Chapter 6 The Approach to Environmental Impact Assessment

6.1 Introduction

1 Under European legislation, transposed into UK and Scottish law (see Chapter 3: Regulatory and Policy Context for further information), certain projects are required to undertake an Environmental Impact Assessment (EIA) to identify and reduce potential impacts arising as a result of the development. Large infrastructure projects, such as the Neart na Gaoithe development require this assessment. The output of the EIA process is the Environmental Statement (ES), a document that is provided to the consenting authority, in this case Marine Scotland, in support of the consent application for the offshore works.

2 A concurrent EIA process is ongoing covering the onshore works (the area from the mean low water springs (MLWS) to the substation) and a separate planning application, under the Town and Country Planning (Scotland) Act (1997), will be made to East Lothian Council in 2012.

3 Ultimately, the offshore ES will support a consent application, under Section 36 of the Electricity Act 1989 and marine licence for the offshore site and inter-array cables, and a second marine licence for the export cable and substation; while the onshore ES will support a planning application for all onshore works (onshore cable route and substation).

6.2 The EIA Process

4 The EIA process is a series of steps that must be taken to ensure environmental issues are captured and considered during the stages of development, from first discussion through to implementation. The emphasis is on prevention rather than on mitigation or restitution, with the process of assessment is undertaken with feedback and interaction linking each step. Positive feedback, in the form of ongoing consultation and engagement with stakeholders, has the potential to shape and guide the impact assessment process and, ultimately, influence the output (see Figure 6.1). Where uncertainty exists over the status of a given project, screening can be undertaken to establish whether an EIA is necessary given the type of development project. If it is, as in the case of Neart na Gaoithe, the steps described below are undertaken. Once screening identifies the need to undertake an EIA, the focus of the EIA can be developed through the scoping process, as discussed below.

5 The first step is the preparation and submission of a Scoping Report to the Scottish Government. This document outlines the proposed format, content of the future ES and asks the competent authority to supply a formal opinion on the information. Consultation is also undertaken at this stage to ensure the widest (reasonable) scope of the EIA. The Neart na Gaoithe Scoping Report was issued in November 2009 and a response (or Scoping Opinion) was received from the Scottish Government in January 2010 (appended as received in Appendix 6.1).

6 On receipt of the Scoping Opinion, the developer has taken into account the opinions of the stakeholders who were consulted by the Scottish Government. These opinions, therefore, feed into the content of the final ES. An overview of the Scoping Opinion and its requirements are presented in Chapter 7: Engagement and Commitments; specific requirements for individual topics are presented in the individual technical chapters within this ES.

7 Following the receipt of the Scoping Opinion the collation of baseline information begins. This baseline describes the current environmental and social conditions of the development site; it also provides a level upon which the impact assessment is based. The baseline description for Neart na Gaoithe was developed using information gathered through both desk based and field studies.

8 Once the baseline is defined, impacts arising as a result of the development alone or through interactions with other developments are assessed. Cumulative and in-combination effects are discussed in more detail in Section 6.7; they essentially refer to the assessment of impacts arising as a result of interactions with the same (cumulative) or different (in-combination) industry developments.

