition, there are plans for around 1,800MW of subsea interconnectors along the West and East coasts of Scotland (Scottish Development International et al, 2011), whilst plans for a strategic set of grid upgrades across Scotland are already progressing (Scottish Government, 2010b). It is therefore likely that the future trend in transmission capacity will be upwards.

It should however be noted that transmission capacity is complicated by the variability in generation which renewables provide (Public Interest Research Centre, 2010). Despite this, it is stressed by the Scottish Executive (2005) that transmission capacity has to be built on the basis of firm development proposals, rather than on the expectation that new or developing technologies will eventually be put in place. Stakeholder responses to this study indicate that there is the hope that energy generation companies can collaborate rather than compete on grid connection to ensure economies of scale are achieved. This is likely to be critical given that the best sources of renewable energy are typically located at the edges of the current grid network, rather than the centre (Scottish Government, 2011).

B6.2.4 Supply Chain for Renewables

It is believed that there is already a strong supply chain due to the well-established and experienced oil and gas sector (Scottish Development International et al, 2011). However, although several locations can deal with operations and maintenance, the future requirements of the renewables supply chain cannot yet be fully met at any one of Scotland's ports (Scottish Enterprise and Highlands and Islands Enterprise, 2010a; 2010b). Plans are currently being developed for offshore wind manufacturing facilities at Leith and Ardersier, together with the creation of an offshore wind O&M facility at Dundee.

For wave and tidal development, facilities have already been developed at Scrabster and Lyness to support developments within the Pentland Firth. Further local development is also likely to occur to support development on the West Coast.

B6.2.5 Transmission Capacity

Scotland's transmission grid is mainly made up of 400 kV and 275 kV lines which join the major nuclear and coal fired power stations in the central belt with the

Peterhead plant in North East Scotland (National Grid, 2012). The Scottish grid is connected to the English grid with four transmission lines which form two double circuits; on the East, the circuit operates at 400 kV, whilst on the West part of the circuit operates at 400 kV and the remainder runs at 275 kV (ibid). Connection between Scotland and Northern Ireland is via the 450MW Moyle Interconnector which joins Ballantrae with Ballylumford (National Grid, 2012).

B6.3 Potential for Interaction

Table B6.2 shows potential interaction pathways between wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B6.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Competition for space (offshore) within Draft Plan Option areas	All arrays,	Reduced renewable energy capacity	**✓ - only where there is spatial overlap between Draft Plan Option areas and each technology occupies >5% of Draft Plan Option areas**	See Section B6.4
Competition for transmission capacity	All arrays	Either reduced energy output from other energy sources (due to displacement by renewables) or reduced renewable energy capacity	✓	See Section B6.4
Cable crossings with existing/planned export cables	Export cables	Additional costs to construct cable crossings	**X** – costs of crossings will be borne by developer.	Not required.
Cable crossings with potential future export cables	Export cables	Additional costs to construct cable crossings	**X** – costs of crossings will be borne by developer.	Not required.

B6.4 Scoping Methodology

B6.4.1 Competition for Space

A spatial analysis of potentially overlapping interests between offshore wind, wave and tidal energy Draft Plan Option areas was undertaken in GIS. For the purpose of this assessment, a potentially negative effect was only considered to be likely where the overlap of wind, wave or tidal Draft Plan Option area was greater than 10% of the combined Draft Plan Option areas.

B6.4.2 Competition for Transmission Capacity

It has been assumed that there will be competition for transmission capacity between all wind, wave and tidal developments.

The results of the scoping exercise are presented in Appendix C6.

B6.5 Assessment Methodology

B6.5.1 Competition for Space

At four sites the wind, wave and/or tidal Draft Plan Option areas overlap by more than 10% and thus spatial overlap of different technologies is considered a potential issue within these areas. Consultation was undertaken with Scottish Renewables and RenewableUK to discuss the issue of spatial overlap on future offshore energy development.

B6.5.2 Competition for Transmission Capacity

Industry and Government plans and policies for increasing transmission capacity across Scotland were reviewed.

Scottish Renewables and RenewableUK were consulted to determine their views on competition for transmission capacity between renewable energy sectors and whether this will hinder wind, wave and/or tidal development in the future.

B7. Military Interests

B7.1 Overview

The military defence sector makes use of the Scottish coastline for the location of bases and training and use of the sea for training, test and evaluation activities and the surveillance and monitoring of waters to detect and respond to potential threats. In this assessment military interests comprise the use of the coast and seas by the Royal Navy (submarine bases, jetties and exercise areas), Army (training camps and firing ranges), Royal Air Force (bases, coastal Air Weapon Ranges and Danger Areas) and MOD (Defence Test and Evaluation Ranges to trial weapon systems) (Baxter et al, 2011). The location of military interests in relation to Draft Plan Option areas is presented in Figure B7. Information sources used in the assessment are listed in Table B7.1.

Table B7.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Scottish Naval Exercise Areas Information	2010	www.rnopsscotland.com
Scotland	Defence Analytical Services and Advice. DASA Quad Service. 4	2010	www.dasa.mod.uk/

B7.2 Future Trends

Specific defence projects may provide significant employment opportunities. For example, with respect to future aircraft carriers, building the hull sections and outfitting the vessels will provide work for about 10,000 people, including 3,500 at the two Clyde yards and 1,600 at Rosyth, Fife at the project's peak (UKMMAS, 2010).

Owing to the confidential nature of military defence activities it is difficult to assess likely future trends, however future employment will be governed by the forth coming spending cuts within the Ministry of Defence. In addition there are plans to build the next generation of submarines, which may be constructed in Scotland as in the past.

B7.3 Potential for Interaction

Table B7.2 shows potential interaction pathways between military activities and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B7.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact will be Assessed**
Competition for space	All arrays	Displacement of activity leading to increased costs	✓ - only where Draft Plan Option areas or cable corridors overlap with Military Practice or Exercise Areas or coastal military locations/installations	Consultation with MOD to identify specific impacts and devise a methodology for assessing impacts.
Interference with radar systems	Wind arrays only	The need to provide radar mitigation for strategic en-route and low level radar interference.	**X –** if required, radar mitigation costs will be borne by the developer rather than the MOD.	Not required. Qualitative assessment of potential issues undertaken (see Section B7.4)
Interference with underwater communications	All arrays	Displacement of activity leading to increased costs	✓	Consultation with the MOD to identify any potentially significant risks to strategic communication systems and devise a methodology for assessing impacts.

B7.4 Scoping Methodology

B7.4.1 Competition for Space

Wind, wave and tidal arrays may cause displacement of military activity leading to increased costs where Draft Plan Option areas and/or cable corridors spatially overlap with military installations/locations[20] on the coast and/or Military Practice or Exercise Areas (PEXA).

As such, the following scoping methodology was applied for proposed wind, wave and tidal Draft Plan Option areas and cable corridors:

Wind:

- Draft Plan Option areas that do not intersect with any type of PEXA (aviation or non-aviation) were scoped out;
- Draft Plan Option areas that intersect with any type of military location or PEXA (aviation or non-aviation) were considered to require a more detailed assessment;
- Cable corridors that did not intersect with any military locations or non-aviation PEXA were scoped out; and
- Cable corridors that intersected with any military locations or non-aviation PEXA were considered to require a quantitative impact assessment.

[20] Military locations/installations included: army bases, explosive jetties, firing ranges, fuel jetties, naval bases, noise ranges, military ports, RAF bases, Royal Navy (RN) armament depots, RN personnel accommodation, Search and Rescue (SAR) bases and sonar buoy developments.

In addition, the DECC Aviation Safeguarding website was used to identify Draft Plan Option areas for wind arrays which were likely to cause interference with military low flying areas and the outputs of this scoping exercise was discussed further with the relevant stakeholder. The output of this scoping exercise is presented in Appendix C7.

Wave and Tidal:

- Draft Plan Option areas that do not intersect with any type of non-aviation PEXA were scoped out;
- Draft Plan Option areas that do intersect with any type of non-aviation PEXA were considered to require a quantitative impact assessment;
- Cable corridors that do not intersect with any military locations or non-aviation PEXA were scoped out; and
- Cable corridors that do intersect with non-aviation PEXA were considered to require a quantitative impact assessment.

It should be noted that the spatial overlap of wave and tidal Draft Plan Option areas and/or cable corridors with aviation PEXA was not used in the scoping method based on the assumption that only aircraft manoeuvres rather than missile firing/testing was undertaken in these PEXA, which would not conflict with wave or tidal energy development. However, it can also be noted that with one exception (Cape Wrath in the North-West/West regions) all ‘aviation PEXA’ fall within ‘non-aviation’ PEXA within which missile firing/testing is undertaken.

B7.4.2 Interference With Radar Systems

Wind turbines can adversely affect a number of MOD operations including radars, seismological recording equipment and communications facilities (DECC website).

Mitigation for radar interference from offshore wind arrays will be required as a condition of consent if there is a potentially significant effect. This cost would be transferred to the developer and hence no quantitative assessment of this cost has been undertaken. However, stakeholders were consulted to assess whether there were any issues or concerns about any of the Draft Plan Option areas and the scale of any potential issues.

Prior to undertaking this consultation the data available on the DECC Aviation Safeguarding website was used to identify Draft Plan Option areas which were likely to cause interference with radar systems and the outputs of this scoping exercise was discussed further with stakeholders. The outcome of this scoping exercise and stakeholder consultation is provided in Appendix C7.

B7.4.3 Interference With Underwater Communication

Underwater communications refer to submarine listening devices, underwater communication systems (submarines) and sonar used by surface vessels. Such interference could lead to the displacement of activity leading to increased costs.

For the purpose of this assessment, this potential negative effect was only considered likely to occur for Draft Plan Option areas or export cable routes that were within 10km of non-aviation PEXA. Using this assumption:

Wind, wave and tidal Draft Plan Option areas:

- Draft Plan Option areas which were > 10km from any non-aviation PEXA area were scoped out; and
- Draft Plan Option areas which were < 10km from any non-aviation PEXA were considered to require a quantitative impact assessment (if sufficient information was available to undertake the assessment).

B7.5 Assessment Methodology

B7.5.1 Competition for Space, Interference with Radar Systems and Interference With Underwater Communications

Consultation was undertaken with the MOD Safeguarding Defence Infrastructure Organisation to establish whether there were any specific areas of concern, and the magnitude of any such concerns for the military defence sector, in relation to the proposed Draft Plan Option areas and export cable corridors. This consultation also sought to establish whether any impacts could be quantitatively assessed.

B8. Oil and Gas

B8.1 Overview

This sector relates to the extraction of Oil and Gas in the sub-sea environment largely from offshore reserves. Oil reserves include both oil and the liquids and liquefied products obtained from gas fields, gas-condensate fields and from the associated gas in oil fields. Gas reserves are the quantity of gas expected to be available for sale from dry gas fields, gas-condensate fields and oil fields with associated gas. For this assessment, activity within this sector includes exploration, production, interconnectors and gas storage (i.e. the ‘upstream’ Oil and Gas sector). The location of oil and gas infrastructure in relation to Draft Plan Option areas is shown in Figure B8. Information sources used in the assessment are listed in Table B8.1.

Table B8.1 Information Sources

Scale	Information Available	Date	Source
Scotland	All pipelines and cables	Current	SeaZone Solutions Ltd and UKDEAL
UK	Oil pipelines - Subsea pipelines and umbilical's related to the petroleum industry.	Current	UKDEAL
UK	Oil and gas employment	2009	Oil and Gas UK 2010 Economic report: www.oilandgasuk.co.uk
Scotland	Revenues and production from Scottish Sea areas (2005-2008). Oil, gas and NGL production and revenue (2005-2008) for all Scottish waters and regional breakdown.	2005-2008	Baxter et al (2011)

B8.2 Future Trends

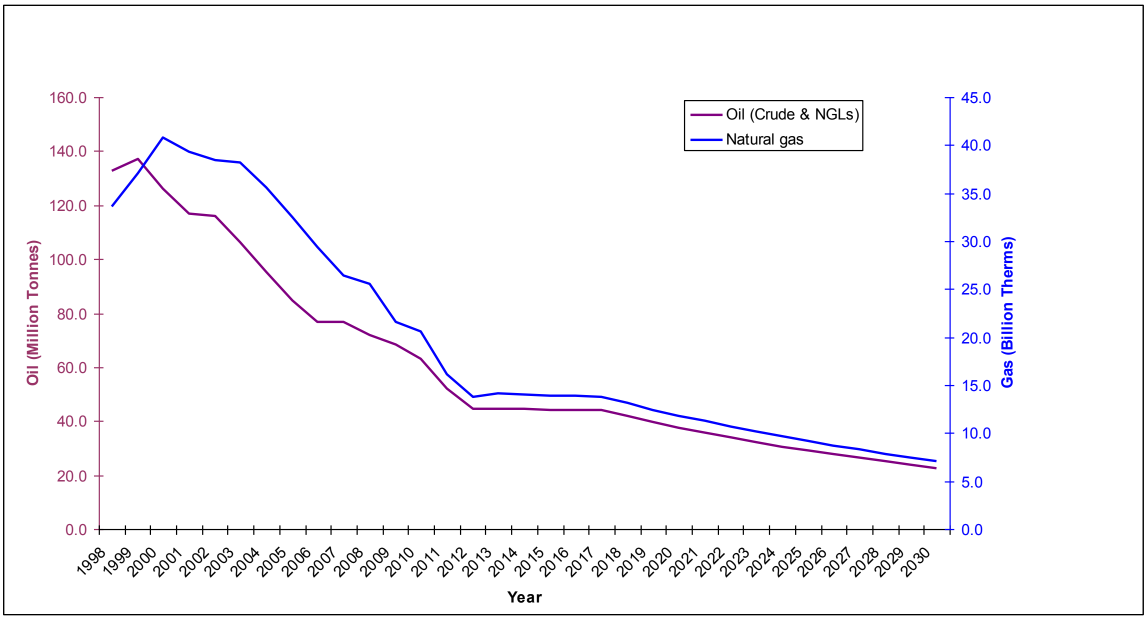
Information on future trends relates to the UK and disaggregation of this data to regional (Scottish) level is not possible.

It has been estimated that in 2020, 70% of primary energy in the UK is still expected to come from oil and gas. The UKCS has the potential to satisfy about 50% of the UK's oil and gas demand in 2020, if the current rate of investment is sustained (Oil and Gas UK, 2012a). However, the amount of oil and gas imported into the UK is also likely to increase. By 2015, around 25% of the UK's annual gas demand is likely to be met by imports (increasing from 20% in 2008). Given the prediction for increasing dependence on imported gas, subsea gas storage facilities and associated pipelines are also likely to increase (Saunders et al, 2011), although no new gas storage is currently planned for Scottish waters.

Over 41 billion boe have been recovered so far from the UKCS, and a further overall recovery of 15 to 24 billion boe is forecast (Oil and Gas UK, 2012a). These are mainly in discoveries awaiting development, areas under current licence or regions where oil can be expected to be found but has not yet been explored (Baxter et al, 2011). Based on the average price of oil and gas forecast by the Energy Information Administration between 2009 and 2030, the wholesale gross value of these remaining reserves may be between £650 billion to £1.1 trillion (Baxter et al, 2011). A significant area of unexploited gas reserves lies to the West of Shetland and a new gas export pipeline from this area is currently being built to support output from the Laggan (about 125km West of Shetland) and Tormore (about 15km further South West) fields, scheduled to start production in 2014 (Baxter et al, 2011).

Image B8.1 shows oil and gas production levels in recent years and DECC's current (October 2012) projections (DECC 2013). A substantial decrease in oil and gas production in the UK since 1998 and the projected 5% decrease from 2018 to 2030 (DECC 2013) is seen. The production projections for 2013 -2018 are consistent with those published by DECC at http://www.gov.uk/oil-and-gas-uk-field-data.

Around 500 individual structures (including platforms and tie backs) will be decommissioned over the next three decades (Saunders et al, 2011, Oil and Gas UK, 2012a). However, some depleted oil and gas fields, and oil and gas infrastructure, may potentially be used in the emerging CCS sector (see Section B3). From 2012 onwards, decommissioning expenditure is projected to be £28.7 billion by 2040 for existing facilities (Oil and Gas UK, 2012a) and over the next five years, decommissioning and cleaning expenditure totals almost £190 m and the cost of disconnection phase activities is over £330m (Oil and Gas UK, 2012b).



Source DECC, 2013.
'The production projections for 2013–2018 are consistent with those published by DECC at https://www.gov.uk/oil-and-gas-uk-field-data.

Image B8.1 Actual and Projected UK Oil and Gas Production 1998-2030

B8.3 Potential for Interaction

Table B8.2 shows potential interaction pathways between oil and gas infrastructure and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B8.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Increased competition for space	All arrays, export cables	Increased costs associated with new pipeline laying operations	✓ **(arrays) –** only where Draft Plan Option areas or export cable routes overlap or lie inshore of hydrocarbon fields	- Consultation with industry to determine any potential developments for which pipeline routes might require extension; - Assessment of cost based on average cost per km for pipeline laying, based on ODIS/ data. See Section B8.4 for detailed methodology
Cable/pipeline crossings	All arrays, export cables	Additional costs to construct cable/ pipeline crossings	**X** – costs of crossings will be borne by developer.	Not required.
Increased difficulty of access at crossing points	All arrays, export cables	Increased maintenance costs for pipeline owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers	**X** – the crossing agreements will generally make offshore energy developers liable for additional costs incurred by the existing asset owner. This essentially involves a transfer of the cost to the developer and therefore does not require assessment here. Consultation will be undertaken with oil & gas interests to identify any significant concerns.	Not required. Qualitative assessment of potential issues undertaken (see Section B8.4)

B8.4 Scoping Methodology

B8.4.1 Increased Competition for Space

Wind, wave and tidal array development in Draft Plan Option areas, and export cable routes from Draft Plan Option areas have the potential to affect future oil and gas infrastructure development, resulting in increased costs associated with additional pipeline laying distance to deviate around Draft Plan Option areas or export cable corridor.

For the purpose of this assessment, this potential negative effect was only considered to be likely where Draft Plan Option areas or export cable corridors overlap or lie inshore of existing hydrocarbon. Using this assumption:

- Draft Plan Option areas and/or cable corridors which do not overlap or lie inshore of existing hydrocarbon fields were scoped out of the assessment; and

- Draft Plan Option areas and/or cable corridors which do overlap or lie inshore of existing hydrocarbon fields were considered to require a quantitative impact assessment.

Note where overlaps between existing oil and gas infrastructure and Draft Plan Option areas/cable corridors exist, these areas were not scoped into the assessment as it was assumed that:

i) Renewables development will not be permitted within a given ‘corridor’ either side of existing infrastructure such as pipelines (see Appendix C8.2 for further discussion) to enable existing infrastructure maintenance; and
ii) The cost of any required cable/pipeline crossings with existing infrastructure will be borne by the renewables developer (see Appendix C8.2 for further discussion).

The assessment has assumed constant prices in real terms based on 2012.

The results of the scoping exercise are presented in Appendix C8.

B8.5 Assessment Methodology

B8.5.1 Increased Competition for Space

In order to identify SORER regions and specific Draft Plan Option areas and/or cable corridors in which this negative interaction was likely to occur, based on any potential developments for which pipeline routes might require extension between before 2035, industry consultation was undertaken.

Where industry consultation identified an interaction between a Draft Plan Option area and future oil and gas pipeline development, the additional miles required for the future pipeline routes/extensions to deviate around the Draft Plan Option area of concern was estimated. Using the average cost of per km for pipeline laying (ODIS, 2011), the cost impact to the sector was calculated as follows:

Length of deviation (km) x average cost pipeline laying per km (£/km)

It was assumed that the length of deviation around wave or tidal Draft Plan Option areas may be smaller compared to deviations around wind Draft Plan Option areas due to the lower proportion of Draft Plan Option areas that would be covered by those devices.

Given the current uncertainty surrounding the routes of the Draft Plan Option area export cable corridors, any assessment of the economic impacts of interactions between future interconnectors and cable corridors is difficult. As such, only a qualitative assessment of this issue was undertaken based on the output of the scoping phase and areas of concern highlighted by consultation with industry.

B8.5.2 Increased Difficulty of Access at Crossing Points

Maintenance barges for pipeline work are generally anchored and require a nominal working space either side of the pipeline. Such pipeline constraint issues at the proposed Triton Knoll offshore wind farm (OWF) development resulted in the OWF site being split into two discrete regions either side of a 1 km buffer zone for three existing sub-sea pipelines (Infrastructure Planning Commission (IPC), 2010). Comments from the Health and Safety Executive on Triton Knoll highlighted the need to ensure that the proposed development did not adversely interact with major accident hazard pipelines (MAHPs) (IPC, 2010). Exclusion zones for pipelines tend to be agreed at a site-specific level and may be less or more than the distance cited in the Triton Knoll case (ABPmer and RPA, 2011).

Oil and Gas UK were consulted to ascertain whether this potentially negative interaction was likely to occur in relation to any of the proposed Draft Plan Option areas/export cable corridors and future oil and gas activities. The outcome of this scoping exercise and stakeholder consultation is provided in Appendix C8.

B9. Ports and Harbours

B9.1 Overview

Ports provide the modal interchange points by which goods and people are transported from land to sea. Harbours are by definition, safe havens for vessels to reside in and are often commensurate with port areas. Within Scottish waters, the ports and harbours sector supports the largest fishing industry in the UK, provides facilities for a significant offshore Oil and Gas industry, as well as maintaining ferry links to island communities and providing the recreational sector with support services. Commercial shipping information is described in Section B5 of this report. There is an intrinsic link between ports, harbours and shipping, however the interactions and issues in relation to marine renewable developments are often distinctly different.

Within this section all port facilities have been evaluated. The supporting Figure B9 shows port and harbour installations, irrespective of whether they are part of a formal Harbour Area, established and defined under a Special Act of Parliament, or a pier/slipway in public or private ownership. Information sources used in the assessment are listed in Table B9.1.

Table B9.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Baseline review of data on commercial shipping.	2012	ABPmer (2012)
Scotland	Passenger and vehicle ferry routes in Scotland, from the Scottish Government's Urban/Rural Classification for 2009-2010. Plus, Orkney Ferries and Calmac Ferries routing information added in 2011.	2011	Spatial Data Management Team, Rural Payments Inspections Directorate (RPID), Scottish Government
Scotland	Commercial listings of ports in Scotland, service providers, contact details, description of services and current development plans	Current (2013)	Port of Scotland
Scotland	Maritime transport statistics and overview, generalised information on Scottish Ports	2009-2010	Baxter et al (2011) The Scottish Government (2011) 'Scotland's Marine Atlas – Information for the National Marine Plan' March 2011.
UK	Port and harbour locations, port types, port ownership, contact details	Current (2013)	Ports and Harbours of the UK, 2013. Website: http://www.ports.org.uk/
UK	Admiralty charted formal anchorages.	2013	UK Admiralty charts
European	Combination bathymetry file of European Marine Observation and Data Network (EMODNET) bathymetry merged with SeaZone data captured in coastal wave models, and General Bathymetric Chart of the Ocean (GEBCO) data which was used to cover areas lying outside the extent of the SeaZone and EMODNET data coverage.	2010	ABPmer, 2010. (R.1684 'Seabed Kinetic Energy - EUseaMAP')

B9.2 Future Trends

The UK Government policy for ports was set out in the Interim Report of the ports policy review published in 2007 (DfT, 2007). This report stated that the Government sought to 'encourage sustainable port development to cater for long-term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner'. This provides confirmation that the ports industry is supported by Government policy into the future, providing assurance of sustained development.

Ports policy was reviewed in 2006 by the Scottish Government, this concluded that the sector benefits substantially from its independence and that the Scottish Government supported its mixed ownership structure, (i.e. Trust, Municipal and Private). Investment decisions are based on market needs rather than through central direction. The challenge for future development of this sector is based on world trade patterns and the economic climate (BPA, 2008).

The Scottish Government is formulating a National Planning Framework. This for the first time identifies important Scottish 'National Development' infrastructure projects that will be rolled out up to 2030. The Scottish Government has said that its economic strategy requires a planning framework that supports sustainable economic growth across Scotland. Of the nine proposed National Developments three are large projects specifically related to the ports industry (BPA, 2008).

Scotland's National Transport Policy states that "An effective road and rail infrastructure to support national and international connections by sea is essential to ensure that the critical role of ports in supporting and contributing to Scotland's business and economic health is fully realised "Future areas of possible development are international transhipment, feeder services and short sea shipping". Also, "We will continue to support UK and international ferry routes including routes to Northern Ireland, Ireland, mainland Europe and beyond" (Scottish Executive, 2006b).

The importance of the oil and gas industry to the Ports industry within Scotland, specifically ports on the East Coast, Shetland and Orkney Isles, provide a close tie between these two sectors. Although the North Sea fields are considered to be 'mature' having produced 36 billion boe, estimates suggest that there may be another 25 million boe available. Operators who specialise in extracting oil and gas from the more mature fields have purchased several of these assets from the oil majors. This has seen higher investment levels for some older fields with increased production being achieved (BPA, 2008). The long term stability of extraction levels past 2020 is uncertain. However, the centre of excellence and expertise established in North East Ports has generated global trade in oil and gas equipment manufactured or services. Aberdeen Harbour (for example) already has three scheduled services to West African oil and gas producing countries and regularly handles other energy related cargoes to and from many other worldwide destinations (BPA, 2008).

The increase in offshore renewable activities provides a potential source of income for ports. This is both as a base for industrial processes including manufacture of offshore renewable devices, and as a service provider for the craft needed to install and maintain offshore renewable sites during the construction and operation. Market potential is driven by the location of offshore renewable developments, and the accessibility of ports for the types of craft involved in installation and maintenance activities.

The future use, growth and development of ports are intrinsically linked to world trade patterns and the economic climate, and are reactive to changing economic circumstances. Government policy continues to support the mixed ownership structure already established, with Government backing for National Infrastructure projects, all of which provides incentives to develop port facilities. Many ports in Scotland have identified opportunities around the developing marine renewables industry, which has the potential to change the landscape of port services and increase marine traffic.

B9.3 Potential for Interaction

Table B9.2 shows potential interaction pathways between ports and harbours and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B9.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Obstruction of maintained navigation channel(s)	All arrays	Loss of customers and revenue; increased costs associated with maintaining alternative routes	✓	Discussions with individual port authority
Reduced development opportunities	All arrays	Loss of customers and revenue (long term); increased costs associated with development	✓	Discussions with individual port authority to identify projected future developments at risk
Loss or reduced use of dredge material disposal sites	All arrays, export cables	Increased costs of disposal	✓ (arrays)	Discussions with individual port authority

B9.4 Scoping Methodology

B9.4.1 Obstruction of Port and Harbour Maintained Navigation Channel(s) and Reduced Development Opportunities

Wind, wave and tidal arrays plus their associated cable corridors may cause obstruction and displacement of maintained navigation channels leading to port and harbour facilities. This may result in increased steaming time or the use of alternative routes with the potential that port and harbour facilities may become unattractive and/or affect commercial competitiveness. This could occur where port and harbour maintained navigation channels and Draft Plan Option areas and/or cable corridors spatially overlap. Cable corridors affect maintained navigation channels during the process of laying cables, with a temporary increase in collision risk and/or a requirement to avoid areas of work to reduce the risk of marine incidents.

As a base assumption, where density of development is less than 5% of the Draft Plan Option area, then it is concluded that avoidance of significant impacts can be achieved through spatial planning. As such, the following scoping methodology was applied for proposed wind, wave and tidal Draft Plan Option areas plus their associated cable corridors.

Offshore Wind:
- Where Draft Plan Option areas are transected by a port or harbour maintained navigation channel(s), the area has been scoped in;
- Where a Draft Plan Option area is within 5km of a port or harbour maintained navigation channel(s), the area has been scoped in; and
- If the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under this scenario and the area has been scoped out.

Wave:
- Where Draft Plan Option areas are transected by a port or harbour maintained navigation channel(s), the area has been scoped in;
- Where a Draft Plan Option area is within 5km of a port or harbour maintained navigation channel(s), the area has been scoped in; and
- If the spatial extent of indicative arrays for a given scenario occupy less than 1% of Draft Plan Option area and it has been assumed that spatial planning of the Draft Plan Option area can be used to avoid significant impacts under these scenarios and the area has been scoped out.

Tidal:
- Where Draft Plan Option areas are transected by a port or harbour maintained navigation channel(s), the area has been scoped in;
- Where a Draft Plan Option area is within 5km of a port or harbour maintained navigation channel(s), the area has been scoped in; and
- Where Draft Plan Option areas are in waters of depths greater than 75m, the area has been scoped out. This follows the rationale that tidal devices are stationed circa 10m from the bed (to avoid bed turbulence) and have a maximum blade around 20m in diameter, providing a 30m bed to blade tip clearance, whereas Ultra Large Crude Carriers have a maximum draught of around 35m. An Under Keel Clearance allowance of 10m is applied as a maximum working clearance (NOREL NAV SUB Group, 2012; and
- If the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario and the area has been scoped out.

The detailed output of this scoping exercise is presented in Appendix C9.

B9.5 Assessment Methodology

The assessment methodology presented in this section takes account of stakeholder concerns regarding the interaction of renewable energy (wind, wave and tidal) with ports and harbours.

B9.5.1 Impacts to Port and Harbour Maintained Navigation Channel(s) and Reduced Development Opportunities

Where a Draft Plan Option area and a maintained port approach channel overlap, the potential impact has been evaluated by consulting with the harbour authority and ascribing a qualitative measure of significance. From this, a quantitative assessment of impact on income can be calculated based on the port turnover and broad-scale effect on trade. Where necessary, alternative channel options have been evaluated and potential impact on the future development (widening/depending) of the navigation channel assessed. This assessment also included potential distribution/displacement of regular ferry routes connecting the port or harbour to other port and harbour locations. This assessment has been considered in Section B5 dealing with Commercial Shipping, with a cross-reference provided to this section for ferry route evaluation.

B10. Power Interconnectors

B10.1 Overview

This sector is concerned with the transmission of power through submarine cables, including international, national and inter-island links. This assessment excludes power cables to/from individual developments (e.g. power supplies to Oil and Gas installations, export cables from existing OWFs). Figure B10 shows an overview of existing interconnector infrastructure in relation to Draft Plan Option areas. Information sources used in the assessment are listed in Table B10.1.

Table B10.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Existing cables	Current	Admiralty Charts
Scotland	Power cables (submarine electricity cables)	Current	Baxter et al. (2011)
Scotland	Potential future subsea cable developments / reinforcements	2009	National Planning Framework for Scotland Annex National development 11 (Scottish Government, 2009b)

B10.2 Future Trends

The location of offshore renewables resources, often remote from locations of power demand, and the large proposed expansion of offshore renewables development may drive the development of an offshore grid network and interconnectors.

UKMMAS (2010) reported that over the period 2007-12 the Office of the Gas and Electricity Markets (Ofgem) provided for capital investment of up to £4.3 billion in the electricity transmission network, an increase of 160% over the previous 5-year price control period, with much of this investment planned for Scotland.

The Scottish National Planning Framework 2 (Scottish Government, 2009b) identifies ‘electricity grid reinforcements’ as one of the fourteen national developments essential to the delivery of the spatial strategy set out in the second National Planning Framework. The strategic grid reinforcements are essential to provide the transmission capacity necessary to realise the potential of Scotland’s renewable energy sources, maintain long-term security of electricity supply and support sustainable economic development. This development would occur throughout Scotland, from the English border to the Shetland Islands and, in relation to marine power interconnectors, would include:

- Reinforcement of the sub-sea cable link between Orkney and the Scottish mainland; and
- New sub-sea cable links for the Outer Hebrides and the Shetland Islands.

B10.3 Potential for Interaction

Table B10.2 shows potential interaction pathways between power interconnectors and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B10.2 Potential for Interaction

1 Potential Interaction	2 Technology Relevance (Wind, Wave, Tidal)	3 Potential Socio-economic Consequence	4 Scoped in (✓) or Out (X) of Assessment	5 How the Economic Impact Will be Assessed
Draft Plan Option areas and/or cable routes intersect proposed interconnectors	All arrays, export cables	Increased costs associated with new cable laying operations	✓ - where Draft Plan Option areas or cable crossings intersect proposed interconnectors	-Consultation with industry to determine any potential developments for which cable routes might require extension or involve additional cable crossings; - If an interaction is identified, cost can be assessed based on average cost per km for relaying costs, based on ODIS information. See Section B10.4 for detailed methodology.

1 **Potential Interaction**	2 **Technology Relevance (Wind, Wave, Tidal)**	3 **Potential Socio-economic Consequence**	4 **Scoped in (✓) or Out (X) of Assessment**	5 **How the Economic Impact Will be Assessed**
Cable crossings with existing interconnectors	All arrays, export cables	Additional costs to construct cable crossings	**X** – costs of crossings will be borne by developer.	Economic assessment not required.
Increased difficulty of access at crossing points	All arrays, export cables	Increased maintenance costs for cable owners; loss of revenue for asset owners; loss of revenue for dependent businesses/ customers	**X** –crossing agreements will generally make offshore energy developers liable for additional costs incurred by the existing asset owner.	Economic assessment not required. Qualitative assessment of potential issues undertaken (see Section B10.4)

B10.4 Scoping Methodology

B10.4.1 Draft Plan Option areas and/or Cable Routes Intersect with Proposed Interconnector Routes

Wind, wave and tidal array development in Draft Plan Option areas, and export cable routes from Draft Plan Option areas have the potential to affect future power interconnector routes, resulting in increased costs associated with additional cable laying distance to deviate around Draft Plan Option areas or export cable corridors.

For the purpose of this assessment, this potential negative effect was only considered to be likely where Draft Plan Option areas or export cable routes intersected with future planned or proposed power interconnector routes that were likely to be constructed after agreements to lease had been issued in relation to Draft Plan Option areas (assumed 2015) or after licence applications for array export cable routes had been submitted (assumed 2020).

Table B10.3 and Figure B10 show future planned/proposed interconnectors identified within this scoping exercise (source: Scottish Government (2012) and Electricity Networks Strategy Group (2012); Saunders et al. (2011); DECC Energy Networks Strategy Group Major Project Status Update (DECC website).

Where the exact landfall points and/or route for a planned/proposed interconnector was not known, the spatial overlap with Draft Plan Option areas and/or cable corridors was assessed visually (as opposed to within GIS). The current project stage and earliest completion date of interconnectors was used to estimate whether consent for the interconnector projects was likely to be granted prior to lease agreements for Draft Plan Option areas (assumed 2015) and Draft Plan Option areas export cable corridors (assumed 2020). Using the assumption that any interconnector may take approximately three years to construct, any interconnector with a completion date up to and including 2018 would be consented prior to the assumed lease agreement date for Draft Plan Option areas (2015) and any interconnector with a completion date up to and including 2023 would be consented prior to the assumed lease agreement date for export cable corridors (2020). Using these assumptions, the following scoping method was applied:

- Draft Plan Option areas and/or cable corridors which are not intersected by planned/proposed interconnector routes were scoped out of the assessment;
- Draft Plan Option areas which are intersected by planned/proposed interconnector routes due for completion by 2018 were scoped out of the assessment;
- Draft Plan Option areas which are intersected by planned/proposed interconnector routes due for completion after 2018 were scoped into the assessment;
- Cable corridors intersected by planned/proposed interconnector routes due for completion by 2023 were scoped out of the assessment; and
- Cable corridors intersected by planned/proposed interconnector routes due for completion after 2023 were scoped in to the assessment.

The assessment has assumed constant prices in real terms based on 2012.

The results of the scoping exercise are presented in Appendix C10.

Table B10.3 Future Planned/Proposed Interconnectors

Project	Description	Current Project Stage*	Earliest Completion Date
Western HVDC Link	West Coast 1.8GW High Voltage Direct Current (HVDC) link between Hunterston and Connah's Quay in North Wales	Construction	2015
Eastern HVDC Link	1.8GW HVDC link between Peterhead and Hawthorne Pit in Humberside	Optioneering	2018 (Q2)
Shetland HVDC Link	Island link connecting Shetland Islands to Moray Firth offshore hub	Design	2017 (Q4)
Orkney 132kV Subsea Link	Island link connecting Orkney and Pentland Firth Subsea Link	Design	2015 (Q4)
Western Isles HVDC Link	Island Link	Planning	2015 (Q4)
Hunterston-Kintyre 240MVA AC subsea link	AC subsea link between Hunterston and Carradale in Argyll and Bute	Planning	2015 (Q4)
Caithness-Moray HVDC reinforcement	HVDC Link: from Caithness to the Moray Coast via the Moray Firth Offshore hub	Design	2016 (Q4)
UK-Norway NorthConnect	Interconnector between Norway (Sima and Samnanger) and Scotland (landfall Peterhead).	Co-operation agreement signed in February 2011	Expected to be operational before 2020

***Current Project Stage:**
Optioneering: Transmission Operator believes that the need case is firm, number of design options provided for public consultation so that a preferred design solution can be identified;
Design: Designing the preferred solution into greater level of detail and preparing for the planning process;
Planning: Continuing with public consultation and adjusting the design as required through the planning process application process;
Construction: Planning consent has been granted and/or contracts have been awarded and manufacturing underway.

B10.5 Assessment Methodology

B10.5.1 Draft Plan Option areas and/or Cable Routes Intersecting with Proposed Interconnector Routes

For any Draft Plan Option area scoped into the assessment, it was assumed that the cost to the sector of having to 'detour' the future interconnector around the Draft Plan Option area could be calculated as follows:

Length of deviation (km) x average cost pipeline laying per km (£/km)

It can be noted that the length of deviation around wave or tidal arrays may be smaller due to the lower proportion of Draft Plan Option areas that would be covered by those devices compared to wind Draft Plan Option areas.

Currently there is still uncertainty surrounding the routes of the Draft Plan Option areas export cable corridors. This makes any assessment of the economic impacts of interactions between future interconnectors and cable corridors difficult. As such, a qualitative assessment of this issue was undertaken where possible interactions were highlighted by the scoping methodology and consultation with industry.

B10.5.2 Increased Difficulty of Access to Existing Interconnectors at Crossing Points

It is possible that export cable routes from proposed Draft Plan Option areas may cross over existing cables. While this does not pose any major issues during the construction phase (and the cost of the cable crossing will be transferred to the developer), the general proliferation of cables in the marine environment may increase the costs of maintaining existing cables in the future (ABPmer et al. 2011).

A qualitative assessment of this issue was undertaken based on any areas of concern highlighted through consultation with the industry sector.

B11. Recreational Boating

B11.1 Overview

For the purpose of this study, recreational boating is considered to include recreational activities undertaken in medium and large sailing vessels, yachts, powerboats and motorboats. Information on smaller sailing boat activity such as dinghies (usually taken out of the water after use) and other types of water sports is provided in Section B15. There are clear socio-economic interactions between General Tourism and Recreational Boating. Tourism is described separately in section B13 of this report as the interactions and issues in relation to marine renewable developments are often distinctly different to those associated with recreational boating. There is some possibility of a degree of double counting using this approach but not to the extent that it materially affects the results of the study. Figure B11 shows an overview of recreational boating activity in relation to the Draft Plan Option areas. Information sources used in the assessment are listed in Table B11.1.

Table B11.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Statistics on sailing tourism	No date	Tourism Resources Company et al (2010)
All Regions	Number of resident home berths Number of visiting berths Proportion of total Scotland berths Demand for home berths (occupancy) Visiting craft demand for berths Average annual spend per boat (high, medium and low) Direct expenditure Multipliers (from Scottish Tourism Multiplier Study) Visiting boat nights Visiting boat expenditure Employment Gross Value Added	No date	Tourism Resources Company et al (2010)
Scotland	Sailing area value and berth numbers	No date	Baxter et al (2011)
Scotland	RYA cruising routes and sailing areas	No date	Baxter et al (2011)
Scotland	General Bathymetric Chart of the Ocean (GEBCO) data set	No date	

Whilst this assessment uses a representative set of data to evaluate the socio-economic consequences from individual Draft Plan Option areas, it should be noted that any marine renewable site development would be subject to individual assessment which includes evaluation of navigational patterns and potential risk. The majority of the developments' navigational risk assessments would also be underpinned by a marine traffic survey relevant to the baseline marine traffic use. The assessment presented in this Chapter provides a high level socio-economic appraisal based on a number of nationally applicable assumptions.

B11.2 Future Trends

UKMMAS (2010) reports that whilst marine recreation has experienced recent growth, future growth and stability of the sector is dependant upon the general health of the UK economy. A strong economy results in consumers having more disposable income to spend on leisure and recreation activities. As a result of the recent global economic downturn, there has been some short-term decline in participation in recreational activities within the UK. However, with infrastructure and technology in place to support the sector, it is expected to continue to grow over the long term and the prospects for growth in Scotland are good.

Scotland's Marine Atlas (Baxter et al., 2011) comments that despite the recent downturn in the global economy, and subsequent reduction in disposable incomes, the recreational sector could have the potential to play an increasingly significant role in Scotland's rural economy. This is evidenced by the recent development of marina facilities at Wick, and the Orkney Islands. Combined with active marketing by marina owners, and support from local authorities (such as Orkney Island's Council as seen in recent developments) the potential for future growth is apparent.

Climate change may also play a small part in increasing overall participation numbers. As the frequency of months when conditions are more comfortable for tourism in North-West Europe (MCCIP, 2008) improve, the warmer weather is more likely to attract visitors to coastal locations in Scotland. The net result will be an extension of the tourist season beyond its traditional limits and opening up new destinations. Climate change as a positive influencing factor must be balanced against predictions of increased storminess, and the severity of storms. Provided increased storminess is predominantly in the winter months, this may not be a factor in future recreational boating trends.

The Scottish Enterprise (2010) report concludes that as long as infrastructure (marinas and shore side facilities) continue to attract investment, resident berthing could increase by 3-5% per annum. The growth potential in visitor berthing is projected at up to 5% per annum. Both of these projects bring an associated increase in expenditure into the local economy.

Planned and possible future offshore renewables development over the assessment period could interact with recreational boating activity. Such development may constrain recreational boating within the vicinity of arrays and increase sailing distances on some cruising and sailing routes. Concentration of developments along the East and West coasts of Scotland may increase the challenges of sailing along these routes with the potential to deter sailors.

B11.3 Potential for Interaction

Table B11.2 shows potential interaction pathways between recreational boating and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B11.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Requires Detailed Assessment (✓) or Does Not Require Detailed Assessment (X)**	**How the Economic Impact Will be Assessed**
Alterations to informal cruising routes	All arrays	Increased fuel costs for motorised vessels; possible relocation of vessels leading to loss of revenues for supply chain	✓	Assess potential additional fuel costs based on increased route distances
Deterrent to investment in marinas/supply chain	All arrays	Reduced investment	✓	The risk of deterring investment in marina capacity or the wider supply chain is very difficult to quantify. Consultation with the recreational boating sector, particularly local marinas, should be undertaken to identify and address potential concerns relating to individual projects.

B11.4 Scoping Methodology

B11.4.1 Impacts to Cruising Routes

Wind, wave and tidal arrays plus their associated cable corridors may cause obstruction and displacement of cruising routes, leading to increased transit time and therefore increased cost. This will occur where cruising routes and Draft Plan Option areas and/or cable corridors spatially overlap. Cable corridors affect recreational boating during the process of laying cables with temporary increases in collision risk and/or a requirement to avoid areas of work to reduce the risk of marine incidents.

As a base assumption, where density of development is less than 5% of the Draft Plan Option area, then it is concluded that avoidance of significant impacts can be achieved through spatial planning. As such, the following scoping methodology was applied for proposed wind, wave and tidal Draft Plan Option areas plus their associated cable corridors.

