4 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS AND METHODOLOGY

4.1 INTRODUCTION

1. This Section sets out the process that has been followed in undertaking the EIA for the Project and in preparing this ES. Further information on relevant regulations and legislation is given in Section 3: Legislation and Consenting Requirements of this ES.

2. As stated in Section 3.3, this ES has been prepared under the following regulations:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008 (where applicable); and
- The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable).

3. This EIA has been carried out in accordance with both of the above regulations, collectively referred to in this ES as the 'EIA Regulations'.

4.2 EIA PROCESS AND OVERARCHING METHODOLOGY

4.2.1 KEY EIA REQUIREMENTS

4. The topics that are required to be considered during an EIA are set out in the EIA Regulations and include:

- Human beings, fauna and flora;
- Soil, water, air, climate and the landscape;
- Material assets and the cultural heritage; and
- The interaction between the factors mentioned above.

5. The term 'environment' includes both the natural environment and the social environment. The EIA Regulations also requires that, as well as any direct effects being described, other types of effects should also be described. These are:

- Secondary;
- Indirect;
- Cumulative;
- Short, medium and long-term;
- Permanent and temporary; and
- Positive and negative effects.

6. The likely significant effects of a project must be described within an ES where these are as a result of:

- The existence of the project;
- The use of natural resources;
- The emission of pollutants;
- The creation of nuisances; and
- The elimination of waste.

7. Once it has been established that there will likely be resulting effects on the environment, the EIA Regulations state that an ES must provide a description of these likely significant effects. The EIA Regulations also require an ES to provide a description of the forecasting methods used to assess the likely significant effects. Furthermore, a description must also be included of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.

8. It is the case therefore that not all topic areas or types of effect may need assessing or reporting. If, once considered at a high level, an effect on a certain receptor is thought to be unlikely, or predicted to be not significant, this can be scoped out of further assessment. The process where these decisions can be made is known as 'EIA Scoping'.

4.2.2 EIA TERMINOLOGY

9. Within the EIA Regulations, and various EIA best practice and guidance documentation there is interchangeable use and understanding of the words 'effect' and 'impact'. For the purposes of this ES the word 'effect' is used. Actions or activities undertaken during the construction, operation and decommissioning of the Project which may lead to a change to the baseline conditions are termed 'effects'.

4.2.3 EIA SCOPING

10. EIA Scoping aims to identify the potential effects that are likely to be significant. Those effects that are not likely to be significant are excluded (scoped out) from the assessment. This process takes into account embedded mitigation measures that are built into the project design at an early stage (e.g. standard industry requirements for lighting or operating procedures for marine vessels). Where there is still uncertainty, even after obtaining a Scoping Opinion from the decision maker, about the likely significance of potential effects then these are included in the assessment. Therefore, there will be potential effects included in the assessment that may ultimately be judged as not significant in terms of the EIA Regulations.

11. To determine the overall scope of the Project EIA, BOWL undertook two EIA Scoping exercises. A Scoping Report for the Beatrice Offshore Wind Farm was submitted to MS in March 2010. A Scoping Report for the Beatrice Transmission Works (OfTW and OnTW) was submitted to MS and The Moray Council in May 2011. Further details of other parties consulted during these exercises are presented in Section 5.2. A summary of the responses to the Scoping Reports are presented in Annex 5A of Section 5: Summary of Consultation Responses.

12. Table 4.1 identifies the topic areas which were scoped in and out of the Project assessment.

Table 4.1 Topic Areas Scoped In and Out of the EIA

Topic Area	Wind Farm Elements	OfTW Elements
Physical Processes and Geomorphology	✓	✓
Underwater Acoustic Environment	✓	✓
Designated Sites and Legislation	✓	✓
Benthic Ecology	✓	✓
Fish Ecology	✓	✓
Marine Mammals	✓	✓
Plankton	X	X
Ornithology	✓	✓
Seascape, Landscape and Visual Environment	✓	X
Marine Archaeology and Cultural Heritage	✓	✓
Commercial Fisheries	✓	✓
Airborne Noise	X	X
Shipping and Navigation	✓	✓
Aviation and MoD	✓	X
Other Infrastructure *	✓	✓
Socio-Economics, Recreation and Tourism	✓	✓
Air Quality	X	X
Marine Waste and Spoil Disposal Sites	X	X
Onshore Traffic and Transport	X	X

* Other infrastructure includes topics areas including oil and gas, pipelines and cables, telecommunications.