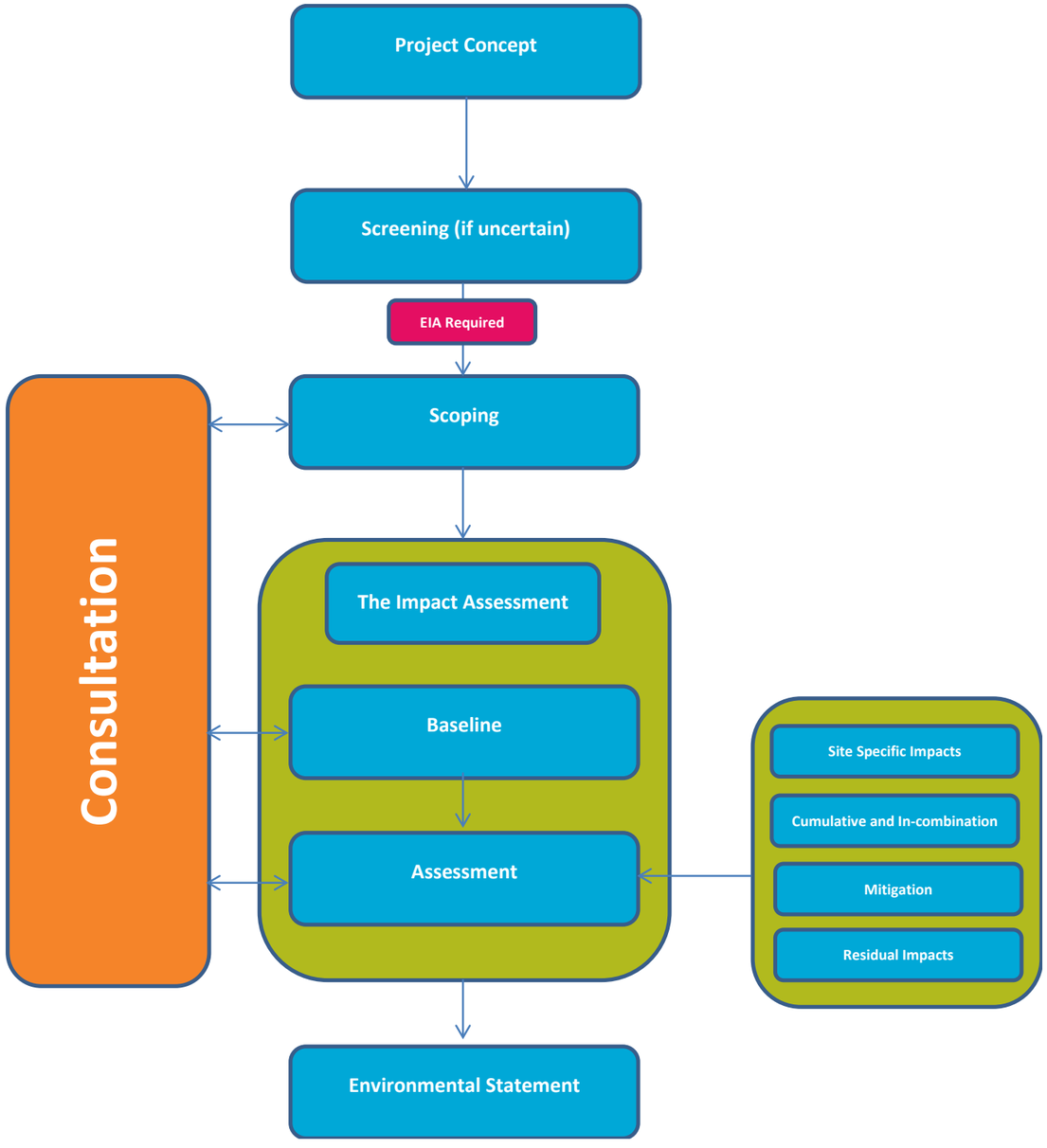

Figure 6.1: Steps within the EIA process

9 Once the impacts have been assessed and their significance quantified, mitigation measures are applied. If necessary, long term monitoring regimes are considered.

10 Consultation is carried out with the consenting authority and other stakeholders throughout the process. A comprehensive consultation strategy is developed at the outset to guide and shape future engagement and ensure the inclusion of all stakeholders. An open and accessible approach to consultation and stakeholder involvement enables the whole EIA process to be more flexible. It results in an iterative process where, at key stages, consultation outcomes feed into and influence design decisions.

11 Consultations carried out as part of the EIA process for Neart na Gaoithe are summarised in Chapter 7: Engagement and Commitments, with results of topic specific consultations presented in individual technical chapters.

12 On submission of the consent applications and the supporting documentation (including the ES), the applications are considered by the Scottish Ministers, who may grant or deny the applications with or without conditions.

6.3 Legislative Framework

13 The European Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment ('the EIA Directive'), as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC, requires an assessment of the environmental impacts of certain developments and projects prior to consent being granted.

14 In Scotland, the EIA Directive is implemented through a number of Regulations, including the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended), together referred to as 'the EIA Regulations'. Under the EIA Regulations, the Scottish Ministers are required to consider whether any proposal for marine works or the construction or operation of a generating station, is likely to have a significant impact on the environment.

15 There are additional legislative instruments that must be taken into account during the EIA process, most notably:

- EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora ('the Habitats Directive');
- EC Directive 2009/147/EC on the Conservation of Wild Birds ('the Birds Directive');
- Conservation (Natural Habitats, &c.) Regulations 1994 ('the Habitats Regulations');
- Marine (Scotland) Act 2010;
- Wildlife and Countryside Act 1981; and
- Nature Conservation (Scotland) Act 2004.

16 These and related legislative instruments and frameworks are discussed in more detail in Chapter 3: Regulatory and Policy Context, as well as in individual topic chapters (such as Chapter 11: Nature Conservation) where appropriate.

6.4 Guidance and Best Practice

17 In addition to the legislative requirements, guidance and best practice documents have been developed to assist with the production of a 'fit for purpose' document. In October 2010, the Institute of Ecological and Environmental Management (IEEM) issued revised Ecological Impact Assessment (EcIA) Guidance (IEEM, 2010). Although this guidance is tailored towards ecological assessment, the principles are applicable to broader EIA.

18 Marine Scotland is developing a Marine Renewable Licensing Manual that is currently in draft form (as of March 2012). This guidance describes the accepted approach to EIA taking into account consultation, monitoring and management plans and has been followed in this approach.

19 In addition to the above best practice guidance, the following documents have been referenced in the development of this ES:

- A Handbook on Environmental Assessment. Guidance for competent authorities, consultees and others involved in the Environmental Assessment Process in Scotland (Scottish Natural Heritage, 2009);
- Marine and Coastal EcIA Guidelines (IEEM, 2010);
- Developing guidance on ornithological cumulative impact assessment for offshore wind farm developers (King *et al*., 2009);
- A Review of Assessment Methodologies for Offshore Wind farms (Maclean *et al*., 2009); and
- Marine Renewable Licensing Manual (Draft) (Emec & Xodus Aurora, 2010).