Offshore Wind:

- Where Draft Plan Option areas are transected by a heavy or medium use cruising route(s), the area has been scoped in;
- If the spatial extent of indicative arrays for a given scenario occupy less than 5% of Draft Plan Option area it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario and the area has been scoped out; and
- Where spatial overlap of RYA Sailing or Racing areas occurs but this is less than 10% of combined area (Draft Plan Option areas plus sailing/racing area) it has been assumed that spatial planning of the Draft Plan Option areas can

be used to avoid significant impacts under all scenarios and the area has been scoped out.

Wave:

- Where Draft Plan Option areas are transected by heavy or medium use cruising route(s), the area has been scoped in; and
- Where Draft Plan Option areas are transected by heavy or medium use cruising route(s), and the spatial extent of indicative arrays for a given scenario occupy less than 1% of the Draft Plan Option area, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

Tidal:

- Where Draft Plan Option areas are transected by heavy or medium use cruising route(s), the area has been scoped in;
- Where Draft Plan Option areas are in waters of depths greater than 75m, the area has been scoped out. This follows the rationale that tidal devices are stationed circa 20m from the bed (to avoid bed turbulence) and have a maximum blade around 10m in diameter, providing a 30m bed to blade tip clearance. The largest keeled yachts are circa 10m draught. To provide allowance for tide and wave activity plus an extra margin for safety, 40m is considered a suitable threshold depth; and
- Where Draft Plan Option areas are transected by heavy or medium use cruising route(s), and the spatial extent of indicative arrays for a given scenario occupy less than 5% of the Draft Plan Option area, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios and the area has been scoped out.

The detailed output of this scoping exercise is presented in Appendix C11.

B11.4.2 Deterrent to Investment

The location of the renewable developments in proximity to marinas or associated access routes may adversely affect marina developments, or the potential for investors to upgrade/expand existing marinas. This would be largest with developments which form a direct blockage to the main access routes to the marinas and nearby anchorages, or dissuade potential recreational boat owners from visiting certain locations due to the perceived increase in navigational difficulty.

B11.4.3 Data limitations

The published information on cruising and sailing routes is indicative and there is a lack of reliable data on the actual routes taken by recreational vessels. There is also a lack of information on vessel numbers passing along particular routes. There is limited information on historical trends in activity and the level of future activity is uncertain, as it is largely dependent on the overall performance of the national economy.

B11.5 Assessment Methodology

The assessment methodology presented in this section also takes account of stakeholder concerns regarding the interaction of renewal energy (wind, wave and tidal) on the Recreational Boating sector. Where individual stakeholders have raised specific concerns these have been included and highlighted.

B11.5.1 Impacts to Cruising Routes

The scoping study carries out an initial review of the potential interaction with cruising routes at the scale of the Draft Plan Option areas, where the Draft Plan Option areas which intersected cruising routes of medium or heavy use were scoped in for assessment.

The RYA heavy use cruising routes are defined as those where six or more recreational craft use the route during summer/daylight hours. RYA moderate use cruising routes are defined as those that recreational craft are seen at most times during summer daylight hours. RYA light use cruising routes are known to be commonly used, but are not supported by observational data (RYA, 2008).

Routes which were identified to have an overlap with Draft Plan Option areas, but scoped out with respect to the density of development and seabed depth in the case of tidal developments, were not assessed. This assessment then goes further to evaluate in more detail the potential impact, based on theoretical development scenarios within the Draft Plan Option areas. The development scenarios within the Draft Plan Option areas are based on the low, central and high estimates of the proportion of the Draft Plan Option areas to be developed, which varies for each renewable energy type. A subjective assessment of where the development scenarios would occur was completed for the Commercial Shipping assessment (see Section B5.4) with the resulting development locations carried forward to this assessment for consistency. Within the Commercial Shipping assessment, developments within the Draft Plan Option areas were positioned based on the density of sea area usage (as informed by AIS density grids). The development scenarios were theoretically positioned in locations that were away from the busiest shipping traffic and established ferry routes based on available AIS information.

For the Draft Plan Option areas scoped in, cruising routes that intersected the development scenarios were identified and potential deviation estimated, along with the potential cost of the additional transit distance. Deviations have been calculated based on the difference between the ‘current’ cruising route through the development scenario and modified transit (route) around the development boundary. Where more than one cruising route intersects the development scenario, the sum of deviations estimated for each route has been used. The cost associated with the additional transit distance was calculated in relation to the fuel used. The following equation is applied:

Difference between the current route (distance in nautical miles) compared to additional transit distance (nautical miles) x marine fuel costs per nautical mile.

Fuel type used in the assessment assume red diesel, where the average unit pence per litre (ppl) for 2012 of 71.46 ppl has been used (AHDB, 2013). The use of this fuel for propulsion carries with it an additional duty of 11.14 ppl based on HMRC rates from 2012. The estimated difference in distance and associated fuel consumptions has been costed for propulsion only, with no use for domestic fuel estimation. The mileage per litre for vessels under motor depends on the size and speed of the vessel in question, ranging from about 13-63 litres/hour. For the purposes of this assessment, fuel usage for a 'generic' averaged sized boat at a consumption rate of 40 litres per hour travelling at a speed of 20 knots has been used. In the assessment, all vessels are assumed to be under power (i.e., sailing boats are not assessed whilst 'sailing').

The additional transit distance, and therefore fuel cost for each journey has then been scaled up to be representative of the total number of potential transits in one year. No detailed information on the number of vessels passing along cruising routes is available to inform the assessment. Hence, for the purposes of this assessment, it has only been possible to calculate the additional fuel costs for an arbitrary number of vessels which may deviate around the development area based on the RYA guidance of Heavy, Medium and Light route use. To provide a measure of Medium route use, a value of five vessels per day has been taken as a representation of peak Medium cruising routes.

The results of this assessment are presented in Section C11.2, where the described methodology was applied.

B11.5.2 Increase in Marine Risk

Radar interference from offshore wind installations is a known factor with respect to marine safety. This increase in marine risk has been assessed qualitatively with comments regarding possible mitigation measures. Mitigation cost would be transferred to the developer and hence no quantitative assessment of this cost has been undertaken. However, relevant stakeholders were consulted to ascertain whether there were any issues or concerns about any of the Draft Plan Option areas, and the scale of any potential issues.

There is also a temporary increase in marine risk along cable corridors whilst cabling is laid. Developers are responsible for ensuring appropriate Navigational Risk Assessments are provided for their marine works, and therefore no quantitative assessment of this cost has been undertaken.

B11.5.3 Deterrent to Investment in Marinas/Supply Chain

Changes to cruising routes could adversely affect marina developments, or the potential for investors to upgrade/expand existing marinas. The risk of deterring investment in marina capacity or the wider supply chain is very difficult to quantify. A qualitative assessment of the potential future investments into Scottish marinas, and in particular berth developments, has been undertaken using literature searches and consultation with the marina sector.

In addition to the above assessment, consultation with the recreational boating sector and sector trade organisations has been undertaken to identify specific concerns. The outcome of which is also presented in Section C11.2.

B12. Telecom Cables

B12.1 Overview

This sector relates to fibre optic submarine telecommunication cables, which carry telephone calls, internet connections and data as part of national and international data transfer networks utilised for the majority of international communication transmissions. Figure B12 shows an overview of existing telecom cables in relation to Draft Plan Option areas. Information sources used in the assessment are listed in Table B12.1.

Table B12.1 Information Sources

Scale	Information Available	Date	Source
Scotland	All pipelines and cables	Current	SeaZone Solutions Ltd
Scotland	Power cables (submarine electricity cables)	Current	Baxter et al. (2011)
Scotland	Potential future subsea cable developments / reinforcements	2009	National Planning Framework for Scotland Annex National development 11 (Scottish Government, 2009b)

B12.2 Future Trends

According to the UK Cable Protection Committee (UKCPC, now Subsea Cables UK) around 95% of international trans-ocean traffic is carried by cable, hence, submarine cables will be vital for the foreseeable future (Baxter et al, 2011). However, there is little information available on how this sector may change in the future (Saunders et al, 2011). According to UKMMAS (2010), changes in bandwidth and the development of high speed internet as well as continued growth in the sector are using up the spare capacity in the current telecommunication networks. The further development of more resilient networks requires a greater reliance on a number of submarine cable routes rather than a few, and major domestic and international systems are now being installed. Future developments in telecom cables are likely to focus on upgrading and increasing the capacity of existing cables along the same routes that are currently present (ABPmer, RPA & SQW, 2011). The extent to which new cables will be laid in Scottish waters is not known (Baxter et al, 2011).

Potential for Interaction

Table B12.2 shows potential interaction pathways between telecom cables and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B12.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Competition for space	All arrays, export cables	Increased costs associated with new cable laying operations	✓ - only where Draft Plan Option areas or export cable routes intersect future telecom cables routes	- Consultation with industry to determine any potential developments for which cable routes might require extension or for which cable crossings might be required; - Assessment of cost based on average cost per km for relaying or cable crossings based on ODIS/ data. See Section B12.4 for detailed methodology
Cable crossings	All arrays, export cables	Additional costs to construct cable crossings	**X** – costs of crossings will be borne by developer.	Not required.
Increased difficulty of access at crossing points	All arrays, export cables	Increased maintenance costs for cable owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers	**X** – the crossing agreements will generally make offshore energy developers liable for additional costs incurred by the existing asset owner. This essentially involves a transfer of the cost to the developer and therefore does not require assessment here. Consultation will be undertaken with relevant asset owners to identify any significant concerns.	Not required. Qualitative assessment of potential issues undertaken (see Section B12.4)

B12.4 Scoping Methodology

Wind, wave and tidal array development in Draft Plan Option areas, and export cable corridors from Draft Plan Option areas have the potential to affect future subsea telecommunication cable routes, or extensions, resulting in increased costs associated with additional cable laying distance to deviate around Draft Plan Option areas or export cable corridor.

For the purpose of this assessment, this potential negative effect was only considered to be likely where Draft Plan Option areas or export cable corridors intersected with current telecom cable routes which would require replacement or extensions prior to 2035, or future telecom cable routes that were likely to be constructed after agreements to lease had been issued in relation to Draft Plan Option areas (assumed 2015) or after licence applications for cable routes had been submitted (assumed 2020). Using this assumption:

- Draft Plan Option areas and/or cable corridors which were not intersected by future telecom cable extensions / routes were scoped out of the assessment; and
- Draft Plan Option areas and/or cable corridors which were intersected by future telecom cable extensions / routes were considered to require a quantitative impact assessment.

To aid industry consultation and highlight the potential for future interactions, the existing subsea telecom cables which intersect with the proposed Draft Plan Option areas and/or Draft Plan Option areas export cable corridors were identified and are shown in Table B12.3.

Table B12.3 Current Telecom Cables which Intersect with Proposed Draft Plan Option Areas and/or Export Cable Corridors

Development	Region	Draft Plan Option Areas	Cable(s) Intersected
Wind Draft Plan Option areas	North	OWN2	TAT14
Wind cable corridors	North	OWN1	Farice(2), Northern Lights
		OWN2	Atlantic Crossing 1 (AC1) SegA; Shefa-2 Seg 8' TAT14
	North-East	OWNE1	CNS Fibre Optic
Wave Draft Plan Option areas	North	WN2	Northern Lights
		WN3	Shefa-2 seg 7-3; TAT 14
Wave cable corridors	North	WN2	Farice(2); Northern Lights
		WN3	Atlantic Crossing 1 (AC1) Seg. A; Shefa-2 Seg 8; TAT 14; Shefa-2 Seg 7-3
Tidal Draft Plan Option areas	West	TW2	Hibernia A
Tidal cable corridor	North	TN1	Farice(2); Northern Lights
		TN5	Atlantic Crossing 1 (AC1) Seg A; Shefa-2 Seg 8; TAT 14
	West	TW2	Hibernia A; Lanisd 3; Sirius North

(Source: Kingfisher, 2013)

B12.5 Assessment Methodology

B12.5.1 Increased Competition for Space

In order to identify SORER regions and specific Draft Plan Option areas and/or cable corridors in which this negative interaction was likely to occur, based on any existing cables which may require extensions, or new telecom cables that will be laid before 2035, industry consultation was undertaken.

Where industry consultation identified an interaction (intersection) with a Draft Plan Option area, the additional miles required for the future cable extension/route to deviate around Draft Plan Option areas of concern was estimated. Using the average cost per km for cable laying (ODIS, 2011), the cost impact to the sector was the calculated as follows:

Length of deviation (km) x average cost cable laying per km (£/km)

It was assumed that the length of deviation around wave or tidal Draft Plan Option areas may be smaller compared to deviations around wind Draft Plan Option areas due to the lower proportion of Draft Plan Option areas that would be covered by those devices.

The assessment has assumed constant prices in real terms based on 2012.

Given the current uncertainty surrounding the routes of the Draft Plan Option area export cable corridors, any assessment of the economic impacts of interactions between future cable replacements/extensions and cable corridors is difficult. As such, only a qualitative assessment of this issue was undertaken based on the output of the scoping phase and areas of concern highlighted by consultation with industry.

B12.5.2 Increased Difficulty of Access at Crossing Points

Table B12.3 shows that some of the proposed Draft Plan Option areas' export cable corridors intersect with existing telecom cables. While this does not pose any major issues during the construction phase (and it has been assumed that the cost of the cable crossing will be transferred to the developer), the general proliferation of cables in the marine environment may increase the costs of maintaining existing cables in the future (ABPmer et al. 2011).

A qualitative assessment of this issue was undertaken based on any areas of concern highlighted through consultation with the industry sector.

B13. Tourism (inc. Ecotourism, Archaeological Heritage)

B13.1 Overview

The tourism sector has been defined as ‘a stay of one or more nights away from home for holidays, visits to friends or relatives, business/conference trips or any other purposes excluding activities such as boarding education or semi-permanent employment’ (VisitScotland[21]). In this assessment, day trips have also been included. Marine and coastal tourism can be defined as any recreational activity that makes use of the marine environment and intertidal coastal zones (Benfield and McConnell, 2007). This can include a range of activities such as walking along the sea-front to sea-side based horse riding. Both non-motorised (walking/picnicking) and motorised (boat-based tourism e.g. wildlife viewing) activities are also considered here. Benefits derived from the wild landscape may also be considered under tourism, indeed McMorran et al (2006) state that the most appropriate valuations of the natural landscape come from tourist expenditure. Tourist activities are also considered to influence other industries, such as accommodation, travel, food and beverage, etc.

It is recognised that the values presented in this section may comprise some water sports and/or recreational boating activity, which are covered separately in Sections B15 and B11 respectively. Where any potential impact on tourism has been identified within a region, the degree to which any overlap in activities/values may have occurred is specifically addressed and estimates of the proportion attributable to these activities are made where possible. Figure B13 shows an overview of tourist activity in relation to Draft Plan Option areas. Information sources used in the assessment are listed in Table B13.1.

Table B13.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Leisure and recreation statistics	2011	Baxter et al (2011)
Scotland	Economic impact of offshore wind farms	2009	GCal Uni (2009)
Scotland	Visitor numbers by region	- 2010	Visit Scotland
Scotland	The tourism prospectus: investing for growth	2007	Visit Scotland
Scotland	Expenditure by coastal and marine wildlife visitors in Scotland.	2009	Bournemouth University (2010)
Scotland	Value of whale watching in Scotland	2009	O’Connor et al. (2009)
Scotland	Value of conserving whales: impacts of cetacean-related tourism on the economy of rural West Scotland	2003	Aquatic Conservation: Marine and Freshwater Ecosystems Journal
Scotland	Scotland’s Coastal and Maritime Managed Heritage Assets; Visitor Numbers and Revenue	2004-2009	Historic Scotland; Visit Scotland
Scotland	Fishing tourism research	2007	Visit Scotland
Scotland	Value to economy of tourism	No date	
Scotland	Towards a Strategy for Scotland’s Marine Historic Environment	2009	Historic Scotland

[21] See VisitScotland Internet site (http://www.visitscotland.com/). The definition of sport includes casual participation in physical recreations such as walking (2+ miles), dance, darts and snooker/billiards/pool as well as more organised sports.

B13.2 Future Trends

Tourism within Scotland is supported by VisitScotland, whose aim is to "maximise the economic benefits of tourism to Scotland". VisitScotland's strategy has five objectives including:

- Maximise the sustainable economic benefit of tourism in Scotland;
- Inspire through information provision;
- Deliver quality assurance;
- Work in partnership; and
- Establish Scotland as perfect stage for events.

The organisation is currently running a new corporate campaign entitled "The Winning Years". This builds on a series of eight events over the years 2012-2014, with each year having a particular theme as follows:

- 2012 – Year of Creative Scotland;
- 2013 - Year of Natural Scotland; and
- 2014 – Year of Homecoming Scotland.

The aims of the campaign are to encourage enthusiasm, support and investment in tourism in Scotland, and to ensure that tourism businesses benefit from the opportunities available. Earlier estimates have indicated that visitor numbers to Scotland are forecast to grow at an average of 2.3% per annum from 2005 to 2015 (RPA and Cambridge Econometrics, 2008), with a 50% increase in gross tourism revenue by 2015 (from 2005) (Scottish Executive, 2006a). However, it is likely that any major developments in tourism in the short term will be affected by this campaign, and also current economic conditions. Indeed, in 2010, overnight visitors to Scotland from the United Kingdom made 12.4 million trips and spent a total of over £2.6 billion (VisitScotland, 2011). These figures represented a decline of 1% in the number of trips and a 4% decrease in expenditure when compared with 2009 data (VisitScotland, 2011). Interestingly, for the same year, international tourism showed a decline in trips of 8% but a growth in expenditure of 6% (VisitScotland, 2011). Therefore, short term tourism trends are uncertain.

Considering trends in particular areas of tourism, the Scottish Recreation Survey has shown that since 2004, there has been an increase in the number of shorter duration visits made closer to home (TNS, 2011). In addition, the percentage of visits taken on foot grew from 50% to 64% in 2008 (TNS, 2010). If these trends are to continue, then it is likely that in the future more tourism will occur close to centres of population and at sites which are easily accessible. Indeed, Brown et al (2010) note that the most likely trend in future outdoor recreation is that there will be a greater range of activities available, but these will be concentrated in a smaller number of locations, dependent amongst other factors on their accessibility. This suggests that areas which are hotspots for particular activities (e.g. surfing) will be the ones which flourish.

However, it should be noted that external factors, such as global climate change may also impact tourism. For example, climate change may affect the distribution and range of cetacean species and thus wildlife watching tourism in Scotland (Lambert et al, 2011). However as such tourism develops, it is important that proper guidelines and management are enforced, so that the growing trend in recreational activities involving the marine and coastal environment does not compromise or destroy the assets which attract so many visitors (Joint Marine Programme, 2004).

B13.3 Potential for Interaction

Table B13.2 shows potential interaction pathways between tourism activities and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B13.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Impacts to landscape or seascape	Wind arrays	Reduction in tourism income and investment	✓ - where Draft Plan Option areas are located within 10km (wind) or 5km (wave and tidal) of land.	**Wind**- For Draft Plan Option areas within 10km of the coast (or 13km in visually sensitive locations), the proportion of the region for which the arrays would be visible was estimated ('zone of influence'). Using published estimates of reductions in tourism expenditure arising indirectly from visual impacts of wind farms, the estimated loss of general tourism-related expenditure per region was calculated. Consideration has also been given to the potential for development to deter tourism investment based on consultation. See Section B13.4 for detailed methodology

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Impacts to landscape or seascape	Manufacturing and O&M facilities, onshore substations	Reduction in tourism income and investment	**X** – the location of manufacturing, O&M facilities or onshore substations is currently unknown. It is unlikely that major manufacturing facilities will be located outside of major urban centres, but some local O&M facilities are likely to be developed.	Economic assessment not possible. The potential for impact has been described qualitatively.
Disturbance from onshore/coastal infrastructure	Manufacturing and O&M facilities, onshore substations	Reduction in tourism income and investment	**X** - – the location of manufacturing, O&M facilities or onshore substations is currently unknown. It is unlikely that major manufacturing facilities will be located outside of major urban centres, but some local O&M facilities are likely to be developed.	Economic assessment not possible. The potential for impact has been described qualitatively.
Disturbance or injury to coastal or marine wildlife	All arrays, export cables	Reduction in income for ecotourism businesses	**X** - Although there is some uncertainty concerning actual environmental impacts, most of the species of interest to marine ecotourism such as cetaceans, seals and seabirds are protected under the EC Birds and Habitats Directives with a legal obligation to ensure that adverse effects on the integrity of designated sites are avoided. There are also wider provisions for the avoidance or minimisation of disturbance of protected species. Therefore, any potentially significant impacts to marine ecotourism species would be expected to be minimised through the application of mitigation measures as part of the licensing process. The consequential impacts to dependent ecotourism businesses are therefore considered to be negligible.	Economic assessment not required.
Disturbance or damage to heritage assets	All arrays, export cables	Reduction in visitor attraction income; reduction in wider tourism income	**X** - Heritage assets (both terrestrial and marine) may potentially be affected by offshore energy development within Draft Plan Option areas and associated cable routes. Significant direct impacts will be avoided through mitigation measures incorporated within licence conditions. Indirect impacts (such as the effect on the setting of heritage assets) are likely to be captured within the overall assessment of tourism impacts and therefore do not need to be assessed separately.	Economic assessment not required.
Creation of new visitor attraction	All arrays	Increase in tourism income	**X** - While there is some evidence that offshore energy developments can provide a visitor attraction, these benefits only tend to be realised when accompanied by investment in a visitor centre or local display boards. In the absence of information on the establishment of visitor centres, this benefit can only be described qualitatively.	Economic assessment not required.

B13.4 Scoping Methodology

B13.4.1 Impacts to Landscape or Seascape

Potential negative impacts on tourism may occur through visual effects on the landscape and seascape[22] deterring visitors to an area or deterring tourism investment.

Offshore Wind:
For the purpose of this assessment, this potential negative effect was considered to only be likely to occur for Draft Plan Option areas which were located within 13km of the coastline. Using this assumption:

- Draft Plan Option areas > 13km from the coast were scoped out of the assessment; and
- Draft Plan Option areas < 13km from the coast were considered to require a quantitative assessment.

The output of this scoping exercise is presented in Appendix C13.

Wave and Tidal:
The height of many wave and tidal devices above sea level (often less than 10m), makes them more analogous to fish farms, which tourists perceive as being of less impact visually than wind farms (Royal Haskoning, 2010; Riddington et al. 2008). Therefore, the effects of impacts to landscape and seascape on tourism would generally be expected to be less than for wind farms. There is no current evidence relating to the visual impacts of wave or tidal devices on tourism volume and value. As such, for the purposes of this assessment it was assumed that there would be no effect on visitor numbers or revenue.

B13.5 Assessment Methodology

The assessment methodology presented in this section takes account of the existing evidence relating to the impacts of wind farms on tourism. A brief overview of this evidence is given below.

Impacts on tourism from visual effects may arise due to a visitor's perceived reduction in the attractiveness of 'quality' of the landscape (i.e. the important feature attracting tourists) due to the presence of an offshore wind farm, which may potentially result in reduced prices for tourism services and/or reduced tourism performance (visitor volumes and value/expenditure).

B13.5.1 Potential Impacts on Visitors to an Area/Return Visits

[22] For the purposes of this study, the definition of 'seascape' has been taken from DTI (2005) in which it is stated that seascape is a term for: "*the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline" and describes "the effect of landscape at the confluence of sea and land.*"

Numerous studies have assessed the attitude and reactions of visitors to wind farms (mainly onshore) in the UK, Europe and reviews of these studies are provided by Riddington et al. (2008), The Tourism Company (2012) and Aitchison (2012). In general, studies show that the majority of visitors would not be deterred from visiting or returning to an area by the presence or expansion of onshore wind farms (75-99% would not be deterred, results from multiple studies cited in The Tourism Company, 2012 and Aitchison, 2012). The Tourism Company (2012) concluded that:

> *"where the studies have sought to draw conclusions they tend broadly to suggest that the overall impact of wind energy on tourism as a whole is not large but that there are issues of visual impact which affect some visitors and therefore care should be taken in future over the siting of wind turbines, particularly in sensitive and attractive landscapes".*

General observations from these studies included (The Tourism Company, 2012):

- Only a minority of tourists appear to be negative about wind turbines and believe that they spoil the landscape. However, this is a significant minority;
- In general, tourists prefer to see wind farms in the distance and preferably off-shore;
- Wind turbines are not seen as negatively as some other structures in the countryside, notably pylons; and
- Evidence is mixed on the proportion of tourists who may choose to stay away from areas with wind turbines in future. While this may be a relatively small minority it could be quite damaging to markets in certain locations.

There is less evidence relating specifically to the potential impacts of offshore wind farms on tourism. A study by Blades Lilley et al. (2010) in Delaware, USA showed that 74% of tourists reported they would visit the same beach if a wind farm existed 10km from shore, while 26% said they would switch beaches (i.e. avoid that beach) (it should be noted that the number of tourists who would visit the same beach if a wind farm existed 0.9 miles offshore was 55% and 45% stated they would switch beaches or not go to a Delaware beach at all). The level of 'avoidance' of an offshore wind farm 10km offshore was smaller than the percentage of tourists who would be attracted to a beach with offshore wind turbines (66%) and the proportion stating they would pay to take a boat tour of the wind farm (44%). Studies in Denmark have suggested that people who use the coastal zone more frequently (i.e. tourists or residents living close by) associate higher visual disamenities with offshore wind farms than people who have 'weaker' connections to coastal areas (Ladenburg, 2010). Hence, potential reductions in capital costs from locating OWFs closer to shore may be outweighed by reductions in visual amenity benefits in coastal areas with high recreational activity – in these areas the optimal location of OWFs may be further offshore compared to coastal areas with lower recreational activity (Ladenburg & Dubgaard, 2009; Ladenburg, 2010).

B13.5.2 Impacts on Tourism Performance

There is very little actual evidence relating to the impacts of wind farms on tourism performance (i.e. tourism volume and value). In Denmark, Kuehn (2003) found neither a decrease in the community's tourism levels nor any reduction in the price of summer house rentals one year following construction of the Horn Rev offshore wind farm (summarised in Blades Lilley et al. 2010). In the UK, a public attitude survey towards the operational North Hoyle OWF in North Wales reported that two thirds of residents (67%) stated the presence of the OWF had no effect on the number of people visiting or using the area, with people more likely to state there had been an increase rather than a decrease in numbers (11% stated increase compared with 4% who stated decrease). 82% of visitors did not see any effect on visitor numbers[23]. .From reviewing the literature The Tourism Company (2012) concluded that *"The negative effect on tourism performance where wind farms have already been established may not be as great as some people fear. However, far too little firm longitudinal evidence on this is available."*

Riddington et al (2008) estimated the impacts of onshore wind farm development on tourism expenditure in Scotland. The estimated potential reductions in general expenditure of tourists in four case study areas (Caithness and Sutherland; Stirling, Perth and Kinross; The Scottish Borders and Dumfries and Galloway) ranged from 1.3% to 1.72%. In the absence of a comparable study for offshore wind development, the findings from this onshore study have been used to estimate impacts on tourism expenditure associated with offshore wind farms, although it is recognised that the findings from onshore studies may not be perfectly transferable.

Overall, research from the UK has demonstrated that wind farms are very unlikely to have any adverse impact on tourist numbers (volume), tourist expenditure (value) or tourism experience (satisfaction) (Riddington et al., 2008; Aitchison, 2004). Moreover, to date, there is no evidence to demonstrate that any wind farm development in the UK or overseas has resulted in any adverse impact on tourism (Aitchison, 2012).

B13.5.3 Impacts on Tourism Investment

There is the potential for offshore wind farm development to adversely affect investment in new resort development in circumstances, where such development is promoted on the basis of a rural location and uncluttered seascapes, for example, golfing or water sports resorts. The Tourism Company (2012) stated that while few tourism enterprises are opposed to wind energy generation in principle, many have concerns about the future effect of wind turbines on their business. However, evidence relating to impacts from offshore wind farms specifically on visitors to coastal/links courses are unknown, as are the impacts on future golf course development in such areas.

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[23] Taken from summary provided on the Parliament UK Website: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmdius/216/216we96.htm

B13.5.4 Landscape/Seascape Impacts and Disturbance from Onshore O&M Facilities and Substations

The location of onshore operations and maintenance (O&M) facilities and onshore substations is not known. Potential impacts of such facilities have therefore been described qualitatively.

B13.5.5 Quantitative Assessment Methodology of Landscape/Seascape Impacts Arising from Offshore Wind Arrays

The methodology below uses regional tourism expenditure values in 2009 sourced from VisitScotand and reported in ABPmer and RPA (2012). These values have been adjusted for GDP to provide baseline regional tourism expenditure values for 2012. For the purposes of this assessment, it has been assumed that tourism levels will remain constant in real terms over the period assessed (i.e. there will be no growth in tourism volume and value).

The potential impact on tourism expenditure within each region between 2023 (estimated start date of cost impact due to array construction) and 2035 was then calculated as follows:

- The total tourism spend (£million) in 2009 within the most relevant VisitScotland regions(s) were identified within the SORERs scoped into the assessment;
- Within these regions, the Zone of Influence (ZOI; the zone within which landscape and visual impacts arising from the array may result in a reduction in visitor numbers and hence expenditure) was calculated by measuring the land area which fell within the buffer zone around each wind Draft Plan Option area.
- For the central scenario, the ZOI was calculated as the area of land which fell within a 10km buffer around each wind Draft Plan Option area;
- For the high scenario, the size of the buffer zone used to calculate the ZOI was determined by the Capacity Index of the coastline adjacent to the wind Draft Plan Option Area. The Capacity Index of a seascape indicates the ability of a seascape to absorb or accommodate development without a fundamental change in character. Where the adjacent coastline had a Capacity Index of 1-2 (a relatively high capacity to accommodate development without affecting character), the ZOI was calculated as the area of land which fell within a 10km buffer. Where the adjacent coastline had a Capacity Index of 3-5 (indicating a lower capacity to accommodate development), the ZOI was calculated as the area of land which fell within a 13km buffer. The increase in buffer distance in these instances was designed to increase the land area over which tourism impacts were calculated, to represent a greater landscape and visual impact;

- The proportion of the VisitScotland regional area within the ZOI was then calculated as:

  land area within the ZOI (km^2) / total land area within the VisitScotland region (km^2)

- The value of tourism expenditure within the ZOI was then calculated as:
- Total VisitScotland regional value (£millions) x proportion of VisitScotland area within the ZOI (%); and
- From the available evidence base, the ‘worst case’ (high) scenario reduction in tourism spending due to negative impacts was assumed to be 1.72% and the moderate scenario reduction was assumed to be 1.30% (both values based on Riddington et al. 2008). As a precautionary approach it was assumed that these reductions were not negated by any positive impacts. The estimated loss of general tourism-related expenditure was then calculated as:
- Value of tourism expenditure within the ZOI x 0.0172 (high scenario)
- Value of tourism expenditure within the ZOI x 0.013 (moderate scenario).

B14. Waste Disposal

B14.1 Overview

This sector includes the disposal of material, dredged from ports, harbours and marinas, into the marine environment. This type of waste disposal is only allowed where the material cannot be used beneficially, for example to replenish beaches or in construction projects. Figure B14 shows an overview of tourist activity in relation to Draft Plan Option areas. Information sources used in the assessment are listed in Table B14.1.

Table B14.1 Information Sources

Scale	Information Available	Date	Source
UK	Dredge disposal sites and volumes disposed of in the OSPAR Maritime Area	2009	OSPAR, (2009): http://www.ospar.org/documents/dbase/publications/p00433_JAMP%20Dumping%20Assessment.pdf
Scotland	Potential future port developments	2009	National Planning Framework for Scotland (Scottish Government, 2009b).
Scotland	Locations and tonnage at open disposal sites	2011	Baxter et al. (2011)

B14.2 Future Trends

The Scottish National Planning Framework 2 (Scottish Government, 2009b) identified future port developments, which may require dredging, including the development of ports and sites in the Inner Moray Firth. A strategy prepared by the Highland Council highlighted Cromarty Firth, which provides service base facilities and sheltered moorings for offshore Oil and Gas industry, and the potential of Nigg as a facility for decommissioning Oil and Gas installations and the manufacture and support services required by the renewable energy industry. In addition, the NRIP identified Nigg, Aberdeen, Ardersier, Peterhead and Wick as sites in this region which may support the offshore wind and/or wave and tidal industries. Infrastructure development at these sites may require dredging, for example, the NRIP identified potential dredging requirements to fulfil infrastructure requirements at Ardersier (dredging of sand would be required for the outer channel) and Aberdeen (widening of entrance channel to accommodate large vessels) (Scottish Enterprise and Scottish Highlands and Islands Enterprise, 2010b).

B14.3 Potential for Interaction

Table B14.2 shows potential interaction pathways between waste disposal and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B14.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Loss or reduced use of dredge material disposal sites	All arrays, export cables	Increased costs of disposal	✓	See Section B14.4
Access to dredged material disposal grounds	All arrays	Increased cost of disposal (vessel steaming times)	✓	See Section B14.4

B14.4 Scoping Methodology

B14.4.1 Loss or Reduced Use of Dredge Material Disposal Sites

Potential negative impacts on waste disposal may occur through the loss or reduced use of dredge material disposal sites causing increased disposal costs as a direct result of displacement by arrays. For the purposes of this assessment, this potential negative effect is only considered to be significant for Draft Plan Option areas in which arrays are likely to occupy more than 5% (Wind and Tidal) or 1% (Wave) of the Draft Plan Option areas. Using this assumption:

- Draft Plan Option areas which do not overlap with dredge disposal sites or Draft Plan Option areas which overlap with dredge disposal sites but where the arrays only occupy <5% of the Draft Plan Option areas were scoped out of the assessment.
- Draft Plan Option areas which overlap with dredge disposal sites and where the arrays occupy >5% of Draft Plan Option area were considered to require a more detailed assessment. Cable routes which traverse disposal sites were also scoped into the assessment.

The output of this scoping exercise is presented in Appendix C14.

B14.4.2 Access to Dredged Material Disposal Grounds

Potential negative impacts on waste disposal may also occur through arrays increasing the cost of disposal through the disruption of access to disposal sites (increasing fuel and staff costs). For the purposes of this assessment, this potential negative effect was considered only likely to occur where Draft Plan Option areas lie inshore of dredged material disposal sites. Using this assumption:

- Draft Plan Option areas which are offshore from dredge disposal sites were scoped out the assessment; and
- Draft Plan Option areas which lie directly inshore of disposal sites were considered to require a more detailed assessment.

The output of this scoping exercise is presented in Appendix C14.

B14.5 Assessment Methodology

B14.5.1 Loss or Reduced Use of Dredge Material Disposal Sites

Data on the amounts disposed at current disposal sites is available. However, no information is available on turnover or GVA associated with this activity. A quantitative estimate has therefore been derived that evaluates the additional steaming cost involved to use an alternative disposal site in response to the loss of reduced use of a nearby site. This quantitative assessment has been applied as a proxy for potential impact on GVA of nearby ports, harbours and marinas should a nearby disposal site be closed.

The additional steaming cost is derived from the additional distance travelled by vessels to get to an alternative disposal in relation to the fuel cost required to make the journey. The additional steaming distance is calculated as the difference in distance between the original theoretical route from the port to the disposal site and modified route to an alternative disposal site. The fuel cost is in turn based on an assumed fuel consumption rate, based on the typical average vessel fuel consumption per day of a dredging vessel.

Using the additional steaming distance and fuel price, the costs associated with the deviation and additional steaming distance was calculated where the additional cost of steaming time was calculated as:

> Current route (distance in nautical miles) compared to additional steaming distance (nautical miles) x fuel costs per nautical mile. The calculation uses an assumed average vessel speed to arrive at fuel consumption per vessel movement. To then infer the annual cost, the journey fuel consumption was multiplied by the anticipated number of transits in one year.

Currently there is still uncertainty surrounding the routes which cables will be laid. This makes any assessment of economic impacts difficult. However, given that disposal sites generally only cover small areas, a large degree of overlap occurring between a cable route and aquaculture site is unlikely. In addition, it is assumed that cable routes will generally be able to be modified slightly to avoid disposal sites. Loss or reduced use of dredge material disposal sites due to cable routes has therefore not been assessed in more detail as part of this study.

B14.5.2 Access to Dredged Material Disposal Grounds

For sites which lie directly inshore of disposal sites an estimation of the additional steaming cost associated with the vessel deviation has also been completed. The assessment follows the same methodology described for the loss or reduced use of dredge material disposal sites impact described above.

The results of the above assessment are presented in Appendix C14.

B15. Water Sports (Sea Angling, Surfing and Windsurfing, Sea Kayaking, Scuba Diving and Small Boat Activities)

B15.1 Overview

Water sports are recreational activities undertaken on or immersed in a body of water. The main marine water sports undertaken in Scotland are recreational angling, surfing, windsurfing, sea kayaking, scuba diving and small sail boat activities (such as dinghy sailing) (BMF et al., 2009; Baxter et al*.,* 2011). Small sail boat activity is defined as dinghies, day boat or other small keelboats, usually taken out of water at the end of use. Recreational boating activity in larger vessels such as yachts is covered in Section B11. General tourism is described in Section B13 of this report as the interactions and issues in relation to marine renewable developments are often distinctly different. Figure B15 shows an overview of tourist activity in relation to Draft Plan Option areas. Information sources used in the assessment are listed in Table B15.1.

Table B15.1 Information Sources

Scale	Information Available	Date	Source
Scotland	Number of sea anglers	2006-2007	Radford et al (2009)
Scotland	Economic impact of sea angling (by region)	No date	Radford et al (2009)
Scotland	Angler days by resident, by origin, by type (short, boat, charter)	No date	
Scotland	Expenditure	No date	
Scotland	Trends (days fished, competitiveness of region)	No date	
Scotland	Output of DREAM® model gives multipliers (associated with angling)	No date	
Scotland	Estimated regional sea angling activity and expenditure (also for Scotland)	No date	Baxter et al (2011)
Scotland	Origin and destination of overnight fishing trips to Scotland	2006-2007	Radford et al (2009)
Highlands and Islands	Statistics on water sports	No date	George Street Research & Jones Economics (2004)
UK/Scotland	Snorkling and Diving Locations (not spatial		www.snorkeling.co.uk and www.ukdiving.co.uk
UK/Scotland	Kitesurfing and Windsurfing locations (user-updated)		www.thewindmap.com
UK	Indicative location of coastal watersports centres	2010	Defra/CP2
Scotland	Surfing and diving locations	2011	Scotland's Marine Atlas Ch5
UK	Surfing locations		SAS (2009) and the 'Stormrider Guides' (www.lowpressure.co.uk)
UK	Indicative location of coastal diving areas (Recreational and otherwise)		CP2 / Magic Seaweed
UK	Statistics on water sports participation levels	2010	BMF (2011a)
UK	Location of scuba diving sites		Dive Site Directory www.divesitedirectory.co.uk/uk
UK	Location of windsurf sites		Windsurf Magazine www.windsurf.co.uk/beach-guide

B15.2 Future Trends

The leisure and recreation sector has experienced large growth in a number of diverse areas over the past decade. The growth and stability of the water sports sector in Scotland is heavily dependent on the general health of the UK economy. A strong economy means that consumers have more disposable income and are more inclined to spend money on this sector than when the economy is weaker. The recent UK economic downturn may lead to a reduction in such activities but in the long-term the sector is expected to continue to grow.

There is little information on future levels of recreational angling activity. Levels of activity are likely to vary in response to trends in the overall economy, changes in fish stocks as a result of improved fisheries management and changes in fish distributions in response to climate change. The nature and direction of these changes remains unclear.

B15.3 Potential for Interaction

Table B15.2 shows potential interaction pathways between water sport activities and wind, wave and/or tidal arrays.

Explanation of column content:

Column 1: Describes the potential interaction between the activity and any renewable technology;
Column 2: Identifies the types of offshore renewable development (wind, wave or tidal) for which the interaction may arise;
Column 3: Identifies the potential socio-economic consequence associated with the interaction identified in Column 1;
Column 4: Indicates whether detailed assessment will or will not be required if activity is scoped in;
Column 5: Identifies how the socio-economic impact will be assessed.

Table B15.2 Potential for Interaction

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
Impacts to seascape / setting	All arrays	Reduction in activity levels leading to loss of revenue for water sport business	✓	See Section B15.4
Spatial overlap between Draft Plan Option areas and water sport activity	All arrays	Reduction in activity levels leading to loss of revenue for water sport business	✓	
Spatial overlap between cable routes and water sports activity	All arrays	Reduction in activity levels leading to loss of revenue for water sport business	✓	
Impacts to wave quality (surfing)	All arrays	Reduction in surfing activity leading to loss of revenue for water sport business	**X** - Evidence from existing offshore renewables developments indicates that there have been negligible or only very minor significant changes in wave quality at the shoreline as a result of developments (RPS, 2005; Halcrow, 2006; ASR Ltd, 2007; PMSS, 2007; Seascape Energy Ltd 2002; ABPmer, 2003 and CEFAS, 2005). However, to date research and EIA studies have concerned the impacts of offshore renewable energy developments that are considerably smaller in scale than proposed future developments. SAS (2009) highlighted concerns that the increased scale associated with future offshore renewable energy development has the potential to impact on surfing resources and recreation. Following consultation it was highlighted that this remains a key issue for both the SAS and Scottish Waveriders Association.	See Section B15.4

1	2	3	4	5
Potential Interaction	**Technology Relevance (Wind, Wave, Tidal)**	**Potential Socio-economic Consequence**	**Scoped in (✓) or Out (X) of Assessment**	**How the Economic Impact Will be Assessed**
			While it remains unlikely that many future developments will significantly affect wave quality, given the current uncertainty, applying broad assumptions and criteria at a Sectoral level is likely to provide inaccurate results. Instead it is recommended that the economic consequences of impacts to wave quality are discussed at project-level. This should be based on the output of wave modelling studies and in consultation with relevant stakeholders as part of the EIA scoping and consultation process. The issue will therefore not be assessed in more detail as part of this study.	

B15.4 Scoping Methodology

B15.4.1 Impacts to Seascape / Setting

Potential negative impacts on water sports may occur through visual effects on the landscape and seascape[24] deterring visitors to an area or deterring water sports related expenditure and investment. The importance of seascape for participants and the priority this has over other factors which contribute to the attraction of a water sport site is likely to vary between different activities and individuals. This is because the user experience is to some extent subjective making potential economic consequences of visual impacts to water sports participants difficult to assess.

For the purpose of this assessment, this potential negative effect for Offshore Wind Array Draft Plan Option areas was considered to only be likely to occur for Draft Plan Option areas which were located within 10km of a water sports site and these are in line with the assessments carried out for tourism (see B13).. Using this assumption:

- Wind Draft Plan Option areas > 10km from a water sports site were scoped out of the assessment; and
- Wind Draft Plan Option areas < 10km from a water sports site were considered to require a quantitative impact assessment.

The height of many wave and tidal devices above sea level (often less than 10m), makes them more analogous to fish farms, which tourists perceive as being of less impact visually than wind farms (Riddington et al. 2008). Therefore, the effects of impacts to landscape and seascape on water sports would generally be expected to

[24] For the purposes of this study, the definition of 'seascape' has been taken from DTI (2005) in which it is stated that seascape is a term for: "*the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline" and describes "the effect of landscape at the confluence of sea and land.*

be less than for wind farms. Therefore, a potential negative effect was considered only to be likely for devices located within 5km of a seascape unit with a capacity score of 4 or more[25] based on Scott et al (2005). Using this assumption:

- Wave and Tidal Draft Plan Option areas > 5km from a water sports site located in a seascape unit with a capacity score of 4 or more were scoped out of the assessment;
- Wave and Tidal Draft Plan Option areas < 5km from a water sports site located in a seascape unit with a capacity score of 4 or more were considered to require a quantitative impact assessment.

The spatial data used to identify popular water sports activity sites can be seen in Table B15.3.