4.2.4 ASSESSMENT APPROACH

13. EIA involves the following main steps:

- Identification of baseline environmental conditions and establishing the sensitivity of receptors;
- Avoiding potentially significant effects through the iterative design process and adoption of good practice measures (referred to as embedded mitigation);
- Assessment of the significance of potential effects through the combination of the magnitude of an effect and sensitivity of the receptor/ resource;
- Identification of mitigation measures to offset negative potentially significant effects; and
- Assessment of the significance of residual effects following the application of mitigation measures.

14. Cumulative effects have also been considered and assessed and the EIA follows the approaches identified in both the Cumulative Impact Assessment Discussion Document (CIADD) prepared for the Project (see section 4.4.3), and relevant best practice guidance.

15. Finally, the EIA assesses both the:

- Routine effects resulting from planned activities of the Project; and
- Non-routine effects arising from unplanned or accidental events within the Project.

16. The environmental effects of the Project have been predicted for each of the scoped in environmental topics by comparing baseline environmental conditions (i.e. the current situation) with the conditions that would prevail following commencement of the Project.

17. This ES presents and describes these predicted effects in relation to the Project. The effects are assessed in detail where they are considered likely to be significant in terms of the EIA Regulations. Each of the topic assessments in the relevant ES sections set out the thresholds and criteria used to determine if a likely effect is considered significant. The evaluation of significance is considered further in Section 4.2.7.1.

4.2.5 POTENTIAL EFFECTS

18. Following the identification of baseline environmental conditions, the sensitivity or value of receptors or resources is established through consultation, reference to relevant guidance and desk-based research. Sensitivity or value is categorised by a multitude of factors which are outlined in the methodologies described in each topic section of the ES.

19. The next step in the EIA process is to identify the Project activities that are likely to result in changes to the natural and social environment throughout the life of the Project (i.e. construction, operation and decommissioning). The magnitude of each effect is then determined, with reference to all the dimensions of the predicted change including:

- The nature of the change (i.e. what resources or receptors are affected and the size, scale or intensity of any changes);
- The spatial extent of the area affected or proportion of the population or community affected; and
- The temporal extent of the effects (i.e. duration, frequency, reversibility).

20. The magnitude is also defined differently according to the type of effect. For readily quantifiable effects, such as noise or sediment plume extent, numerical values can be used, whereas for other topics (e.g. landscape and visual) a more qualitative definition may be necessary.

21. Table 4.2 provides definitions for the spatial and temporal dimension of the magnitude of effects used in the EIA. Where different spatial and temporal dimensions have been used in topic areas, these are defined.

Table 4.2 Magnitude Definitions - Spatial and Temporal Dimensions

Effect Magnitude – Degree of Change upon the Environment	
Spatial Scale	**On site –** effects that are limited to the Wind Farm site or OfTW corridor. **Local –** effects that are generally within the area of one tidal excursion (or a similar buffer around the Wind Farm area or OfTW corridor). **Regional –** effects that are experienced at a regional scale e.g. the Moray Firth.

Effect Magnitude – Degree of Change upon the Environment	
	National – effects that are experienced at a national (UK) scale. **Transboundary / International –** effects that are experienced at an international scale i.e. affecting another country or international waters.
Temporal Scale	**Short term –** effects that are predicted to last only for the duration of a specific construction operation e.g. noise for piling and plume dispersion. **Medium term –** effects that are predicted to last during the construction period (e.g. 1 to 3 years). **Long term –** effects that will continue beyond the construction period but will cease in time (e.g. recovery of benthos, vessel movements). **Temporary –** effects that are predicted to be reversible and will return to a previous state when the effect ceases or after a period of recovery. **Permanent –** effects that cause a permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime. **Continuous –** effects that occur continuously or frequently. **Intermittent –** effects that are occasional or occur only under specific circumstances.