6.5 Impact Assessment Methodology

20 The assessment of potential impacts arising from the development must evaluate those changes to baseline conditions above background environmental variation. Such changes can be considered to be either positive or negative. Impacts are measured in terms of their significance, which is considered to be a function of both the magnitude of the impact and the vulnerability of the receptor. Impacts assessed to be of moderate or high significance are considered to be unacceptable and require mitigation to be applied.

6.5.1 Rochdale Envelope Approach

21 The nature of offshore wind farm construction, where consent is applied for and obtained often several years before construction commences, has the potential to leave the developer unable to use advances in technology or installation methodology that were considered not to be viable at the time of assessment. Conversely, as the EIA and ES are completed before detailed technical assessment of the site has been undertaken, there may be a great deal of uncertainty relating to installation techniques, foundation types and even size of turbine.

22 To assist with technical uncertainty in the consent application process it has become common practice to define what has become known as a 'Rochdale Envelope'; named after two legal cases relating to a proposed business park in Rochdale. The cases considered applications for outline planning consent in the context of preparing an environmental impact assessment.

23 The adoption of the Rochdale Envelope approach allows meaningful EIA to take place by defining a 'realistic worst case' scenario that decision makers can consider in determining the acceptability, or otherwise, of the environmental impacts of a project. As long as a project's technical and engineering parameters fall within the limits of the envelope and the EIA process has considered the impacts of that envelope and provides robust and justifiable conclusions, then flexibility within those parameters is deemed to be permissible within the terms of any consent granted, i.e., if consent is granted on the assessed maximum parameters of a development, any parameters equal to or less than those assessed is permitted to be constructed. The principle of Rochdale permits the developer or applicant to provide broad or alternative project engineering and construction parameters, of which one or a selection of the scenarios or parameters will ultimately be constructed.

24 The 'realistic worst case' scenario assumes that one or other of the parameters will have a more significant adverse effect than the alternative. Where a range is provided, i.e., turbine outputs or blade tip heights, the most detrimental is assessed in each case.

25 The design that could result in the most significant impact may be different for each receptor type. Understanding the cause and effect specific to each receptor leads to the definition of the appropriate Rochdale parameter for that receptor and, therefore, identifies the 'realistic worst case'. Taking the 'realistic worst case' scenario, it can be assumed if no significant impact is demonstrated at the 'realistic worst case', then no significant impact is likely for any scenario. An example Rochdale table is presented in Table 6.1.

Project design element	Parameter	Turbine capacity			
		3.6 MW	4.1 MW	6 MW	7 MW
Turbines					
Turbines	Number at 450 MW capacity	125	109	75	64
	Maximum rotor tip height (m) (LAT)	175	171.25	175.5	197
	Max turbine spacing (m)	1320	1240	1330	1805
	Min turbine spacing (m) (approx.)	480	450	484	656
	Position of turbines (coordinates / shapefiles)	**Indicative layout A**		**Indicative layout B**	
Jacket foundations					
Jacket foundations	Jacket leg spacing at seabed level (m x m)	15x15 - 25x25	15x15 - 25x25	20x20 - 30x30	25x25 - 35x35
	Foundation diameter (m) (piles)	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5
	Foundation bed penetration depth (m) (piling)	15-40	15-40	20-50	20-50
	Foundation installation duration (per foundation) (hours)	Piling (62-180 hours for 4 piles), jacket installation (12-24 hours). This includes time for setting up and changing equipment between piling locations.			
	Total seabed occupied by substation	100 – 250 m^2			
Gravity base foundations					
Gravity base foundations	Size of foundation footprint (m^2)	300-700	300-700	490-1600	490-1600
	Quantity of material dredged	Average of 1500 m^3 dredged per foundation. Approximately 190,000 m^3 of material dredged over entire site.	Average of 1500 m^3 dredged per foundation. Approximately 160,000 m^3 of material dredged over entire site.	Average of 4,000 m^3 dredged per foundation. Approximately 320,000 m^3 of material dredged over entire site.	Average of 4,000 m^3 dredged per foundation. Approximately 320,000 m^3 of material dredged over entire site.
	Installation duration (per foundation)	Seabed levelling and gravel bed placement 8-14 days, Foundation placement and filling 4 - 7 days scour protection placement 7 - 14 days.			
	Gravel bed	Minimum 530 m^3 per foundation, maximum 1850 m^3 per foundation.			
	Foundation diameter (m)	20-30	20-30	25 - 45	25 - 45
	Turbine Foundation Scour Protection and footprint size	Gravel bed extends 2-4 m outside full foundation perimeter. Scour protection extends 5-8 m outside foundation perimeter.			
Cables					
Inter-array cables	Number of cables (no.)	Indicative 85 - 140 km of cable			
Export cables	Number of cables (no.)	2	2	2	2
	Cable Corridor width (m)	500 m either side of cable route centre line. Burial depth 1-3 m.			