Table B15.3 Data Used to Identify Water Sports Sites

Activity	Data
Surfing and Windsurfing	Surfing and windsurfing sites highlighted in the baseline report (ABPmer, 2012) including those listed in SAS (2009); 'Stormrider Guide', 2010 (http://www.lowpressure.co.uk) and the Windsurf Magazine 'Beach Guide', 2011 (http://www.windsurf.co.uk/beachguide).
Sea Kayaking	Sea kayaking sites are defined as those listed in the top ten most popular kayaking locations based on a 2011 questionnaire survey undertaken by Canoe Scotland. A buffer extending offshore to 3km has been used around these (see Table15.2 for rationale).
Scuba diving	Visual impacts assumed to be negligible given that the focus of the activity is underwater--no assessment required.
Small sail boat activities	RYA racing and sailing areas and sailing clubs (which support small sail boat activity highlighted in the baseline report (ABPmer, 2012).
Sea angling	Visual impacts assumed to be negligible-no assessment required

The output of this scoping exercise is presented in Appendix C15.

B15.4.2 Spatial Overlap Between Draft Plan Option Areas and Water Sport Activity

Potential negative impacts on water sports may also occur through direct overlap between a Draft Plan Option area and water sport site causing displacement or obstruction of water sports activity and a potential collision risk for humans or vessels. This could cause a reduction in activity levels leading to loss of revenue for water sport business. The scoping criteria which had been used are different for each water sports activity. A summary can be seen in Table B15.4.

25 Seascape capacity was evaluated by assessing character sensitivity, visual sensitivity and seascape value of seascape units around the Scottish coast. Calculated seascape values ranged from 1 (lowest score) to 5 (highest score) and relates to how much a seascape can absorb or accommodate development without fundamental change in character (Scott et al, 2005).

Table B15.4 Criteria Used to Identify Overlap Between Draft Plan Option Areas and Water Sport Activity

Activity	Criteria
Surfing and Windsurfing	Activities are undertaken close to beaches and so no direct overlap with Draft Plan Option areas expected to occur-**no assessment required.**
Sea kayaking	The majority of sea kayaking is undertaken close inshore, exploring interesting aspects of the coast such as sea caves, inlets and wildlife. Safety issues and a lack of interesting features in general prevent kayaking further offshore. However, open crossings (between two points such as a headland and an offshore island), often through strong tidal currents are regularly undertaken by more experienced sea kayakers. Unlike other water sports activities which are often undertaken in relatively discrete areas (such as a surf spot or diving site), sea kayaking has the potential to be undertaken along much of the Scottish coast and is only constrained by the availability of suitable launching spots such as beaches or slipways. The assumption has therefore been made that kayaking could be undertaken along any stretch of Scottish coastline offshore to 3km. This area has been extended offshore if it is possible to undertake an open sea crossing between two parts of land less than 12km apart (such as the mainland and a nearby headland/island or one island to the next). Using this assumption: ▪ Draft Plan Option areas > 3km off the coastline (or 12km in areas where an open crossing is possible) were scoped out of the assessment ▪ Draft Plan Option areas < 3km off the coastline (or 12km in areas where an open crossing is possible) were considered to require a quantitative impact assessment
Small sail boat activities	Most small sail boat activity is expected to occur within RYA racing or sailing areas or in the vicinity of sailing clubs. Using this assumption: ▪ Draft Plan Option areas which do not overlap with small sail boat locations26 were scoped out of the assessment ▪ Draft Plan Option areas which overlap with small sail boat locations were considered to require a quantitative impact assessment
Scuba diving	Scuba diving is generally undertaken at discrete diving sites such as wrecks or areas with interesting features such as rich marine life or seascapes. Based on the direct overlap with dive sites identified in the baseline: ▪ Draft Plan Option areas which do not overlap with dive sites were scoped out of the assessment ▪ Draft Plan Option areas which overlap with dive sites were considered to require a quantitative impact assessment
Sea angling	The majority of sea angling is undertaken within 6nm of the coast[27]. For those SORER regions with Draft Plan Option areas proposed within 6nm of the coast, the total combined area of development (for Wind, Wave and Tidal Sectors) which falls within 6nm was measured and calculated as a percentage of the total area of coastal water within 6nm (or 11km) for the appropriate SORER region. The total combined area of development was based on the proportion of each Draft Plan Option areas area likely to be occupied under the High Case, Central Case and Low case development scenarios for each sector (26.5% Wind, 1% Wave and 5.1% Tidal). The assumption has been made that if the total area of development represents less than 1% of region, the interaction is assumed not significant and can be scoped out. Based on this assumption: ▪ Total combined area of development representing <1% of a region were scoped out of the assessment ▪ Total combined area of development representing >1% of a region were considered to require a quantitative impact assessment

B15.4.3 Spatial Overlap Between Cable Routes and Water Sports Activity

In addition, cable routes have the potential to overlap with some water sport activity sites which could also potentially cause some displacement during construction. The scoping criteria which had been used for each water sports activity is summarised in Table B15.5.

26 Small sail boat locations were based on RYA racing and sailing areas or sailing clubs which support small sail boat (dingy) activities as identified in the baseline report.

27 Based on SSACN observation that the great majority of recreational angling occurs within 6nm of the coast.

Table B15.5 Criteria Used to Identify Overlap Between Cable Routes and Water Sport Activity

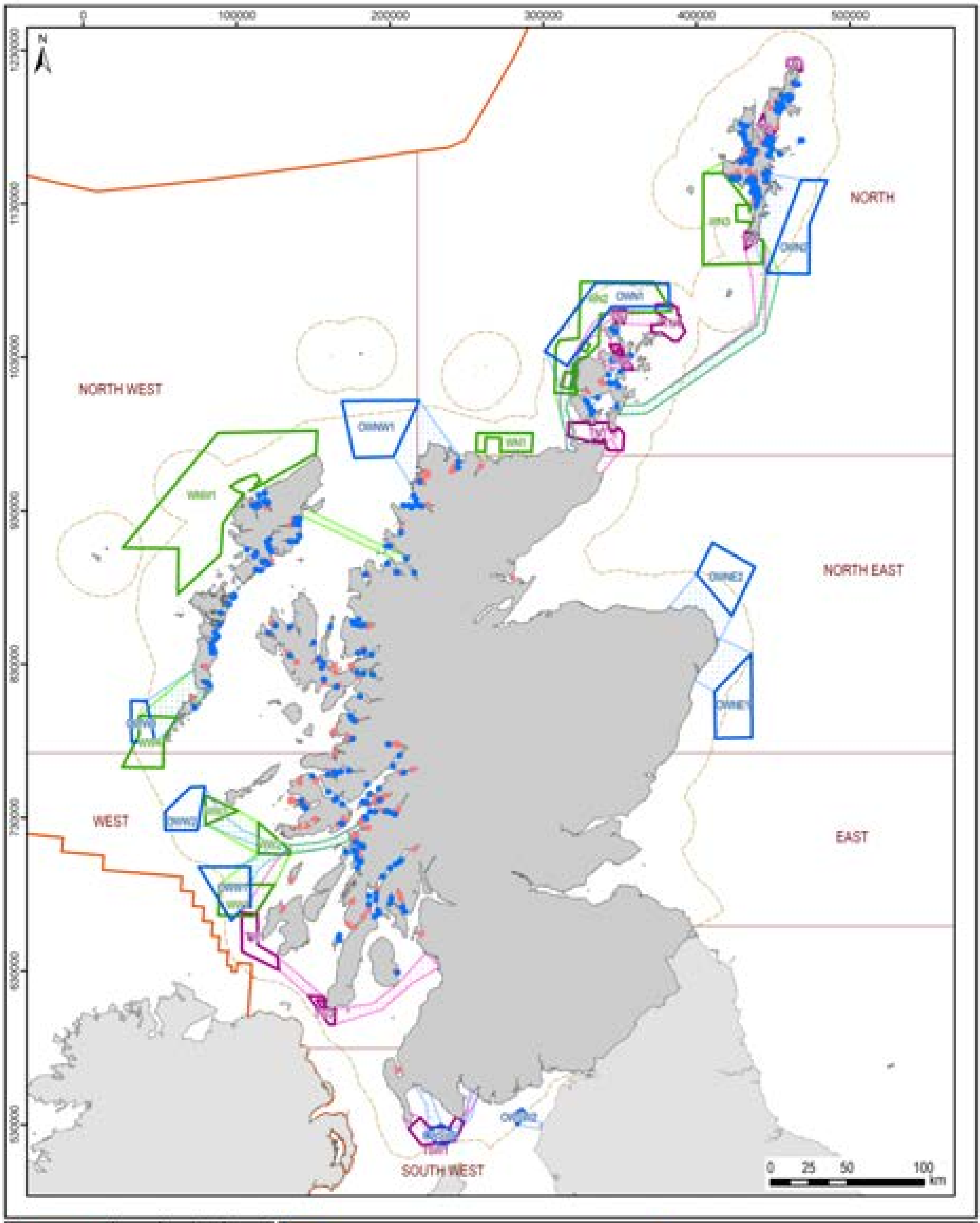
Activity	Criteria
Surfing and Windsurfing	SAS have suggested that any restriction in access that may be implemented for any duration throughout the installation period of the cable at the cable landfall site could impact surfers using beaches. They have also raised concerns that any alteration of the seabed due to sediment transportation at a cable landfall site could have the potential to alter the wave regime. Based on this information: • Draft Plan Option areas cable routes which do not overlap with surf sites were scoped out of the assessment • Draft Plan Option areas cable routes which overlap with surf sites were considered to require a quantitative impact assessment.
Sea kayaking	Sea kayakers would be expected to be able to navigate safely around any restriction to access at a cable landfall site during installation with any temporary restriction not expected to extend far offshore.
Small sail boat activities	Small sail boats would be expected to be able to navigate safely around any restriction to access at a cable landfall site during installation with any temporary restriction not expected to extend far offshore.
Scuba diving	Scuba diving is generally undertaken at discrete diving sites such as wrecks or areas with interesting features such as rich marine life or seascapes. Based on the direct overlap with dive sites identified in the baseline: • Draft Plan Option areas cable routes which do not overlap with dive sites were scoped out of the assessment • Draft Plan Option areas cable routes which overlap with dive sites were considered to require a quantitative impact assessment
Sea angling	Concerns have been raised relating to the impact of EMF (electromagnetic fields) arising from cables on elasmobranch species, and in-particular, whether EMF may alter the foraging behaviour and migration patterns of elasmobranch species and the subsequent impact on sea angling activity and economic input into local economies. There is still some uncertainty concerning actual environmental impacts of EMF (Gills and Bartlett, 2010; Normandeau et al. *2011*). Strategic Environmental Assessment (SEA) that will be prepared to accompany future sectoral plans for offshore wind, wave and tidal energy will help provide the necessary environmental information to inform an assessment of potential socio-economic impacts, should this be required. In addition, developers have a legal obligation under various environmental legislation to ensure that adverse effects on species are avoided or minimised. The issue will therefore not be assessed in more detail as part of this study but should be considered as part of the EIA process for specific developments.

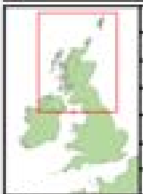
B15.5 Assessment Methodology

The impact to boat-based sea angling has been assessed quantitatively where the combined area of offshore wind, wave or tidal Draft Plan Option Areas estimated to be populated by arrays exceeded 1% of the total area within 6nm of the coast for a given SORER. The impact was assessed as a reduction in expenditure by boast based sea anglers (loss of income to the supply chain e.g. potential reduced spend in tackle shops, charter boat hire and expenditure by private boat owners (e.g. fuel purchase)). The total reduction in expenditure/loss of income was estimated by multiplying the percentage potential loss of area by the estimated value of boat-based sea angling in the relevant SORER (derived from Radford et al, 2009). Estimates of impacts for individual technologies (offshore wind, wave and tidal energy) were then calculated based on the relative size of area occupied by respective arrays under each scenario. The assessment has assumed constant prices in real terms based on 2012.

For the other water sports considered, economic data in Scotland is limited and a qualitative assessment has been undertaken for sites scoped into the assessment based on available data. This might include data on visitor numbers, economic values of competitions held in the area and the extent that the site helps support associated local business such as water sports shops or hotels (through visitor expenditure). Where possible the assessments have also taken into account the importance of the site based on other more intrinsic values (e.g. a surfing spot can have a ‘world class’ reputation due to the quality of the waves but is rarely surfed by many people owing to its remoteness). Water sports can also provide important health and social benefits and so any available information which highlights these factors has been reviewed (Depledge and Bird, 2009).

Appendix B. Figures



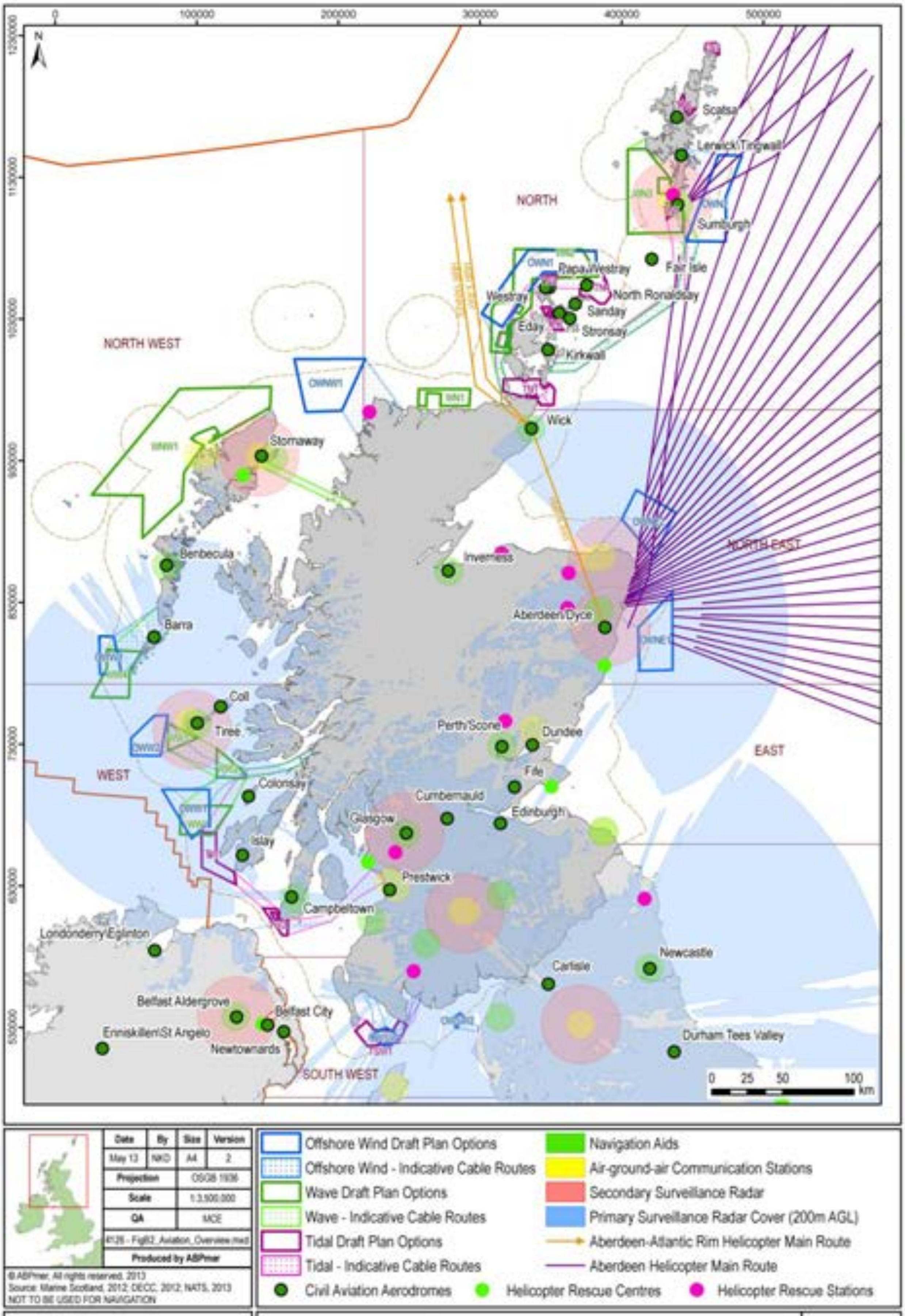


Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MOE	
4126 - FigB1_Aquaculture.mxd			
Produced by ABPmer			

Source: Marine Scotland, 2012
NOT TO BE USED FOR NAVIGATION

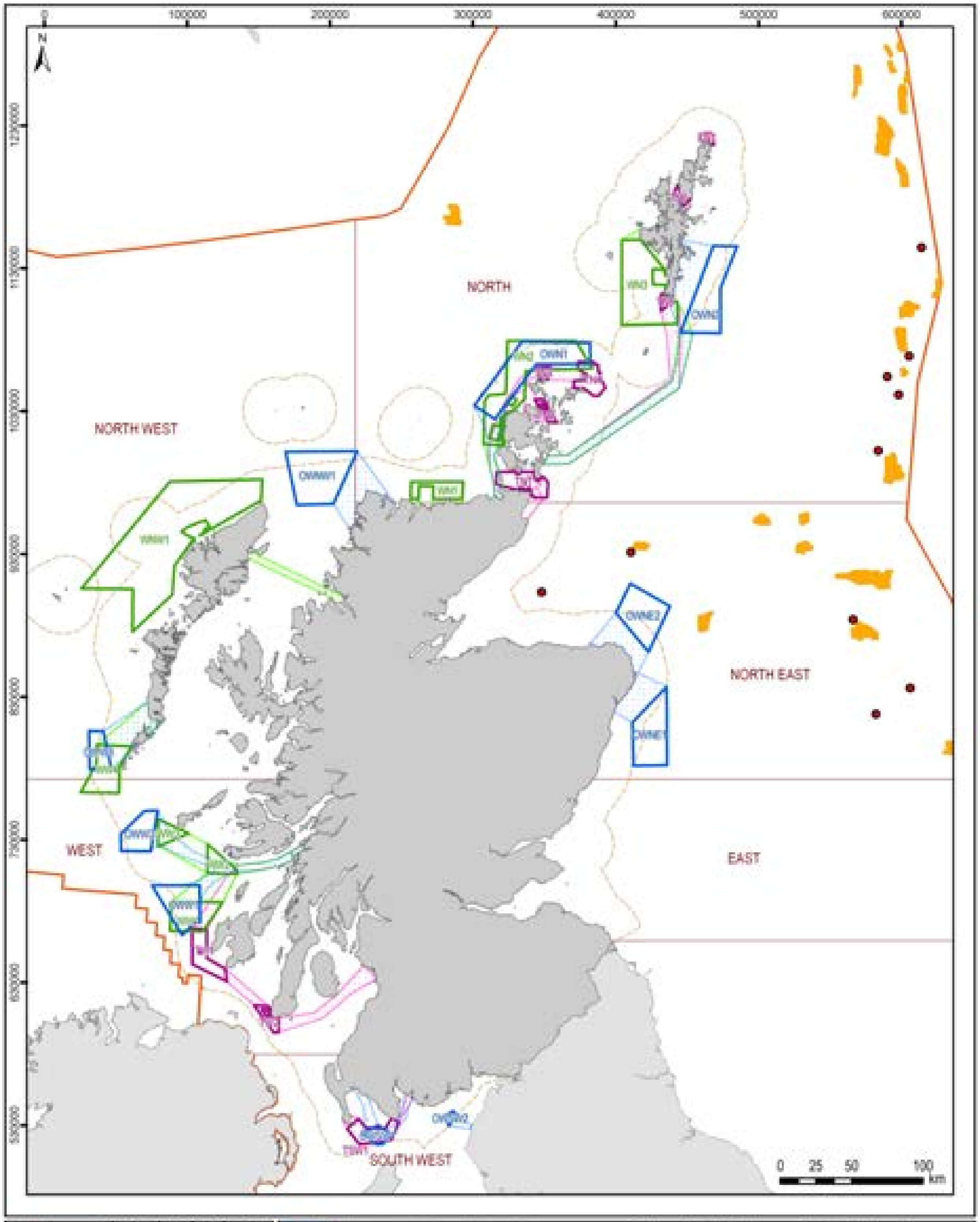
- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- Finfish Locations
- Shellfish Locations
- SORER Regions
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

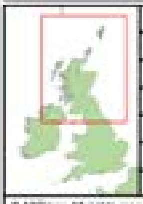
Aquaculture Overview | **Figure B1**



Draft Plan Options for Offshore Wind, Wave and Tidal Development with Aviation Information

Figure B2





Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,750,000	
QA		MOE	
4126 - FigB3_CCS.mxd			
Produced by ABPmer			

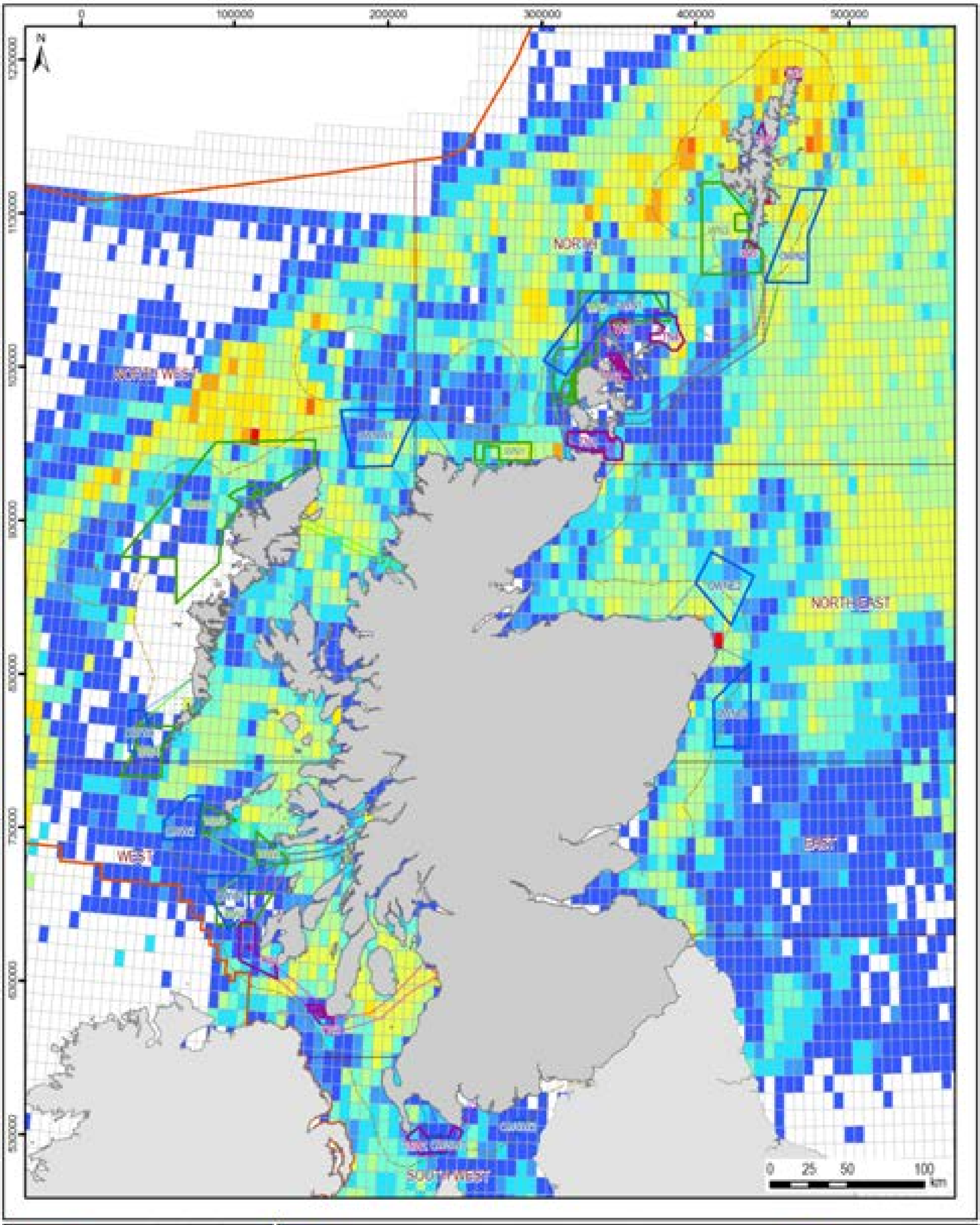
Source: Marine Scotland, 2012, Scottish Government, 2009
NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes

Carbon Dioxide Storage (Potential Areas)
- Hydrocarbon Fields
- Saline Aquifers
- SORER Regions
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

Carbon Capture and Storage Overview

Figure B3



Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB4.1_Fish_VMS.mxd			
Produced by ABPmer			

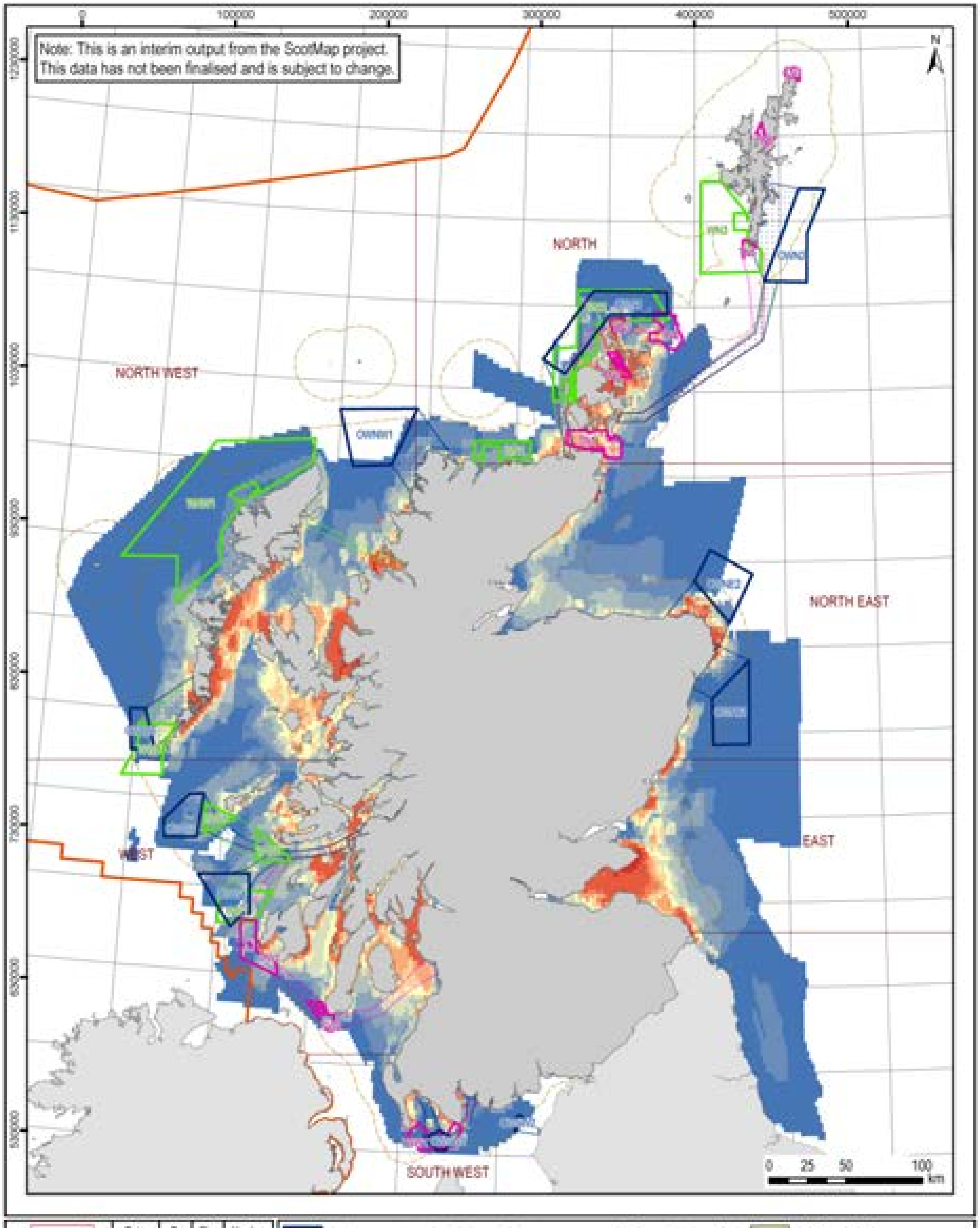
Source: Marine Scotland, 2012, 2013
NOT TO BE USED FOR NAVIGATION

Offshore Wind Draft Plan Options
Offshore Wind - Indicative Cable Routes
Wave Draft Plan Options
Wave - Indicative Cable Routes
Tidal Draft Plan Options
Tidal - Indicative Cable Routes
SORER Regions

Average Value - All Gears (2007-11)
No Value
£1 - £5,000
£5,001 - £10,000
£10,001 - £25,000
£25,001 - £50,000
£50,001 - £100,000
£100,001 - £250,000
£250,001 - £500,000
£500,001 - £750,000
£750,001 - £1,000,000
£1,000,001 - £2,884,580

Average Annual Value of Landings Based on Fishing Effort (VMS) For Over-15m Vessels For All Gear Types (2007–2011)

Figure B4.1



Date	By	Size	Version
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Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB4.2_Fish_nonVMS.mxd			
Produced by ABPmer			

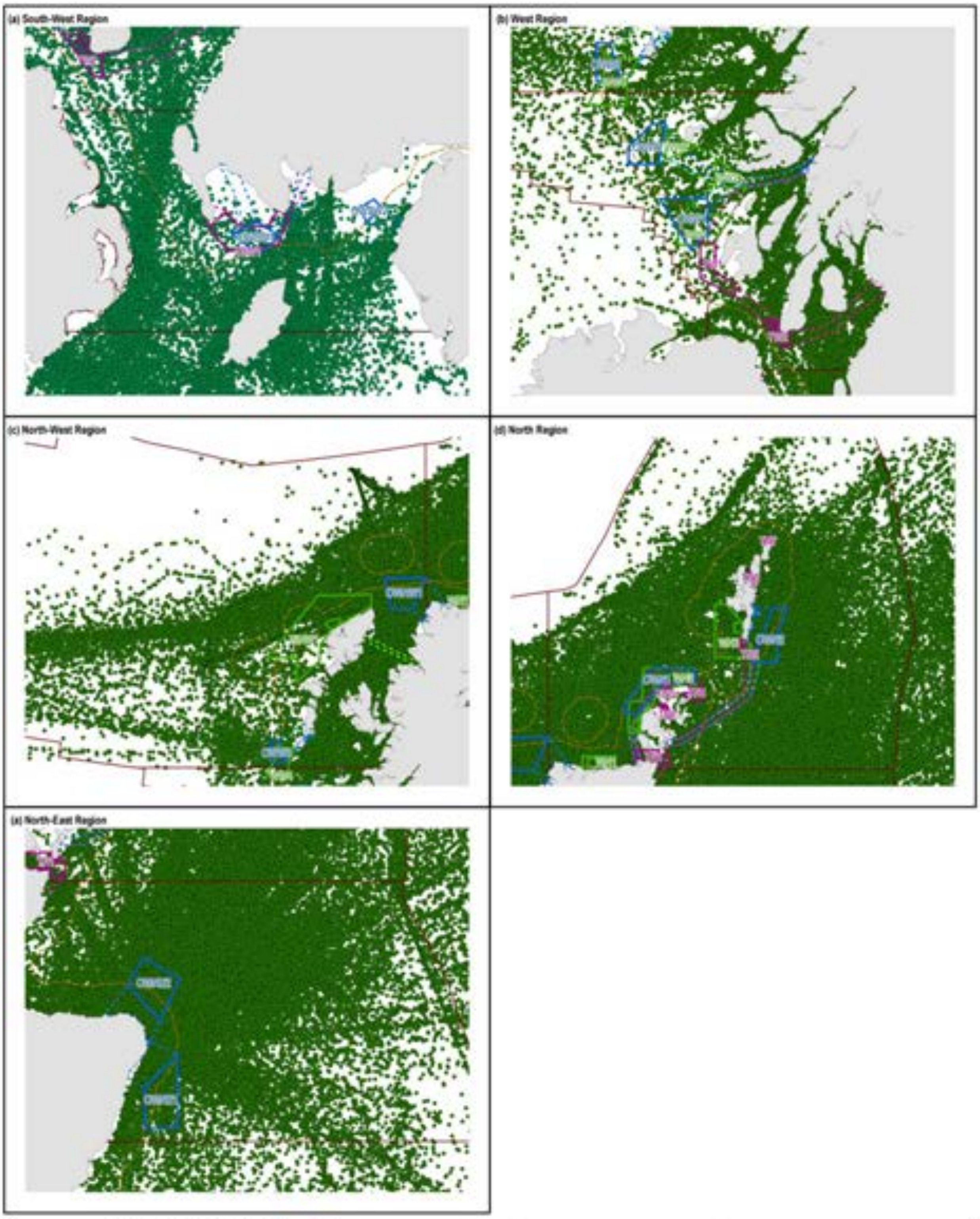
Source: Marine Scotland, 2012, 2013
NOT TO BE USED FOR NAVIGATION

Offshore Wind Draft Plan Options
Offshore Wind - Indicative Cable Routes
Wave Draft Plan Options
Wave - Indicative Cable Routes
Tidal Draft Plan Options
Tidal - Indicative Cable Routes
ICES Rectangles

All Gears Value (£'s)
1 - 500
501 - 1,000
1,001 - 2,000
2,001 - 3,000
3,001 - 4,000
4,001 - 5,000
5,001 - 6,000
6,001 - 8,000
8,001 - 10,000
10,001 - 25,000
> 25,000

Average Annual Earnings for Under-15m Vessels For All Gear Types (2007–2011)

Figure B4.2



Date	By	Size	Version
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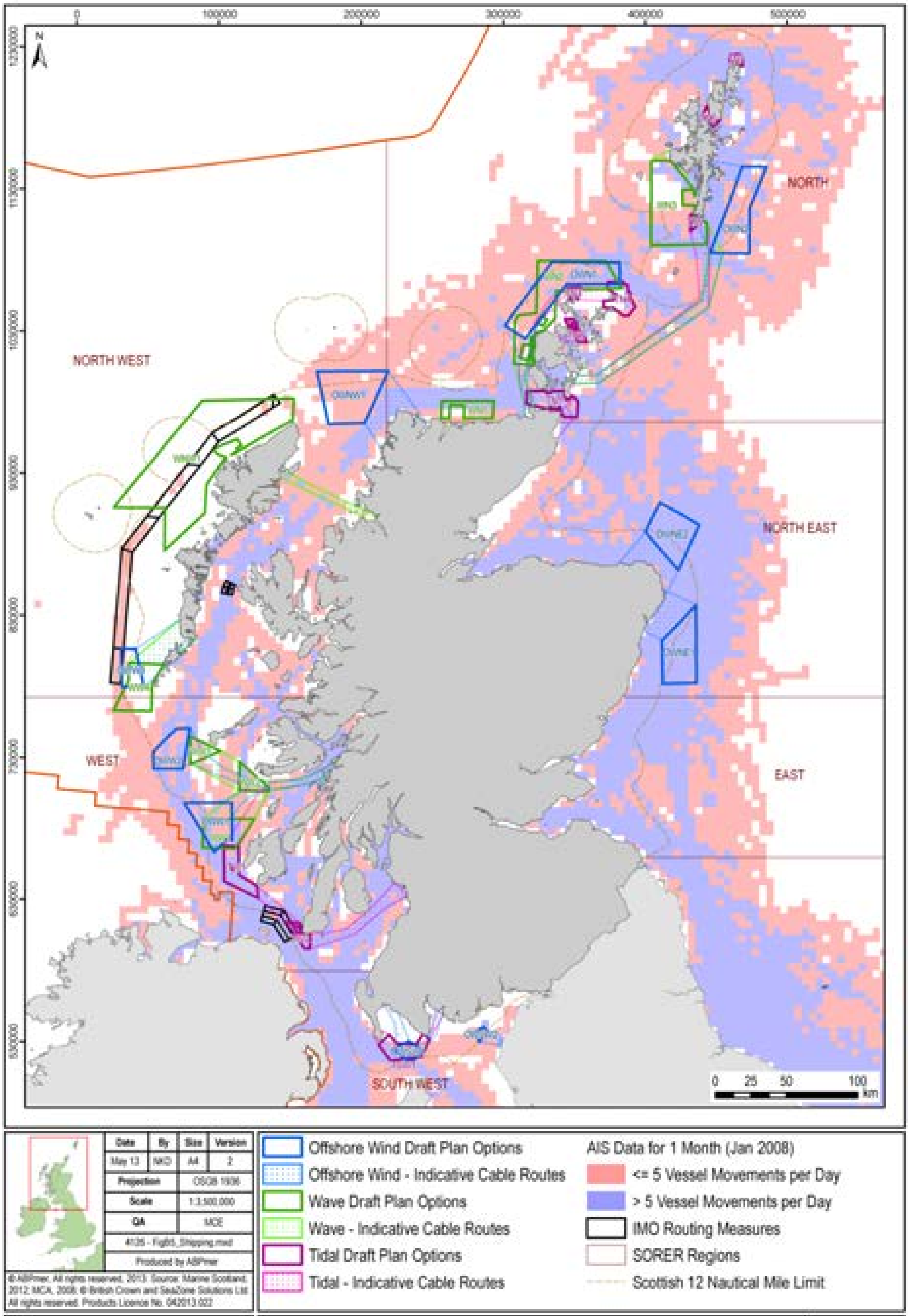
Projection		OSGB 1936	
Scale		Various	
QA		NKD	
4126 - FigB4.3_Fish_Steaming.mxd			
Produced by ABPmer			

Source: Marine Scotland, 2012, 2013
NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- VMS Steaming Pings
- SORER Regions
- Scottish 12 Nautical Mile Limit

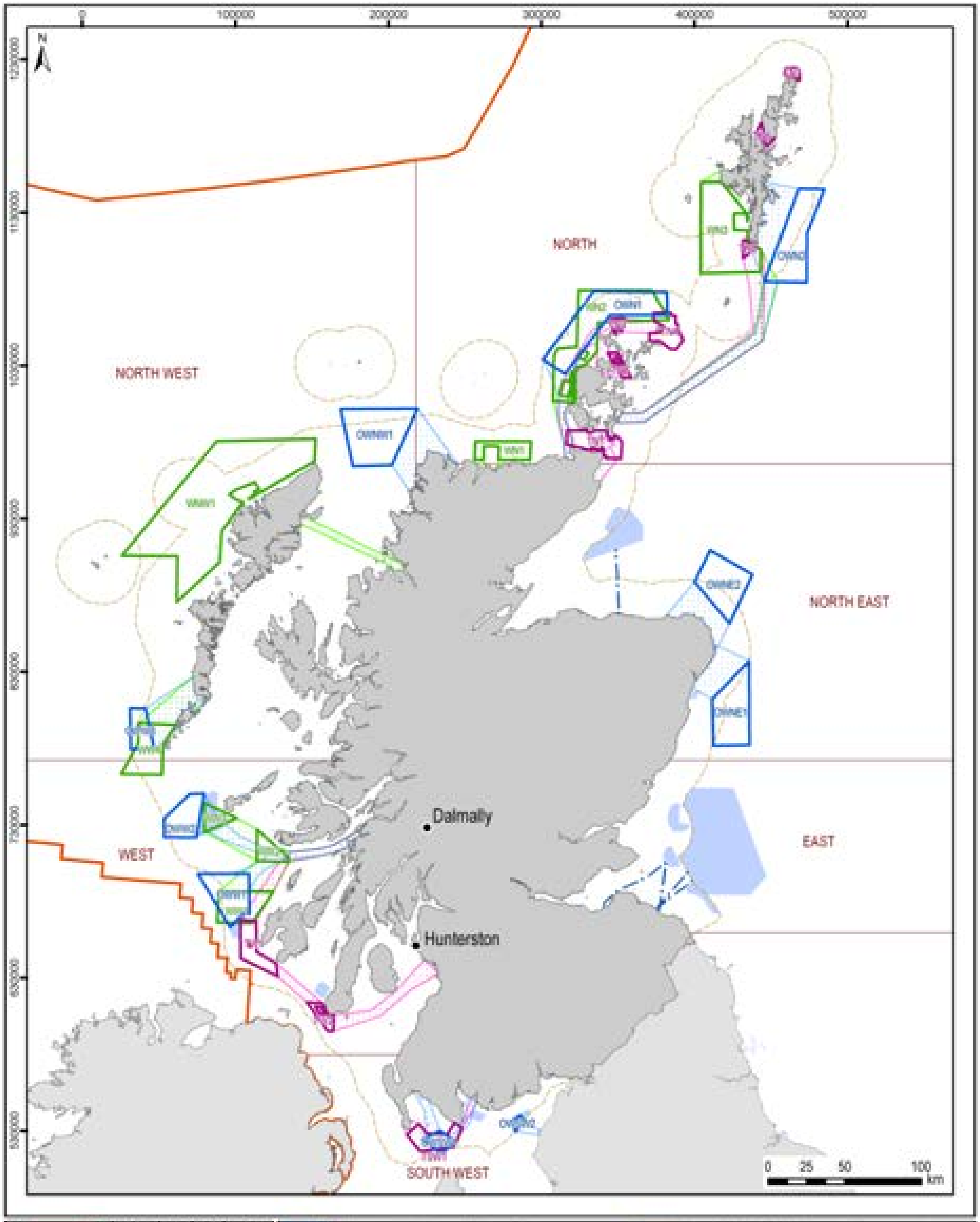
VMS 'Steaming' Pings Showing Main Fishing Navigation Routes in (a) South West Region; (b) West Region; (c) North West Region; (d) North Region; (e) North East Region

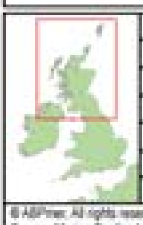
Figure B4.3



Commercial Shipping Overview

Figure B5





Date	By	Size	Version
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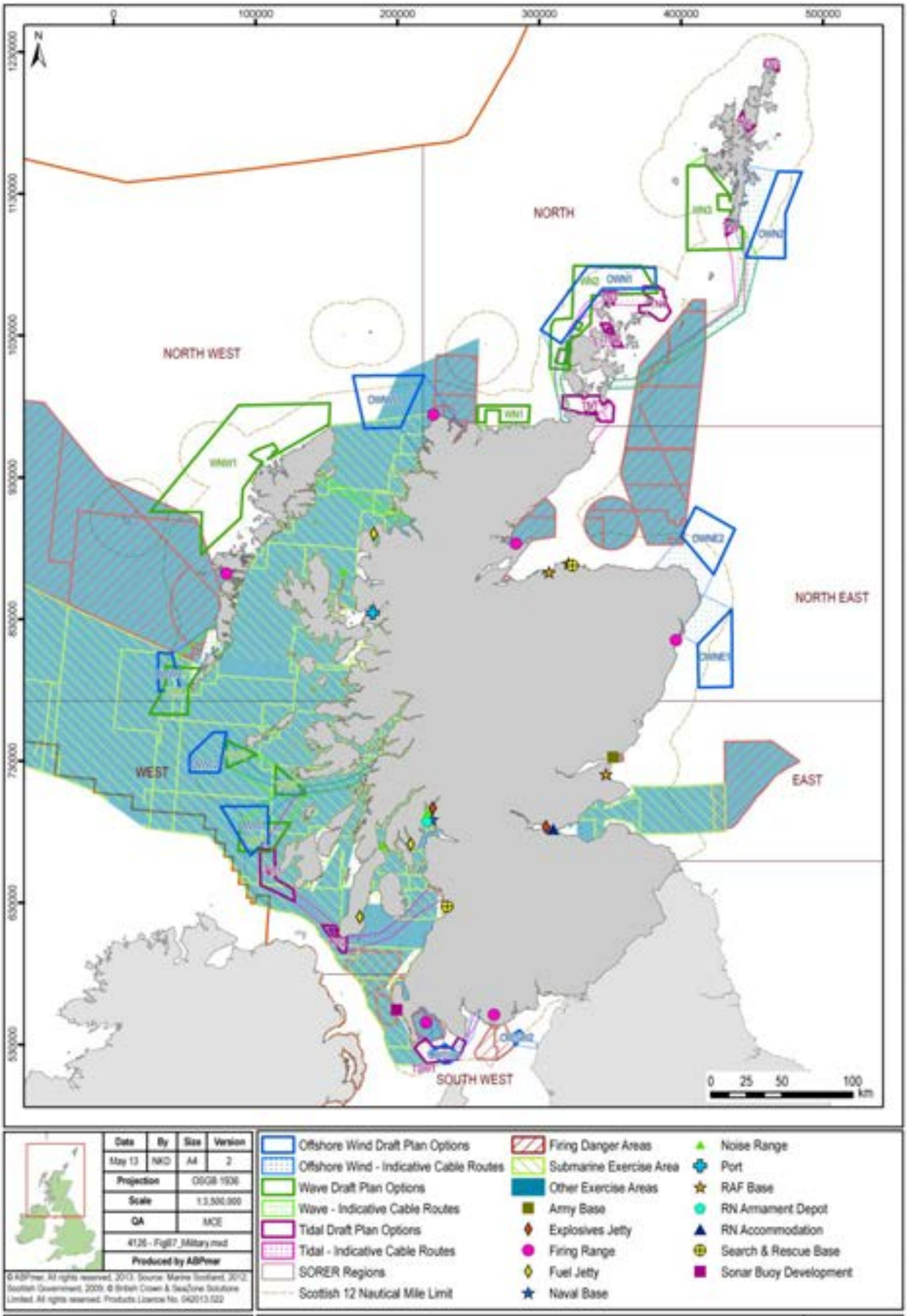
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB6_Energy_Gen.mxd			
Produced by ABPmer			