22. Magnitude therefore describes the actual change that is predicted to occur in the resource or receptor (e.g. the area and duration over which disturbance of the seabed will occur, the level of certainty of predictions (defined in specific topic sections as likelihood/probability/certainty as appropriate), and the consequences of the effect). The assessment of the overall magnitude of an effect takes into account all the dimensions of the change as described above to determine whether there will be an effect and if so, whether it will be of negligible, small, medium or large magnitude.

4.2.6 EMBEDDED MITIGATION MEASURES

23. The assessment of effects is determined taking into account embedded mitigation measures (also referred to as development design mitigation) including measures established through the iterative EIA and Project design process, and application of good practice measures as appropriate. This may include:

- Changes to the design of the project during the design process to reduce the magnitude of effects (e.g. siting, layout, foundation types and installation methods);
- Engineering controls and other physical measures applied (e.g. installation of lights, colour scheme used); and
- Operational plans and procedures (e.g. timing of operations, soft-starts, vessel transit routes).

24. The iterative design process and assessment process therefore allows mitigation measures to be identified and assessed.

4.2.7 ASSESSMENT OF EFFECTS

25. As set out in Section 4.2.1 the EIA Regulations require that likely significant effects are assessed. There is no statutory definition of 'significant', therefore the evaluation of significance in this EIA is based on the professional judgement of the EIA team, informed by legal standards, national and regional government policy,

current industry good practice and stakeholder responses. The assessment of effects takes into account the magnitude of an effect and the value or sensitivity of the affected resource or receptor. Effects can be positive or negative.

26. For the purposes of this ES, it is considered that the probability of an effect occurring is considered to be 'likely' unless the topic specific Section states otherwise.

27. The EIA utilises the following terminology for the assessment of effects:

- The magnitude of effect can be negligible, small, medium or large; and
- The value/sensitivity of a receptor/resource can be low, medium or high.

28. The approach followed in this ES is that magnitude and sensitivity are generally combined to ascertain significance of an effect as illustrated in Table 4.3. significance is a term used to evaluate the level of effect.

29. Where terminology varies this has been defined in the methodology of each technical Section.

Table 4.3 Evaluation of Effects

Sensitivity or Value of Resource or Receptor	**Magnitude of Effect**			
	Negligible	**Small**	**Medium**	**Large**
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Major

4.2.7.1 Evaluation of Significance

30. As described above, effects are categorised as being of major, moderate, minor or negligible significance. Where there is no effect, this is stated. Effects of major and moderate significance are considered to be significant in terms of the EIA Regulations. Effects of minor and negligible significance are considered to be not significant in terms of the EIA Regulations. In topic sections, where an effect is identified, the level of effect and the significance of that effect in terms of the EIA Regulations are clearly stated.

31. The categories of effect shown in Table 4.3 and described above are not precise classifications and there may be cases where an effect is assessed as being between these categories, or in the assessor's professional judgement, the significance of an effect does not relate to the significance in terms of the EIA Regulations precisely as outlined above e.g. to follow specific guidance applicable to that topic area. For clarity, each of the specialist topic sections in this ES refers to this Section, and/or sets out the topic-specific criteria used to determine the level of effect and its significance in terms of the EIA Regulations.

4.2.8 MITIGATION, MONITORING AND ENHANCEMENTS

32. One of the key objectives of an EIA is to identify and define socially, environmentally and technically acceptable and practicable mitigation measures. These mitigation measures should be developed to avoid unnecessary damage to the environment; safeguard valued or finite resources, natural areas, habitats and ecosystems; and protect humans and their associated social environments.