Table 6.1: Example Rochdale Envelope scenarios

26 Table 6.1 represents an abridged version of the full Rochdale Envelope. The full list of parameters is presented in Chapter 5: Project Description. From these parameters and additional information relating to construction methods and schedules, vessel movements and decommissioning information, individual worst (realistic) case scenarios were developed for each receptor resulting in a tailored Rochdale Envelope. The full Rochdale Envelope is used in the preliminary assessment of each receptor, but only those parameters that would have an effect on the given topic are assessed. For example, when considering the visual environment the volume of dredged material for each foundation will not have any effect and is, therefore, not considered in the assessment parameters for visual impact.

27 Once the Rochdale Envelope has been developed for each receptor, it is checked to ensure the assessment covers all aspects of the design that could be constructed, while avoiding an unrealistic project. The site is constrained by a maximum permitted energy output; this means any scenario that generates over 450 MW is unrealistic and would not be built as it could not be constructed within the lease conditions of the site. Consequently, the 'worst case' must be tempered to produce the 'worst (realistic) case' for assessment.

28 Ultimately, a clear picture of the realistic worst case development scenario is constructed specific to each individual receptor. Chapter 24: Summary of Environmental Impact Assessment draws together the conclusions of the individual chapter assessments to provide a clear and concise summation of the potential impacts. It is not the intention of the developer to imply that any one receptor has more or less value than another but rather to present a clear comparison of impacts to the consenting authority.

6.5.2 Approach to Impact Assessment

29 Central to the assessment is the conceptual 'source-pathway-receptor' model. The 'source-pathway-receptor' model defines those receptors considered to be at risk. Where there is no known 'pathway' then no impact is considered to occur (see Figure 6.2). This highlights the event from which the effect arises (source), the potential receptor, and the mechanism linking the effect and receptor (pathway).

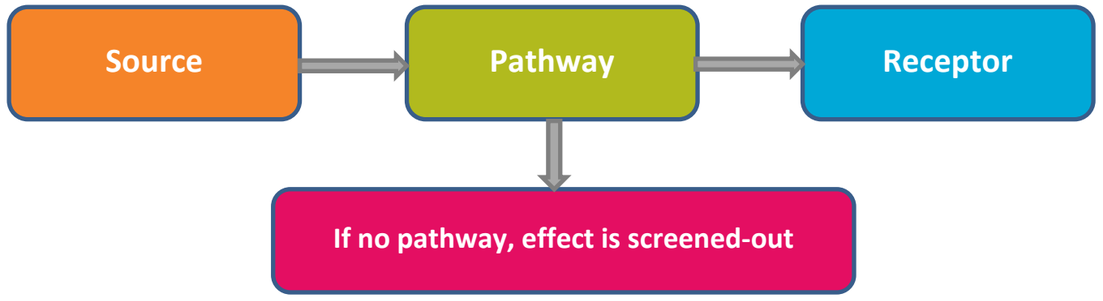

Figure 6.2: Source-pathway-receptor model

30 Identifying the cause, or 'source', of the potential impact quantifies the origin and understanding the route, or 'pathway', establishes whether it is possible for that 'source' to have an impact on a given receptor. For example, an activity such as anchoring (the source) could result in disturbed sediment being re-suspended into the water column. Tidal flow and currents (the pathway) could result in a receptor, such as a benthic organism, being smothered as the sediment resettles on the seabed (the impact). If no 'pathway' to a receptor exists, then the effect can be screened-out. This environmental impact chain model can be applied to local and distant impacts in the context of ongoing or background environmental changes.

31 Once potential effects have been identified and assessed, the impact must be quantified. Under the EIA approach, impacts are not considered 'significant' or 'not significant', but rather are categorised on the acceptability of the impact, i.e., whether the impact should be mitigated to reduce the consequences or whether it is considered to have a sufficiently low consequence that it can continue unabated (see Figure 6.3). In the wider context of impact identification, this stepped model can assist in identifying and mitigating potential effects at the 'source' level. Early mitigation will break the impact chain and reduce, or potentially eliminate, the environmental impact.