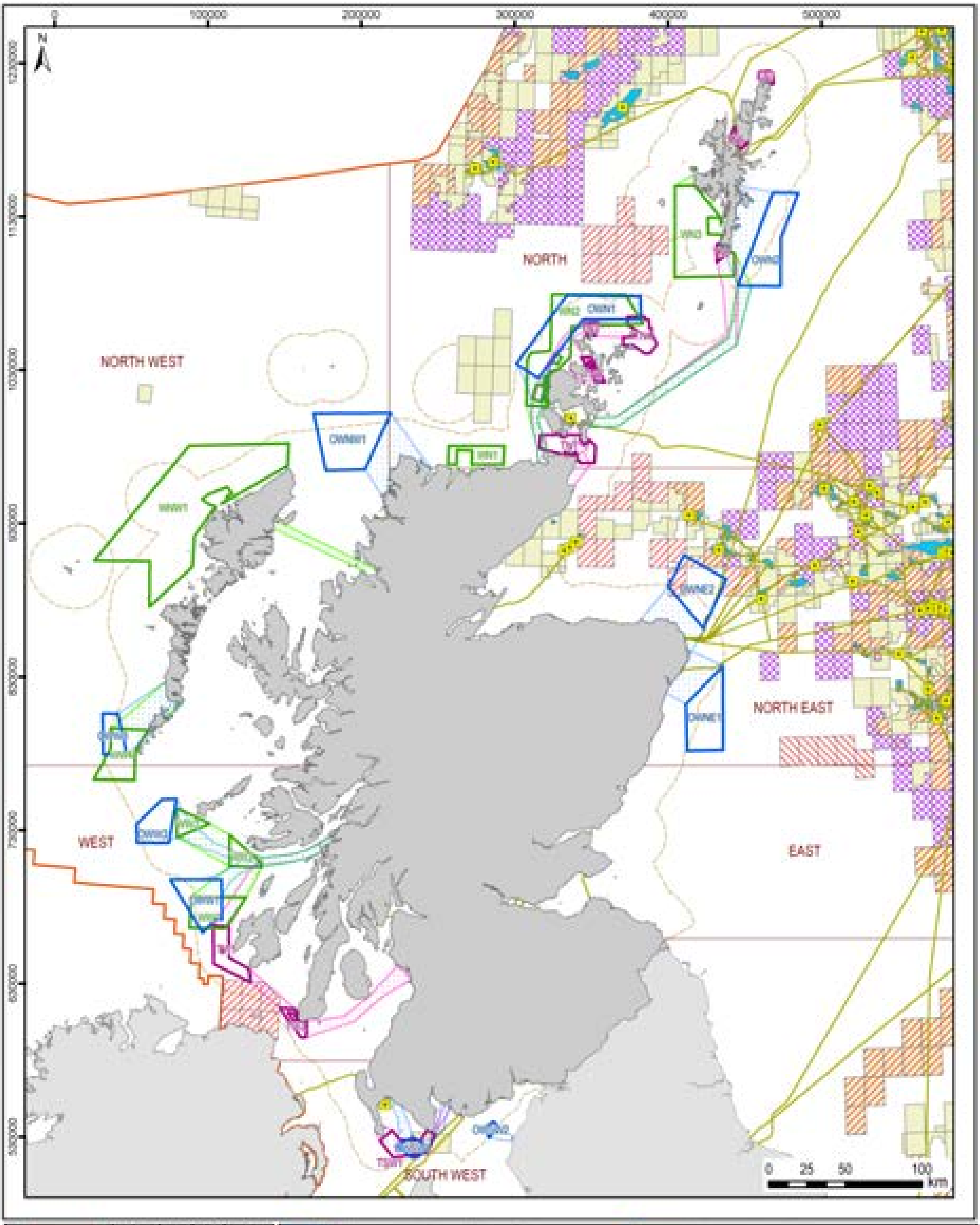
- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- R1, R2 & R3 Offshore Wind Lease Areas
- R1 & R2 Export Cable Routes
- SORER Regions
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

Energy Generation Overview

Figure B6



Military Interests Overview | **Figure B7**



Date	By	Size	Version
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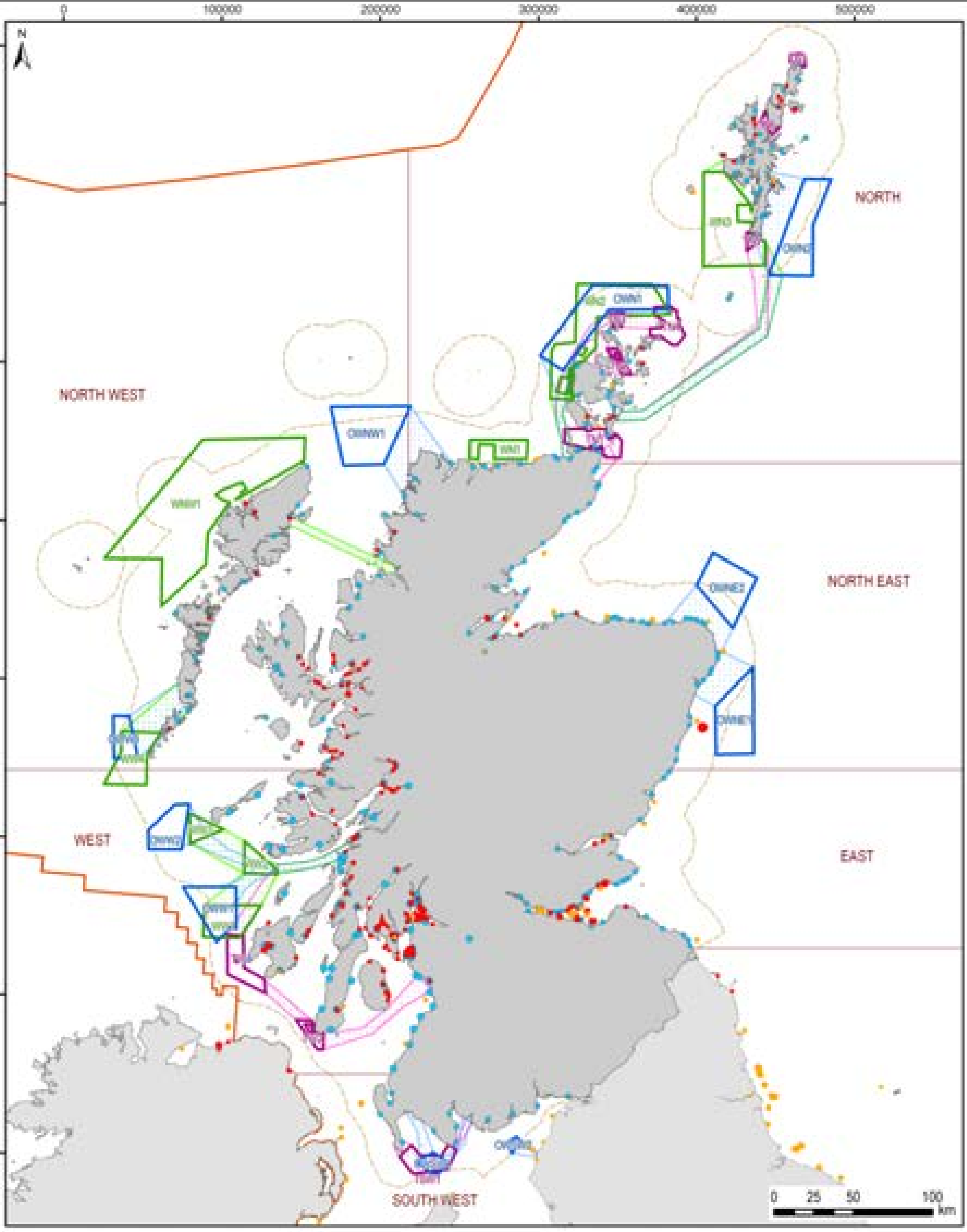
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB8_Oil_and_Gas.mxd			
Produced by ABPmer			

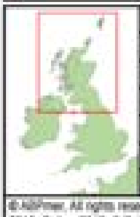
Source: Marine Scotland, 2012, DECC, 2012
NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- SORER Regions
- Hydrocarbon Fields
- 27th Round Awards
- 26th Round Awards (accepted)
- 26th Round Awards (remaining)
- Licensed Blocks
- Oil and Gas Pipelines
- Platforms

Oil and Gas Overview

Figure B8



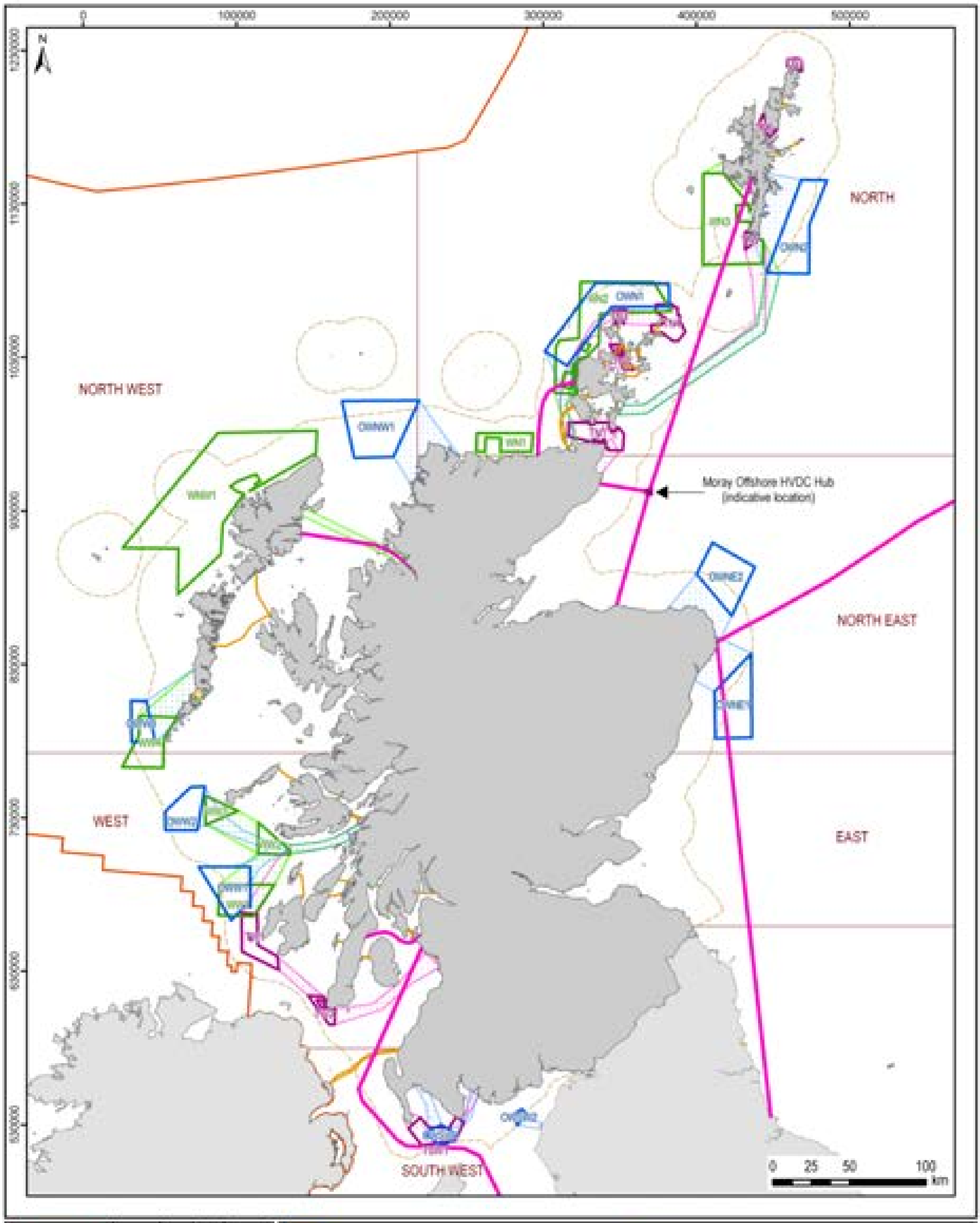


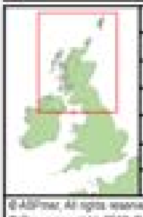
Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MOE	
4128 - FigB9_Ports_Harbours.mxd			
Produced by ABPmer			

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- Anchorage Areas
- Disposal Sites (open)
- Scottish Ports
- SORER Regions
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

Ports and Harbours Overview

Figure B9





Date	By	Size	Version
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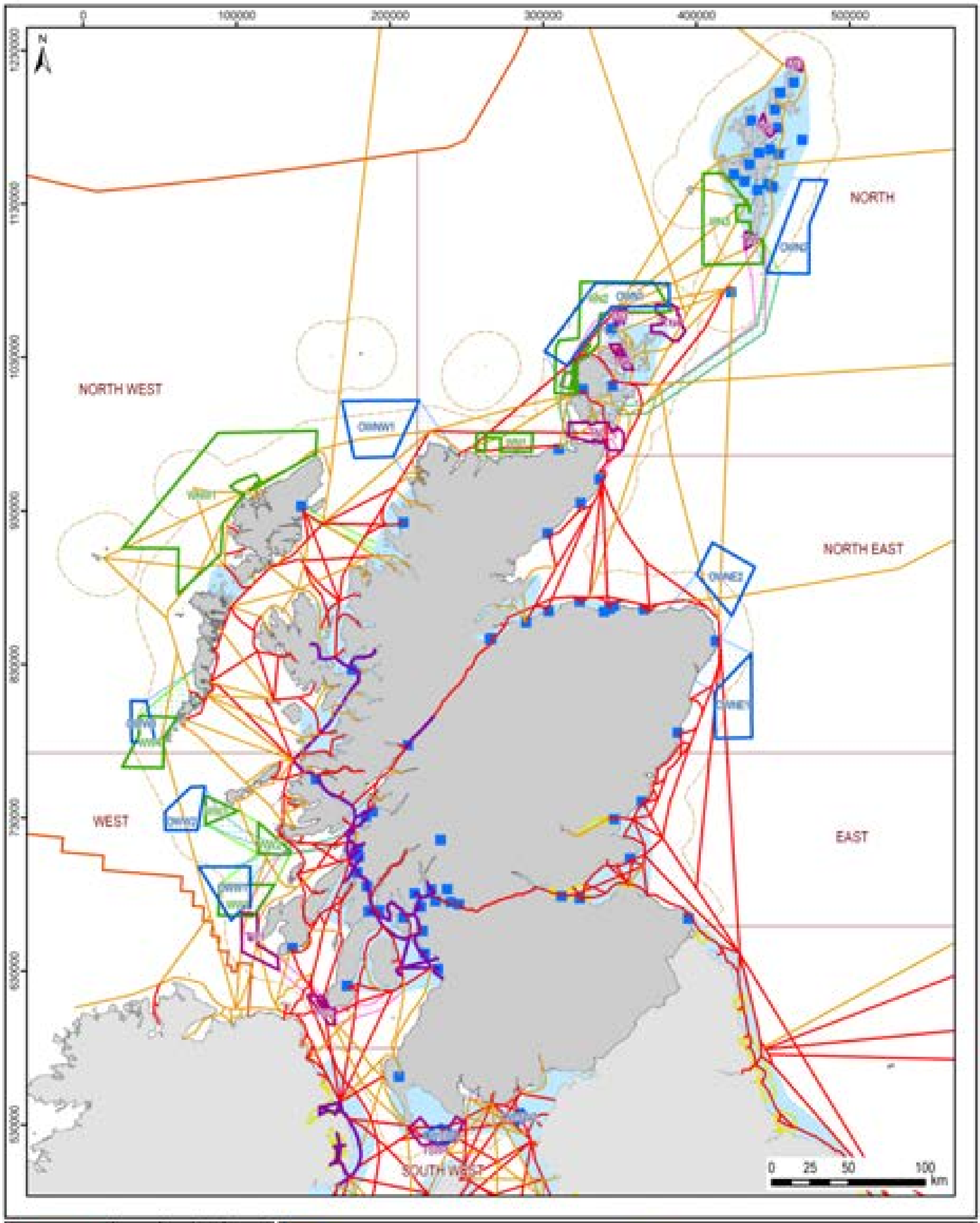
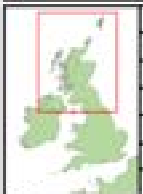
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB10_Interconnectors.mxd			
Produced by ABPmer			

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- Existing Submarine Power Cables
- Future Planned/Proposed Interconnectors
- Scottish 12 Nautical Mile Limit
- SORER Regions
- UK Continental Shelf Boundary

Power Interconnectors Overview

Figure B10





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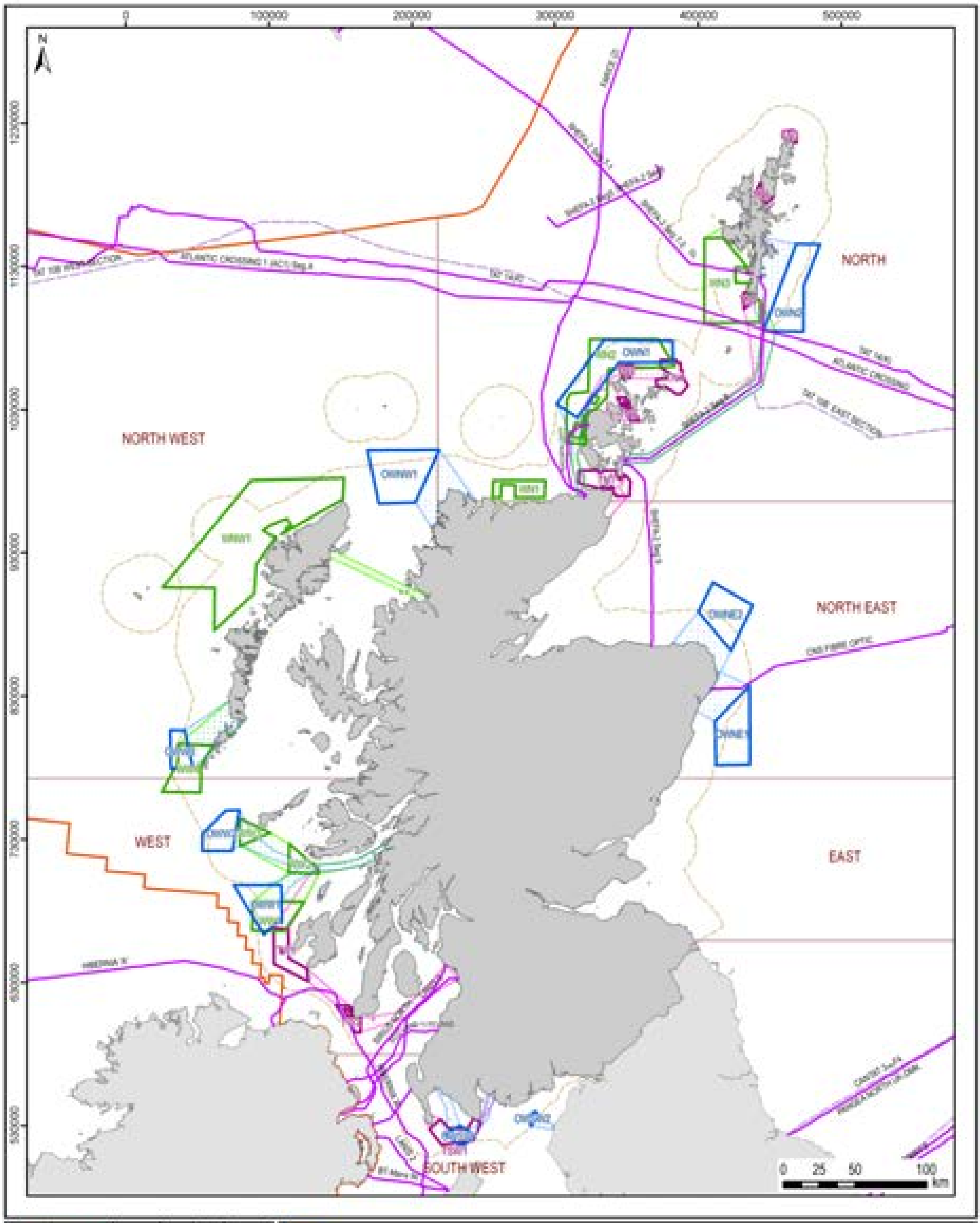
QA		MOE	
4126 - FigB11_Rec_Boating.mxd			
Produced by ABPmer			

Source: Marine Scotland, 2012, RYA, 2008 © Data reproduced under licence from the Royal Yachting Association

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- SORER Regions
- RYA Cruising Routes - Light
- RYA Cruising Routes - Medium
- RYA Cruising Routes - Heavy
- RYA Racing Areas
- RYA Sailing Areas
- Scottish Marinas
- Scottish 12 Nautical Mile Limit

Recreational Boating Overview

Figure B11



Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,750,000	
QA		MOE	
4126 - FigB12_Telecom_Cables.mxd			
Produced by ABPmer			

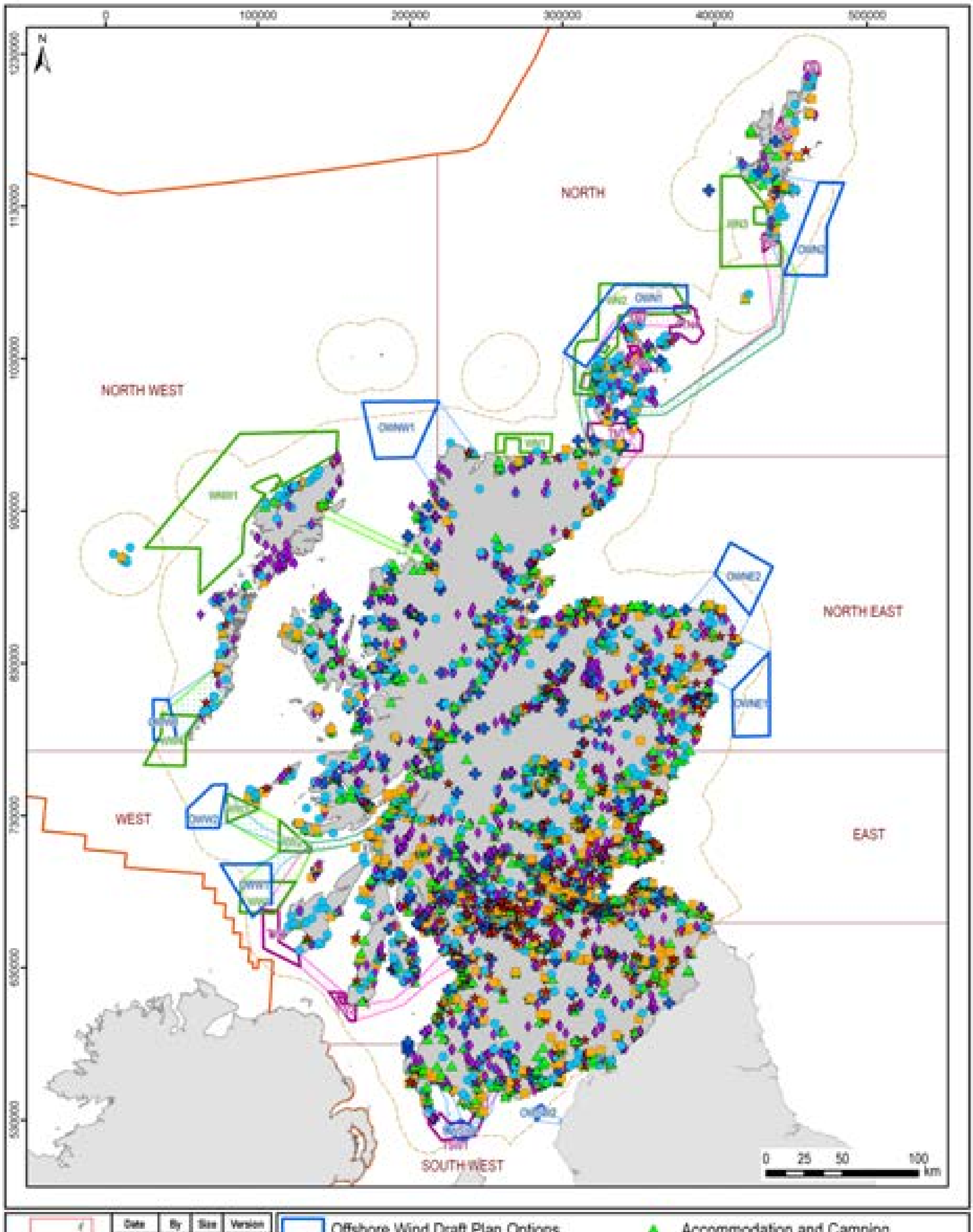
Source: Marine Scotland, 2012; Kingfisher Awareness Charts, 2013. NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes

Subsea Telecommunication Cables
- Active
- Out of Service
- UK Continental Shelf Boundary
- SORER Regions
- Scottish 12 Nautical Mile Limit

Telecommunication Cables Overview

Figure B12



Date	By	Size	Version
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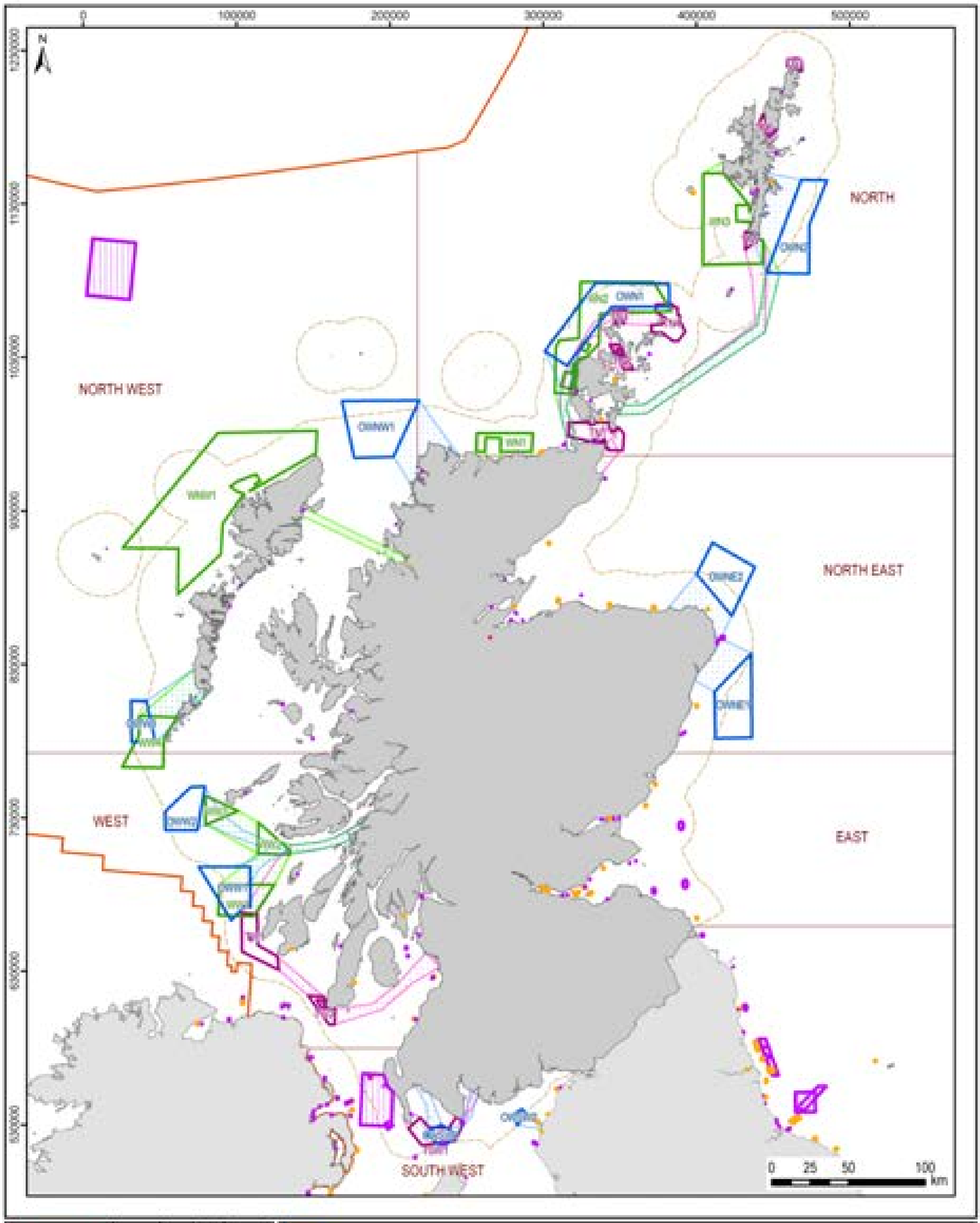
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MCE	
4126 - FigB13_Tourism.mxd			
Produced by ABPmer			

Tourism (Including Ecotourism and Archaeological Heritage) Overview

Figure B13



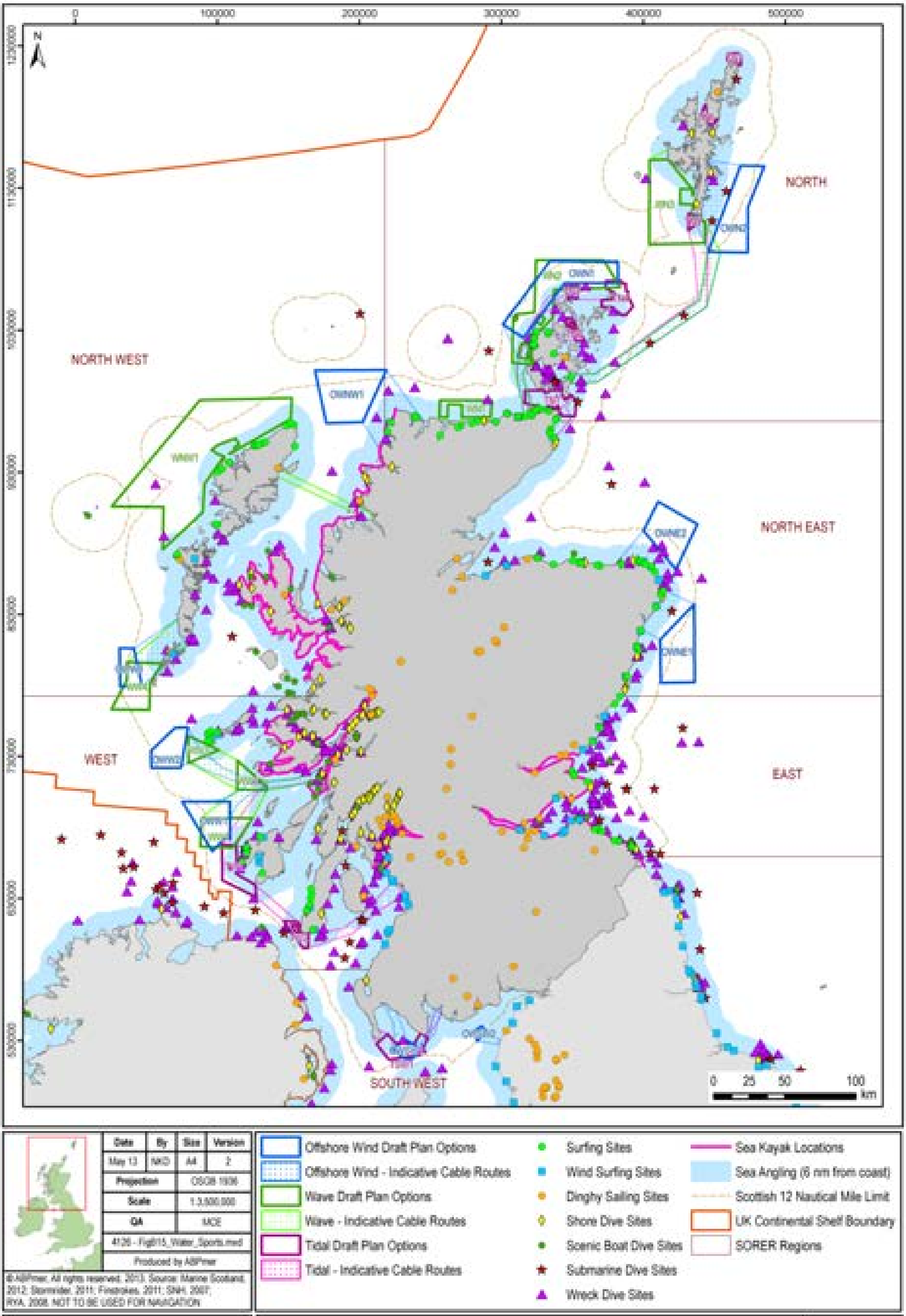
Date	By	Size	Version
May 13	NKD	A4	2
Projection		OSGB 1936	
Scale		1:3,500,000	
QA		MOE	
4126 - FigB14_Waste_Disposal.mxd			
Produced by ABPmer			

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- Wave Draft Plan Options
- Wave - Indicative Cable Routes
- Tidal Draft Plan Options
- Tidal - Indicative Cable Routes
- SORER Regions

Disposal Sites
- Open
- Open, Not in Use
- Closed/Disused
- UK Continental Shelf Boundary
- Scottish 12 Nautical Mile Limit

Waste Disposal Overview

Figure B14



Water Sports Overview

Figure B15

Appendix C

Scoping and Assessment Results

Appendix C. Scoping and Assessment Results

C1. Aquaculture

C1.1 Scoping Results

The results of the scoping assessment are presented in Table C1.1 (Offshore Wind), Table C1.2 (Wave) and Table C1.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C1.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW1	OWW2	OWW3	OWNW1
Displacement of aquaculture activity	N	N	N	N	N	N	N	N	N	N
Disturbance or injury to aquaculture species in production (underwater noise)	N	N	N	N	N	N	N	N	N	N

Table C1.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Displacement of aquaculture activity	N	N	N	N	N	N	N	N
Disturbance or injury to aquaculture species in production (underwater noise)	N	N	N	N	N	N	N	N

Table C1.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Displacement of aquaculture activity	N	N	N	N	N	N	N	N	N	N
Disturbance or injury to aquaculture species in production (underwater noise)	N	N	N	N	N	Y	N	N	N	N

C1.2 Assessment Results – Estimation of Costs and Benefits

C1.2.1 Displacement OF Aquaculture Activity

No current aquaculture sites were identified which might be displaced due to a Draft Plan Option area. However, based on consultation with the industry, it was noted that in the event that an aquaculture site was forced to relocate the cost could be over £1 million (Chris Webb, Meridian Salmon Farms Limited *pers comm*).

The conditions currently required for renewable developments to be effective are such that the aquaculture industry are unlikely to want to operate in the same areas, however, as aquaculture equipment gets stronger and turbines become more efficient there is a chance for increased overlap (*Chris Read,* Marine Harvest Scotland Ltd *pers comm*). Offshore aquaculture could also become strategically important to the UK in the future due to a finite supply of available inshore sites which could cause conflict with wind developments (James and Slaski, 2006; Faber Maunsell Limited, 2008). However, success will be dependent on improved safety and technological development (Faber Maunsell Limited, 2008; Defra, 2008). It has also been proposed that offshore aquaculture and renewable developments could be co-managed in the same area (Chris Read*, pers comm;* Blyth-Skyrme, 2010 and Mee, 2006). This could provide an opportunity to share resources and could lead to greater spatial efficiency in the offshore environment (Michler-Cieluch, 2009).

The issue of tidal Draft Plan Option areas limiting access to aquaculture sites (which could increase steaming coats for vessels such as maintenance and feed delivery boats) was raised during consultation with stakeholders. However, further analysis identified no current sites where this might be an issue.

C1.2.2 Disturbance or Injury to Aquaculture Species in Production (Underwater Noise)

Only one Draft Plan Option area (TN6 in the North SORER region) overlapped with shellfish and finfish aquaculture sites where there exists the potential for disturbance or injury to aquaculture species from underwater noise. However, given that these aquaculture sites (including a 2km noise buffer) only represents a small percentage of the TN6 Draft Plan Option area (approximately 3%) it is considered possible to locate the arrays within the Draft Plan Option area at a distance which would not produce unacceptable noise disturbance to aquaculture species. Based on current scientific knowledge, it is unlikely that shellfish would be significantly affected by intense underwater noise, even if they were located within 2km of an offshore renewables development.

C1.2.3 Summary

No current aquaculture sites were identified which might be displaced due to a Draft Plan Option area, however, it is possible that displacement might occur in the future as aquaculture equipment gets stronger and turbines become more efficient. Only one Draft Plan Option area (TN6 in the North SORER region) overlapped with shellfish and finfish aquaculture sites where there exists the potential for disturbance or injury to aquaculture species from underwater noise. However, with spatial planning it is considered possible to locate the arrays within the Draft Plan Option areas at a distance which would not produce unacceptable noise disturbance to aquaculture species. Economic impacts to the Aquaculture sector from the Draft Plan Option areas are therefore expected to be negligible.

C1.3 References

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Blyth-Skyrme, R.E., 2010. Options and opportunities for marine fisheries mitigation associated with windfarms. Final report for Collaborative Offshore Wind Research Into the Environment contract FISHMITIG09. COWRIE Ltd, London. 125 pp.

Defra. 2008. The United Kingdom operational program for the European Fisheries Fund (2007-2013).

Faber Maunsell Limited, 2008. Scottish Marine Bill Strategic Environmental Assessment (SEA): Environmental Report (ER). Scottish Government.

FAO, 2010. The state of world fisheries and aquaculture.

IECS, 2007. The River Humber (Upper Burcom Tidal Stream Generator) Order. Environmental Statement, Final Draft. October 2007. A report produced by the Institute of Estuarine and Coastal Studies, University of Hull.

Marine Scotland, 2011. Scottish Sea Fisheries Statistics 2010. Published by Marine Scotland, The Scottish Government, September 2011 DPPAS11957 (08/11). 92pp

Mee, L., 2006. Complementary Benefits of Alternative Energy: Suitability of Offshore Wind Farms as Aquaculture Sites SEAFISH - Project Ref: 10517, April 2006

Michler-Cieluch, T; Gesche, K and Buck B. 2009. Marine Aquaculture within Offshore OWF’s: Social Aspects of Multiple-Use Planning. GAIA-Ecological perspectives for science and society 18 158-162.

Pugh, D. 2008. Socio-economic indicators of marine-related activities in the UK economy. The Crown Estate

Scottish Government, 2010. Delivering Planning Reform for Aquaculture

SSPO, 2010. Scottish Salmon Producers’ Organisation Annual Report. Scottish Salmon Producers’ Organisation Limited. 12pp.

SSPO 2012. Scottish Salmon Farming. Industry Research Report. Scottish Salmon Producers' Organisation Limited, April 2012. 12pp.

Thomsen F., Lüdemann K., Kafemann R., Piper W., 2006. Effects of offshore wind farm noise on marine mammals and fish. Biola, Hamburg, Germany on behalf of COWRIE Ltd. 62pp.

Nedwell, J. and Howell, D., 2004. A review of offshore wind farm related underwater noise sources. Report No. 544 R 0308.

C2. Aviation

C2.1 Scoping Results

The results of the scoping assessment for offshore wind Draft Plan Option areas are presented in Table C2.1 and identify whether more detailed assessment is required (Y/N). No significant issues for wave and tidal Draft Plan Option areas were identified, although consideration needs to be given to possible impacts during construction.

Table C2.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW1	OWW2	OWW3	OWNW 1
Spatial overlap between Draft Plan Option areas and helicopter routes	N	Y* – for central and high scenarios only	N	Y* – for central and high scenarios only	N	N	N	N	N	N
Within the line of sight of at least one of the primary surveillance radar (PSR) used or operated by NATS En-Route	N	N	Y	Y	Y	Y	Y	Y	Y	N
Within the 15nm of the safeguarding zones around secondary surveillance radar (SSR) around airports	N	Y	Y	Y	N	N	N	Y	N	N
Intersects with the suggested CAA consultation zones around airports	N	Y	Y	N	N	N	N	N	N	N

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW1	OWW2	OWW3	OWNW 1
Within areas likely to cause concern with regard to Meteorological radar zones	N	N	N	N	N	N	N	N	N	N
Within the 10km safeguarding zones around En-route navigation aids	N	N	N	N	N	N	N	N	N	N
Within the 10km safeguarding zones around Air-Ground-Air communication sites	N	N	N	N	N	N	N	N	N	N
* Draft Plan Option areas transected by helicopter routes, but arrays for low scenario occupy <5% of Draft Plan Option areas. It has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.										

C2.2 Assessment Results – Estimation of Costs and Benefits

C2.2.1 Height Obstruction to Commercial Helicopter Navigation Routes

Figure B2 shows that multiple HMRs intersect with the wind Draft Plan Option area OWN2 in the North SORER and OWNE1 and OWNE2 in the North East SORER, indicating potential impacts in these areas. However, at the time of writing no information was available regarding the frequency of use of HMRs in these regions or the proportion of total flights affected by inclement weather requiring low flying. As such no meaningful quantitative estimate of the cost to industry could be undertaken.

The Civil Aviation Authority advised that with regard to site specific interactions with HMRs, consultation should occur between the developer, the helicopter operators and the Air Navigation Service Providers (ANSPs) that operate in and around the HMR structure. It was also highlighted that in contrast to other HMRs, which are ‘signposts’ to aid flight safety, the HMR structure around Aberdeen (i.e. the helicopter routes in/out of Aberdeen airport) are used differently and helicopters will often follow the routes in this area. NATS Aberdeen should be consulted regarding any potential interactions with these routes (Kelly Lightowler, CAA, *pers. comm.* 12 March 2013).