33. Mitigation measures are developed to avoid, reduce, remedy or compensate for any negative significant effects identified. Mitigation measures have been identified for significant effects, i.e. moderate and major effects. Mitigation measures may include operational controls as well as management actions such as restoration or compensation (e.g. in the event that an area is predicted to be damaged).

34. In some cases, where residual uncertainty has been identified, monitoring has been proposed.

35. Enhancement may also be proposed to create or enhance positive effects such as environmental and social benefits.

36. Where a negative effect has been assessed as being significant in terms of the EIA Regulations, mitigation, monitoring and/or enhancement is identified where available to avoid, reduce, remedy or compensate a significant effect.

4.2.9 ASSESSMENT OF RESIDUAL EFFECTS

37. Following the application of mitigation or enhancement, an assessment is made of the residual effect associated with the Project. This is reported in at the end of each assessment within the technical Sections.

4.3 DEFINING PROJECT PARAMETERS

38. Uncertainty can arise as a result of the stage in the design process at which an EIA is undertaken, for example, at the outline design stage. Where uncertainty affects the assessment of effects a worst-case approach to assessing the likely residual effects is adopted, with mitigation measures developed accordingly.

39. It is recognised by regulators that within the offshore wind industry some final design details will not be available to the EIA team at the time of consent application submission. For example, it is not certain what specific type or size of wind turbine would be best suited to a site until closer to the construction phase, following detailed engineering studies, contractor appointment and a competitive tendering process. Given this uncertainty it is accepted by regulators and consenting bodies that a 'Rochdale Envelope' can be created containing realistic minimum/maximum extents of a range of design parameters that are to be included in the application for consent. For each topic in the ES, the EIA team assesses the likely significant effects arising from the worst case scenario within the Rochdale Envelope.

40. This approach is acceptable as long as the final specified and detailed design of the Project elements sit within the specified range and parameters of the Rochdale Envelope and so the ES has assessed the likely significant effects of the worst case

Project. Further background to the Rochdale Envelope approach is provided in Section 3.3.1 of this ES.

41. Each topic area identifies and describes its worst case scenario under the Assessment of Effects Methodology heading of each Section. A summary of the Project's Rochdale Envelope parameters is presented in Table 7.1A-G of Section 7: Project Description. It should be noted that the final detailed design of the Wind Farm will fall within these parameters but that each parameter will be dependent on others. For example, the number of wind turbines built will determine the length of inter-array cabling, the number of OSPs required, and the number of offshore transmission cables. Detailed information on the Project Description is included in Section 7.

4.3.1 INFORMATION GAPS

42. Even with a final project design and an unchanging environment, predictions of the likely significant effects on resources and receptors can, by definition, be uncertain. Predictions can be made using varying means ranging from qualitative assessment and expert judgement through to quantitative techniques (e.g. modelling). The accuracy of predictions depends on the methods used and the quality of the environmental baseline data and project description information. Where assumptions have been made the nature of any uncertainties which stem from these will be presented in the topic specific sections. The range of prediction techniques employed during the course of the EIA has enabled the likely significant effects of the Project to be identified, assessed and reported.

43. An indication of any difficulties encountered in compiling the required information, or any information gaps are highlighted under the Assessment Methodology heading of each topic section within this ES.

4.4 ASSESSMENT OF CUMULATIVE EFFECTS

4.4.1 REQUIREMENT FOR ASSESSMENT OF CUMULATIVE EFFECTS

44. In line with the requirements of the EIA Regulations, an EIA must consider, and the ES must include, a description of the likely significant cumulative effects of a development. Cumulative effects and the methodologies used to assess cumulative effects are outlined in individual topic Sections.

4.4.2 DEFINITION OF TERMS

45. There is no single statutory definition of what a cumulative effect is. Guidance, however, is provided as to how the term should be defined. The terms cumulative and in-combination are considered to be synonymous for the purposes of the EIA and this ES. European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (1999) provides the following definition of cumulative effects (referred to as "cumulative impacts" in the EC guidance) and this is the definition used in the assessments:

> "*Cumulative impacts are impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project*".