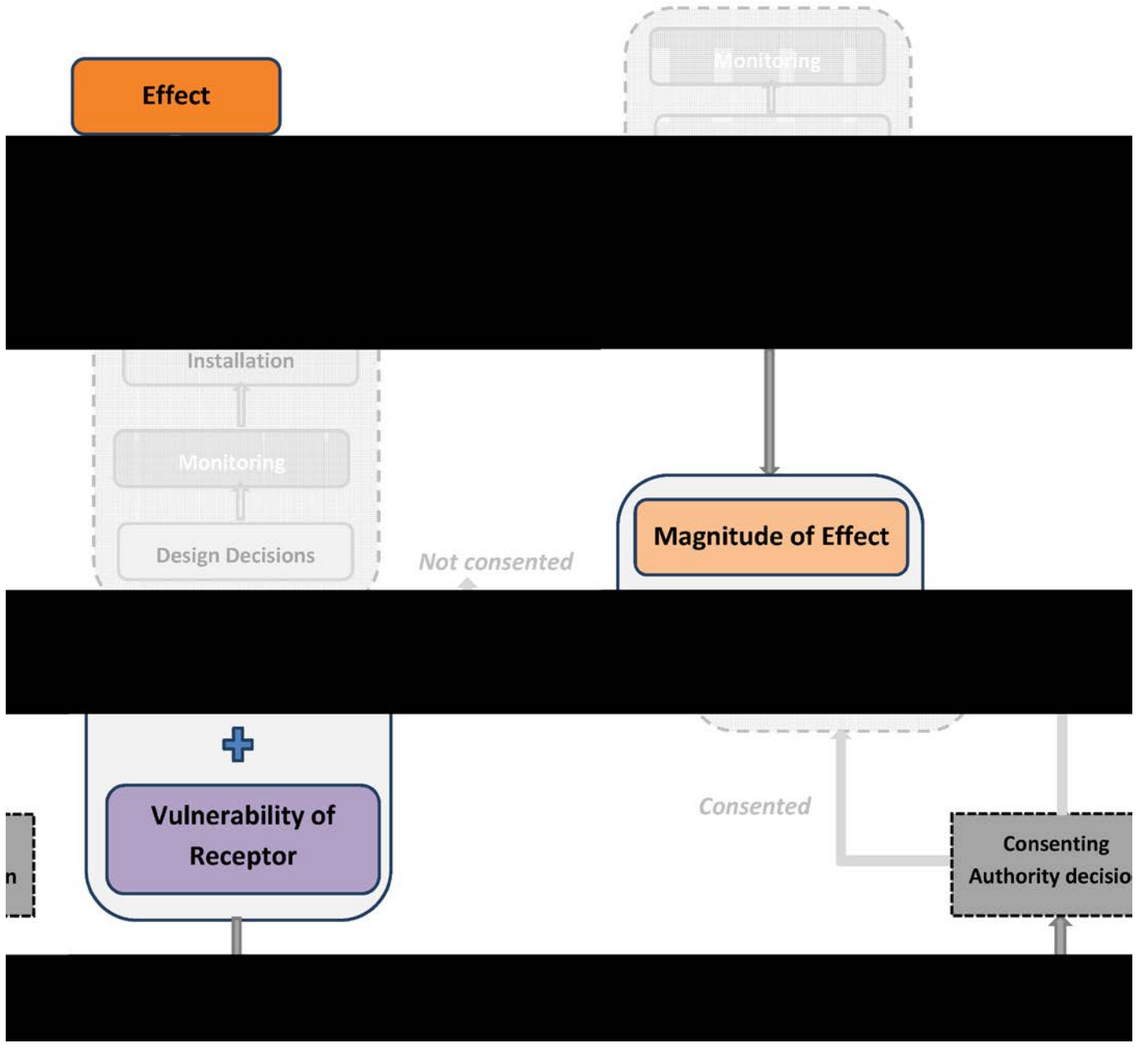

Figure 6.3: Conceptual EIA process model for screened-in effects

32 A range of 'sources' and 'pathways' can result in direct impacts on individual receptors, but also either indirectly or in conjunction with other impacts. These indirect and inter-relationship impacts often occur due to the complexity of marine ecosystems. Given such complexity and in keeping with the 'ecosystem approach', a framework advocated by the Convention on Biological Diversity (CBD), assessment of the impacts of effects on receptors will be carried out in a holistic manner.

6.5.3 Defining Effects and Impacts

33 The terms 'effects' and 'impacts' are often used interchangeably to describe what happens to a receptor following a specific event. To date, no definitive technique has been agreed which applies certainty to terminology or method of approach. It is important to note that in the context of this ES, an effect is considered to result in an impact if a pathway to a receptor exists.

34 An effect is defined as a physical change in the environment as a result of an action or activity related to the development. For example, the placement of gravity bases on the seabed may have an effect on sediment transport or water quality. Effects are generally measurable in space or time, for example by spatial extent or duration.

An effect is a change to the baseline environment arising from an activity or event related to the development

35 Impacts are the consequence of this change and are defined as the way in which sensitive receptors are affected or 'impacted' by the change in the environment. The **significance** of an impact is directly related to the **magnitude** of the effect and the **vulnerability** of the receptor. An overview of types of impacts is shown in Table 6.2.

An impact is the consequence of this change on a given receptor

36 It is important to put these impacts in the context of what would have happened had the project not been undertaken, given background variability. Scottish Natural Heritage (SNH) (2009) describes this approach as the 'do nothing' comparison.

Impact	Occurrence	Example
Direct impacts	Direct impacts on receptors as caused by physical changes within the Neart na Gaoithe area.	Habitat loss due to the placement of turbine foundations.
Indirect impacts	These impacts occur as a consequence of a direct impact (sometimes as part of a chain of events) and may be experienced at a point spatially or temporally removed from the direct impact.	Displacement of a species from the area due to habitat loss.
Inter-relationship impacts	Changes which occur on a single receptor from multiple sources and pathways.	A wreck could be damaged by an anchor, but also covered by dispersed sediment.
Cumulative impacts	Impacts resulting from the interaction of effects from the Neart na Gaoithe development with other offshore and onshore wind farm projects, both temporally and spatially, and considered in the context of background variability.	From certain vantage points terrestrial viewers may be able to see more than one wind farm.
In-combination Impacts	These arise through the interaction with other offshore activities, again both temporally or spatially.	Marine mammals being disturbed by noise being generated from the wind farm, and shipping activity.