C2.2.2 Interference with Radar Systems

NATS provided an assessment of where the proposed wind Draft Plan Option areas overlapped with areas of primary radar cover and other relevant safeguarded zones (e.g. Secondary Surveillance Radars; SSRs). The outputs are summarised below:

- Area OWNW1 and OWN1 are free from any conflict;
- Area OWN2 is largely unaffected, however, the western part is within a safeguarded zone in which an impact (interference) could occur on the SSR. As such, an early dialogue should be undertaken with NATS regarding development in this area to enable a more detailed analysis, which would consider the exact characteristics and locations of turbines, to ascertain if/what impact can be expected and to discuss any obvious solutions to these impacts (turbine relocation etc);
- All areas (except OWNW1 and OWN1) overlap with Primary Radar Cover at 200m above ground level (agl), falling within areas of good radar cover. As such, depending on their height, all of the turbines are very likely to generate clutter on the Air Traffic Control (ATC) displays. Depending on the number of turbines, this has the potential to render the radar unusable in that area, while also affecting its general performance beyond the range of the wind farm, effectively preventing an affected radar from detecting real aircraft. Coupled with the Air Traffic Requirements for low level radar cover in order to provide Air Traffic Services to the offshore helicopter industry and other airspace users, this can be a safety issue. Early engagement with NATS would be advisable; and
- Although all of the proposed Draft Plan Option areas fall outside of the safeguarded zones for navigation aids and communications, NATS advised that depending on the size, numbers and relative proximity of the turbines within the proposed developments, the potential for interference is a possibility.

The following response was received from the CAA:

"The CAA do not routinely provide objections or support to particular wind farm developments, or in this case, Draft Plan Option areas for potential wind farm development sites. As the regulator, the CAA must remain impartial to each application that is received and provide regulatory and policy advice for each potential development. The CAA has no responsibilities for safeguarding sites other than its own property and would not comment on the potential impact upon specific radar systems. Rather, the CAA would suggest consultation with the Air Navigation Service Provider (ANSP) or site operator. The ANSP / site operators remain responsible for providing expert testimony as to any impact on their operations and the lack of a statement of objection or support from the CAA should not be taken to mean that there are no aviation issues, or that a comment from an operator lacks weight. During planning the CAA reminds those involved of their obligations to consult in accordance with ODPM/DfT Circular 1/2003 or Scottish Government Circular 2/2003, and in particular to consult with NATS and the Ministry of Defence as well as any aerodromes listed in Annex 3 of the above documents, taking note of appropriate guidance and policy documentation. Whilst the CAA recommends all aerodrome operators/licence holders develop associated safeguarding maps and lodge such maps with local planning authorities, the CAA additionally encourages planners to undertake relevant consultation with known local aerodromes regardless of status or the existence of any aerodrome/council safeguarding agreement".

C2.2.3 Summary

It was not possible to undertake a quantitative impact assessment of the cost to commercial aviation interests, due to lack of information relating to the particular sector impacted (i.e. helicopter operators). However, in relation to impacts on radar systems, consultation with NATS confirmed that there are anticipated impacts of offshore wind array development in all SORER on radar systems, affecting both primary and secondary surveillance radar and possibly navigation aids. The costs of mitigation measures (assuming the measures are acceptable to NATS) would be borne by the developer. Early consultation with NATS is advised to discuss potential solutions and mitigation. Consultation should also be undertaken with all known local aerodromes.

There are potential cost impacts for helicopter operators where helicopters need to deviate around offshore wind farms when low flying during adverse weather. However, it has not been possible to quantify these costs.

C2.3 References

ABPmer, RPA and SQW, 2011. Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish territorial Waters: Costs and Benefits to Other Marine Users and Interests. Report for Marine Scotland. Report R. 1743, March 2011.

Department of Energy and Climate Change (DECC) website. Aviation Safeguarding Maps: https://restats.decc.gov.uk/cms/aviation-safeguarding-maps/

Department for Transport (DfT), 2011. UK Aviation Forecasts. August 2011. Available online: http://www.dft.gov.uk/publications/uk-aviation-forecasts-2011

National Air Traffic Service (NATS) website. Aeronautical Information Service. http://www.nats-uk.ead-it.com/public/index.php.html Accessed: 15/03/13

National Air Traffic Service (NATS), 2013. Self Assessment Maps. http://www.nats.co.uk/services/information/wind-farms/ self-assessment-maps/Accessed: 15/03/13

C3. Carbon Capture and Storage

C3.1 Scoping Results

The results of the scoping assessment are presented in Table C3.1 (Offshore Wind), Table C3.2 (Wave) and Table C3.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C3.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN 1	OWN2	OWNE1	OWNE2	OWS W1	OWS W2	OWW 1	OWW 2	OWW 3	OWNW1
Draft Plan Option areas overlap or lie inshore of potential storage areas	N	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	N	N	N	N	N	N
Cable corridors overlap or lie inshore of potential storage areas	Y		Y		N		N			N
* Draft Plan Option areas lie inshore of possible CCS areas and thus could require extended pipeline routeing. However, arrays for low scenario occupy <5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.										

Table C3.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Draft Plan Option areas overlap or lie inshore of potential storage areas	N*	N*	N	N	N	N	N	N
Cable corridors overlap or lie inshore of potential storage areas	Y			N			N	
* Draft Plan Option areas lie inshore of possible CCS areas and thus could require extended pipeline routeing. However, arrays for all scenarios occupy <1% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under all scenarios.								

Table C3.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Draft Plan Option areas overlap or lie inshore of potential storage areas	Y* – for high scenario only	N	N	Y* – for high scenario only	N	N	N	N	N	N
Cable corridors overlap or lie inshore of potential storage areas	Y							N	N	
* Draft Plan Option areas lie inshore of possible CCS areas and thus could require extended pipeline routeing. However, arrays for low and central scenarios occupy <5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.										

C3.2 Assessment Results – Estimation of Costs and Benefits

C3.2.1 Competition for Space

The UK Government has called for proposals for a variety of new projects to support the building of the UK's first carbon capture and storage (CCS) plants as part of its CCS Commercialisation Competition. On 30 October 2012, the Government announced that four projects had been shortlisted to be taken forward into a new intensive phase of negotiations before decisions on which projects to support further are taken in 2013 (CCSA, 2012). The UK Government currently intends for the chosen projects to start demonstrating the CO_2 capture, transport and storage by 2016-2020 (DECC, 2013). Two of the currently shortlisted projects are located on the east coast of Scotland and include:

- Captain Clean Energy Project - Grangemouth, Scotland; and
- Scottish and Southern Energy (SSE) Generation Limited - Peterhead, Scotland.

The CCS proposal at Grangemouth is led by Summit Power and involves CO2DeepStore, a Petrofac subsidiary, and National Grid. The scheme, named the Captain Clean Energy Project, would see a full-chain commercial-scale CCS plant developed at Grangemouth with the plant using CCS technology in a bid to reduce emissions by more than 90%. The project proposes to capture CO_2 emissions at the plant, transporting the CO_2 via a new 18km pipeline under the Grangemouth Harbour which will then link up to an existing onshore pipeline transporting the CO_2 to St Fergus in Aberdeenshire (CCSA, 2012). From there CO_2 will be transferred offshore, as far as possible re-using existing pipeline infrastructure, and stored beneath the North Sea in a vast saline aquifer called The Captain Sandstone. In addition, the developer has raised the prospect of using captured CO_2 to pump out more oil from the North Sea in a process known as enhanced oil recovery (EOR) (WWF-Scotland, 2012; CO_2DeepStore, 2012).

At Peterhead, Shell and SSE plan to retrofit part of the existing gas power station to capture CO_2 emissions after combustion. The CO_2 will then be transported to the St. Fergus gas terminal in Aberdeenshire where it will be further treated for dispatch and transported offshore to the Shell-operated Goldeneye gas field in the North Sea, which will have ceased production (SCCS, 2012). Given the location and quantity of emissions anticipated from the Peterhead CCS demonstration project, the requirement for new transport infrastructure is limited to an onshore CO_2 pipeline running from Peterhead Gas Station to the St Fergus gas terminal, a distance of approximately 16km (Scottish Enterprise, 2011).

The developers of the Peterhead and Grangemouth projects envisage that in the short term (up to 2020) compressed CO_2 in dense phase will be dispatched offshore from St Fergus via existing pipeline routes for injection and storage at the Goldeneye field and the Aspen formation within the Captain sandstone, respectively (Scottish

Enterprise, 2011). Due to the fact that these oil and gas pipelines already exist, any impacts and associated costs of spatial overlap with the proposed Draft Plan Option areas, in particular the wind array areas OWNE1 and OWNE2 and their proposed cable routes (see Figure C3), will be borne by the wind array developer.

In addition, the proposed pipeline under the Grangemouth Harbour, linking the CO2 captured at the power plant with existing onshore pipelines, does not overlap with any of the proposed Draft Plan Option areas and thus there will be no additional costs to the CCS developers.

The Office of Carbon Capture and Storage (OCCS) were unable to comment on the methodology at the time of consultation due to their focus on the on-going Commercialisation Competition. Following consultation with the Carbon Capture and Storage Association (CCSA) they were able to confirm that in the main (excluding the pipeline under Grangemouth Harbour), existing pipelines will be used in the early stages of CCS (assuming these projects are the Grangemouth and Peterhead projects currently in the CCS Commercialisation Programme). CCSA also confirmed that once the next decision has been made regarding which of the four shortlisted projects under the CCS Commercialisation Programme will receive funding it will be easier to estimate the likelihood of these projects going ahead.

Therefore, in the short term (up to 2020), there is considered to be no economic impact on CCS development.

Presuming the successful completion of the demonstration projects at Peterhead and Grangemouth, CCS will move into the deployment phase by 2030. Where practical, CCS deployment into the North Sea will utilise existing oil and gas pipelines. As mentioned previously, as these oil and gas pipelines already exist, any impacts and associated costs of spatial overlap with the proposed Draft Plan Option areas, in particular the wind array areas OWNE1 and OWNE2 and their proposed cable routes (see Figure C3), will be borne by the wind array developer.

In the long term, post 2020, the Scottish Government envisage that clusters of source emitters, such as along the Firth of Forth, will be linked to collection hubs to reduce costs and risks to CCS infrastructure. A pipeline network would be used to transport CO_2 to offshore storage hubs for local distribution to diverse storage sites. The preferred route, identified by SCCS and the Scottish Government, is through an onshore pipeline from the Firth of Forth to St Fergus, then onwards to an offshore storage hub. However, they also note that there may be issues associated with a change of use for transporting CO_2 in existing onshore pipelines and that an offshore pipeline route from the Firth of Forth should also be considered (SCCS and Scottish Government, 2011). Transport of additional CO_2 from North East England would also be best served by a pipeline direct to an offshore storage hub (SCCS and Scottish Government, 2009; Scottish Enterprise, 2011).

At this early stage in CCS development these potential pipeline routes are still indicative and no defined pipeline routes have been suggested. The Scottish Enterprise's CO_2 Transport Options for Scotland Report (2011) under its 2030 scenario suggested indicative pipeline routes linking the Firth of Forth to Peterhead and Tees Valley to the offshore Goldeneye hub. A number of potential shipping routes were also identified within the Scottish Enterprise report, however, for the purposes of this assessment it has been assumed that pipelines are the preferred transportation method.

This assessment has assumed that the preferred pipeline routes would take the shortest route possible and thus neither of these identified pipelines intersect with any of the Draft Plan Option areas (Figure C3). Therefore, there are assumed to be no costs associated with pipeline deviation.

However, were pipeline deviation needed CCSA commented that in the extreme, re-routing a pipeline may be too costly or technically unfeasible for a project, making the project financially unviable. There are also non-cost impacts of re-routing a pipeline which must be considered, such as re-routing through a difficult offshore area (e.g. trenches) which would have been avoided in the original design.

The potential pipeline linking the Firth of Forth with Peterhead is likely, however, to pass inshore of the OWNE1 Draft Plan Option area and thus there are associated costs with cable crossings. Table C3.4 shows how these costs were calculated.

Table C3.4 Costs of Cable Crossings Associated with OWNE1

Scenario	Notional iNstalled Capacity (MW)	Export Cable Capacity (kV)	Number of Cables Needed	Cost Per caBle Crossing (£M)	Total Cost of Cable Crossings (£M)
High	1943	132 000	15	1	15
Medium	900		7		7
Low	372		3		3

The cost of potential cable crossings was estimated to be £15million (high scenario), £7million (medium scenario) and £3milliom (low scenario).

These costs are considered to be one off costs which will be incurred during construction. Costs have been estimated at 2012 rates, although the year of construction has been estimated as 2028.

C3.2.2 Data Limitations

Future scenarios for CCS development have been based on DECC investment plans as well as Scottish Government reviews of CCS opportunities in Scotland. These are not established developments and the schemes proposed in this chapter have yet to be approved. This means that assumptions about future costs are based on projections that might arise from future plans rather than on existing approved actions.

C3.2.3 Summary

There are no socio-economic impacts on CCS from the proposed wave and tidal Draft Plan Option areas. However, there are potential costs associated with a possible future CCS pipeline route, linking the Firth of Forth to Peterhead, crossing the cable corridor from the OWNE1 wind array. Under the low, medium and high scenarios the total cost of cable crossings is estimated to be £3m, £7m and £15m respectively. This will be a one off cost during construction, estimated to be incurred in 2028.

C3,3 References

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Brown A., 2009. 2008 Survey of the UK Seafood Processing Industry. Published by Seafish. 104 pages.

Carbon Capture and Storage Association (CCSA), 2012. CCS project proposals. http://www.ccsassociation.org/why-ccs/ccs-projects/current-projects/

CO2DeepStore, 2012. Captain Clean Energy Project. http://co2deepstore.com/co2-storage-for-caledonia-clean-energy-project

DECC, 2013. CCS commercialisation programme. http://www.decc.gov.uk/en/content/cms/emissions/ccs/ukccscomm_prog/commercialise/commercialise.aspx

ODIS, 2011. Offshore Development Information Statement: Appendices. Published by National Grid in September 2011.

Scottish Centre for Carbon Storage (SCCS), 2009. Opportunities for CO2 storage around Scotland: An integrated strategic research study. Report for the Scottish Government. April, 2009.

Scottish Centre for Carbon Storage (SCCS), 2011. Progressing Scotland's CO2 storage opportunities. Report for the Scottish Government. March, 2011.

SCCS, 2012. http://www.sccs.org.uk/map.html

SCCS and Scottish Government, 2009. Opportunities for CO2 Storage around Scotland — an integrated strategic research study. April 2009.

SCCS and Scottish Government, 2011. Progressing Scotland's CO2 storage opportunities. March 2011.

Scottish Enterprise, 2011. Carbon Capture and Storage CO2 Transport Options for Scotland. http://www.scottish-enterprise.com/~/media/SE/Resources/Documents/ABC/CO2-Transport-Options-for-Scotland.ashx

Scottish Government and Scottish Enterprise, 2010. Carbon Capture and Storage – A Roadmap for Scotland. March 2010.

WWF-Scotland, 2012. Peterhead and Grangemouth make short list for UK's CCS competition. http://scotland.wwf.org.uk/what_we_do/press_centre/?6284/Peterhead-and-Grangemouth-make-short-list-for-UKs-CCS-competition

C4. Commercial Fisheries

C4,1 Scoping Results

The results of the scoping assessment are presented in Table C4.1 (Offshore Wind), Table C4.2 (Wave) and Table C4.3 (Tidal) and indicate that more detailed assessment is required for all Draft Plan Option areas for Commercial Fisheries.

Table C4.1 Scoping Results for Offshore Wind

	North		North East		South West		West			North West
	OWN1	OWN2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW1	OWW2	OWW3	OWNW 1
Loss of traditional fishing grounds	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obstruction of navigation routes	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fouling of fishing gear on cables or seabed infrastructure	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Consequential impacts to fish processors	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table C4.2 Scoping Results for Wave

	North			West			North West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Loss of traditional fishing grounds	Y	Y	Y	Y	Y	Y	Y	Y
Obstruction of navigation routes	Y	Y	Y	Y	Y	Y	Y	Y
Fouling of fishing gear on cables or seabed infrastructure	Y	Y	Y	Y	Y	Y	Y	Y
Consequential impacts to fish processors	Y	Y	Y	Y	Y	Y	Y	Y

Table C4.3 Scoping Results for Tidal

	North							South West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Loss of traditional fishing grounds	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obstruction of navigation routes	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fouling of fishing gear on cables or seabed infrastructure	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Consequential impacts to fish processors	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

C4.2 Assessment Results – Estimation of Costs and Benefits

C4.2.1 Loss of Traditional Fishing Grounds

All of the Draft Plan Option areas potentially overlap with fishing activity, and therefore all have been scoped in to the assessment for the potential loss of traditional fishing grounds. The results are discussed below by region. The results are presented as the annual value of landings, based on an average from 2007–2011.

C4.2.1.1 South west

In the South West region, there are two wind Draft Plan Option areas (OWSW1 and OWSW2) and one tidal Draft Plan Option area (TSW1). The values of landings derived from these areas, scaled according to each development scenario, and broken down by gear type, vessel length and species group, are shown in Tables C4.4 for wind and C4.5 for tidal developments.

The total value of landings affected in the South West region is £21,635 (low scenario), £35,693 (central scenario) or £72,747 (high scenario).

This is predominantly attributable to wind, due to the larger areas involved: the total value of landings from the wind Draft Plan Option areas in the South West region is £18,013 (low scenario), £23,924 (central scenario) or £49,661 (high scenario); and from the tidal Draft Plan Option areas is £3,621 (low scenario), £11,769 (central scenario) or £23,086 (high scenario).

The impacts fall predominantly on the over-10m sector, and on dredgers and potters that are active in the region, targeting shellfish.

Table C4.4 Value of Landings Affected IN Wind Draft Plan Option Areas in South West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	4,518	5,954	12,211
	Over 10m & under 15m	6,340	8,304	16,856
	15m & over	7,153	9,662	20,588
Gear Type	Demersal Trawl (TR1)	120	145	255
	Nephrops Trawl (TR2)	1,662	1,995	3,444
	Beam Trawl (BT1 and BT2)	425	438	498
	Pelagic Trawl (PEL)	880	1,201	2,599
	Other Trawl (inc TR3)	3	3	3
	Gill Nets (GN1)	48	57	93
	Long Lines (LL1)	1	2	4
	Pots	7,227	9,799	20,999
	Dredges	7,642	10,277	21,754
	Shell Fishing by Hand	1	2	4
Species Type	Cod	10	11	16
	Haddock	1	1	2
	Monkfish	2	2	4
	Other Whitefish	816	931	1,432
	Herring	878	1,199	2,594
	Mackerel	3	4	9
	Other pelagic	0	0	0
	Nephrops	683	793	1,271
	Scallops	3,895	5,284	11,335
	Other Shellfish	11,726	15,698	32,999
	Total	**18,013**	**23,924**	**49,661**

Table C4.5 Value of Landings Affected in Tidal Draft Plan Option Areas in South West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	880	2,861	5,612
	Over 10m & under 15m	1,203	3,911	7,671
	15m & over	1,537	4,996	9,800
Gear Type	Demersal Trawl (TR1)	15	50	99
	Nephrops Trawl (TR2)	204	662	1,299
	Beam Trawl (BT1 and BT2)	8	27	53
	Pelagic Trawl (PEL)	197	639	1,254
	Other Trawl (inc TR3)	0	0	0
	Gill Nets (GN1)	5	17	33
	Long Lines (LL1)	0	1	2
	Pots	1,576	5,121	10,046
	Dredges	1,615	5,248	10,295
	Shell Fishing by Hand	0	1	2
Species Type	Cod	1	2	4
	Haddock	0	0	1
	Monkfish	0	1	2
	Other Whitefish	70	229	449
	Herring	196	638	1,251
	Mackerel	1	2	5
	Other pelagic	0	0	0
	Nephrops	67	219	429
	Scallops	851	2,767	5,427
	Other Shellfish	2,434	7,911	15,518
	Total	**3,621**	**11,769**	**23,086**

The value of landings needs to be converted to changes in GVA to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used, based on the average GVA % across all Scottish fleet segments to revise the Present Value (PV) estimate of the value of landings.

The knock-on effects on GVA have then been estimated using the Type I and Type II GVA multipliers (rather than GVA effect as for the other sectors). Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment.

C4.2.1.2 West

In the West region, there are three wind Draft Plan Option areas (OWW1, OWW2 and OWW3), four wave Draft Plan Option areas (WW1, WW2, WW3, WW4) and two tidal Draft Plan Option areas (TW1, TW2). The values of landings derived from these areas, scaled according to each development scenario, and broken down by gear type, vessel length and species group, are shown in Tables C4.6 for wind, C4.7 for wave and C4.8 for tidal developments.

Table C4.6 Value of Landings Affected in Wind Draft Plan Option Areas in West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	14,101	34,076	73,734
	Over 10m & under 15m	11,962	28,908	62,552
	15m & over	22,893	55,324	119,709
Gear Type	Demersal Trawl (TR1)	2,058	4,974	10,762
	Nephrops Trawl (TR2)	12,384	29,928	64,757
	Beam Trawl (BT1 and BT2)	0	0	1
	Pelagic Trawl (PEL)	1,988	4,805	10,398
	Other Trawl (inc TR3)	22	52	113
	Gill Nets (GN1)	43	105	227
	Long Lines (LL1)	6	14	30
	Pots	24,754	59,822	129,443
	Dredges	6,879	16,623	35,969
	Shell Fishing by Hand	821	1,985	4,294
Species Type	Cod	51	122	265
	Haddock	597	1,443	3,122
	Monkfish	759	1,834	3,969
	Other Whitefish	1,713	4,140	8,959
	Herring	535	1,293	2,797
	Mackerel	1,337	3,232	6,993

Category	Category Subset	Development Scenario		
		Low	Central	High
	Other pelagic	124	299	646
	Nephrops	12,942	31,276	67,674
	Scallops	6,917	16,716	36,171
	Other Shellfish	23,981	57,953	125,399
	Total	**48,955**	**118,309**	**255,995**

Table C4.7 Value of Landings Affected in Wave Draft Plan Option Areas in West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	1,350	2,299	4,527
	Over 10m & under 15m	1,112	1,665	3,228
	15m & over	1,943	3,484	6,852
Gear Type	Demersal Trawl (TR1)	120	199	379
	Nephrops Trawl (TR2)	1,363	2,229	4,349
	Beam Trawl (BT1 and BT2)	0	0	0
	Pelagic Trawl (PEL)	70	163	326
	Other Trawl (inc TR3)	2	3	6
	Gill Nets (GN1)	2	3	6
	Long Lines (LL1)	0	0	0
	Pots	2,222	3,711	7,280
	Dredges	494	1,003	2,006
	Shell Fishing by Hand	132	136	254
Species Type	Cod	5	9	18
	Haddock	31	57	108
	Monkfish	53	126	251
	Other Whitefish	103	191	368
	Herring	35	81	161
	Mackerel	26	73	148
	Other pelagic	9	10	19
	Nephrops	1,514	2,324	4,514
	Scallops	498	1,010	2,019
	Other Shellfish	2,130	3,568	7,000
	Total	**4,405**	**7,448**	**14,606**

Table C4.8 Value of Landings Affected in Tidal Draft Plan Option Areas in West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	1,647	5,181	10,163
	Over 10m & under 15m	1,281	3,983	7,813
	15m & over	3,241	9,733	19,091
Gear Type	Demersal Trawl (TR1)	27	80	156
	Nephrops Trawl (TR2)	2,637	7,645	14,996
	Beam Trawl (BT1 and BT2)	-	-	-
	Pelagic Trawl (PEL)	125	375	736
	Other Trawl (inc TR3)	1	4	8
	Gill Nets (GN1)	0	0	0
	Long Lines (LL1)	3	10	19
	Pots	2,046	6,601	12,948
	Dredges	1,300	4,096	8,035
	Shell Fishing by Hand	29	86	169

Category	Category Subset	Development Scenario		
		Low	Central	High
Species Type	Cod	5	14	28
	Haddock	22	65	127
	Monkfish	2	6	11
	Other Whitefish	28	82	160
	Herring	78	237	465
	Mackerel	28	80	157
	Other pelagic	0	0	0
	Nephrops	2,696	7,819	15,338
	Scallops	1,273	4,021	7,887
	Other Shellfish	2,039	6,574	12,895
	Total	**6,170**	**18,898**	**37,069**

The total value of landings affected in the West region is £59,530 (low scenario), £144,654 (central scenario) or £307,670 (high scenario).

This is predominantly attributable to wind, due to the larger areas involved. The value of landings affected from the wind Draft Plan Option areas in the West region (central development scenario) is £118,309, from the wave Draft Plan Option areas is £7,448, and from the tidal Draft Plan Option areas is £18,898. The impact on fisheries from wave energy development in the West region is expected to be minimal, due to the small areas expected to be developed under the three scenarios. Under the high scenario, the total value of landings affected is £10,021, £3,479 of which is attributable to potters within area WW1. This is likely to be an over-estimate, as provisional ScotMap data show that the majority of under-15m average earnings are from areas closer to shore within the relevant ICES rectangle (Figure B4.2). The impact from tidal energy development in the West region is also expected to be minimal.

The impacts in the West region are predominantly on potters (accounting for 49% of the value of landings affected) and Nephrops trawlers (accounting for 28% of the value of landings affected). The majority of the impacts arise as a result of area OWW1 for wind development (accounting for 56% of the value of landings affected). However, it should be noted that the actual impact of area OWW1 may be lower, since this Draft Plan Option area for wind development intersects with several ICES rectangles. The value of landings from these ICES rectangles has been used to calculate the potential value of landings affected from the Draft Plan Option area. When the value of landings based on VMS effort for the over-15m vessels is considered, which provides a finer-scale resolution of the distribution of the areas from which landings are derived, area OWW1 is not an intensively-fished area (Figure B4.1). Furthermore, ScotMap data, which provide greater resolution for the under-15m vessels, do not show intensive fishing activity in this area (Figure B4.2).

Although the impacts are predominantly on the over-15m sector in terms of value of landings affected, the relative impact on overall earnings may be significant for the smaller-scale sectors.

The value of landings needs to be converted to changes in GVA to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used, based on the average GVA % across all Scottish fleet segments to revise the Present Value (PV) estimate of the value of landings.

The knock-on effects on GVA have then been estimated using the Type I and Type II GVA multipliers (rather than GVA effect as for the other sectors). Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment.

C4.2.1.3 North West

In the North West region, there is one wind Draft Plan Option area (OWNW1) and one wave Draft Plan Option area (WNW1). No tidal energy development is foreseen. The values of landings derived from these areas, scaled according to each development scenario, and broken down by gear type, vessel length and species group, are shown in Table C4.9 for wind and Table C4.10 for wave.

Table C4.9 Value of Landings Affected in Wind Draft Plan Option Areas in North West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	746	1,802	3,899
	Over 10m & under 15m	2,823	6,823	14,763
	15m & over	38,792	93,749	202,852
Gear Type	Demersal Trawl (TR1)	4,851	11,722	25,364
	Nephrops Trawl (TR2)	1,085	2,622	5,674
	Beam Trawl (BT1 and BT2)	0	0	0
	Pelagic Trawl (PEL)	26,479	63,990	138,461
	Other Trawl (inc TR3)	528	1,275	2,760
	Gill Nets (GN1)	0	0	0
	Long Lines (LL1)	10	24	53
	Pots	9,103	21,998	47,599
	Dredges	307	741	1,604
	Shell Fishing by Hand	0	0	0
Species Type	Cod	63	151	328
	Haddock	1,839	4,443	9,614
	Monkfish	221	533	1,154
	Other Whitefish	2,690	6,500	14,064
	Herring	19,880	48,044	103,957
	Mackerel	7,084	17,119	37,043
	Other pelagic	8	19	41
	Nephrops	1,035	2,502	5,415
	Scallops	307	741	1,604
	Other Shellfish	9,236	22,320	48,296
	Total	**42,361**	**102,373**	**221,514**

Table C4.10 Value of Landings Affected in Wave Draft Plan Option Areas in North West Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category Subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	1,059	2,928	5,919
	Over 10m & under 15m	398	1,101	2,225
	15m & over	10,154	28,074	56,745
Gear Type	Demersal Trawl (TR1)	1,033	2,856	5,772
	Nephrops Trawl (TR2)	723	1,998	4,038
	Beam Trawl (BT1 and BT2)	0	0	0
	Pelagic Trawl (PEL)	7,240	20,016	40,457
	Other Trawl (inc TR3)	144	399	807
	Gill Nets (GN1)	22	62	125
	Long Lines (LL1)	104	287	579
	Pots	2,250	6,222	12,576
	Dredges	61	168	339
	Shell Fishing by Hand	35	98	198
Species Type	Cod	19	52	106
	Haddock	227	627	1,268
	Monkfish	262	726	1,467
	Other Whitefish	644	1,780	3,598
	Herring	502	1,387	2,804
	Mackerel	6,746	18,652	37,701
	Other pelagic	127	352	712
	Nephrops	1,012	2,799	5,658
	Scallops	98	271	547
	Other Shellfish	1,974	5,456	11,029
Total		**11,612**	**32,103**	**64,890**

The total value of landings affected in the North West region is £53,973 (low scenario), £134,477 (central scenario) or £286,404 (high scenario).

This is predominantly attributable to the wind Draft Plan Option area, OWNW1 (76% of the value of landings affected, £102,373 under the central scenario). Although the wave energy Draft Plan Option area is a very large area, the actual proportion of the overall area expected to be developed under each of the development scenarios, is very small (less than 1% in all three development scenarios), and the majority of the value of landings from the North West region as a whole is from the pelagic sector which is active further offshore.

The impacts in the North West region are predominantly on the pelagic sector (£63,990 under the central development scenario, accounting for 62% of the value of landings affected in the region), and to a lesser extent on potters (accounting for 21% of the value of landings affected) and demersal (whitefish) trawlers (accounting for 11% of the value of landings affected). As a result, the over-15m sector is most affected, and those vessels targeting herring (predominantly in the wind OWNW1 area) and mackerel (predominantly in the wave WNW1 area). Provisional ScotMap data indicate that the Draft Plan Option areas are not significant areas for earnings for the under-15m sector.

The value of landings needs to be converted to changes in GVA to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used, based on the average GVA % across all Scottish fleet segments to revise the Present Value (PV) estimate of the value of landings.

The knock-on effects on GVA have then been estimated using the Type I and Type II GVA multipliers (rather than GVA effect as for the other sectors). Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment.

C4.2.1.4 North

In the North region, there are two wind Draft Plan Option areas (OWN1 and OWN2), three wave Draft Plan Option areas (WN1, WN2 and WN3) and seven tidal Draft Plan Option areas (TN1, TN2, TN3, TN4, TN5, TN6 and TN7). These areas are mainly focussed around Shetland, Pentland Firth and Orkney. The values of landings derived from these areas, scaled according to each development scenario, and broken down by gear type, vessel length and species group, are shown in Tables C4.11 for wind, C4.12 for wave and C4.13 for tidal developments.

Table C4.11 Value of Landings Affected in Wind Draft Plan Option Areas in the North Region Under Low, Central and High Scenarios, Broken Down by Vessel length, Gear Type and Species Type (£)

Category	Category subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	37,556	90,761	196,387
	Over 10m & under 15m	13,174	31,836	68,887
	15m & over	233,505	564,303	1,221,036
Gear Type	Demersal Trawl (TR1)	106,391	257,111	556,335
	Nephrops Trawl (TR2)	8,758	21,165	45,797
	Beam Trawl (BT1 and BT2)	23	54	118
	Pelagic Trawl (PEL)	120,042	290,101	627,717
	Other Trawl (inc TR3)	5,469	13,216	28,597
	Gill Nets (GN1)	438	1,058	2,290
	Long Lines (LL1)	2,432	5,878	12,719
	Pots	34,753	83,986	181,728
	Dredges	4,226	10,212	22,097
	Shell Fishing by Hand	1,172	2,832	6,128
Species Type	Cod	21,057	50,889	110,112
	Haddock	22,521	54,425	117,764
	Monkfish	25,538	61,717	133,543
	Other Whitefish	34,771	84,030	181,824
	Herring	23,562	56,941	123,208
	Mackerel	101,239	244,661	529,395
	Other pelagic	733	1,772	3,834
	Nephrops	11,316	27,347	59,174
	Scallops	5,422	13,104	28,354
	Other Shellfish	38,075	92,015	199,101
	Total	**284,235**	**686,900**	**1,486,310**

Table C4.12 Value of Landings Affected in Wave Draft Plan Option Areas in the North Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	2,171	5,551	11,220
	Over 10m & under 15m	1,211	3,082	6,229
	15m & over	8,780	23,283	47,061
Gear Type	Demersal Trawl (TR1)	4,446	11,914	24,082
	Nephrops Trawl (TR2)	141	369	746
	Beam Trawl (BT1 and BT2)	1	3	7
	Pelagic Trawl (PEL)	3,434	9,137	18,468
	Other Trawl (inc TR3)	402	1,055	2,132
	Gill Nets (GN1)	14	38	77
	Long Lines (LL1)	108	294	594
	Pots	2,673	6,672	13,485
	Dredges	828	2,161	4,368
	Shell Fishing by Hand	104	245	495
Species Type	Cod	947	2,575	5,205
	Haddock	1,047	2,830	5,719
	Monkfish	1,093	2,859	5,779
	Other Whitefish	1,219	3,270	6,609
	Herring	1,420	3,537	7,150
	Mackerel	2,339	6,464	13,066
	Other pelagic	27	74	150
	Nephrops	305	804	1,624
	Scallops	915	2,376	4,802
	Other Shellfish	2,851	7,127	14,406
	Total	**12,162**	**31,916**	**64,510**

Table C4.13 Value of Landings Affected in Tidal Draft Plan Option Areas in the North Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	4,005	9,750	19,125
	Over 10m & under 15m	4,321	10,864	21,309
	15m & over	16,535	28,028	54,977
Gear Type	Demersal Trawl (TR1)	5,611	9,497	18,629
	Nephrops Trawl (TR2)	96	261	512
	Beam Trawl (BT1 and BT2)	0	0	0
	Pelagic Trawl (PEL)	10,186	16,747	32,850
	Other Trawl (inc TR3)	258	355	697
	Gill Nets (GN1)	159	178	349
	Long Lines (LL1)	107	146	286
	Pots	6,697	17,517	34,360
	Dredges	1,007	1,984	3,891
	Shell Fishing by Hand	659	1,740	3,414
Species Type	Cod	1,113	1,676	3,288
	Haddock	1,250	2,174	4,264
	Monkfish	1,788	3,596	7,054
	Other Whitefish	1,535	2,109	4,137
	Herring	4,056	9,129	17,906
	Mackerel	6,402	7,946	15,586
	Other pelagic	11	28	56
	Nephrops	142	314	616
	Scallops	1,598	3,503	6,871
	Other Shellfish	6,966	18,167	35,635
	Total	**24,861**	**48,642**	**95,412**

The total value of landings affected in the North region is the greatest of any region - £321,258 (low scenario), £767,457 (central scenario) or £1,646,232 (high scenario).

This is predominantly attributable to the two wind areas (together accounting for 88% of the value of landings affected), which occupy much larger areas than the wave and tidal areas under the three development scenarios. The Draft Plan Option area OWN1 accounts for £334,161 of the value of landings affected under the central scenario, mainly due to impacts on demersal (whitefish) trawlers (£133,202), the pelagic sector (£95,203) and potters (£83,281). Area OWN2 account for £351,452 of the value of landings affected under the central scenario, mainly due to impacts on the pelagic sector (£194,898) and demersal (whitefish) trawlers (£123,909). These impacts are predominantly on the over-15m sector (£564,303 for both areas combined under the central scenario), but impacts on smaller vessels may also be significant (£122,597 for under-15m vessels under the central scenario, predominantly the under-10m vessels).

The impact of the wind Draft Plan Option areas in the North region would be predominantly on the pelagic sector (targeting herring and mackerel, accounting for 44% of the value of landings affected), whitefish sector (accounting for 37% of the value of landings affected - cod, haddock, monkfish and other whitefish), and to a lesser extent shellfish (accounting for 19% of the value of landings affected).

While the development of wave and tidal energy is often a concern for the under-10m and under-15m vessels, because these technologies are usually deployed closer to the coast, the actual value of landings expected to be affected is not great: £5,551 for the wave Draft Plan Option areas under the central scenario, and £9,750 for the tidal Draft Plan Option areas under the central scenario. WN2, WN3, TN1 and TN4 have the largest impact on the under-10m sector, but even the most significant of these, TN1, is only expected to impact on £4,895 worth of landings from the under-10m sector under the central scenario. Nevertheless, the ScotMap data (Figure B4.2) do show that areas TN1 and TN2 overlap with important fishing grounds for the under-15m sector, and if these areas are taken forward for development, the location of arrays should be planned in close consultation with the fishing industry in order to minimise any potential impacts.

The tidal areas are most likely to impact on shellfish fisheries. 45% of the value of landings affected by the tidal Draft Plan Option areas are attributed to shellfish (£21,984 under the central scenario). 35% of the value of landings affected by the tidal Draft Plan Option areas would be on herring and mackerel, and 20% on whitefish landings.

ScotMap data do not cover Shetland, so it is difficult to assess the relative importance of the Draft Plan Option areas for the under-15m fleet beyond the resolution provided by the ICES rectangle-based data, however the area surrounding Shetland is a valuable fishing ground for under-15m vessels, particularly to the east of Shetland where Draft Plan Option area OWN2 is located.

The value of landings needs to be converted to changes in GVA to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used, based on the average GVA % across all Scottish fleet segments to revise the Present Value (PV) estimate of the value of landings.

The knock-on effects on GVA have then been estimated using the Type I and Type II GVA multipliers (rather than GVA effect as for the other sectors). Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment

C4.2.1.5 North East

In the North East region, there are only two wind Draft Plan Option areas (OWNE1 and OWNE2); no wave or tidal energy development is foreseen. The values of landings derived from these areas, scaled according to each development scenario, and broken down by gear type, vessel length and species group, are shown in Table C4.14.

Table C4.14 Value of Landings Affected in Wind Draft Plan Option Areas in North East Region Under Low, Central and High Scenarios, Broken Down by Vessel Length, Gear Type and Species Type (£)

Category	Category subset	Development Scenario		
		Low	Central	High
Vessel Length	10m & under	18,548	44,824	96,990
	Over 10m & under 15m	4,121	9,960	21,550
	15m & over	45,130	109,065	235,995
Gear Type	Demersal Trawl (TR1)	11,417	27,591	59,702
	Nephrops Trawl (TR2)	11,001	26,586	57,526
	Beam Trawl (BT1 and BT2)	0	0	0
	Pelagic Trawl (PEL)	3,917	9,466	20,482
	Other Trawl (inc TR3)	2,444	5,905	12,778
	Gill Nets (GN1)	0	0	0
	Long Lines (LL1)	3,450	8,337	18,039
	Pots	14,975	36,189	78,306
	Dredges	20,615	49,819	107,798
	Shell Fishing by Hand	1	1	3
Species Type	Cod	797	1,926	4,168
	Haddock	8,893	21,491	46,502
	Monkfish	1,417	3,424	7,410
	Other Whitefish	2,029	4,904	10,611
	Herring	3,700	8,942	19,349
	Mackerel	4,319	10,437	22,584
	Other pelagic	0	0	0
	Nephrops	9,078	21,940	47,473
	Scallops	20,468	49,464	107,031
	Other Shellfish	17,117	41,365	89,506
	Total	**67,818**	**163,894**	**354,633**

The total value of landings affected from the Draft Plan Option areas is between £67,818 (low scenario) and £354,633 (high scenario). This is predominantly attributable to Draft Plan Option area OWNE2 (63% of the value of landings affected), which overlaps a more valuable fishing area than OWNE1.

The impacts are predominantly on the over-15m sector, and predominantly on dredgers (30% of the value of landings affected), potters (22% of the value of landings affected), demersal (whitefish) trawls (17% of the value of landings affected) and Nephrops trawls (16% of the value of landings affected). Target species most affected are shellfish (scallops, Nephrops and other shellfish), and to some extent, haddock.

While the impacts on the under-10m sector appear to be relatively high (between £18,548 and £96,990) the ScotMap data on spatial allocation of average annual earnings for the under-15m fleet does not show much activity in the OWNE2 area (Figure B4.2). This apparent impact is therefore probably an artefact of the calculation methodology which was based on value of landings from ICES rectangles — the area from which the under-15m vessels derive the majority of their earnings value is from areas closer inshore than the OWNE2 Draft Plan Option area.

The value of landings needs to be converted to changes in GVA to take account of the effects of the displacement of current (and future) output due to the footprint of the renewable technologies. This is based on the potential direct reduction in GVA due to the potential reduction in the value of landings. The Seafish Industry Authority Multi-year Fleet Economic Performance Dataset (Seafish, 2013) has been used as the basis for this calculation. However, directly comparable data on fleet segments and gear types were not available. Therefore, a GVA ratio of 39% has been used, based on the average GVA % across all Scottish fleet segments to revise the Present Value (PV) estimate of the value of landings.

The knock-on effects on GVA have then been estimated using the Type I and Type II GVA multipliers (rather than GVA effect as for the other sectors). Data on landings have been used to inform the consideration of downstream supply chain effects (such as impacts on fish processors) but no estimate has been made of the GVA impact on processors. Instead, this is assessed as part of the (qualitative) social assessment.

C4.2.2 Displacement

The assessment carried out here assumes the worst-case scenario for the fishing industry - the total loss of the value of landings derived from the Draft Plan Option areas. As such, displacement issues are not considered in the quantification of impacts, as it is assumed that the landings, and therefore the activity, ceases. In practice, however, this is unlikely to be the case, and fishing vessels may be expected to adjust their operations in order to target different fishing grounds and/or different species.

Targeting different fishing grounds has a number of potential impacts, which have not been quantified but are discussed qualitatively. Displacement to different fishing grounds may put the vessels in conflict with other fishing vessels that already fish in the area. It may also result in environmental impacts as different areas (e.g. of seabed and the associated benthic habitats and communities) are affected by the fishing gears used. There may be longer steaming times to reach the new fishing grounds, and associated additional fuel costs, and impacts on available fishing time for effort-limited vessels under the days-at-sea regulations. Furthermore, there may be impacts on the level of commercial return and profitability of individual vessels and fleet sectors, as the costs and earnings from targeting different fishing grounds, with potentially different catch rates, are likely to be different. Depending on the extent of displacement, there may also be costs associated with obtaining quota for different quota management areas.

If vessels decide to target different species as a result of being displaced from their traditional fishing grounds, gear adjustments may be necessary. This may require small adjustments, or complete replacement of fishing gear and reconfiguration of the vessel to accommodate the new gear. There may also be a need for new types of gear to be developed and associated costs with this.

C4.2.3 Obstruction of Navigation Routes

Navigation routes of fishing vessels were assessed based on ‘steaming’ VMS pings (average speed since last ping equal to or greater than 5 knots).

In the South West region, the main navigation routes in the region are from Whithorn heading south and south-east, from Kirkudbright heading south and from Whitehaven heading east (Figure B4.3(a)). These routes do not cross the Draft Plan Option areas. There is some steaming that overlaps with tidal area TSW1 and wind area OWSW1. For the tidal area, the actual proportion of the Draft Plan Option areas that will be developed will be between 0.8% and 5.1%, and of the wind area, the proportion would be between 8% and 25% (under low and high scenarios respectively). Therefore it would be expected that impacts, particularly from the tidal area can be avoided through careful location of the devices.

In the West region, the main navigation routes are predominantly close to shore and in between the islands (Figure B4.3(b)). Tidal area TW2, off the south west tip of the Mull of Kintyre, overlaps with a significant navigation route for vessels steaming around this area. Coupled with the strong currents experienced in this location, this may pose a potential navigation hazard. Only 5.1% of the area would be occupied by any tidal array and therefore it may be possible to minimise potential impacts, but navigational safety for vessels transiting, particularly in poor weather conditions, should be considered. Other areas such as OWW1 and OWW3 for wind and WW4 for wave, overlap with moderate concentrations of steaming pings. Whilst careful location of devices is expected to be able to avoid impacts for the wave area (less than 1% of the area would be occupied by arrays under the high scenario), there may be some deviation of navigation required to avoid wind arrays in OWW1 and

OWW3, particularly under the high scenario, in which 25% of the areas area expected to be occupied by arrays.