46. Examples of cumulative effects are as follows:

- Incremental noise from a number of separate developments;
- Combined effect of individual effects, e.g. noise, dust and visual, from one development on a particular receptor;
- Several developments with insignificant effects individually but which together have a cumulative effect and a significant effect; and
- The potential for cumulative effects to occur as a result of onshore elements of the project have been assessed where applicable in the cumulative assessments.

47. For proposals that are likely to have a significant effect on a Natura 2000 site under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) there is a requirement to assess the effects of the proposals alone and in combination with other plans or projects.

48. The SEA, the Draft Plan for Offshore Wind Energy in Scottish Territorial Waters (2010) outlined the key issues for which cumulative effects should be considered. These included:

- Water quality – including sediment disturbance and the wildlife that may depend on water quality including commercial fish species;
- Geology sediments and coastal processes – potential cumulative disturbance of the seabed which may affect water quality and the associated impacts on wildlife and coastal Sites of Special Scientific Interest (SSSI's);
- Biodiversity, flora and fauna – including the cumulative effect of various noise sources on marine mammals, increased vessel movements effects on marine mammals and collision risk to birds from cumulative developments;
- Landscape, Seascape and Visual effects ;
- Population and human health – potential combined pressures of those using the sea for recreation, i.e. increasing number of vessels being displaced from areas due to new offshore developments; and
- Cultural Heritage – potential combined pressures on setting of listed structures from various offshore wind zones/developments.

49. These cumulative effects have been assessed within the relevant Sections of this ES.

50. Additionally, the EC guidance refers to "impact interactions" which themselves can combine to create a cumulative effect, defined as follows:

> "*Impact interactions are the reactions between impacts whether between the impacts of just one project or between the impacts of other projects in the area*".

51. Table 4.4 outlines the impact interactions and inter-relationships of effects considered in each topic Section.

Table 4.4 Impact Interactions

Topic Area	Impact Interactions
Physical Processes and Geomorphology	None
Benthic Ecology	Physical Processes and Geomorphology

Topic Area	Impact Interactions
Fish and Shellfish Ecology	Physical Processes and Geomorphology Benthic Ecology Commercial Fisheries
Marine Mammals	Physical Processes and Geomorphology Benthic Ecology Fish and Shellfish Ecology Shipping and Navigation
Ornithology	Benthic Ecology Fish and Shellfish Ecology
Seascape Landscape and Visual Environment	None
Marine Archaeology and Cultural Heritage	Seascape Landscape and Visual Environment Physical Processes and Geomorphology
Commercial Fisheries	Fish and Shellfish Ecology Shipping and Navigation
Airborne Noise	None
Shipping and Navigation	Commercial Fisheries
Aviation and MoD	None
Socio-economics Recreation and Tourism	Marine Mammals Seascape Landscape and Visual Environment Shipping and Navigation
Other Issues	Physical Processes and Geomorphology Shipping and Navigation Aviation

4.4.3 CUMULATIVE IMPACT ASSESSMENT DISCUSSION DOCUMENT

52. A collaborative consultation exercise was undertaken by the MFOWDG on cumulative assessment. A CIADD (see Annex 5B) was sent to consultees in April 2011 for comment on the proposed approach to the cumulative assessment. A list of the consultees who received the document is provided in Section 5.4 of Section 5: Consultation of this ES and a summary of responses is provided in Annex 5A.

53. The CIADD outlined the developments to be considered in the cumulative assessment. These are illustrated in Figures 4.1, 4.2, 4.3, 4.4 and 4.5. These developments are considered as applicable in the cumulative assessment of each topic Section.

4.5 CONSULTATION

Consultation is a key aspect of EIA and the robust prediction of environmental effects depends on a number of aspects, including good data. Responses from stakeholders gained during consultation have been fundamentally important in guiding the EIA process. The consultation undertaken as part of the EIA is discussed further in Section 5: Consultation.