Table 6.2: Definitions of impacts

6.6 Assessment of Impacts

6.6.1 Determining Magnitude of Effect

37 Predicting the physical effects of wind farm construction, operation and decommissioning activities on the environment is a critical step in the assessment process. It involves determining the magnitude of the potential physical changes and comparing it to baseline conditions. In this way, inferences can be made on future potential changes to the sensitive receptors. The magnitude of effect is quantified, where possible, and based on the following four characteristics:

- Spatial extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

38 These characteristics, further described in Table 6.3, allow magnitude to take into account aspects, such as whether a change as a result of the project is localised or widespread, one-off or continuous, and the scale of the change. It is also crucial that magnitude of effect takes background variability into consideration. The characteristics of an effect could be termed negligible as the effect is not discernible against background baseline variability.

39 Considering the magnitude of an effect, in terms of its spatial extent relative to the cable route and the offshore wind farm site, gives rise to a different understanding of scale, depending on the receptor in question. To ensure the descriptor of spatial extent would be appropriate, individual scale definitions have been developed on an individual receptor basis using common categories (Table 6.3). To relate this to the overall significance of impact, the magnitude of the effect should be assigned in parallel to the assessed vulnerability of the receptor (where a pathway exists). Professional judgement is then applied to give an overall determination of the magnitude of effect. Essentially, magnitude should not be determined in isolation but should be assigned on an individual 'source-pathway-receptor' basis.

40 The initial magnitude of effect described within this ES does not include mitigation, cumulative or in-combination effects, as these are discussed separately within each topic.

Characteristic	Description	Example categories
Spatial extent (S)	The geographic area of influence where the effect is noticeable against background variability.	• Negligible; • Low; • Medium; or • High.
Duration (D)	The temporal extent of the effect is noticeable against background variability.	• Negligible; • Low; • Medium; or • High.
Frequency (f)	How often the effect occurs.	• Negligible; • Low; • Medium; or • High.
Severity (v)	The degree of change – toxicity, mass, volume, concentration.	• Negligible; • Low; • Medium; or • High.

Table 6.3: Definition of magnitude of effect

6.6.2 Determining Receptor Vulnerability

41 Vulnerability is the susceptibility of a given receptor to a change in baseline conditions and is quantified using the following four factors:

- Adaptability (how well a receptor can avoid or adapt to an effect). High adaptability results in low vulnerability;
- Tolerance (the ability of a receptor to be either affected or unaffected). High tolerance results in low vulnerability;
- Recoverability (how well a receptor recovers following exposure to an effect). High recoverability results in low vulnerability; and
- Value (the scale of importance). High value results in high vulnerability.

42 The exact determination of each factor of vulnerability of each receptor and the overall vulnerability for that receptor will vary according to the receptor in question and as such, will be defined on a receptor by receptor basis using industry best practice. Expert judgement is applied to determine overall vulnerability for each receptor. As with magnitude, an understanding of the baseline conditions is also critical to making an informed decision on vulnerability.

43 Within the ES, vulnerability is therefore attributed on a topic by topic basis with ES chapters using existing best practice guidelines and industry standards as appropriate. Table 6.4 provides a summary of the characteristics and terminology.

Characteristic	Clarification	Descriptor
Adaptability (A)	How well a receptor can avoid or adapt to an effect.	• Negligible; • Low; • Medium; or • High.
Tolerance(T)	The ability of a receptor to be either affected or unaffected (temporarily and/or permanently) by an effect.	• Negligible; • Low; • Medium; or • High.
Recoverability (R)	A temporal measure of how well a receptor recovers following exposure to an effect.	• Negligible; • Low; • Medium; or • High.
Value (V)	The scale of importance (e.g., level of conservation status and keystone species), rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., its socioeconomic, cultural and amenity value).	• Negligible; • Low; • Medium; or • High.

Table 6.4: Definition of vulnerability of receptor

6.6.3 Assessing Significance of Impacts

44 Following identification of sources, effects, receptors and impacts, an assessment of the significance of the impact can be undertaken, relevant to specific receptors. Significance is determined through consideration of both the magnitude of effect and the vulnerability of the receptor. The assessed level of magnitude and vulnerability are put into a matrix to determine the overall level of significance of the impact on a given receptor.

45 All impacts have a level of significance but not necessarily a high significance. The classifications for magnitude and vulnerability will be defined on a topic by topic basis, i.e., the level or limit that is considered to be 'high', 'moderate', 'low' or 'negligible'. Through this, significance can be defined through expert judgement for specific topics.

46 For example, an effect of high magnitude acting on a highly vulnerable receptor will result in the impact being assessed as having a major significance (refer to Table 6.5).