In the North West region, the main navigation routes are inshore and around the islands, from Ullapool and Lochinver to Stornoway, around the northern tip of the Isle of Lewis and east, as well as heading east from the southern side of the Isle of Skye (Figure B4.3(c)). Wave area WNW1 overlaps with the navigation routes heading east from the northern coast of the Isle of Lewis, but impacts on navigation routes are expected to be avoidable through location of devices, given that less than 1% of the area would be occupied with wave devices even under the high scenario. Wind area OWNW1 also overlaps with significant navigation routes from the north west coast of Scotland heading east and north east. This area could impact on navigation routes and result in deviation being necessary, particularly under the high scenario, in which 25% of the area is expected to be occupied by arrays.

In the North region, the main navigation routes are along the north coast of Scotland, through the Pentland Firth and Westray Firth, and around Shetland especially to the east of Shetland and between the islands particularly through Yell Sound and Calgrave Sound (Figure B4.3(d)). Wave area WN1 and Tidal area TN1 overlap with the navigation route along the north coast of Scotland, and TN2 with the navigation route through Westray Firth. Impacts may be avoided for WN1 since less than 1% of the area would be occupied by arrays under the high scenario. Up to 5% of TN1 and TN2 would be occupied by arrays under the high scenario, and careful consideration should be given to the location of devices to avoid impacts. TN5 and TN6 also overlap significant navigation routes around Shetland. Wind areas OWN1 and OWN2 both overlap significant navigation routes, and up to 25% of the areas would be occupied by arrays in the high scenario. This may be expected to impact on navigation routes, particularly for OWN2 — location of devices in the northern part of OWN1 may avoid interaction with the most significant navigation routes.

In the North East region, the main navigation routes emanate out from the north east tip of Aberdeenshire, due to the location of Fraserburgh and Peterhead ports (Figure B4.3(e)). Wind area OWNE1 is predominantly outside of these major navigation routes, being located slightly further south. Wind area OWNE2 is located in the area of the highest concentration of ‘steaming’ pings and major navigation routes. The development of wind arrays in this area would have an impact on navigation routes for fishing vessels, and cause a significant number of vessels and of individual fishing trips to have to deviate around any arrays located here.

Where development of offshore renewable areas does impact on fishing vessels’ navigation routes, deviation of routes is expected. This implies costs to the fishing vessels in terms of time spent steaming to fishing grounds and extra fuel costs, with associated carbon emissions. Those vessels that are effort-limited by days-at-sea regulations would be further impacted by a reduction in the amount of time available for fishing.

C4.2.4 Fouling of Fishing Gear on Cables or Seabed Infrastructure

No significant interactions with cables were identified by the fishing industry, in particular because it is expected that cables would be laid in consultation with the fishing industry. The Scottish Fishermen's Federation (SFF) is developing a Memorandum of Understanding with Subsea Cables UK (similar to the agreement that the National Federation of Fishermen's Organisations (NFFO) has already developed) that recognises that future cable laying activity is carried out in consultation with the industry, and includes a protocol on methods of laying cables. This would include burying cables where appropriate and feasible, and should minimise potential impacts of cables on the fishing industry.

Nevertheless, the potential for impacts on the fishing industry due to fouling of gear on cables or seabed infrastructure still exists, since even buried cables may become exposed with time. In relation to the Oil and Gas industry, a fund exists to address losses or damage to the fishing industry as a result of fouling of fishing gear on Oil and Gas subsurface infrastructure (SFF, pers. comm.). This was set up through negotiations with Oil and Gas companies and provides a method of compensating individual fishermen who suffer loss of fishing or damage to gear as a direct result of debris or equipment associated with the Oil and Gas Industry. This fund is managed independently and does not require a burden of proof to identify the specific operator responsible for the debris or equipment. A similar type of system should be considered for offshore renewables to provide compensation where loss or damage is incurred as a result of offshore energy infrastructure.

C4.2.5 Consequential Impacts to Fish Processors

The potential impacts on fish processors are considered in terms of the value of landings that may be affected by the offshore renewables developments in each region, for whitefish, pelagics and shellfish. This is presented in terms of the value of landings affected under the central scenario that are caught within the respective offshore renewable region. It should be noted that this does not necessarily reflect the area where those catches are landed. For example, Peterhead is an important port in the North-East Region for landings of pelagic species, but these may have been caught from the North and North-West Regions.

The total value of landings, value of landings affected by offshore renewables development (for wind, wave and tidal combined), and the value affected as a percentage of the total landings, is provided in Table C4.15. In all regions, less than 1% of the value of landings is affected for whitefish, pelagics and shellfish, for the central scenario.

The geographical distribution of the turnover of the Scottish industry is 65% around Aberdeen; 24% in central and southern Scotland; and 11% in the Highlands and Islands (RSE, 2004). A substantial proportion of the fish processed is imported, particularly in the whitefish sector due to the reductions in local landings over the last few decades. The degree of dependence on imported supplies can affect the processing sector's ability to respond to changes in supplies from local landings.

Table C4.15 Total Value of Landings (£), Value of Landings Affected by Offshore Renewable Development (£), and Percentage of Total Landings Affected, by Region (Average 2007–2011)

Region	Parameter	Whitefish	Pelagics	Shellfish
South-West	Total landings	2,107,777	1,404,608	17,566,287
	Value affected	1,177	1,843	32,672
	% of value affected	0.06%	0.13%	0.19%
West	Total landings	3,601,103	14,787,058	37,346,544
	Value affected	8,089	5,304	131,261
	% of value affected	0.22%	0.04%	0.35%
North-West	Total landings	37,868,496	45,299,831	30,768,355
	Value affected	14,813	85,574	34,090
	% of value affected	0.04%	0.19%	0.11%
North	Total landings	77,082,972	85,405,144	29,391,133
	Value affected	272,149	330,552	164,756
	% of value affected	0.35%	0.39%	0.56%
North-East	Total landings	11,159,619	2,531,237	30,606,371
	Value affected	31,745	19,380	112,769
	% of value affected	0.28%	0.77%	0.37%
East	Total landings	4,934,500	1,808,315	22,485,695
	Value affected	-	-	-
	% of value affected	0.00%	0.00%	0.00%
Total	Total landings	137,082,439	151,678,846	168,639,935
	Value affected	318,708	435,505	311,615
	% of value affected	0.23%	0.29%	0.19%

Although the overall figures indicated that any impact on the processing sector would be minimal, in terms of the value of landings affected compared to the total value of landings, more significant impacts may arise at a local level. For example, the Shetland economy is remote from the main markets, and is narrowly based, depending heavily on fish catching, fish farming, fish processing, oil related activities and knitwear (RSE, 2004). Similarly, fish and shellfish processing is important in Orkney. Any reductions in landings to these areas, particularly as a result of impacts on the landings from the under-10m and under-15m fleets, may have greater knock-on impacts on the processing sector and the wider economy than may be expected from the figures in Table C4.15.

C4.3 References

ABPmer and RPA, 2012. Socio-economic baseline reviews for offshore renewables in Scottish waters. Volume 1: Main text. Report R.1905, September 2012.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Marine Scotland, 2012. Scottish Sea Fisheries Statistics 2011. A National Statistics Publication for Scotland. ISBN 978-1-78256-067-8. Edinburgh: The Scottish Government. 99 pages.

Royal Society of Edinburgh, 2004. Inquiry into the Future of the Scottish Fishing Industry. Edinburgh: Royal Society of Edinburgh.

Scottish Government, 2010. Future of Fisheries Management in Scotland.

UKFEN & Seafish, 2012. Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments. Seafish and UK Fisheries Economics Network, August 2012. 50 pages.

UKMMAS, 2010. Charting Progress 2 Feeder Report Productive Seas. Department for Environment Food and Rural Affairs on behalf of UKMMAS (Eds. Saunders, J. and McKie, J.). United Kingdom Marine Monitoring and Assessment Strategy. 472 pages. Available online: http://chartingprogress.defra.gov.uk/

C5. Commercial Shipping

C5.1 Scoping Results

The results of the scoping assessment are presented in Table C5.1 (Offshore Wind), Table C5.2 (Wave) and Table C5.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C5.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	**OWN2**	**OWNE1**	**OWNE2**	**OWSW1**	**OWSW2**	**OWW1**	**OWW2**	**OWW 3**	**OWNW1**
Spatial overlap between Draft Plan Option areas and commercial navigation routes greater than 5 or more vessels per day or ferry route	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	N	Y* – for central and high scenarios only
IMO recognised "ship routeing system"	N	N	N	N	N	N	N	N	Y	N
Potential impact on ferry turnaround times	N	Y* – for central and high scenarios only	N	Y* – for central and high scenarios only	N	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and commercial anchorages	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and commercial anchorages	N	Y – qualitative assessment	N		N		Y – qualitative assessment			N

* Draft Plan Option areas transected by commercial navigation route(s) or ferry route greater than 5 or more vessels per day. However, arrays for low scenario occupy less than 5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.

Table C5.2 Wave

	North			**West**			**North-West**	
	WN1	**WN2**	**WN3**	**WW1**	**WW2**	**WW3**	**WNW 1**	**WW4**
Spatial overlap between Draft Plan Option areas and commercial navigation routes greater than 5 or more vessels per day or ferry route	N*	N*	N*	N*	N*	N	N	N
IMO recognised "ship routeing system"	N	N	N	N	N	N	Y	N
Potential impact on ferry turnaround times	N	N	N*	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and commercial anchorages	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and commercial anchorages	N			Y – qualitative assessment			N	N
* Draft Plan Option areas transected by commercial navigation route(s) or ferry route greater than 5 or more vessels per day. However, arrays for all scenarios occupy less than 1% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.								

Table C5.3 Tidal

	North							**South-West**	**West**	
	TN1	**TN2**	**TN3**	**TN4**	**TN5**	**TN6**	**TN7**	**TSW1**	**TW1**	**TW2**
Spatial overlap between Draft Plan Option areas and commercial navigation routes greater than 5 or more vessels per day or ferry route	Y* – for high scenario only	Y* – for high scenario only	N	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only
IMO recognised "ship routeing system"	N	N	N	N	N	N	N	N	N	Y
	TN1	**TN2**	**TN3**	**TN4**	**TN5**	**TN6**	**TN7**	**TSW1**	**TW1**	**TW2**
Potential impact on ferry turnaround times	Y* – for high scenario only	Y* – for high scenario only	N	Y* – for high scenario only	N	Y* – for high scenario only	Y* – for high scenario only	N	N	Y* – for high scenario only
Spatial overlap between Draft Plan Option areas and commercial anchorages	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and commercial anchorages	N							N	Y – qualitative assessment	
Draft Plan Option areas transected by commercial navigation route(s) or ferry route greater than 5 or more vessels per day. However, arrays for low and central scenarios occupy less than 5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.										

C5.2 Assessment Results – Estimation of Costs and Benefits

C5.2.1 Quantitative Assessment of Impacts to Shipping Routes and Ferry Routes

Indicative costs associated with modifying existing navigation routes for ferries and commercial shipping have been calculated with respect to additional steaming time.

C5.2.1.1 IMO ship routing lanes

It is noted that two Draft Plan Option areas overlap IMO ship routing lanes within the North-West region, these are wave site WNW1 and the wind site OWW3 (see Figure B5). The wind development (OWW3) marginally intersects the ship routing lane, whereas the lane transects the entire length of the wave development (WNW1). These measures are international standards; for the purposes of this assessment no deviation costs are estimated and it is considered that renewable developments within these Draft Plan Option areas would be placed away from IMO ship routing lanes.

C5.2.1.2 Commercial shipping and ferry routes – wind

Calculated costs associated with transiting around wind development boundaries for commercial shipping and ferry routes are summarised set out in Table 5. With the exception of OWW3, all wind Draft Plan Option areas are scoped in for the central and high development density scenarios only. As the Draft Plan Option areas are located along commercial shipping navigation routes with over five vessels a day, and would have over 5% of the Draft Plan Option area developed under the central and high scenarios.

Renewable development scenarios were applied using the methodology outlined in Appendix B5, in order to derive associated costs. The worst credible scenario has been evaluated to provide a conservative economic cost which considers that routes running perpendicularly offshore from the coast would mostly be impacted by the location of the wind developments. The largest deviation and associated cost are observed with the higher development scenarios, which are often up to double the cost associated with the central scenario as demonstrated in Table C5.4.

Table C5.4 Offshore Wind

		North		North-East		South-West		West		North-West
		OWN1	OWN2	OWNE1	OWNE2	OWSW1	OWSW2	OWW1	OWW2	OWNW1
Scoping output: Spatial overlap between Draft Plan Option areas and commercial navigation routes greater than 5 or more vessels per day or ferry route		Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only
Central Scenario	Deviation (nm)	2.2	1.7	1.5	1.4	0.2	0.2	1.1	0.8	2.0
	Cost individual journey (£)	229	178	156	143	25	18	113	83	208
	Annual average journeys	1,485	1,762	23,159	6,022	2,914	21,392	1,664	1,960	642
	Cost annual journey (£ millions)	0.3404	0.3136	3.6022	0.8609	0.0726	0.3941	0.1874	0.1621	0.1335
High Scenario	Deviation (nm)	4.4	3.4	3.0	2.8	0.5	0.2	2.2	1.7	4.0
	Cost individual journey (£)	455	358	316	291	53	18	232	172	415
	Annual average journeys	1,485	1,762	23,159	6,022	2,914	21,392	1,664	1,960	642
	Cost annual journey (£ millions)	0.6751	0.6315	7.3078	1.7539	0.1551	0.3941	0.3861	0.3377	0.2665

C5.2.1.3 Commercial shipping routes – wave

All wave developments are scoped out for assessments as the density of the development within each Draft Plan Option area is less than 1%.

C5.2.1.4 Commercial shipping and ferry routes - tide

All tide developments are scoped in for the high development scenarios with the exception of TN3, this site is not scoped in under the high scenario due to its relatively low sea area use for commercial shipping. The scoped in tidal Draft Plan Option areas are located close to, and adjoining the coast, and overlap with commercial shipping and ferry routes. Of note are the series of developments in the Northern sector, between the Scottish mainland and The Orkney Islands, with a series of other developments within the Orkney Islands and within the Shetland

Islands. As the Draft Plan Option areas are located between the islands, in a high development scenario, the sea area usage is a higher percentage, and therefore provides cumulatively significant deviations for shipping. In all cases depths are not sufficient to scope out the Draft Plan Option areas, as depths are predominantly less than 75m with only small regions having larger depths. Off the west and south west coast of Scotland and in relation to developments TW1, TW2 and TSW1, the navigation routes perpendicularly offshore from the coast would mostly be impacted by the location of the tide Draft Plan Option areas, while vessels moving in a north to south direction are less likely to be obstructed.

Calculated costs associated with transiting around tidal development boundaries (where depths are not great enough to safely navigate over them) are summarised in Table C5.5.

Table C5.5 Tide

		North						South-West	West	
		TN1	TN2	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Scoping output: Spatial overlap between Draft Plan Option areas and commercial navigation routes greater than 5 or more vessels per day or ferry route		Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only
High Scenario	Deviation (nm)	0.29	0.05	0.22	0.04	0.03	0.04	0.25	0.27	0.09
	Cost individual journey (£)	30	6	22	4	3	4	26	28	10
	Annual average journeys	13,654	5,315	2,365	1,764	54,467	41,382	3,781	3,608	7,711
	Cost annual journey (£ millions)	0.4163	0.0299	0.0530	0.0075	0.1885	0.1621	0.0983	0.1005	0.0735

C5.2.1.5 Ferry routes - wind

Based on the implemented development scenarios, a number of ferry routes intersect with wind developments. Using the Scottish Government supplied Passenger and Vehicle ferry routes GIS layer ferry routes affected by wind developments include those listed in Table C5.6. The assessment of fuel used for additional steaming distance is part of the overall shipping and ferry deviation calculations detailed in Table C5.4.

Table C5.6 Wind

Draft Plan Option Area	Ferry Route	Location of Intersection
OWN2	Lerwick - Hanstholm	Through the middle
OWN2	Aberdeen - Lerwick	Intersects with South West corner
OWNE2	Aberdeen - Kirkwall	Crosses Western corner
OWNE2	Aberdeen - Lerwick	Crosses Easter corner

C5.2.1.6 Ferry routes - wave

All wave developments are scoped out for assessments as the density of the development within each Draft Plan Option area is less than 1%. Therefore there are no impacted ferry routes.

C5.2.1.7 Ferry routes - tide

Based on the implemented development scenarios, there 10 ferry routes intersecting the tide Draft Plan Option areas as shown in Table C5.7. It is considered that spatial planning will seek to locate tidal developments to minimise interactions, which is especially important where ferry services provide lifeline connections to island communities. The overall calculation of fuel costs based on deviation around tidal sites has been presented in Table C5.5 for all shipping, including ferry services. It should be noted that site specific assessments on individual developments would address ferry route geographic extents, at which time consultation with Harbour Authorities and ferry operators would highlight potential intersections and route deviation.

Table C5.7 Tide

Draft Plan Option Area	Ferry Route	Location of intersection
TN1	Orkney ferries (Other ferry routes)	Through the middle
TN1	Orkney ferries (Other ferry routes)	Through the middle
TN1	Orkney ferries (Other ferry routes)	Through the middle
TN2	Orkney ferries (Other ferry routes)	Through the middle
TN2	Kirkwall - Lerwick	Crosses southern end
TN2	Kirkwall - Stronsay	Crosses southern end
TN2	Orkney ferries (Other ferry routes)	Crosses southern end
TN4	Kirkwall - Lerwick	Crosses South East corner
TN6	Toft - Yell (Ulsta)	Through the middle
TW2	Campbeltown - Ballycastle	Crosses Southern end

C5.2.2 Qualitative Assessment of Increase in Marine Risk

Potential risks to commercial shipping activities from offshore wind developments include:

- Collisions with structures and (or) other vessels either under power or drifting;
- Effects of the wind turbine generators, blades and supports on navigation safety aids, including position-fixing systems (AIS, radar and GPS positioning) and communications (VHF radio); and
- Issues of visibility including obscuration of visual markers as well as obscuration to vessel or shore-based radar when in proximity to the developments.

Due to the commercial navigation intensity combined with other water users such as fishing and recreational users, the potential for vessel to vessel encounters exists. This does not however translate to vessel to vessel collision risk or vessel to structure collision. Instead, the collision risk and frequency would depend on a wide range of factors including conditions, visibility, vessel characteristics and vessel speed. In respect of a wind farm site, the outer structures are most exposed to shipping collision and relate to vessels navigating in restricted visibility, or those with inadequate bridge watch keeping, or vessels adrift and/or not under command. In terms of vessel to vessel collisions, wind farm developments may be a contributory factor if radar systems are affected by reflection from blades and towers.

In the case of the wind Draft Plan Option areas in this study, these are sited further offshore but notably overlap or are positioned in close proximity to established recreational and commercial shipping navigation routes. The implementation of developments on or in close proximity to these routes could lead to the diversion of vessel traffic thereby creating much busier navigation routes and increasing the potential for vessel encounters. In terms of navigation safety and visibility aids, studies by the MCA in association with QinetiQ found that the effects of offshore wind structures on communication and position-fixing systems were not significant enough to affect navigational efficiency or safety (MCA & QinetiQ, 2004). The exception however was a recognised risk to ship-borne and shore-based radar systems. As the presence of wind farm structures can produce false (multiple and reflected) radar echoes, due to the vertical extent of the wind turbine generators. At the same time the turbines can introduce interference and cause shadowing round the structures or development. The potential for radar induced collision is greater with commercial vessel and smaller craft interaction, as smaller craft provide a limited radar return potential, which could potential be 'lost' if wind farm radar effects are significant. The concern is that due to the interference on radar systems from wind farm developments, commercial vessels will reduce the gain of their radar sets and as a result loose smaller recreational craft.

This risk can be mitigated by carrying AIS which provides another means of verifying radar targets. However, AIS carriage is optional for some classes of vessels, including smaller commercial, recreational and fishing vessels. As a result of the recognised risk, documents have been produced which give guidance to mariners navigating in the vicinity of wind farms (MCA, 2004; 2008a), as well as templates for wind farm siting in relation to navigation routes (MCA, 2008b) and the assessment of impacts (DTI, 2005).

With regards to wave developments, the presence of floating structures on or near the sea surface poses a risk to all vessels. This is primarily through the risk of an underwater collision or snagging of vessel lines with structures and their moving parts, while the vessel is either underway or anchoring. Any wave development with surface or near surface wave devices would be identified on a chart and appropriately marked with buoyage as an exclusion zone. The effectiveness of these controls relies on both commercial and recreational vessels monitoring up to date charting information and maintaining an effective watch whilst at sea. The assessment of vessel to structure, and vessel to vessel collision risks described for the wind developments are also applicable here. The largest risks are from the devices located on the outer extents of the development.

The risk associated with communications and visibility through position-fixing systems is not applicable in this instance as the wave devices are at the water surface and do not extend vertically to cause interference. There is however the additional risk of the wave devices breaking free of their moorings and floating into nearby navigation routes, thereby creating a risk of collision. The risk of a vessel not under command, or a vessel struggling to maintain its course and speed in heavy weather and drifting into the wave development exclusion zone should also be recognised. In this instance the ship's crew and the emergency services and their personal would be at risk in performing their duties to preserving life at sea.

The risk associated with the tidal developments is the presence of submerged structures on the seabed posing a risk to surface navigating vessels. This is primarily through the risk of a collision or snagging of vessel lines with structures and their moving parts, while the vessel is either underway or anchoring. Tidal sites would be marked on charts with clearance distances identified. The effectiveness of these controls relies on both commercial and recreational vessels monitoring up to date charting information.

For all the renewable developments, there is the increased risk of collision with installation vessels along cable routes while cabling is laid. This risk is increased in proximity to navigation channels (for example, in port and harbour approaches) and through increased vessel activity in these areas. The risk is transient in nature, and can be mitigated for through planning and informing relevant parties through notices to mariners. Although less likely, but still apparent, is the additional risk of the physical snagging of anchors on cables prior to burial. If cables are laid on the seabed the risk would continue during the operational period of the developments. Burying the cables below the seabed or protection to an appropriate depth, would limited the exposure at the seabed surface and the potential risk. The cabling route would be marked on charts and thereby reduced the risk of damage from anchoring vessels, assuming that vessels update their charted information. Any cabling across port approach channels where routine maintenance dredging is carried out would require agreed burial depth and possible armour protection to prevent damage to dredger dragheads and cabling.

C5.2.3 Quantitative Assessment of Impacts to Displacement of Formal and Informal Anchorages

There are no overlaps between any commercial anchorages and the renewable Draft Plan Option areas or the implemented development scenarios.

There is the potential for overlap between the proposed cable routes and commercial anchorages for wind, wave and tide Draft Plan Option areas. Cable routes associated with OWW1, OWW2 (wind Draft Plan Option areas), WW1, WW2, WW3 (wave Draft Plan Option areas) and TW1 and TW2 (tide Draft Plan Option areas). This would be subject to a site specific risk assessment for each cable route, during which the developer would take into account ship anchoring requirements and history, and identify alternative suitable anchorage locations. Any newly identified anchorage locations are required to provide some protection from weather, wind and waves, be of sufficient seabed depth and sediment to hold an anchor and have enough room for a vessel at anchor to swing with varying conditions.

At the time of writing information on informal anchorages is not available. Therefore in the event that Draft Plan Option areas or associated cable routes overlap these anchorages, similar alternatives in terms of orientation and shielding from wave and storm conditions would be required. The same risks associated with commercial anchorages also apply to informal sites.

C5.2.4 Benefits

Construction of the renewable developments would lead to an increase of commercial short transits in relation to the preparation and construction of the developments. This would in turn generate some economic return for the ports and harbours used in relation to the construction.

C5.2.5 Summary

The assessment has concluded that the most significant deviation for shipping occurs with wind farm development sites, specifically in the North-East around OWNE1 (£7.3 million annually) and to a lesser extent around OWNE2 (£1.8 million annually). The cost relates to additional fuel usage for steaming times as a summation. Within the North at OWN1 and OWN2, circa £0.65 million of additional fuel use has been assessed. At OWN2 this relates to vessel traffic transiting north-south along the eastern side of the Shetland Islands in-combination with vessels transiting to Lerwick and other smaller Shetland Islands Council ports.

All wave sites are scoped out as spatial planning can be used to avoid undue effect on commercial shipping. All tide developments are scoped in for the high development scenarios with the exception of TN3, this site is not scoped in under the high scenario due to its relatively low sea area use for commercial shipping. All tidal sites provide an annual deviation cost of fuel less than £0.2million, with the exception of the West TN1 site which provides a £0.4 million cost.

In respect of ferry routes, a number of routes transect Draft Plan Option areas. The assessment of additional fuel usage is included within the Shipping assessment. Route transecting Draft Plan Option areas have been identified in Tables C5.6 and C5.7.

For all the renewable developments, there is the increased risk of collision with installation vessels along cable routes while cabling is laid. This risk is increased in proximity to navigation channels (for example, in port and harbour approaches) and through increased vessel activity in these areas. The risk is transient in nature, and can be mitigated for through planning and informing relevant parties through notices to mariners.

C5.3 References

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Department of Trade and Industry, 2005. Guidance on the Assessment of the Impact of Offshore Wind Farms: Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms. DTI/Pub 8145/0.5k/12/05/NP

Maritime and Coastguard Agency, 2004. Proposed Offshore Renewable Energy Installations (OREI), Guidance on Navigational Safety Issues. Marine Guidance Note 275

Maritime and Coastguard Agency, 2008a. Offshore Renewable Energy Installations (OREIs), Guidance on UK Navigational Practice, Safety and Emergency Response Issues. Marine Guidance Note 371.

Maritime and Coastguard Agency, 2008b. Offshore Renewable Energy Installations (OREIs), Guidance to Mariners Operating in the Vicinity of UK OREIs. Marine Guidance Note 372.

NOREL NAV SUB Group, 2012. Draft Copy: ‘Under Keel Clearance – Policy Paper Guidance To Developers in Assessing Minimum Water Depth Over Devices’. December 2012

Transport Scotland. 2012. Scottish Ferry Services: Ferries Plan (2013-2022). 89pp. http://www.transportscotland.gov.uk/files/documents/reports/j254579_1.pdf

C6. Energy Generation

C6.1 Scoping Results

The results of the scoping assessment are presented in Table C6.1 (Offshore Wind), Table C6.2 (Wave) and Table C6.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C6.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN 1	OWN 2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW 1	OWW 2	OWW 3	OWNW 1
Spatial overlap between Draft Plan Option areas for different technologies >10% of combined Draft Plan Option areas	Y	N	N	N	Y	N	Y	N	Y	N
Competition for transmission capacity	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table C6.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Spatial overlap between Draft Plan Option areas for different technologies >10% of combined Draft Plan Option areas	N	Y	N	Y	N	N	N	Y
Competition for transmission capacity	Y	Y	Y	Y	Y	Y	Y	Y

Table C6.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Spatial overlap between Draft Plan Option areas for different technologies >10% of combined Draft Plan Option areas	N	N	N	N	N	N	N	Y	N	N
Competition for transmission capacity	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

C6.2 Assessment Results – Estimation of Costs and Benefits

RenewableUK were unable to comment on the methodology at the time of consultation due to the short deadlines imposed by the project.

C6.2.1 Qualitative Assessment of Competition for Space

Scottish Renewables welcomed the recognition that there is a possible impact between renewable sectors. Monetising the degree of impact was considered an extremely difficult challenge, however, Scottish Renewables considered that the fact that offshore wind and marine energies are not established industries is fundamental to the potential degree of impact. Early arrays are essential to the development of the industry as a whole, helping to erode potential future impacts. Any further assessment of spatial overlap will depend on the specific technologies to be deployed at the site, and a more detailed analysis of resource, constraints and development layout at a site specific level.

Scottish Renewables noted the possibility of negative impacts, stemming from developments looking to deploy in the same area within the Draft Plan Option areas, or from separate developments within the Draft Plan Option areas sterilising the resource of another technology type.

The possibility of co-location will also depend on the specific technology types to be deployed in the area. Scottish Renewables, for example, suggested that any issues between Draft Plan Option areas OWSW1 and TSW1 would be minimal due to the fact that fixed tidal may well be able to co-exist with offshore wind. They also noted that there may be more challenges and a higher risk of negative impact with floating wave and offshore wind devices (as wind structures may affect the wave resource). This may be the case for Draft Plan Option areas OWN1 and WN2, OWW3 and WW4 and OWW1 and WW1 (Figure B6). However, Scottish Renewables highlighted that deploying offshore wind developments in high tidal and wave energy environments can be challenging therefore this may reduce the risk of wind developments overlapping with wave and tidal developments.

Another risk relating to the environmental carrying capacity of a region and increased consenting risk due to cumulative impacts was raised by Scottish Renewables. However, it is understood that cumulative environmental impacts will be assessed through the Strategic Environmental Assessment (SEA) and Habitats Regulations Assessment (HRA) process.

C6.2.2 Qualitative Assessment of Competition for Transmission Capacity

The National Electricity Transmission System Seven Year Statement (National Grid, 2011) indicates that there is likely to be a need for new infrastructure/reinforcement in many areas of Scotland to ensure that generated power can be transmitted to where it is required. There are also issues with congestion in the power transmission network between the North and the South of the UK (National Grid, 2011).

A key conclusion of the Scottish Government’s Electricity Generation Policy Statement (EGPS) is that transmission constraints would be a significant factor in ensuring that renewable energy produced in Scotland is properly utilised. However, plans exist to increase the capacity of power interconnections from Scotland. In 2012 Ofgem announced the ‘fast tracking’ of plans for over £7billion investment in Scotland’s high voltage transmission network by 2021. This £7 billion investment to upgrade Scotland’s electricity grid will boost capacity and bring new renewables developments on stream by connecting and transporting energy across Scotland and to other markets (Scottish Government, 2012).

The Scottish Government is part of the Electricity Networks Steering Group (ENSG), led by DECC and Ofgem, which in February 2012 published a Vision for 2020 report highlighting the necessary range of grid development and reinforcement. The report reconfirms the scale of the need for reinforcement across Scotland; reiterates how important these grid upgrades will be to meeting Scotland's renewables ambitions; and improves the capability on Scotland's main interconnector assets by adding around a further 3 GW of import and export capacity in central Scotland, therefore strengthening security of supply and system stability as the generation portfolio moves to a greater balance of renewable energy sources (ENSG, 2012). Based on the above developments, it is therefore likely that the future trend in transmission capacity will be upwards.

Consultation was undertaken with Scottish Renewables to explore the specific Draft Plan Option areas in which competition for transmission capacity was likely to occur. Scottish Renewables were able to confirm that adjacent or overlapping projects may actually have a positive effect by providing critical mass to justify grid investment. Grid liabilities present a challenge for many offshore projects therefore a collaborative approach may help to ease burdens.

Scottish Renewables response to this study indicates that there is the hope that energy generation companies can collaborate rather than compete on grid connection to ensure economies of scale are achieved. This is likely to be critical given that the best sources of renewable energy are typically located at the edges of the current grid network, rather than the centre.

However, Scottish Renewables also noted that indicative cable routes on the west coast would potentially connect into Dalmally and Hunterston substations (Figure B6). If there is capacity at these locations for additional projects, there could be competition for suitable landing locations that meet all the technical and environmental criteria the developer must consider. A shortage of suitable locations could lead to cables being brought onshore several kilometres from the connection point, thus significantly increasing the scope, costs and consenting risks of the onshore transmission works being developed.

Therefore, when determining Draft Plan Option areas for further development, the financial and consenting risks associated with grid capacity, the location of connection points with spare capacity and availability of suitable landing points should all be considered.

C6.2.3 Data Limitations

Offshore renewables are not established industries and therefore it is difficult to determine their interactions with each other and the degree to which any spatial overlap will affect energy generation.

The future of transmission capacity has been based on National Grid and the Scottish Government's future projections for investment and improvement works, however, it is not known exactly where or when these developments will occur.

C6.2.4 Summary

Specific technologies to be deployed within Draft Plan Option areas will determine the degree of impacts associated with spatial overlap of sites. However, in most instances sensitive site development and constructive dialogue between developers will enable technologies to co-exist.

Adjacent or overlapping projects may have a positive effect on transmission capacity by providing critical mass to justify grid investment. However, costs may arise through competition for suitable landing sites close to connection points with spare capacity. Given the uncertainties at this stage, it is not possible to quantify potential cost impacts.

C6.3 References

ABPmer and RPA, 2012. Socio-economic Baseline Reviews for Offshore Renewables in Scottish Waters. Report for Marine Scotland. September 2012.

Allan, G., McGregor, P.G., Swales, J.K. and Turner, K., 2006. Impact of alternative energy generation technologies on the Scottish economy: an illustrative input-output analysis, Proceedings of the Institution of Mechanical Engineers, Vol. 221 Part A: J. Power and Energy, pp243-254.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191

Black, K., 2011. Macroalgae for energy: What's going on in Scotland and Chile? Presentation to The Crown Estate, 31 March 2011.

ENSG, 2012. Our Electricity Transmission Network: A Vision for 2020. February 2012.

FRM, 2010. A review of initiatives and related R&D being undertaken in the UK and internationally regarding the use of macroalgae as a basis for biofuel production and other non-food uses relevant to Scotland. Report commissioned by the Marine Scotland, 79pp.

National Grid, SP Transmission and SSE Power Distribution, 2004. Interim Great Britain Severn Year Statement, November 2004, available from the National Grid Internet site (www.nationalgrid.com).

National Grid, 2012. Electricity Ten Year Statement. November 2012.

Public Interest Research Centre on behalf of The Offshore Valuation Group, 2010. The Offshore Valuation, A valuation of the UK's offshore renewable energy resource. Report available from the Offshore Valuation Group Internet site (http://www.offshorevaluation.org/).

Scottish Development International, Highlands and Islands Enterprise, and Scottish Enterprise, 2011. Scottish Offshore Renewables Development Sites, West Coast Cluster, available from the Scottish Development International Internet site (www.sdi.co.uk).

Scottish Enterprise & Highlands & Islands Enterprise, 2010a. National Renewables Infrastructure Plan. February 2010.

Scottish Enterprise & Highlands & Islands Enterprise, 2010b. National Renewables Infrastructure Plan Stage 2. July 2010.

Scottish Executive, 2005. Scotland's Renewable Energy Potential: realising the 2020 target, Future Generation Group Report 2005, available from the Scottish Government Internet site (www.scotland.gov.uk/Resource/Doc/54357/0013233.pdf).

Scottish Government, 2011. 2020 Routemap for Renewable Energy in Scotland, available electronically on the Scottish Government Internet site (http://www.scotland.gov.uk/Publications/2011/08/04110353/0).

Scottish Government, 2012. Electricity Generation Policy Statement. March 2012.

Verso Economics, 2011. Worth the Candle? The Economic Impact of Renewable Energy Policy in Scotland and the UK, March 2011, available from the Verso Economics Internet site (www.versoeconomics.com).

C7. Military Interests

C7.1 Scoping Results

The results of the scoping assessment are presented in Table C7.1 (Offshore Wind), Table C7.2 (Wave) and Table C7.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C7.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	**OWN2**	**OWNE1**	**OWNE2**	**OWSW1**	**OWSW2**	**OWW1**	**OWW2**	**OWW3**	**OWNW1**
Spatial overlap between Draft Plan Option areas and military practice and exercise areas	N	N	N	Y	N	Y	Y	Y	Y	Y
Spatial overlap between Draft Plan Option areas and military practice and exercise areas - aviation	N	N	N	Y	N	N	N	N	N	Y
Spatial overlap with Low Priority Military Low Flying Area	Y	N	N	N	N	N	N	N	N	N
Potential interference with underwater communications	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spatial overlap with meteorological radar zones	N	N	N	N	N	N	N	N	N	N
Spatial overlap with Eskdalemuir (UK seismic monitoring site) precautionary 80km boundary	N	N	N	N	N	N	N	N	N	N
Spatial overlap with MOD Air Traffic Control/Air Defence radar coverage areas	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and military practice and exercise areas	Y – qualitative assessment		Y – qualitative assessment		Y – qualitative assessment		Y – qualitative assessment			Y – qualitative assessment

[1] Areas where the MOD anticipates the construction of wind turbines is less likely to result in concern due to their likely effect on the UK low flying system, however, for developments within these areas liaison with the MOD is still encouraged prior to making applications for permissions.

Table C7.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Spatial overlap between Draft Plan Option areas and military practice and exercise areas	N	N	N	Y	Y	Y	Y	Y
Potential interference with underwater communications	Y	Y	Y	Y	Y	Y	Y	Y
Spatial overlap with meteorological radar zones	N	N	N	N	N	N	N	N
Spatial overlap with Eskdalemuir (UK seismic monitoring site) precautionary 80km boundary	N	N	N	N	N	N	N	N
Spatial overlap with MOD Air Traffic Control/Air Defence radar coverage areas	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and military practice and exercise areas	Y – qualitative assessment			Y – qualitative assessment			Y – qualitative assessment	

Table C7.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Spatial overlap between Draft Plan Option areas and military practice and exercise areas	N	N	N	N	N	N	N	N	Y	Y
Potential interference with underwater communications	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spatial overlap with meteorological radar zones	N	N	N	N	N	N	N	N	N	N
Spatial overlap with Eskdalemuir (UK seismic monitoring site) precautionary 80km boundary	N	N	N	N	N	N	N	N	N	N
Spatial overlap with MOD Air Traffic Control/Air Defence radar coverage areas	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and military practice and exercise areas	Y – qualitative assessment							Y – qualitative assessment	Y – qualitative assessment	

C7.2 Assessment Results – Estimation of Costs and Benefits

C7.2.1 Competition for Space

The Defence Infrastructure Organisation (DIO) stated that it was not possible to quantify the economic cost impact that would arise from the loss of military testing facilities, should activity be displaced through wind, wave or tidal arrays. Particular areas (for example, Cape Wrath) were extremely important to national defence and there were no equivalent facilities where displaced military exercises could be undertaken (Jon Wilson, DIO, *pers. comm.* 28 February 2013). Marine renewable developments have the potential to affect danger/practice areas and strategic and navigational interests.

C7.2.2 Interference with Radar Systems and Underwater Communications

The DIO stated that interference with radar would arise in relation to wind arrays occurring within the line of sight of radar. At the time of writing no further information had been received regarding any specific areas of concern in relation to interference with radar or underwater communications.

C7.2.3 Summary

It is not possible to quantify the economic cost impact to this sector. Military practice areas and testing facilities are important to national defence and there are no equivalent areas in which these activities can be undertaken. A preliminary assessment of interaction between military installations/locations and PEXA using DECC Safeguarding maps indicated that no wind Draft Plan Option areas fell within areas likely to cause concern with regard to meteorological radar zones or the UK seismic monitoring site precautionary boundary.

C7.3 References

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

DECC website. MOD safeguarding https://www.gov.uk/MOD-safeguarding

United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS), 2010. Charting Progress 2 Feeder Report Productive Seas. Department for Environment Food and Rural Affairs on behalf of UKMMAS (Eds. Saunders, J. and McKie, J.) 472pp Available online: http://chartingprogress.defra.gov.uk/

C8. Oil and Gas

C8.1 Scoping Results

The results of the scoping assessment are presented in Table C8.1 (Offshore Wind), Table C8.2 (Wave) and Table C8.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C8.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	**OWN2**	**OWNE1**	**OWNE2**	**OWSW 1**	**OWSW 2**	**OWW 1**	**OWW 2**	**OWW 3**	**OWNW1**
Draft Plan Option areas overlap or lie inshore of existing hydrocarbon fields	N	Y* – for central and high scenario only	Y* – for central and high scenario only	Y* – for central and high scenario only	N**	N	N	N	N	N
Cable corridors overlap or lie inshore of hydrocarbon fields	Y – qualitative assessment		Y – qualitative assessment		N		N			N

* Draft Plan Option areas lie inshore of hydrocarbon fields. However, arrays for low scenarios occupy <5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.
** Overlap with existing oil and gas licence blocks and pipelines. Renewables developer will bear the cost of any cable crossings required and will not be able to develop within a set distance (corridor) of these pipelines to enable maintenance access to them.

Table C8.2 Wave

	North			West			North-West	
	WN1	**WN2**	**WN3**	**WW1**	**WW2**	**WW3**	**WNW1**	**WW4**
Draft Plan Option areas overlap or lie inshore of existing hydrocarbon fields	N*	N*	N*	N	N	N	N	N
Cable corridors overlap or lie inshore of hydrocarbon fields	Y – qualitative assessment			N			N	

* Draft Plan Option areas lie inshore of hydrocarbon fields. However, arrays for all scenarios occupy <1% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

Table C8.3 Tidal

	North							South-West	West	
	TN1	**TN2**	**TN3**	**TN4**	**TN5**	**TN6**	**TN7**	**TSW1**	**TW1**	**TW2**
Draft Plan Option areas overlap or lie inshore of existing hydrocarbon fields	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	N	N	N	N	N	N
Cable corridors overlap or lie inshore of hydrocarbon fields	Y – qualitative assessment							N	N	

* Draft Plan Option areas lie inshore of hydrocarbon fields. However, arrays for low and central scenarios occupy <5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

C8.2 Assessment Results – Estimation of Costs and Benefits

C8.2.1 Increased Competition for Space

Consultation with industry did not highlight any particular areas of concern or 'conflict' between Draft Plan Option areas or export cable corridors and future sector activity (Mick Borwell, Oil and Gas UK, *pers. comm.*. 4 March 2013). As such, no quantitative cost impact assessment was undertaken.

C8.2.2 Cable/Pipeline Crossings

The standard industry cost of cable crossings is £0.5-£1million (ODIS, 2011) and this assessment has assumed that this cost will be transferred to the renewables developer should power export cables traverse oil or gas pipelines.

However, concerns relating to cable crossing agreements were highlighted by consultation for another industry sector (Power Interconnectors, see Section C10) which would also apply to the Oil and Gas sector. Specifically, industry have highlighted concerns relating to cable crossings and future liabilities, which if realised may have large cost impacts on the sector. It is not currently possible to estimate these cost impacts.

C8.2.3 Increased Difficulty of Access at Crossing Points

Industry consultation indicated that the width of 'working space' (corridor) required to enable maintenance barge access either side of existing oil and gas infrastructure should be determined on a case by case basis, as the anchor spread of some barges may require larger buffers than those established for previous developments (Mick Borwell, Oil and Gas UK, pers. comm. 4 March 2013).

A further future interaction highlighted by Oil and Gas UK was in relation to the potential removal of pipelines at decommissioning. Although this is not currently required under OSPAR, circumstances may change in the future. The corridor for this activity would have to be determined and is not yet known (Mick Borwell, Oil and Gas UK, *pers. comm*. 4 March 2013).

C8.2.4 Summary

Consultation with industry indicated that no significant interactions were anticipated between renewable developments and future oil and gas activities that would result in a cost impact to the oil and gas sector. However, where potential renewable development areas (Draft Plan Option areas or cable corridors) overlap with existing infrastructure future liabilities are uncertain. The width of 'corridors' required to enable maintenance activity will also need to be determined on a case by case basis.

C8.3 References

ABPmer, RPA and SQW, 2011. Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish territorial Waters: Costs and Benefits to Other Marine Users and Interests. Report for Marine Scotland. Report R. 1743, March 2011.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Department for Energy and Climate Change (DECC). 2013. UKCS Oil and Gas Production Projections. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/136390/production_projections.pdf

Infrastructure Planning Commission (IPC), 2010. Scoping Opinion: Proposed Triton Knoll Offshore Wind Farm. September, 2010.

ODIS, 2011. Offshore Development Information Statement: Appendices. Published by National Grid in September 2011.

Oil and Gas UK. 2012a. Economic Report, 2012. http://www.oilandgasuk.co.uk/cmsfiles/modules/ publications/pdfs/EC030.pdf 60pp

Oil and Gas 2012b. 2012 Decommissioning Insight. http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/OP073.pdf 27pp

Saunders, J., Tinch, R., Ozdemiroglu, E. & Hull, S., 2011. Valuing the Marine Estate and UK Seas: Dynamic Baseline Assessment (draft). Marine Estate Research Report for The Crown Estate.