47 Those impacts assessed as moderate or major significance are considered to require mitigation measures to be applied.

		Vulnerability			
		Negligible	Low	Medium	High
Magnitude	Negligible	Not significant	Minor significance	Minor significance	Moderate significance
	Low	Minor significance	Minor significance	Moderate significance	Moderate significance
	Medium	Minor significance	Moderate significance	Moderate significance	Major significance
	High	Moderate significance	Moderate significance	Major significance	Major significance

Table 6.5: Level of significance related to magnitude of effect and vulnerability of receptor

6.6.4 Overall Significance

48 After the significance is determined, there are additional factors that can further inform the assessment process and should be applied to qualify the validity and acceptability of the significance output. It is important to understand the effects of these additional factors on the importance or weighting of a significance assessment. The implications of not taking into consideration the use of unreliable data, or where the probability of the event unfolding as assessed is low, may result in those aspects assessed as being of higher significance, skewing the overall assessment.

49 Where an impact has been assessed as significant it is then appropriate to consider the validity of the inputs. Where the probability of the effect occurring as predicted is considered to be unlikely or the data are considered to be unreliable the influence of these on the outcome should be examined. Ultimately, the overall significance will not change, but the importance of the assessed impact can be placed in the wider project context.

6.6.5 Probability

50 Probability considers the likelihood that an effect will occur as predicted. For example, impacts can be classified via the following four-point scale (IEEM, 2010):

- Certain/near certain: Probability estimated at 95% or higher;
- Probable: Probability estimated above 50% but below 95%;
- Unlikely: Probability estimated above 5% but less than 50%; or
- Extremely unlikely: Probability estimated at less than 5%.

51 Probability is taken into account in assessing impacts for specific receptors within the individual technical chapters in the ES.

6.6.6 Uncertainty

52 It is important to establish the uncertainty or reliability of data that are used to predict the magnitude of effects and the vulnerability of receptors, as the level of confidence in the decisions made on significance depends on it. There are three levels of uncertainty, namely:

- Low uncertainty: Interactions are well understood and documented. Predictions are modelled and maps based on interpretations are supported by a large volume of data. Information/data have very comprehensive spatial coverage/resolution;
- Medium uncertainty: Interactions are understood with some documented evidence. Predictions are modelled but not validated and/or calibrated. Mapped outputs are supported by a moderate degree of evidence. Information/data have relatively moderate spatial coverage/resolution; or
- High uncertainty: Interactions are poorly understood and not documented. Predictions are not modelled and maps are based on expert interpretation using little or no quantitative data. Information/data have poor spatial coverage/resolution.

53 In the absence of certainty, it is necessary to adopt a precautionary approach. Where data are missing or unreliable, this uncertainty is applied after the significance is assessed, i.e., significance may be assessed as **major significance** but where there is uncertainty over the reliability of data the assessment may be tempered by this.

6.6.7 Qualification of Significance of Impact

54 In general, if an impact is classed as not significant or of low significance, it is considered to be acceptable. Impacts of moderate or major significance are considered further to reduce the overall impact through mitigation measures. However, it is important that professional judgement is applied to quantify the significance in terms of the wider perspective. For example, an effect which results in a moderate impact at the local (project area) level may be acceptable when considered at the regional level. The stepped process shown in Figure 6.3 is followed until the final assessed significance is considered to be acceptable. It may be necessary to assess significance and apply mitigation multiple times to reach an acceptable outcome. An example of this process is represented in Table 6.6.

55 In this example (Table 6.6) the 'source-pathway-receptor' approach has been used. The overall magnitude of effect and overall vulnerability of the receptor have been assessed as described above. These combine using the matrix in Table 6.5 to determine the overall significance of the impact prior to any mitigation being applied. Uncertainty and probability of the effect and impact occurring as predicted are taken into account and a final decision is taken on qualification of the impact.

Source	Pathway	Receptor	Magnitude of effect	Vulnerability	Significance	Qualification of Significance
Shadowing of radar signals behind turbines	Reduced detectability of aircraft behind turbines	Royal Air Force (RAF) Leuchars Primary Surveillance Radar (PSR)	Low	High	Moderate significance	Shadowing will occur, so vulnerability is high. Height of shadowing is limited to approximately 1000 m Above Mean Sea Level (AMSL). Significance of impact could reduce if the provision of radar services reduces at RAF Leuchars but the future of the base is not yet known.

Table 6.6: The process in action

56 If the impact is considered to be unacceptable (having moderate or major significance), mitigation measures should be suggested and applied to then reassess the significance of the residual impact, as illustrated in Table 6.7.

Source	Pathway	Receptor	Significance (assuming industry standard mitigation)	Mitigation	Significance post-mitigation	Cumulative/ in-combination impact significance	Qualification of significance
Physical presence of wind farm structures.	Physical change in the environment due to wind farm structures leading to a loss of navigable sea room and deviations around structures which may lead to increased collision risk (vessel-to-vessel and vessel-to-structure).	Commercial shipping	Moderate significance	Best practice Marine Control Centre monitoring vessel activity and safety zones/guard vessels.	Minor significance	Moderate significance	Vessels should be able to pre-plan their voyage and based on analysis of shipping data there is available sea room east and west of the site for shipping to increase passing distance from wind farm structures.