C9. Ports and Harbours

C9.1 Scoping Results

The results of the scoping assessment are presented in Table C9.1 (Offshore Wind), Table C9.2 (Wave) and Table C9.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C9.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWN E1	OWNE2	OWS W1	OWSW 2	OW W1	OW W2	OW W3	OWN W1
Spatial overlap between Draft Plan Option areas and port or harbour maintained navigation channel(s)	N	N	N	N	N	N	N	N	N	N
Draft Plan Option areas within 5km of maintained navigation channel	N	N	N	N	N	N	N	N	N	N
Potential reduced development opportunities (also see ferry routes – section C5)	N	Y* – for central and high scenarios only	N	Y* – for central and high scenarios only	N	N	N	N	N	N
Spatial overlap between cable routes and maintained navigation channels	Y – qualitative assessment		Y – qualitative assessment		N		Y – qualitative assessment			N
* If arrays for low scenario occupy less than 5% of the Draft Plan Option areas, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.										

Table C9.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Spatial overlap between Draft Plan Option areas and port or harbour maintained navigation channel(s)	N	N	N	N	N	N	N	N
Draft Plan Option areas within 5km of maintained navigation channel	N	N	N	N	N	N	N	N
Potential reduced development opportunities (also see ferry routes – section C5)	N	N	N**	N	N	N	N	N
Spatial overlap between cable routes and maintained navigation channels	Y – qualitative assessment			Y – qualitative assessment			N	
* If arrays for low scenario occupy less than 1% of the Draft Plan Option areas, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios. ** Draft Plan Option areas within 5km of maintained navigation channel. However, arrays for all scenarios occupy less than 1% of the Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.								

Table C9.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Spatial overlap between Draft Plan Option areas and port or harbour maintained navigation channel(s)	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	N	N	Y* – for high scenario only	N
Draft Plan Option areas within 5km of maintained navigation channel	N**	N**	N**	N**	N**	N**	N	N**	N**	N**
Potential reduced development opportunities (also see ferry routes – section C5)	Y* – for high scenario only	Y* – for high scenario only	N	Y* – for high scenario only	N	Y* – for high scenario only	Y* – for high scenario only	N	N	Y* – for high scenario only
Spatial overlap between cable routes and maintained navigation channels	Y – qualitative assessment						N	N	Y – qualitative assessment	Y – qualitative assessment

* Spatial overlap between Draft Plan Option areas and port or harbour maintained navigation channel(s). However, arrays for low and central scenarios occupy less than 5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

** Draft Plan Option areas within 5km of port or harbour maintained navigation channel(s). However, arrays for low and central scenarios occupy less than 5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

C9.2 Assessment Results – Estimation of Costs and Benefits

C9.2.1 Quantitative Assessment of Impacts to Port and Harbour Maintained Navigation Channel(s) and Reduced Development Opportunities

No wind or wave Draft Plan Option areas overlap maintained port or harbour channels. Cable corridors from wind and wave Draft Plan Option areas do provide potential for overlapping or crossing port and harbour approaches. Due to the proximity of tidal Draft Plan Option areas to the coast, a number of the developments overlap Port and Harbour maintained navigation channels and access routes; however these are scoped in for high scenarios only. Following the rationale used to assess the impacts on shipping, the high scenario development area identified for shipping (informed by AIS sea area usage and ferry routing) were positioned within each Draft Plan Option areas. From this development positioning within each tidal Draft Plan Option area, an evaluation of distance to the nearest port or harbour was made. This identified only one interaction within 5km, which occurs in TSW1 for the Isle of Whithorn harbour located in Dumfries and Galloway. For vessel navigating to and from this harbour in a NE-SW direction, the deviation around a high scenario tidal site has been evaluated and considered within the shipping section (see Table C5.3) which concluded that the additional steaming distance would be 0.4nm, with an additional annual fuel cost of £39,443. This evaluation is based on AIS data density counts within the boundary of the Draft Plan Option areas and assumed development location.

Cable corridors provide potential for overlapping or crossing port and harbour approaches, the impact on port activity is more evident in close proximity to port and harbour access routes. The impacts can be managed through careful planning and informing relevant parties, possibly identifying alternative access routes (if practical and possible). Ports and harbours can also have a level of control in the cable laying activities through granting works license within their statutory harbour areas. Cable routing will be addressed comprehensively at a site specific assessment stage, when navigation risk assessments are prepared for each development project. More detailed site specific studies will identify the most appropriate cable routes and the ports and harbours likely to be affected by associated activities.

C9.2.2 Reduced Development Opportunities

Table C9.1 (Offshore Wind) and C9.3 (Tidal) identify that for the high scenario only, it is considered that a reduction in development opportunities for Ports may be evident. Following the assessment methodology outlined in B9 Harbour Authorities adjacent to these Draft Plan Option Areas were contacted to understand their view on potential reduced development. Harbour Authorities responding to consultation (Orkney Harbour Authority, Shetland Islands Council Harbour Authority, Scrabster Harbour Authority, etc) expressed interest in seeking to offer port services to the renewable industry, and saw the development of marine renewables in a positive light. As consultees to individual developments within or adjacent to their statutory boundaries, Harbour Authorities would be consulted and would raise any immediate concerns for sighting developments at that time. Therefore it is concluded that offshore renewables provide an opportunity for increased business developments, with any specific concerns with individual developments being address through site specific assessment.

C9.2.3 Summary

The assessment process has not identified any significant adverse effects to Ports and harbours in respect of wind, wave and tidal renewable developments. The assessment has identified that the scale of the development within each Draft Plan Option area can be planned to avoid conflicting with port access routes and channels. The only harbour to have an evident deviation in its approach channel is the Isle of Whithorn harbour located in Dumfries and Galloway. Any temporary increase in marine risk associated with cable laying will be addressed in site specific assessments by renewable development companies, however it is possible to state that these effects are temporary in nature and can be mitigated through Navigational Risk Assessments, good communication and marine planning. The assessment of Shipping (see section C5) provides the monetary values associated with deviations around development sites and therefore the Ports and Harbours evaluation does not carry forward any values into the final financial assessment.

C9.3 References

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

British Ports Association (BPA), 2008. 'Scottish Ports Committee Ports In Scotland "Delivering Value".

Department for Transport (DfT) 2007. Ports Policy Review Interim Report, 19 July 2007. Available from: www.dft.gov.uk/pgr/shippingports/ports/portspolicyreview/portspolicyreviewinterimreport

NOREL NAV SUB Group 2012. Draft Copy: 'Under Keel Clearance – Policy Paper Guidance To Developers in Assessing Minimum Water Depth Over Devices'. December 2012

Scottish Executive, 2006b. 'Scotland's National Transport Policy'. December 2006 Accessed: 15 November 2011. http://www.scotland.gov.uk/Resource/Doc/157751/0042649.pdf

C10. Power Interconnectors

C10.1 Scoping Results

The results of the scoping assessment are presented in Table C10.1 (Offshore Wind), Table C10.2 (Wave) and Table C10.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C10.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE1	OWNE2	OWSW1	OWSW2	OWW1	OWW2	OWW3	OWNW1
Draft Plan Option areas intersect proposed interconnectors	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and proposed interconnectors	N		Y		N		N			N

Table C10.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Draft Plan Option areas intersect proposed interconnectors	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and proposed interconnectors	N			N			N	

Table C10.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Draft Plan Option areas intersect proposed interconnectors	N	N	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and proposed interconnectors	N							N	N	

C10.2 Assessment Results – Estimation of Costs and Benefits

C10.2.1 Intersections with Proposed Interconnectors and Cable Crossings

The proposed UK-Norway NorthConnect Interconnector was the only future interconnector identified which was due for completion after 2018. Although landfall sites have been identified as Sandford Bay, Peterhead (Aberdeenshire) and Sima or Samnanger in Norway, the final cable route is not yet confirmed, although an indicative route is shown in Figure C10[28].

Based on this indicative cable route, this assessment suggests that it is unlikely that the NorthConnect interconnectors will intersect with any Draft Plan Option area in the North East SORER but there is the potential for intersection with the export cable corridors from the wind Draft Plan Option areas OWNE1 and OWNE2.

The standard industry cost of cable crossings is £0.5-£1million (ODIS, 2011) and this assessment has assumed that this cost will be transferred to the renewables developer if the interconnector is consented prior to the assumed lease agreement date for export cable corridors (2020).

However, concerns relating to cable crossing agreements were highlighted by the industry consultation, specifically in relation to whether cable crossing agreements will cover future liability. Meetings are currently being held with regulators in England to ascertain the stance on cable crossings, compensation and consequential compensation and this issue is likely to need to be similarly addressed in Scottish Waters.

28 Public Exhibition material UK, November 2012; available via the NorthConnect website: http://www.northconnect.no/;

C10.2.2 Increased Difficulty of Access to Existing or Future/Proposed Interconnectors at Crossing Points

In addition to the above concerns relating to cable crossings, where there are multiple cables in close proximity, it is likely to become more difficult to retrieve cables for maintenance. Furthermore, where maintenance is required in the vicinity of cable crossovers, this is likely to preclude maintenance techniques which involve cable retrieval. Instead, more expensive maintenance methods will be required, potentially relying on the use of divers or Remote Operated Vehicles (ROVs). These methods will be significantly more expensive than traditional cable maintenance techniques (ABPmer et al. 2011). No information was received from industry as to whether there were any areas of concern or the significance of this issue in relation to the proposed wind, wave or tidal Draft Plan Option areas and cable corridors.

C10.2.3 Summary

Based on the assumptions stated in the methodology, the assessment indicates that all current planned/proposed interconnectors, except the UK-Norway NorthConnect, are likely to be consented prior to the leasing of Draft Plan Option areas or cable corridors and hence no interactions with this sector are anticipated for these future interconnectors. Although the NorthConnect interconnector route has not been finalised, based on current understanding of the potential route corridor, it may not intersect (and therefore need to deviate around) any Draft Plan Option areas, indicating that it is unlikely that there will be a significant cost impact to this sector. However, industry have highlighted concerns relating to cable crossings and future liabilities, which if realised may have large cost impacts on the sector. It is not currently possible to estimate these cost impacts.

C10.3 References

ABPmer, RPA and SQW, 2011. Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish territorial Waters: Costs and Benefits to Other Marine Users and Interests. Report for Marine Scotland. Report R. 1743, March 2011.

DECC website. Electricity Networks Strategy Group (ENSG) http://webarchive.nationalarchives.gov.uk/20121217150421/www.decc.gov.uk/en/content/cms/meeting_energy/network/ensg/ensg.aspx Accessed: 15/03/13

Electricity Strategy Network Group, 2012. ENSG ‘Our Electricity Transmission Network: A Vision For 2020’. Available online: http://webarchive.nationalarchives.gov.uk/20121217150421/www.decc.gov.uk/en/content/cms/meeting_energy/network/ensg/ensg.aspx

ODIS, 2011. Offshore Development Information Statement: Appendices. Published by National Grid in September 2011.

Saunders, J., Tinch, R., Ozdemiroglu, E. & Hull, S., 2011. Valuing the Marine Estate and UK Seas: Dynamic Baseline Assessment (draft). Marine Estate Research Report for The Crown Estate.

Scottish Government, 2009. National Planning Framework for Scotland 2.

Scottish Government, 2012. Energy Generation Policy Statement, March 2012. ISBM 978-78045-724-6 (web only). Available online: http://www.scotland.gov.uk/Resource/0039/00390216.pdf

United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS), 2010. Charting Progress 2 Feeder Report Productive Seas. Department for Environment Food and Rural Affairs on behalf of UKMMAS (Eds. Saunders, J. and McKie, J.) 472pp Available online: http://chartingprogress.defra. gov.uk/

C11. Recreational Boating

C411.1 Scoping Results

The results of the scoping assessment are presented in Table C11.1 (Offshore Wind), Table C11.2 (Wave) and Table C11.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C11.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE1	OWNE2	OWSW1	OWSW2	OWW1	OWW2	OWW3	OWNW1
Spatial overlap between Draft Plan Option areas and heavy or medium cruising routes	N	N	Y* – for central and high scenarios only	N	Y* – for central and high scenarios only	Y* – for central and high scenarios only	N	N	N	N
Spatial overlap between Draft Plan Option areas and sailing areas	N	N	N	N	N**	N**	N	N	N	N
Spatial overlap between Draft Plan Option areas and racing areas	N	N	N	N	N	N	N	N	N	N
Potential deterrent to investment	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only

* Draft Plan Option areas transected by heavy or medium use cruising route(s), arrays for low scenario occupy less than 5% of Draft Plan Option areas and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under this scenario.
** Spatial overlap of RYA Sailing or Racing areas with Draft Plan Option areas, but this is less than 10% of combined area (Draft Plan Option areas plus sailing area) and it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under all scenarios.

Table C11.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Spatial overlap between Draft Plan Option areas and heavy or medium cruising routes	N*	N*	N	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and sailing areas	N	N	Y	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and racing areas	N	N	N	N	N	N	N	N
Potential deterrent to investment	N	N*	N*	N	N	N	N	N

* Draft Plan Option areas transected by heavy or medium use cruising route(s), and arrays for all scenarios occupy less than 1% of Draft Plan Option areas, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

Table C11.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Spatial overlap between Draft Plan Option areas and heavy or medium cruising routes	N**	N	Y* – for high scenario only	N	N	N	N	Y* – for high scenario only	N	N**
Spatial overlap between Draft Plan Option areas and sailing areas	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Spatial overlap between Draft Plan Option areas and racing areas	N	N	N	N	N	N	N	N	N	N
Potential deterrent to investment	N**	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	Y* – for high scenario only	N**

* Draft Plan Option areas transected by heavy or medium use cruising route(s), and arrays for low and central scenarios occupy less than 5% of Draft Plan Option areas, it has been assumed that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios.

** Draft Plan Option areas scoped out due to depths greater than 40m.

C11.2 Assessment Results – Estimation of Costs and Benefits

C11.2.1 Quantitative Assessment of Impacts to Cruising Routes

Indicative costs associated with modifying existing cruising routes for recreational vessels have been calculated with respect to additional transit distance and cost.

C11.2.1.1 Cruising routes - wind

For the Draft Plan Option areas associated with offshore wind, three have been scoped in for assessment and are OWNE1, OWSW1 and OWSW2. These Draft Plan Option areas are crossed by Medium cruising routes, no Heavy use routes cross any Draft Plan Option areas. Typically, more than one medium intensity route overlaps each of the Draft Plan Option areas. The calculated costs associated with transiting around wind development boundaries for recreational vessels are summarised in Table C11.4.

Table C11.4 Offshore Wind Costs

		North-East	South-West	
		OWNE1	**OWSW1**	**OWSW2**
	Scoping result: Spatial overlap	Y* – for central and high scenarios only	Y* – for central and high scenarios only	Y* – for central and high scenarios only
Central Scenario	Number of routes intersecting	1	2	1
	Deviation (nm)	0.21	0.44	0.26
	Cost individual journey (£)	0.37	0.77	0.45
	Annual journeys	1825	1825	1825
	Cost annual journey (£ millions)	0.0007	0.0014	0.0008
High Scenario	Number of routes intersecting	1	3	1
	Deviation (nm)	1.01	1.21	0.47
	Cost individual journey (£)	1.74	2.10	0.82
	Annual journeys	1825	1825	1825
	Cost annual journey (£ millions)	0.0032	0.0038	0.0015

Based on the assessment, the largest deviation and associated cost is observed with site OWSW1 under the high development scenario, where an annual deviation cost is approximately £4,000 has been assessed. Costs are larger for the developments within OWSW1 as three cruising routes intersect the development boundary. Costs are also much lower for the medium development scenarios, with a maximum annual additional transit cost of less than £1000.

C11.2.1.2 Cruising routes - wave

All wave developments are scoped out for assessments as the density of the development within each Draft Plan Option area is less than 1%. The assumption that spatial planning of the Draft Plan Option areas can be used to avoid significant impacts under these scenarios can therefore be applied.

C11.2.1.3 Cruising routes - tide

For the Draft Plan Option areas associated with tide developments, two were identified to have overlapping cruising routes. These were TN3 and TSW1, where the others were scoped either because the seabed depths are greater than 40m or no routes intersected the Draft Plan Option area. For the two Draft Plan Option areas scoped in the impact is considered to occur only for the high development scenario, where the density of development is greater than 5% of the Draft Plan Option area.

Of the scoped in Draft Plan Option areas, cruising routes only intersect one development boundary, which is that in TSW1. At the same time although up to five medium use cruising routes intersect the wider Draft Plan Option areas, only one route actually intersects the development boundary. As such, the assessment has been completed on the single route through the boundary, the results of which are presented in Table C11.5.

Table C11.5 Tide Costs

		South-West
		TSW1
	Scoping result: Spatial overlap	Y* – for high scenario only
High Scenario	Number of routes intersecting	1
	Deviation (nm)	1.43
	Cost individual journey (£)	2.48
	Annual journeys	1825
	Cost annual journey (£ millions)	0.0045

C11.2.2 Qualitative Assessment Of Increase in Marine Risk

Potential risks to recreational boating activities from the offshore wind developments include collision with structures, effects on navigation and communication equipment and visibility creating a vessel to vessel collision risk. Collision risk is dependant on a wide range of factors including conditions, visibility, vessel characteristics and vessel speed.

Studies in relation to wind farms in the UK and using characteristic site conditions identified that for vessel to structure collision scenarios, the outer structures provide the largest potential for collision. This risk is however minimal assuming the vessel is being correctly navigated with an alert helm on watch, and is therefore collision are only likely to occur where a vessel is not under command or adversely affected by the weather to a point where the intended course cannot be maintained. In this situation, the risk is posed by the Wind Farm moving parts, particularly the rotor blade, and any other solid structure such as the supports. Due to this risk to recreational vessels, the RYA has specified a minimum rotor height clearance above mean high water springs of 22.6m (RYA, 2008). These clearances should also take into account sea conditions and may need to take a further 2 metres clearance (additional height on sea conditions).

In the case of the wind Draft Plan Option areas in this study, these are sited further offshore but notably overlap or are positioned in close proximity to established recreational and commercial shipping navigation routes. The displacement of Commercial Shipping routes due to wind farm developments may increase the risk to recreational vessels through increased use of other sea areas; this is especially the case for the North-East site of OWNE1.

In terms of navigation safety and visibility aids, studies by the MCA in association with QinetiQb found that the effects of offshore wind structures on communication and position-fixing systems were not significant enough to affect navigational efficiency or safety (MCA & QinetiQ, 2004). The exception however was a recognised risk to ship-borne and shore-based radar systems as the presence of wind farm structures can produce false (multiple and reflected) radar echoes, due to the vertical extent of the wind turbine generators. At the same time the turbines can reduce introduce interference and cause shadowing for a given distance round the structures or development. The risk to recreational vessels is that the resulting lack of visibility of such small craft to search and rescue vessels, each other and larger commercial vessels in proximity to wind farm structures. This is particularly true for small craft and their navigational equipment as these are often not as powerful as commercial vessels.

With regards to wave developments, the presence of floating structures on or near the sea surface poses a risk to all vessels. This is primarily through the risk of an underwater collision or snagging of vessel lines with structures and their moving parts, while the vessel is either under power or adrift. Any wave development with surface or near surface wave devices would be identified on a chart and appropriately marked with buoyage as an exclusion zone. The effectiveness of these controls relies on both commercial and recreational vessels monitoring up to date charting information and maintaining an effective watch whilst at sea. The risk of a vessel not under command or a vessel struggling to maintain its course and speed in heavy weather and drifting into the wave development exclusion zone, should also be recognised. In this instance the boats crew and the emergency services and their personal would all be at risk in performing their duties in preserving life at sea.

The risk associated with the tidal developments is principally the risk of underwater collision or snagging of rope or anchor chain with structures whilst under power or adrift. The water depth for tidal devices has been assessed to be 40m, which provides an allowance of circa 20m from the bed (to avoid bed turbulence) and a maximum blade around 10m in diameter, providing a 30m bed-to-blade-tip clearance. This provides a clearance of at least 8m assuming a 2m draught vessel. Where tidal sites are situated in water depths less than this and an exclusion zone needs to be established, the risk posed to smaller vessels navigating further from shore is apparent. For example, in the West at TW2, vessels rounding the Mull of Kintyre which are deviated away from the coast could be set further out to sea. This would affect the attractiveness of navigating from the Clyde to the cruising grounds and outer islands within this region. Other examples of this increased risk and associated dissuasion of planned passage can be found in the South-West region around the Mull of Galloway for the TSW1 Draft Plan Option area.

For all the renewable developments, there is a marginal increased risk of collision with installation vessels along cable routes while cabling is laid. This risk is increased in proximity to navigation channels and port and harbours approaches through increased vessel activity in these areas. The risk is however transient in nature and can be adequately mitigated for through planning and informing relevant parties through notices to mariners. It is concluded that cable installations are unlikely to have an impact on the recreational community as sailors and power boat owners are used to taking account of shipping, which is common place requirement of navigation interaction with Commercial Shipping.

C11.2.3 Deterrent to Investment in Marinas/Supply Chain - Qualitative Assessment

C11.2.3.1 Deterrent to investment – New marina berth developments

Measures from 2007 indicate that the GVA contribution of coastal marinas to the UK economy is estimated to be in excess of £500 million and potentially up to £700 million (BMF, 2005; 2007). At the same time, coastal marinas directly employ over 1,700 people and support the employment of 22,000 more people. Furthermore coastal marinas provide significant benefits to local economies, in terms of supply chain businesses and tourist jobs. Scottish marinas potentially account up to 9% of this value based on their ability to meet the demand due to the number of coastal marina berths (Robinson, 2009).

The Scottish Development International (SDI) highlights the revenue sailing and marinas bring into the Scottish economy with ongoing investment into this sector. This is in terms of Key Performance Indicators (KPI) which indicate that Scotland's sailing sector itself is worth over £101 million, with which there is an associated future growth in demand (SDI, 2012). As such over a thousand new pontoon berths, some of which would be associated with marina developments are either in planning or currently under development (SDI, 2012). At the same time the SDI also indicate that the new provision of berths would need to double in the next ten years in order to meet demand, meaning there are in excess of 2000 new berths required by 2025. Assuming the number of berths as a proxy for investment required to meet the demand, based on the most recent investment example from Rhu Marina on the Firth of Clyde, an approximate investment value of £10 million over a 10-year period has been inferred.

It is not possible to provide a quantitative assessment of the potential deterrent of investment from Draft Plan Option area at a national scale. Site specific evaluation for individual developments should take into account the potential deterrent to marina investment. The results of these site specific assessments will be highly dependent on the renewable energy development location, cruising, racing and leisure use in the local area; plus the potential demand for berths.

C11.3.2.2 Deterrent to investment – established marinas

To provide a more detailed consideration of the potential for deterrent to use existing marinas, Draft Plan Option areas that overlapped medium intensity cruising routes with direct links to marinas were identified.

This assessment identified that for offshore wind Draft Plan Option, OWNE1 and OWNE2 located on the North-East region overlapped two medium intensity routes that linked to the Peterhead Bay marina. For wave Draft Plan Option areas WN2 fronted the Stromness and Westray marinas thereby limiting direct access from offshore locations, and WN2 fronted the Scalloway, Skeld and Walls marinas, which limited offshore access especially as the boundaries of this development abuts with the coast. For tidal developments, one Draft Plan Option area was identified, which was TW2 which overlapped a medium intensity route into the marina at Port Ellen. The pathway for affecting economic factors (as commented upon by the RYA) is noted as:

1) Vessels are discouraged from sailing to particular areas because offshore renewable energy installation schemes as skippers are dissuaded from making passage plans that involve passage through or in proximity to renewable developments leading to consequent effect on local businesses, this in tern leads to;
2) Deterrent to investment in facilities for visiting sailors including by community groups in remote areas due to reduced numbers of visiting craft, this in tern leads to;
3) A reduction in the number of craft visiting communities reliant on tourism because of no inward investment into berthing or onshore facilities, which potentially leads to;
4) Loss of business, potential failures of existing businesses as business plan targets are unable to be met. (Graham Russell RYA Scotland pers. comm.).

The additional journey time is important to recreational sailors, whilst the assessment in this report has covered additional costs for fuel, it is has not been possible to quantify the potential for lost revenue through dissuasion of attempting the passage or holiday. Most cruising sailors around Scotland either spend a long time on an extensive voyage or charter a vessel from a charter base (largely but not entirely on the Clyde or the west coast) and spend a week or a fortnight cruising. Unlike the owner who can choose to leave his or her vessel in a safe haven if conditions deteriorate, the charterer has to return the boat on time and additional journey time around renewable developments may mean that some passages are no longer prudent.

C11.2.3.3 Deterrent to investment – cable routes

In a number of instances the potential cable routes associated with the renewable developments overlapped marina locations as well as the cruising routes into the marinas. However it is assumed that the cables would be buried below the seabed or protection, meaning there would be limited to no exposure at the seabed surface.

C11.2.4 Summary

The assessment of costs incurred through deviations for renewable development sites has concluded that three wind sites (OWSW1, OWSW2 and OWNE1) provides a combined additional fuel cost of circa £8,500 annually. The assessment assumes that all vessels are under power. The relative risk of development sites on recreational boating has been assessed qualitatively, and has concluded that increased risks are apparent, especially for development sites located in sea areas which are already challenging to navigate. This increased risk is mitigated through passage planning and awareness, plus the update and circulation of up to date navigational information via charting publications. The effect on deterrent to marina developments has also been highlighted; identify the role of site specific assessments for individual renewable developments which should recognise and evaluate the potential for deterrent in marina investment.

C11.3 References

Agriculture and Horticulture Development Board, 2013. Monthly Fuel Price Tracker. Published 6 February 13. www.ahdb.org.uk.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

British Marine Federation, 2005. Economic Benefits of the UK Leisure Boating Industry. The British Marine Federation Report.

British Marine Federation, 2007. Executive Summary. Economic Benefits of Coastal Marinas UK and Channel Islands. The British Marine Federation Report.

MCCIP, 2008. Marine climate change impacts. Annual Report Card 2007–2008

Robinson, K., 2009 Marinas: The Tourism Aspect of Leisure Boating. Unpublished report: http://www.insights.org.uk/articleitem.aspx?title=Marinas:%20The%20Tourism%20Aspect%20of%20Leisure%20Boating. Accessed 8th March 2003.

RYA, 2008. UK Coastal Atlas of Recreational Boating.

Russell, G., 2013. Personal Communications. Response to consultation invitation (February 2013).

Scottish Development International, 2012. Scotland: Opportunities in Tourism Investment. Scottish Development International Report.

Scottish Enterprise, 2010. 'Sailing Tourism In Scotland' February 2010

United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS), 2010. Charting Progress 2 Feeder Report Productive Seas. Department for Environment Food and Rural Affairs on behalf of UKMMAS (Eds. Saunders, J. and McKie, J.) 472pp Available online: http://chartingprogress.defra. gov.uk/

C12. Telecom Cables

C12.1 Scoping Results

No information was received from industry regarding potential cable route replacements/extensions or future cable routes. As such it was not possible to identify any wind, wave or tidal Draft Plan Option areas or export cable corridors which may have a potentially negative effect on this sector and hence no areas could be taken forward for assessment.

C12.2 Assessment Results – Estimation of Costs and Benefits

C12.2.1 Increased Competition for Space

No information was received from the industry consultation regarding potential cable route extensions or future cable routes. As such no assessment could be undertaken of this potential cost impact to the sector.

C12.2.2 Cable/Pipeline Crossings

The standard industry cost of cable crossings is £0.5-£1million (ODIS, 2011) and this assessment has assumed that this cost will be transferred to the renewables developer if the telecom cable extension/route is consented prior to the assumed lease agreement date for export cable corridors (2020).

However, concerns relating to cable crossing agreements were highlighted by consultation for another industry sector (Power Interconnectors, see Section C10) which would also apply to the Telecommunication sector. Specifically, industry have highlighted concerns relating to cable crossings and future liabilities, which if realised may have large cost impacts on the sector. It is not currently possible to estimate these cost impacts.

C12.2.3 Increased Difficulty of Access at Crossing Points

In addition to the above concerns relating to cable crossings, where there are multiple cables in close proximity, it is likely to become more difficult to retrieve cables for maintenance. Furthermore, where maintenance is required in the vicinity of cable crossovers, this is likely to preclude maintenance techniques which involve cable retrieval. Instead, more expensive maintenance methods will be required, relying on the use of divers or Remote Operated Vehicles (ROVs). These methods will be significantly more expensive than traditional cable maintenance techniques (ABPmer et al. 2011). No information was received from industry as to whether there were any particular areas of concern in relation to the proposed wind, wave or tidal Draft Plan Option areas and cable corridors or the significance of this issue.

C12.2.4 Summary

No information was obtained from the telecommunications cable industry regarding any areas of significant concern for the sector in relation to the proposed Draft Plan Option areas and export cable corridors. As such, no cost impact could be assessed for this sector. As for other industry sectors which utilise subsea cables or pipelines, the cost impacts of cable crossings and increased difficulty of access of maintenance are currently unclear.

C12.3 References

ABPmer, RPA and SQW, 2011. Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish territorial Waters: Costs and Benefits to Other Marine Users and Interests. Report for Marine Scotland. Report R. 1743, March 2011.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

Kingfisher, 2013. Kingfisher Cable Awareness Charts.

ODIS, 2011. Offshore Development Information Statement: Appendices. Published by National Grid in September 2011.

Saunders, J., Tinch, R., Ozdemiroglu, E. & Hull, S., 2011. Valuing the Marine Estate and UK Seas: Dynamic Baseline Assessment (draft). Marine Estate Research Report for The Crown Estate.

C13. Tourism (Inc. Ecotourism, Archaeological Heritage)

C13.1 Scoping Results

The results of the scoping assessment are presented in Table C13.1 (Offshore Wind) and indicate whether more detailed assessment is required (Y/N).

Table C13.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE 1	OWNE 2	OWS W1	OWS W2	OWW1	OWW2	OWW3	OWNW1
Potential landscape/seascape impact on tourism	Y*	Y	N	Y	Y*	Y*	Y	N	Y*	N
* Central and high scenarios only. It has been assumed that in the low scenario, spatial planning could be used to avoid landscape and visual impacts										

C13.2 Assessment Results – Estimation of Costs and Benefits

C13.2.1 Landscape/Seascape Impacts Arising from Wind Arrays

For each of the SORER regions scoped into the assessment, the proportion of the relevant VisitScotland Region affected by wind Draft Plan Option areas (i.e. the percentage of the VisitScotland Region within the 'Zone of Influence' of a Draft Plan Option area) is shown in Table C13.2 and FiguresC13.1and C13.2[29].

Table C13.2 Proportion of VisitScotland Regions Affected by Wind Draft Plan Option Areas

	North	North	South-West	South-West	West
	OWN1	OWN2	OWSW1	OWSW2	OWW3
Potential landscape/seascape impact on tourism	Y*	Y*	Y*	Y*	Y*
VS Region*	Orkney	Shetland	Dumfries & Galloway	Dumfries & Galloway	Western Isles
2012 Tourism Expenditure (£million)	35	14	165	165	58
Area of VS Region (km^2)	1,012	1,465	5,435	5,435	3,115
Area of ZOI (km^2)	76.53	0.01	6.20	3.30	6.72
% VS Region within ZOI (%)	7.56	0.001	0.11	0.06	0.22
* VS Region = VisitScotland Region					

The proportion of the VisitScotland region within the ZOI was then used to estimate the reduction in tourism expenditure as described in Appendix B13. Given the small proportion of the Shetland Islands area contained within the ZOI of the wind Draft Plan Option area OWN2 (0.001%), no cost estimate was undertaken of this interaction as it was considered negligible.

Table C13.3 shows the cost impacts calculated to arise from each wind Draft Plan Option areas in 2023 and 2035.

29 Note - although the Draft Plan Option OWNE2 was scoped into the assessment (Table C13.1), due to the adjacent coastline having a Capacity Index score of 1, and no area of overlap with the 10km buffer around the Draft Plan Option (see Section B13.5.5), no cost impact assessment was undertaken.

Table C13.3 Cost Impacts to Tourism Expenditure

	North	South-West	South-West	West	West
	OWN1	OWSW1	OWSW2	OWW3	OWW1
VS Region	Orkney	Dumfries & Galloway*	Dumfries & Galloway*	Western Isles	Argyll & the Isles, Loch Lomond, Stirling and Forth Valley*
2012 Tourism Expenditure (£million)	32	152.53	152.53	53.33	693.30
Estimated cost impact from 2025 (full operation) - central (£million)	.0.031	0.0023	0.0012	0.0015	n/a**
Estimated cost impact from 2025 (full operation) - high (£million)	0.084	0.0254	0.0207	0.0026	0.0054

VS Region = VisitScotland Region;
* It is acknowledged that not all of this VS Region is within the corresponding SORER, however the expenditure data cannot be disaggregated further; ** no cost impact estimate was made for OWW1 in the central scenario as the Draft Plan Option does not lie within 10km of the coastline.

C13.2.2 Landscape/Seascape Impacts and Disturbance From Onshore Operation and Maintenance (O&M) Facilities and Substations

The requirement for and/or location of substations and O&M facilities is uncertain. It has therefore, not been possible to quantify potential impacts.

The nature and size of onshore components for offshore renewable developments vary. Some developments feature onshore powerhouses with associated buried pipelines potentially crossing the foreshore and immediate hinterland while other offshore devices have integral turbines. A sub-station is needed for all schemes and this will have associated vehicular access with security fencing around the facility also a requirement. Multiple onshore facilities may be required for some schemes.

O&M facilities associated with any of the proposed developments are likely to be small and no larger manufacturing facilities are likely to be located outside of urban centres. In order to gain planning permission any facilities will likely need to be ‘in scale’ with the local environment.

C13.2.3 Data Limitations

The lack of resolution of the data and the lack of evidence relating to the impact of offshore wind farms on tourism volume and values mean that the estimated cost impacts are relatively uncertain. These limitations are expanded on below.

The VisitScotland regions used to estimate the baseline tourism expenditure values do not align with the SORER regions and as such the baseline values are an indicative estimate of the value of tourism within each SORER. Furthermore, the baseline regional tourism values used in the impact assessment represent all tourism within the VisitScotland regions (i.e. coastal and inland) and the assessment assumes that this tourism is evenly distributed throughout the region. It is likely that this is not the case and as such the values of tourism expenditure and the impacts on these values should also be regarded as indicative.

The impact assessment has assumed that the expenditure lost within a ZOI is lost from the region and from Scotland as a whole. The Riddington et al. (2008) study on which the impact assessment is based, has estimated reductions in expenditure for its case study areas, which are broadly of a similar scale to draft Plan regions. Thus the assumption that displacement occurs from within a Region is possibly valid, although given the small area of land that falls within the ZOI in each region this is considered to be unlikely. Similarly, the assumption that displacement occurs for Scotland as a whole is likely to be highly conservative, as even in the event that some expenditure is displaced from a region, it is likely to be displaced to other regions within Scotland.

Despite the existence of OWFs in England, there is still no evidence identifying significant impacts on tourism volume and value from these developments. As such, the above assessment has used evidence relating to the impacts of onshore wind farms, although it is recognised that the findings from onshore studies may not be perfectly transferable.

No information was sourced relating to major tourism investment projects in any of the regions scoped into the assessment. As such, the costs calculated do not account for any impacts related to loss of investment.

C13.2.4 Summary

The assessment indicated that the recurring cost impacts on tourism would be greatest in the North SORER, in Orkney specifically. Within the other regions, cost impacts were markedly lower and likely to be insignificant.

C13.3 References

ABPmer and RPA, 2012. Socio-economic baseline reviews for offshore renewables in Scottish waters. Volume 1: Main text. Report R.1905, September 2012.

Aitchison, 2012. Tourism Impact Assessment Report. Appendix 8.1. Llanbrynmair Wind Farm, Volume II - Supplementary Environmental Information: Supporting Appendices. Available online: http://www.llanbrynmairwindfarm.co.uk/media/1058782/sei%203%20volume%20ii.pdf

Aitchison, C. (2004) The Potential Impact of Fullabrook Wind Farm Proposal, North Devon: Evidence Gathering of the Impact of Wind Farms on Visitor Numbers and Tourist Experience, Bristol: University of the West of England/Devon Wind Power.

Benfield, S and McConnell, S (2007): Marine and Coastal Visitor Management, Public Engagement and Interpretation in Argyll and the Islands: the way forward. Marine and Coastal Development Unit, Argyll & Bute Council, 2007, pp1-145.

Blaydes Lilley, M., Firestone, J., Kempton, W. 2010. The effect of wind power installations on coastal tourism. Energies, 3, 1-22.

Brown, K.M., Curry, N., Dilley, R., Taylor, K. & Clark, M., 2010. Assessing future recreation demand. Scottish Natural Heritage Commissioned Report No.404.

BWEA, 2006. The Impact of Wind Farms on the Tourist Industry in the UK, London: British Wind Energy Association.

Department of Trade and Industry (DTI), 2005. Guidance on the assessment of the impacts of offshore wind farms: Seascape and visual impact report. Available online: http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file22852.pdf

Joint Marine Programme, 2004. The tangle of the Clyde, why we must reform the management of Scotland's marine environment, WWF and Scottish Wildlife Trust, April 2004, pp 1-16.

Kuehn, S. Sociological Investigation of The Reception of Horns Rev and Nysted Offshore Wind Farms In the Local Communities; Annual Status Report 2003; Elsam Engineering: Fredericia, Denmark, 2005; pp. 1-25.

Ladenburg, J & Dubgaard, A. 2009. Preferences of coastal zone user groups regarding the siting of offshore wind farms. Ocean & Coastal Management, 52(5), 233-242.

Ladenburg, J, 2010. Attitudes towards offshore wind farms - the role of beach visits on attitude and demographic and attitude relations. Energy Policy, 38(3). 1297-1304.

Lambert, E., MacLeod, C.D., Hunter, C. and Pierce, G.J., 2011. The Future of Cetacean Watching in Scotland under Different Climate Change Scenarios – The Changing Nature of Scotland, eds. S.J. Marrs, S. Foster, C. Hendrie, E.C. Mackey, D.B.A. Thompson. TSO Scotland, Edinburgh.

McMorran, R., M. F. Price, and A. McVittie. A review of the benefits and opportunities attributed to Scotland's landscapes of wild character. Scottish Natural Heritage, 2006.

Riddington, G., Harrison, T., McArthur, D., Gibson, H., Millar, K. The economic impacts of wind farms on Scottish tourism. A report for the Scottish Government. March 2008.

Royal Haskoning 2010

RPA & Cambridge Econometrics, 2008. The Economic Impact of Scotland's Natural Environment. Scottish Natural Heritage Commissioned Report No.304 (ROAME No. R07AA106).

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F., MacFarlane, R., 2005. An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore wind farms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

Scottish Executive, 2006a. Scottish Tourism: the next decade. A tourism framework for change, Report published by the Scottish Executive, March 2006.

The Tourism Company, 2012. The impact of wind turbines on tourism - a literature review. Prepared for Isle of Anglesey County Council, February 2012. Available online: http://www.anglesey.gov.uk/Journals/2012/10/30/the-impact-of-wind-turbines-on-tourism.pdf

TNS Research International, 2010. Scottish Recreation Survey: annual summary report 2009. Scottish Natural Heritage Commissioned Report No.395.

TNS Research International, 2011. Scottish Recreation Survey: annual summary report 2010. Scottish Natural Heritage Commissioned Report No.465.

VisitScotland, 2011. Insight Department: Wind Farm Consumer Research: Topic Paper.

C14. Waste Disposal

C14.1 Scoping Results

The results of the scoping assessment are presented in Table C14.1 (Offshore Wind), Table C14.2 (Wave) and Table C14.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C14.1 Offshore Wind

	North		North-East		South-West		West			North-West
	OWN1	OWN2	OWNE 1	OWNE 2	OWSW 1	OWSW 2	OWW 1	OWW 2	OWW 3	OWNW1
Loss or reduced use of dredge material disposal sites-Draft Plan Option areas overlap	N	N	N	N	N	N	N	N	N	N
Access to dredged material disposal grounds	N	N	N	N	N	N	N	N	N	N

Table C14.2 Wave

	North			West			North-West	
	WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WW4
Loss or reduced use of dredge material disposal sites-Draft Plan Option areas overlap	N	N	N	N	N	N	N	N
Access to dredged material disposal grounds	N	N	N	N	N	N	N	N

Table C14.3 Tidal

	North							South-West	West	
	TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Loss or reduced use of dredge material disposal sites-Draft Plan Option areas overlap	N	N	N	N	N	N	N	N	N	N
Access to dredged material disposal grounds	N	N	N	N	N	N	N	N	N	N

C14.2 Assessment Results – Estimation of Costs and Benefits

C14.2.1 Loss or Reduced Use of Disposal Sites

All wind, wave and tide Draft Plan Option areas have been scoped out as none of them presently overlap open disposal grounds.

C14.2.2 Restricted Access to Disposal Sites

All wind Draft Plan Option areas have been scoped out. None of the wind Draft Plan Option areas presently restrict direct steaming access to open disposal grounds, as the wind developments are located further offshore from the disposal grounds.

All the wave Draft Plan Option areas have also been scoped out of the assessment. Although these Draft Plan Option areas are located between the coast and open disposal grounds, the density of the development within each Draft Plan Option areas is less than 1% for all scenarios. Spatial planning can therefore be used to avoid significant impacts under all the development scenarios. In addition, all tidal Draft Plan Option areas have been scoped out as none restrict direct steaming access to open disposal grounds.

C14.2.3 Summary

None of the Draft Plan Option areas overlap open disposal grounds and so loss or reduced use of disposal sites is not anticipated. In addition, no Draft Plan Option areas were identified which presently restrict direct steaming access to open disposal grounds. Economic impacts to Waste Disposal from the Draft Plan Option areas are therefore expected to be negligible.

C14.3 References

Scottish Enterprise & Highlands & Islands Enterprise, 2010b. National Renewables Infrastructure Plan Stage 2. July 2010.

Scottish Government, 2009b. National Planning Framework for Scotland 2.

C15. Water Sports (Sea Angling, Surfing and Windsurfing, Sea Kayaking, Scuba Diving and Small Boat Activities)

C15.1 Scoping Results

The results of the scoping assessment are presented in Table C15.1 (Offshore Wind), Table C15.2 (Wave) and Table C15.3 (Tidal) and indicate whether more detailed assessment is required (Y/N).

Table C15.1 Offshore Wind

		North		North-East		South-West		West			North-West
		OWN1	OWN2	OWNE 1	OWNE 2	OWS W1	OWS W2	OWW 1	OWW 2	OWW 3	OWNW 1
Impacts to seascape / setting	Surfing and Windsurfing	Y	N	N	N	N	N	N	N	N	N
	Sea kayaking	N	N	N	N	N	N	N	N	N	N
	Small sail boat activities	N	N	N	N	N	N	N	N	N	N
	Sea angling	N	N	N	N	N	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and water sport activity	Sea kayaking	N	N	N	N	N	N	N	N	N	N
	Small sail boat activities	N	N	N	N	N	N	N	N	N	N
	Scuba diving	Y	N	N	Y	N	N	N	N	N	N
	Sea angling	Y	Y	N	N	N	N	N	N	N	N
Spatial overlap between cable routes and water sports activity	Surfing and Windsurfing	Y	Y	Y	Y	N	N	N	N	Y	Y
	Scuba diving	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Sea angling	N	N	N	N	N	N	N	N	N	N

Table C15.2 Wave

		North			West			North-West	
		WN1	WN2	WN3	WW1	WW2	WW3	WNW1	WNW4
Impacts to seascape / setting	Surfing and Windsurfing	N	N	N	N	N	N	Y	N
	Sea kayaking	N	N	N	N	N	N	N	N
	Small sail boat activities	N	N	N	N	N	N	N	N
	Sea angling	N	N	N	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and water sport activity	Sea kayaking	Y	Y	Y	Y	Y	Y	Y	Y
	Small sail boat activities	N	N	N	N	N	N	N	N
	Scuba diving	N	Y	N	N	Y	N	Y	N
	Sea angling	Y	Y	Y	N	N	N	N	N
Spatial overlap between cable routes and water sports activity	Surfing and Windsurfing	Y	Y	Y	N	N	N	Y	Y
	Scuba diving	Y	Y	Y	Y	Y	Y	Y	Y
	Sea angling	N	N	N	N	N	N	N	N

Table C15.3 Tidal

		North							South -West	West	
		TN1	TN2	TN3	TN4	TN5	TN6	TN7	TSW1	TW1	TW2
Impacts to seascape / setting	Surfing and Windsurfing	N	N	N	N	N	N	N	N	N	N
	Sea kayaking	N	N	N	N	N	Y	N	N	N	N
	Small sail boat activities	N	N	N	N	N	N	N	N	N	N
	Sea angling	N	N	N	N	N	N	N	N	N	N
Spatial overlap between Draft Plan Option areas and water sport activity	Sea kayaking	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Small sail boat activities	N	N	N	N	N	N	N	N	N	N
	Scuba diving	N	N	Y	N	N	N	N	Y	N	N
	Sea angling	Y	Y	Y	Y	Y	Y	Y	N	N	N
Spatial overlap between cable routes and water sports activity	Surfing and Windsurfing	Y	Y	Y	Y	Y	N	N	N	N	Y
	Scuba diving	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Sea angling	N	N	N	N	N	N	N	N	N	N

C15.2 Assessment Results – Estimation of Costs and Benefits

C15.2.1 Surfing and Windsurfing

The impact of renewable energy developments on surfing wave resources is considered the primary issue of concern for surfers (through potential changes to the wave climate i.e. wave height, period and direction). As discussed in Section B15.2, given the current uncertainty surrounding the scale of impacts associated with future renewable developments the issue has not been considered further in this study. However, the issue should be considered in detail at project level based on the output of wave modelling studies and in consultation with relevant stakeholders as part of the Environmental Impact Assessment (EIA) scoping and consultation process.

C15.2.1.1 Impacts to seascape / setting

A number of Draft Plan Option areas were identified in which impacts to seascape / setting could occur at surfing sites. Given the large distance offshore of Wind Draft Plan Option areas (most are more than 10km and the small height of many wave and tidal devices above sea level (often less than 10m), these structures are expected to only cause a minimal obstruction of the horizon for surfing and windsurfing participants. In addition, for many surfers wave quality will primarily drive use of the wave resource and often supersedes any other factor such as landscape, seascape or water quality (William Watson, Scottish Surfing Associations *pers comm;* SAS, *2009*). The economic and social impacts associated with changes to seascape are therefore expected to be negligible.

C15.2.1.2 Spatial overlap between cable routes and water sports activity

The scoping phase also highlighted a number of sites in which spatial overlap between cable routes and surfing/windsurfing sites occurs. This kind of interaction could cause a restriction in access at surf spots that may be implemented for any duration throughout the installation period at the cable landfall site. In addition, any alteration of the seabed due to sediment transportation at a cable landfall site could have the potential to alter the wave regime.

SAS (2010) note that when ‘valuing’ the worth of a wave, the number of surfers that would be affected if the wave was destroyed or degraded needs to be considered. In general, the value of a wave increases as a function of the number of people that surf it, where a wave is probably worth more if it is in accessible part of the UK with a regular surfing population nearby compared to if it is in a less accessible area. However, many surfers are willing to travel large distances to undertake surfing at good quality spots (Lazorow, 2009). Therefore, high quality waves located in remote areas could bring economic benefits to a rural area through travel, accommodation and subsidence expenditure of visiting surfers.

The assessment has primarily been based on surfing data as limited windsurfing information was available from both the baseline and through further consultation. However, many popular surfing locations are also popular windsurfing destinations. Based on the information in Table C15.4 it is apparent that that most of the surfing sites identified in the scoping phase are only used by a small number of local and visiting surfers. However, Fraserburgh and the Isle of Lewis typically have a larger number of surfers which may be impacted. While these sites support some local business (particularly in the summer tourism months and when competitions are held), the overall economic contribution of surfing to these areas is very small. However, it is worth noting that many of these sites are still considered an important recreational resource for local surfers bringing social and health benefits to people living in remote areas (Andy Cummins, SAS *pers. comm*). Scottish Wave Riders Association considers the social benefits surrounding Scottish surfing would far outweigh its actual economic worth. For example, some Scottish surfers have chosen a lifestyle of lesser financial reward so they can benefit from a surf lifestyle. The sport has also offered a degree of stability and focus for many youths in the coastal towns of Scotland (such as Fraserburgh) which have struggled with drug and other social problems (William Watson, Scottish Surfing Associations pers comm.)

Table 15.4 Surfing sites overlapping with Draft Plan Option areas cable corridors

Draft Plan Option Areas Cable Corridor	Surfing Spots Which Potentially Overlap with Proposed Landfall of the Draft Plan Option Areas Cable Corridor	Overview of Surfing Activity in the Area
OWN1	Surf spots located in East Caithness around Dunnet Bay and Dunnet Head including Point of Ness and Murkle Point	Some of the UK's best surfing breaks are situated along the North coast of Scotland such as Thurso (which is considered world class and holds major international competitions). An estimated 40 local surfers regularly use the Caithness North Coast for surfing with a larger number of visiting and tourist surfers. The area has one surf shop and a dedicated surf school. However, the proposed cable corridor overlaps with spots which are generally rarely surfed due to being very remote and only suitable for experienced surfers (such as Murkle Point and Castehill). Dunnet Bay is however considered a good spot for beginners and is regularly used by the nearby local surf shop for lessons.
OWN2	Sites around east coast of Shetland and Bu Sands, Orkney	Orkney and Shetland have a small but dedicated number of local surfers (approximately 30 regular surfers) with occasional visiting and tourist surfers. No surf shops or surf schools are currently located on the Islands.
OWNE1, OWNE2	Sites from Cruden Bay to Pennan including Fraserburgh and Peterhead	The area has one of the most well established surfing communities within Scotland. Approximately 50 regular local surfers are found in Peterhead and Fraserburgh area with around 100 local surfers at nearby Aberdeen which could travel to use these breaks further North. Fraserburgh is one of the few towns within Scotland where a consistent surfing beach is within short walking distance of the local schools. The area has an informal surf club known as The Broch Surf Club.' The setting and strength of the surf community pushed the standard of the sport with the area becoming known as the epi-centre of surfing performance for Scotland. Fraserburgh, regularly holds surf competitions and events such as the UK Surf Tour and Fraserburgh Surf Festival. A survey conducted by Event Scotland predicted the Fraserburgh Surf Festival competition would generate a £100,000 windfall for the town, with surfers and visitors making use of local hotels and restaurants**.
OWNW1	Sites located between Durness and Oldshoremore in North East of Sutherland	Remote area with a small number of regular local surfers in this area (less than 10) and occasional visiting surfers. No shops or surf schools.
WN1	Sites located between Strathy and the Kyle of Tongue, North Scotland	Remote area with a small number of regular local surfers in this area (less than 10) and occasional visiting surfers. No shops or surf schools.
WN2	Dunnet Bay, Castlehill to Murkle, Point of Ness, Murkle Point	Some of the UK's best surfing breaks are situated along the North coast of Scotland such as Thurso (which is considered world class and holds major international competitions). An estimated 40 local surfers regularly use the Caithness North Coast for surfing with a larger number of visiting and tourist surfers. The area has one surf shop and a dedicated surf school. However, the proposed cable corridor overlaps with spots which are generally rarely surfed due to being very remote and only suitable for experienced surfers (such as Murkle Point and Castehill). Dunnet Bay is however considered a good spot for beginners and is regularly used by the nearby local surf shop for lessons.
WN3	Sites around south coast of Shetland and Bu Sands, Orkney	Orkney and Shetland have a small but dedicated number of local surfers (approximately 30 regular surfers) with occasional visiting and tourist surfers. No surf shops or surf schools are currently located on the Islands.
WNW1:	Isle of Lewis including Mangersta Eoropie	There are a small number of surfers scattered across the Western Isles (approximately 25 local regular surfers) with the majority residing on the Isle of Lewis. Although access from the mainland is restricted via ferry, the Outer Hebrides have hosted international surf events in recent years such as the International Hebridean Surf Festival in 2001. One surf school is located on the Isle of Lewis and the Island receives some surf tourism over the summer months. The islands are also home to the 'Outer Hebrides Surf Association'.

Draft Plan Option Areas Cable Corridor	Surfing Spots Which Potentially Overlap with Proposed Landfall of the Draft Plan Option Areas Cable Corridor	Overview of Surfing Activity in the Area
TN1-TN5	Surf spots located in East Caithness around Dunnet Bay and Dunnet Head along with from Skirza to Sinclair's Bay.	Some of the UK's best surfing breaks are situated along the North coast of Scotland such as Thurso (which is considered world class and holds major international competitions). An estimated 40 local surfers regularly use the Caithness North Coast for surfing with a larger number of visiting and tourist surfers. The area has one surf shop and a dedicated surf school. However, the proposed cable corridor overlaps with spots which are generally rarely surfed due to being very remote and only suitable for experienced surfers (such as Murkle Point and Castehill). Dunnet Bay is however considered a good spot for beginners and is regularly used by the nearby local surf shop for lessons.
* Based on information from The Scottish Surfing Federation, 2013; SAS, 2009, www.magicseaweed.com and www.surf-forecast.com ** Source: The Press and Journal Website : http://www.pressandjournal.co.uk/Article.aspx/1927287		

Currently there is still uncertainty surrounding the precise routes which cables will be laid within the indicative corridors. Therefore, while surfing and windsurfing sites have been identified, overlap may not necessarily occur with these sites. While a restriction in access at a beach or reef during cable installation could prevent access for surfers or windsurfers, any restriction is likely to be temporary. It has also been assumed in areas where there is a risk of cables becoming exposed (such as at surfing beaches) developers will use Horizontal Directional Drilling (HDD) at a depth suitable to avoid cable exposure[30]. This will reduce disturbance on the beach area and make any impact on coastal sediment processors (which might cause a change in wave quality) unlikely.

Given that predicted impacts are expected to be minor, the economic and social cost of a restriction in access or changes in wave quality due to cables is therefore likely to be negligible.

C15.2.2 Scuba Diving

The most popular locations for scuba diving around Scotland such as Scapa Flow (Orkney), the Voluntary Marine Reserve of St Abbs and Eyemouth off the Berwickshire coastline, Skye and Mull do not overlap with any Draft Plan Option areas or cable corridors. The majority of sites located on the East coast also do not overlap with any Draft Plan Option areas or cable corridors.

C15.2.2.1 Spatial overlap between Draft Plan Option areas and water sport activity

A small number of dive sites were identified as overlapping with a Draft Plan Option area. However, almost all these sites were wrecks (with the exception of one site in WN2 and also in OWN2). Turbines are unlikely to be placed on or in proximity to wrecks due to potential turbine damage or boat navigation risk. No overlap with

30 HDD is a steerable trenchless method of installing underground pipes, conduits and cables in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area.

these wreck sites is therefore anticipated. Given the remoteness of the dive sites in WN2 and OWN2 they are unlikely to be dived regularly by a large number of divers.

Based on these factors it is only anticipated that a very low number of scuba divers will be displaced due to overlap with a Draft Plan Option area and so economic and social impacts are expected to negligible.

C15.2.2.2 Spatial overlap between cable routes and water sports activity

Overlap between all the proposed Draft Plan Option areas cable corridors and one or more diving sites was identified during the scoping phase. Currently there is still uncertainty surrounding the precise routes which cables will be laid within the indicative corridors. Therefore, while scuba diving sites have been identified, overlap may not necessarily occur with these sites. In addition given that dive sites only cover small, discrete areas the chance of a large degree of overlap occurring between cable routes and dive sites id unlikely. In addition, many of the sites identified were also wreck sites. Wrecks require a 50m buffer around which cables cannot be laid (more if the wreck is protected) to reduce the risk of cable damage. Therefore, no overlap between cable routes and wreck sites will occur.

Based on these factors it is unlikely that scuba divers will be displaced due to overlap with a Draft Plan Option area and so economic and social impacts are expected to negligible.

C15.2.3 Sea Kayaking

C15.2.3.1 Spatial overlap between Draft Plan Option areas and water sport activity

Based on the scoping criteria, all tidal Draft Plan Option areas and several wave Draft Plan Option areas (WN1 WN3, WW3 and WNW1) were identified in which overlap with sea kayaking is possible.

None of the Draft Plan Option areas identified were listed the top ten most popular kayaking identified by Canoe Scotland which includes the Inner Hebrides and nearby West Scotland coast (such as Skye and Knoydart), the Clyde and the Firth of Forth31. The majority of kayaking shops are also located in these areas.

In addition, kayaks are highly manoeuvrable and can successfully be navigated through very small spaces such as sea caves and small rock channels. Therefore, wave and tidal devices are unlikely to physically displace sea kayaking. Rotating tidal blades that could cause a collision with a kayak or capsized person are considered to be too deep to pose a threat. Moving parts on the surface are likely to be covered and not expected to cause damage. The exposed nature of wave sites and strong

[31] Based on a 2011 questionnaire survey undertaken by Canoe Scotland

currents associated with tidal sites also prevents inexperienced kayakers from utilising these areas.

Based on these factors it is unlikely that sea kayakers will be displaced due to overlap with a Draft Plan Option area and so economic and social impacts are expected to negligible.

C15.2.4 Sea Angling

C15.2.4.1 Spatial overlap between Draft Plan Option areas and water sport activity

The only SORER for which a potential impact on sea angling was scoped in (based on a combined area of wind, wave and tidal development representing more than 1% of a SORER region), was the North SORER under a high scenario[32].

Boat based sea angling was estimated to be worth about £9.7million (approximately £1000 per km^2) in the North SORER Region in 2009 (Radford et al. 2009; ABPmer, 2012). Total combined development is predicted at representing about 1.3% of the North SORER Region (121 km^2) based on the high scenario. Assuming it was not possible to fish within arrays developed with Draft Plan Option areas, a worse case loss in sea angler expenditure for the entire region is estimated to be £140,000 (at 2012 prices) (Table C15.5).

Table C15.5 Cost impacts to angling in the North SORER

Draft Plan Option Areas	2009	2012
OWN1	61,956	70,364
WN1	2,736	3,107
WN2	5,594	6,353
WN3	5,387	6,118
TN1	21,917	24,891
TN2	4,019	4,564
TN3	3,015	3,424
TN4	8,508	9,663
TN5	3,007	3,415
TN6	2,471	2,806
TN7	2,793	3,172
Total	**121,403**	**137,877**

In other SORER areas in which combined development under the high scenario were <1%, the predicted loss in sea angler expenditure was calculated as being much less for each region (under £1000).

For wave and tidal scenarios only a very small proportion of each Draft Plan Option areas will need to be developed to achieve the desired installed capacity even under the high scenario (1% and 5.1% respectively). For offshore wind the value is slightly

32 Under the Low Case and Medium Case scenarios overlap was less than 1%.

higher (between 4.8% and 26.5%). However, most wind Draft Plan Option areas are located further offshore than 6nm with the majority of recreational angling occurring further inshore. It is therefore considered possible to avoid the most sensitive angling areas with appropriate spatial planning, even under the high scenarios.

For turbine foundations attached to the seabed (as used in all wind turbines and some wave/tidal turbines), it is possible that these structures could also provide positive impacts for Sea Angling. By acting as an artificial reef, additional food, shelter and nursery benefits for angling target species could be provided. Arrays will also be enclosed within enforced fisheries exclusion zones for both safety and protection and therefore may also act as *de facto* marine protected areas (MPA) to most fisheries. Installations could therefore improve angling opportunities away from an array through beneficial 'spillover effects' such as increased fish abundance (Inger et al. 2009)

C15.2.5 Summary

The impact of renewable energy developments on surfing wave resources is considered the primary issue of concern for surfers (through potential changes to the wave climate). However, given the current uncertainty surrounding the scale of impacts associated with future renewable developments the issue is best considered in detail at project level based on the output of wave modelling studies and in consultation with relevant stakeholders as part of the EIA process.

Concerns have also been raised relating to the impact of EMF (electromagnetic fields) arising from cables on elasmobranch species, and in particular, whether EMF may alter the foraging behaviour and migration patterns of elasmobranch species and the subsequent impact on sea angling activity and economic input into local economies. However, the magnitude of environmental impacts of EMF is still uncertain. This issue should therefore be considered in detail as part of the EIA process for specific developments based on the findings of future research.

Predicted impacts to water sports from other interactions are generally expected to be minor with economic impacts negligible under all scenarios. However, direct spatial overlap between boat based angling and Draft Plan Option areas in the North SORER under the high scenario could cause a loss in sea angler expenditure (estimated at approximately £140,000 pro rata for 2012 for the entire region).

C15.3 References

ABPmer, 2003. Scarweather Sands Offshore Wind Farm: Further Investigation of Coastal Process Issues Raised by Countryside Council for Wales. Report for Hyder Consulting (for United Utilities Scarweather Sands Ltd). Report No. R.1029. May 2003.

ABPmer, 2012. Socio-economic Baseline Reviews for Offshore Renewables in Scottish Waters. Volume 1: Main Text. Report R.1905

ASR Ltd, 2007. Review of Wave Hub technical studies: Impacts on inshore surfing beaches. ASR Ltd, April 2007.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh.

BMF, MCA, RYA and Lifeboats, 2009. Water sports and Leisure Participation Survey 2009. Available online: http://www.britishmarine.co.uk/upload_pub/WatersportsandLeisureOmnibus2009finalpublic.pdf

Cefas, 2005. Assessment of the significance of changes to the inshore wave regime as a consequence of an offshore wind array. Contract AE1227. Research project final report. September 2005.

Depledge, M.H and Bird, W.J. 2009. The Blue Gym: Health and wellbeing from our coasts, Marine Pollution Bulletin, Volume 58, Issue 7, July 2009, Pages 947-948.

Gill, A.B. & Bartlett, M. 2010. Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage Commissioned Report No.401

Halcrow, 2006. Wave Hub. Environmental statement. June 2006.

Inger, R., Attrill, M.J., Bearhop, S., Broderick, A.C., Grecian, W.J., Hodgson, D.J., Mills, C., Sheehan, E., Votier, S.C., Witt, M.J. & Godley, B.J. 2009. Marine renewable energy: potential benefits to biodiversity? An urgent call for research J. Appl. Ecol. 46: 1145–1153.

Normandeau, Exponent, T. Tricas, and A. Gill. 2011. Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

PMSS, 2007. Wave Dragon pre-commercial wave energy device. Environmental statement.

Radford, A., Riddington, G. and Gibson, H., 2009. Economic Impact of Recreational Sea Angling in Scotland. Prepared for the Scottish Government. July 2009. ISBN: 978-0-7559-8130-4

Riddington, G., Harrison, T., McArthur, D., Gibson, H., Millar, K. 2008. The economic impacts of wind farms on Scottish tourism. A report for the Scottish Government. March 2008.

RPS, 2005. London Array offshore windfarm. Environmental statement. Volume 1. Offshore works. January 2005.

SAS, 2009. Guidance on environmental impact assessment of offshore renewable energy development on surfing resources and recreation.

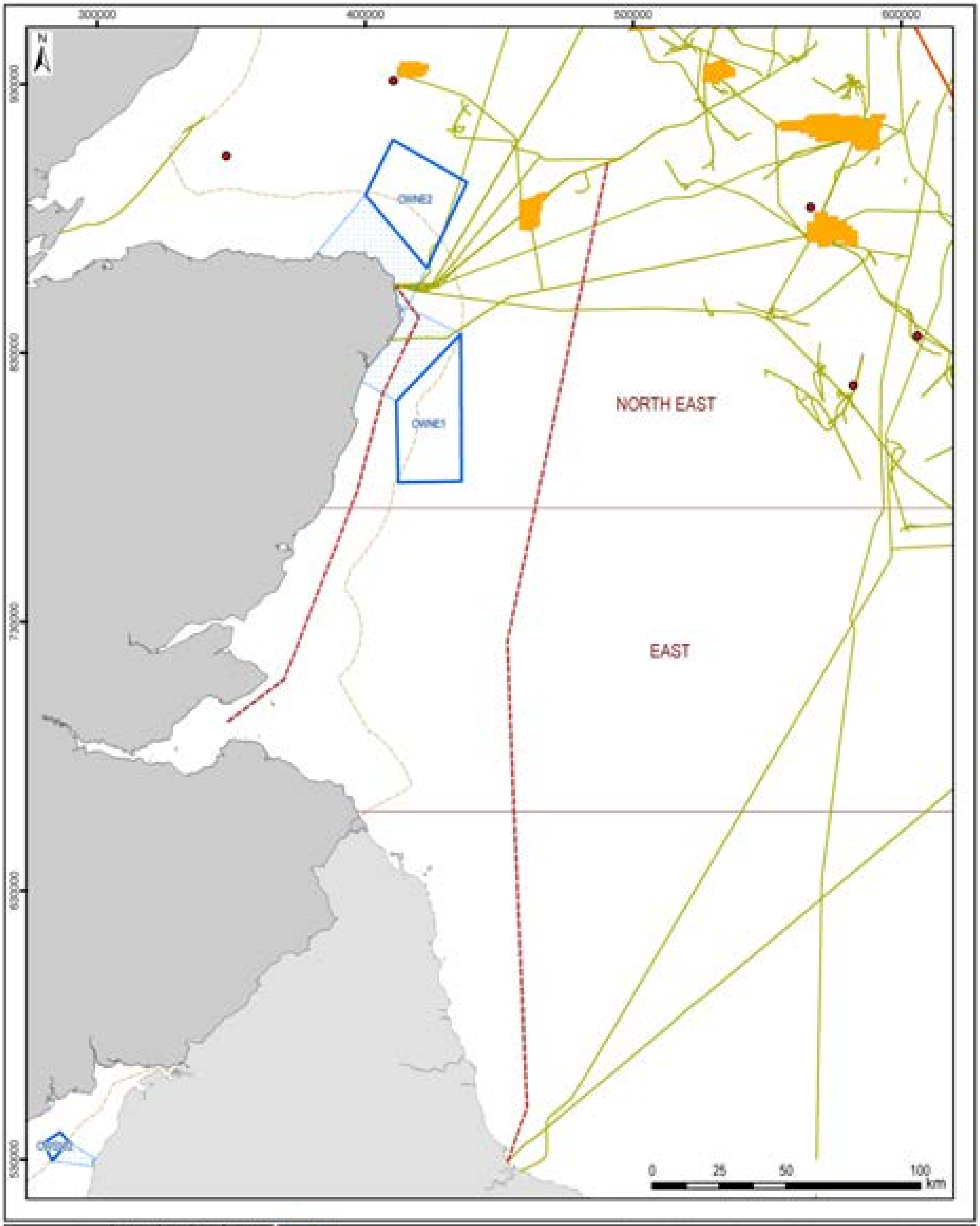
Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F., MacFarlane, R., 2005. An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore wind farms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

SeaScape, 2002. Burbo Offshore Wind Farms.

Surfers Against Sewage (SAS), 2010. The WAR Report: Waves Are Resources. Available online: http://www.sas.org.uk/news/2010/08/04/sas-release-the-war-report-waves-are-resources/

The Scottish Surfing Federation, 2013. Scottish Marine Recreational Resources: Assessment of the Sport of Surfing within Scottish Waters.

Appendix C. Figures



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QA		MCE	
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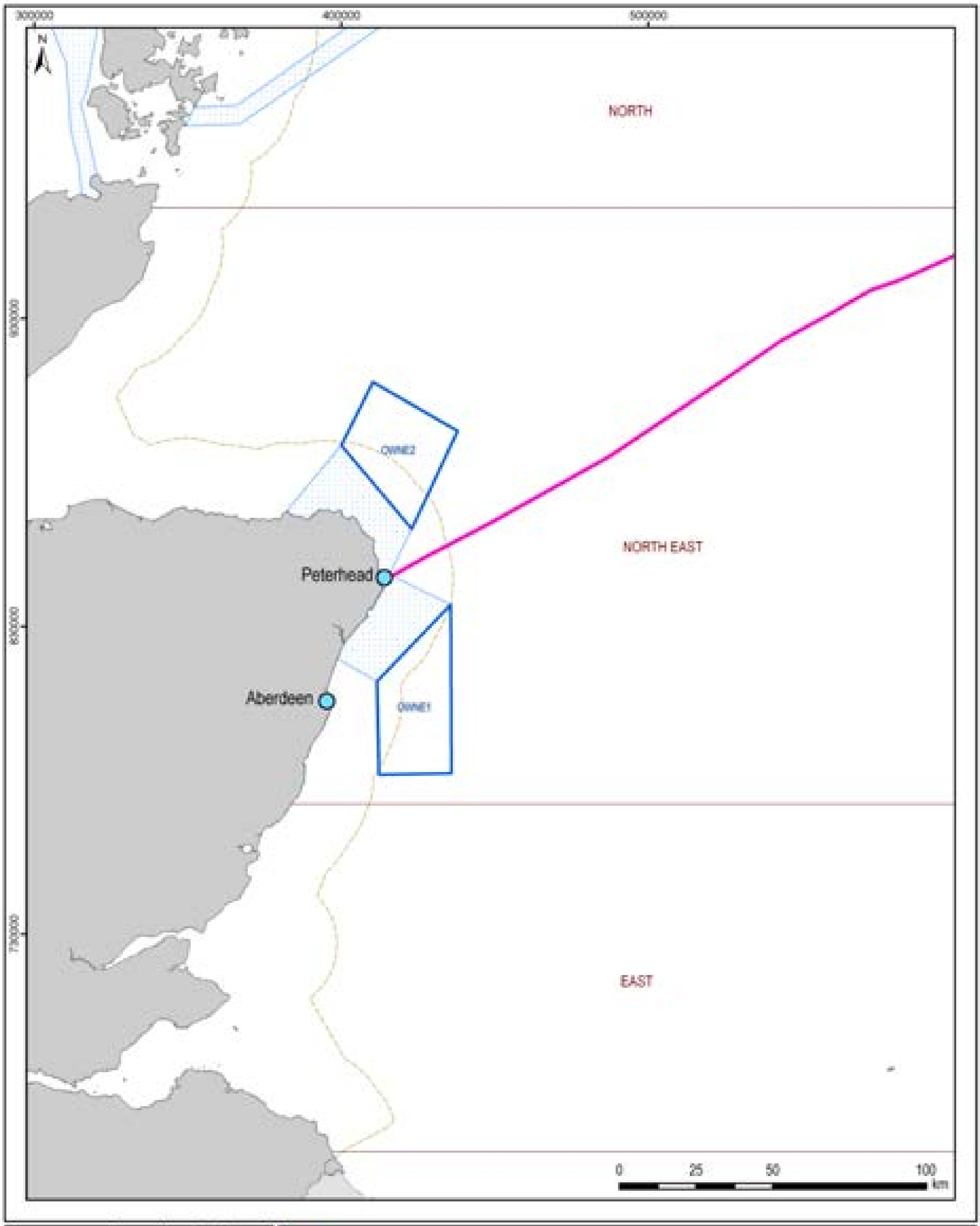
Produced by ABPmer			

Source: Marine Scotland 2012, Scottish Government, 2009, Scottish Enterprise, 2011, DECC, 2011.

Offshore Wind Draft Plan Options
Offshore Wind - Indicative Cable Routes
SORER Regions
UK Continental Shelf Boundary
Scottish 12 Nautical Mile Limit

Carbon Dioxide Storage (Potential Areas)
Hydrocarbon Fields
Saline Aquifers
Potential CCS Pipelines
Existing Oil and Gas Pipelines

Carbon Capture and Storage Assessment | **Figure C3**



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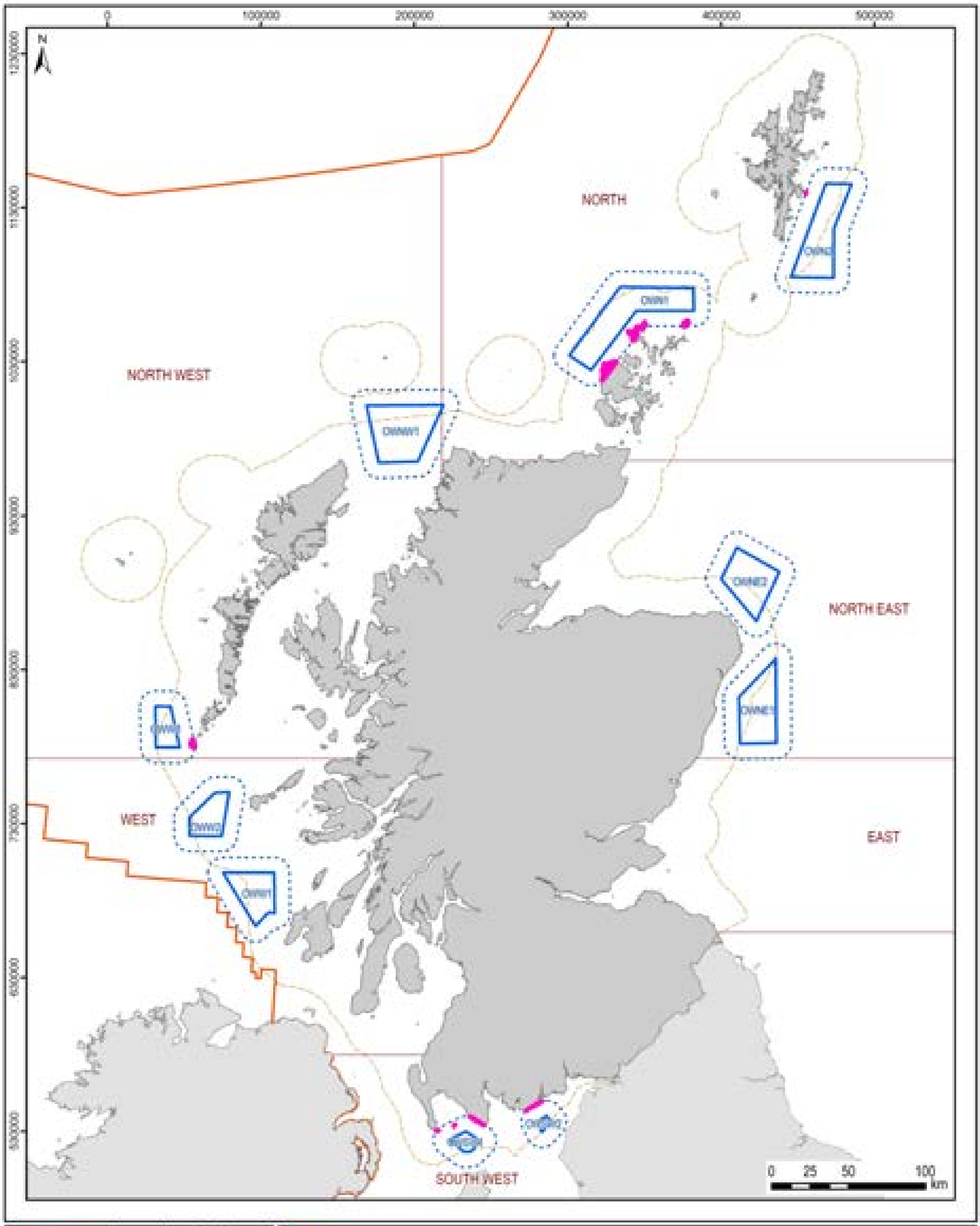
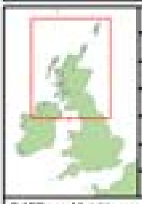
Produced by ABPmer			

- Offshore Wind Draft Plan Options
- Offshore Wind - Indicative Cable Routes
- SORER Regions
- UK Continental Shelf Boundary
- UK-Norway NorthConnect
- Scottish 12 Nautical Mile Limit

Power Interconnectors Indicative Route - Peterhead and Norway

Figure C10





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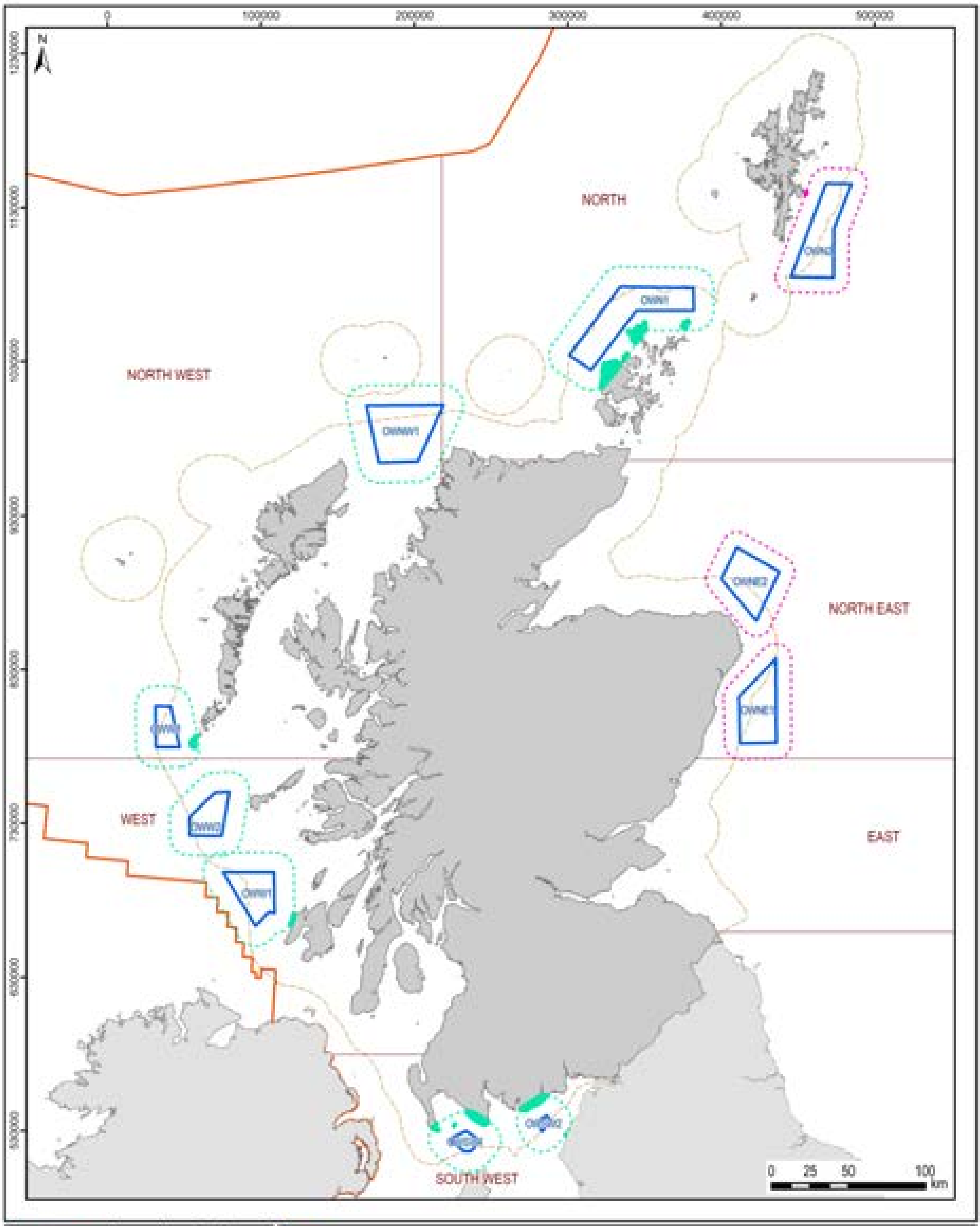
4126 - FigC13.1_Tourism_Assess.mxd			
Produced by ABPmer			

Source: Marine Scotland, 2013
NOT TO BE USED FOR NAVIGATION

Offshore Wind Draft Plan Options
Offshore Wind Draft Plan Options - 10km Buffer
Land Overlapping Offshore Wind Draft Plan Options 10km Buffer
UK Continental Shelf Boundary
SORER Regions
Scottish 12 Nautical Mile Limit

Tourism Assessment (Central Case)

Figure C13.1



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Produced by ABPmer			

Source: Marine Scotland, 2013
NOT TO BE USED FOR NAVIGATION

- Offshore Wind Draft Plan Options
- UK Continental Shelf Boundary
- SORER Regions
- Scottish 12 Nautical Mile Limit

Offshore Wind / Coast Overlap
- Offshore Wind Draft Plan Options Buffer (13 km)
- Overlap with Coastline Capacity Index 3 to 5
- Offshore Wind Draft Plan Options Buffer (10 km)
- Overlap with Coastline Capacity Index 1 to 2

Tourism Assessment (High Case)

Figure C13.2

Appendix D

List of Stakeholders Contacted

Appendix D. List of Stakeholders Contacted

Organisation	Contact name	Email address
Argyll & Bute Council	Mark Steward	Mark.Steward@argyll-bute.gov.uk
Association of Scottish Shellfish Growers	Walter Speirs	walter.speirs@btconnect.com
Bond Offshore Helicopters	Paula Wilson (communications manager)	pwilson@bondoffshorehelicopters.com
Bristow Helicopters European Operations - Aberdeen	Scott Butler	scott.butler@bristowgroup.com
Bristow Helicopters European Operations - Aberdeen	Tim Glasspool (Flight Operations)	tim.glasspool@bristowgroup.com
British Marine Federation	Carolyn Elder	Carolyn@largsyachthaven.com
British Ports Association	Sandra Laurenson	slaurenson@lerwick-harbour.co.uk
BT	Glen Lipsham	glen.lipsham@bt.com
Capt. Tom Hemingway	Capt. Tom Hemingway (Harbour Master)	capt.hemingway@peterheadport.co.uk
CCSA	Judith Shapiro	judith.shapiro@ccsassociation.org
CHC Helicopters	Jon Hopkinson (Flight Operations Manager)	jon.hopkinson@chc.ca
Civil Aviation Authority	Kelly Lightowler	windfarms@caa.co.uk kelly.lightowler@caa.co.uk
Clyde Fishermen's Association	Archie McFarlane	amf@clydefish.org
Community Land Scotland	Ian Hepburn	ian.hepburn@communitylandscotland.org.uk
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Energy Skills Partnership at Scotland:College	Jim Brown	Jim.brown@scotcol.ac.uk
Events Scotland		information@eventscotland.org
Forth Ports/UK Major Ports Group	Bob Baker	bob.Baker@forthports.co.uk
Fraseborugh Harbour Commissioners	Andrew Ironside (Harbour Master)	andrew@fraserburgh-harbour.co.uk
Highland and Islands Enterprise/Scottish Enterprise	Calum Davidson	calum.davidson@hient.co.uk
Highland and Islands Enterprise/Scottish Enterprise	Elain Cameron	Elain.cameron@hient.co.uk

Organisation	Contact name	Email address
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Infratil - Operator of Glasgow Prestwick Airport	Ann Mackenzie	amackenzie@infratilairports.com
Joint Nature Conservation Committee	Mark Tasker	mark.tasker@jncc.gov.uk
MalinWaters		info@malinwaters.com
Marine Alliance for Science and Technology for Scotland	Tavis Potts via PAG	
Marine Conservation Society Scotland	Calum Duncan	Scotland@mcsuk.org
Maritime & Coastguard Agency	Graeme Proctor	Graeme.Proctor@mcga.gov.uk
Ministry of Defence	Jon Wilson (Defence Infrastructure Organisation)	dio-safeguarding-offshore@mod.uk
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National Air Traffic Services	Sacha Rossi	Sacha.Rossi@nats.co.uk
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National Trust	Richard Luxmore	rluxmore@nts.org.uk
Natural Power	Jeremy Sainsbury	jeremys@naturalpower.com
Northern Lighthouse Board	Capt. Philip Day	phild@nlb.org.uk
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Scottish Development International	Kenneth Clarke	Kenneth.Clark@scotent.co.uk
Scottish Enterprise	Euan Dobson	euan.dobson@scotent.co.uk
Scottish Environment Protection Agency	Professor James Curran	james.curran@sepa.org.uk

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Scottish Hydro Electric Transmission Limited (SHETL)	Edward Douglas	edward.douglas@sse.com
Scottish Natural Heritage	George Lees	George.Lees@snh.gov.uk
Scottish Pelagic Fishermen's Association (SPFA)	Ian Gatt	ian.gatt@scottishpelagic.co.uk
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Scottish Salmon Producers' Organisation	Stephen Bell	sbell@scottishsalmon.co.uk
Scottish Sea Angling Conservation Network	Steve Bastiman	stephen@bastiman.co.uk
Scottish Surfing Federation	Chris	scottishwaveriders@gmail.com
Scottish Sustainable Management Environment Initiative	Isabel Glasgow	isabelglasgow@aol.com
Scottish White Fish Producers Association (SWFPA)	Mike Park	mike@swfpa.com
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SeaFish	George White	georgewhite0@gmail.com
Shetland Islands Council	Colin Reeves (Harbour Master)	colin.reeves@shetland.gov.uk
SportScotland	Campbell Gerard	Campbell.gerrard@sportscotland.org.uk
Subsea Cables UK	Alisdair Wilkie	chairman@subseacablesuk.org.uk
Surfers Against Sewage	Andy Cummins	andy@sas.org.uk
Surfing GB	Matt Knight	info@surfinggb.com
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The Princes Trust	Mr Mike Strang	mike.strang@princes-trust.org.uk
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UK Major Ports Group	Derek McGlashan	derek.mcglashan@forthports.co.uk
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UK Windsurfing Association	Alastair Campbell	webmaster@ukwindsurfing.com
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Wild Scotland	Caroline Warburton	Caroline@wild-scotland.co.uk

Appendix E

Initial Letter to Stakeholders

Appendix E. Initial Letter to Stakeholders

DEVELOPING THE SOCIO-ECONOMIC EVIDECE BASE FOR OFFSHORE RENEWABLE SECTORAL MARINE PLANS IN SCOTTISH TERRITORIAL WATER INCEPTION REPORT

ABPmer, in association with economic consultants Risk & Policy Analysts (RPA), has been commissioned by Marine Scotland to develop the socio-economic evidence base to inform the impact assessment for draft offshore renewable sectoral marine plans by identifying those activities (i.e. those that take place in marine waters or on the immediate foreshore) that may experience socio-economic impacts as a result of offshore wind, wave and tidal development under the plans. The study forms part of Marine Scotland's overall approach to sustainability appraisal of the draft plans, encompassing Strategic Environmental Assessment, Habitats Regulations Appraisal, Business and Regulatory Impact Assessment and stakeholder consultation.

The aims of this study are to:

- Ascertain the extent to which activities already take place in areas identified as potential plan options for offshore renewables (wind, wave and tidal);
- To explore how those activities may be affected by the development of offshore renewables in the plan option areas; and
- To estimate the potential economic and social consequences arising from any potential interactions.

It is being overseen by a Project Steering Group (PSG) drawn from staff within Marine Scotland and wider Scottish Government representatives, together with a broader Project Advisory Group (PAG) which includes a selection of stakeholders who will provide wider guidance to the project.

The study will build on the information gathered during the baseline review and data gap analysis which was undertaken earlier in the year, found on the links below:

http://www.scotland.gov.uk/Publications/2012/12/3988

http://www.scotland.gov.uk/Publications/2012/12/6651

http://www.scotland.gov.uk/Publications/2012/12/4944

As part of the study we may wish to contact you to discuss the availability of additional data, the detailed methodologies that we intend to use to quantify potential socio-economic impacts and/or the findings of our draft assessments.

The timescales for our project are tightly controlled by the needs of Marine Scotland and we are looking to provide the PSG with a draft report by 15 February 2013.

I would be grateful if you could indicate your willingness to contribute to this study if approached by replying to this email. If you think another individual within your organisation or another organisation is better placed to provide input, please let us know. A list of organisations contacted is attached.

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