Table 6.7: Example mitigation and reassessment process for residual environmental impacts

6.7 Assessment of Cumulative and In-Combination Impacts

57 It is important to consider the potential impacts on individual receptors, not only as a result of the Neart na Gaoithe offshore wind farm alone, but also those that may occur as a result of interactions with other developments, projects or plans.

58 As described above, cumulative impacts are considered to be those arising from interaction with similar developments, i.e., the impacts on receptors of one offshore wind farm combined with the impacts of other wind farms.

Cumulative Impacts: Impacts arising as a result of interactions between Neart na Gaoithe and other wind farms

59 As described in Chapter 3: Policy and Regulatory Context, this ES accompanies the application for consent for the offshore works of the Neart na Gaoithe offshore wind farm; the onshore elements of the project will be dealt with through a separate application to East Lothian Council.

60 There are some receptors that could be impacted by effects arising from both the offshore and onshore aspects of the project, such as those in the intertidal or coastal zone, and so there may be cumulative impacts arising from the development of the onshore aspects of the Neart na Gaoithe offshore wind farm.

61 In-combination impacts are considered to be those arising from interaction with unlike activities, i.e., the impacts arising from one offshore wind farm combined with those from offshore dredging.

In-combination Impacts: Impacts arising as a result of interactions between Neart na Gaoithe and other non-wind farm activities

6.7.1 Consideration of Cumulative Impacts

62 The Scottish Government's plan for offshore wind energy in Scottish territorial waters outlines potential offshore wind farm development in the area in both the short and medium term and will ultimately act as a route map for all offshore wind development in Scottish waters (Marine Scotland, 2011). Currently, there are three potential offshore wind farm developments in the Firth of Forth and Tay area working towards the consenting process, as shown in Figure 6.4. For certain receptors, such as long ranging bird and marine mammal species, connectivity to the wind developments in the Moray Firth area are also being considered (refer to Figure 6.5).

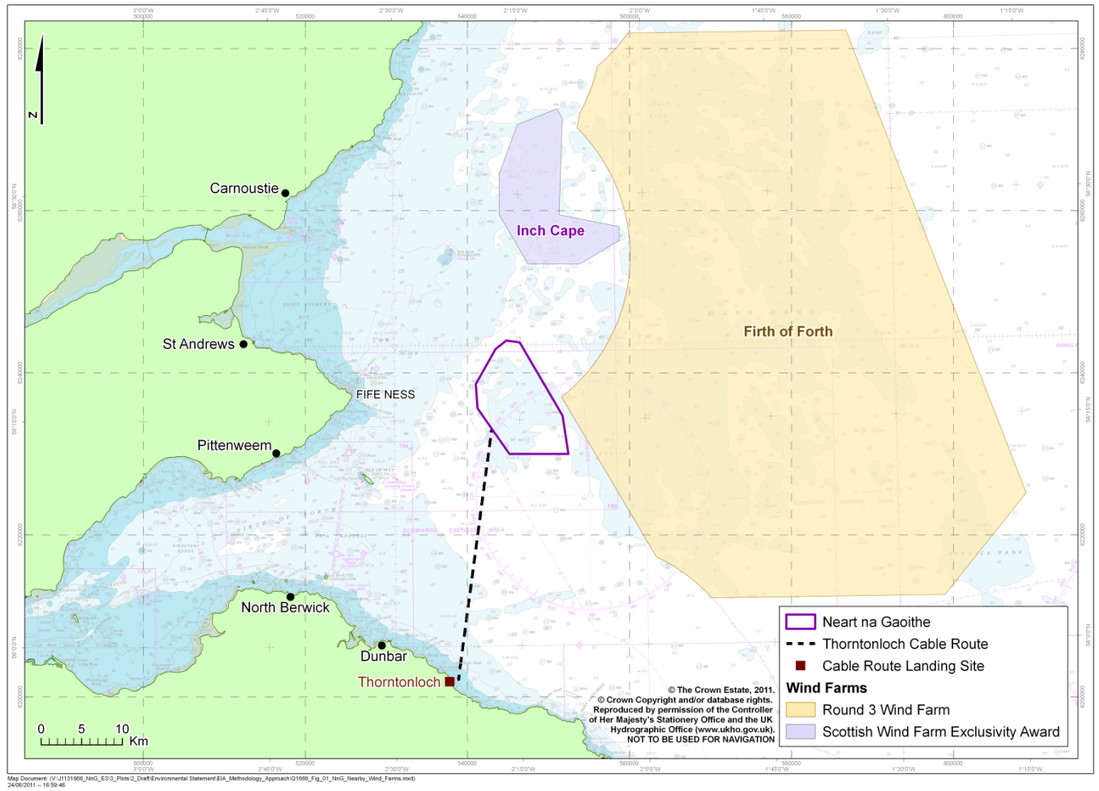

Figure 6.4: Other offshore wind farms planned in the Firths of Forth and Tay area

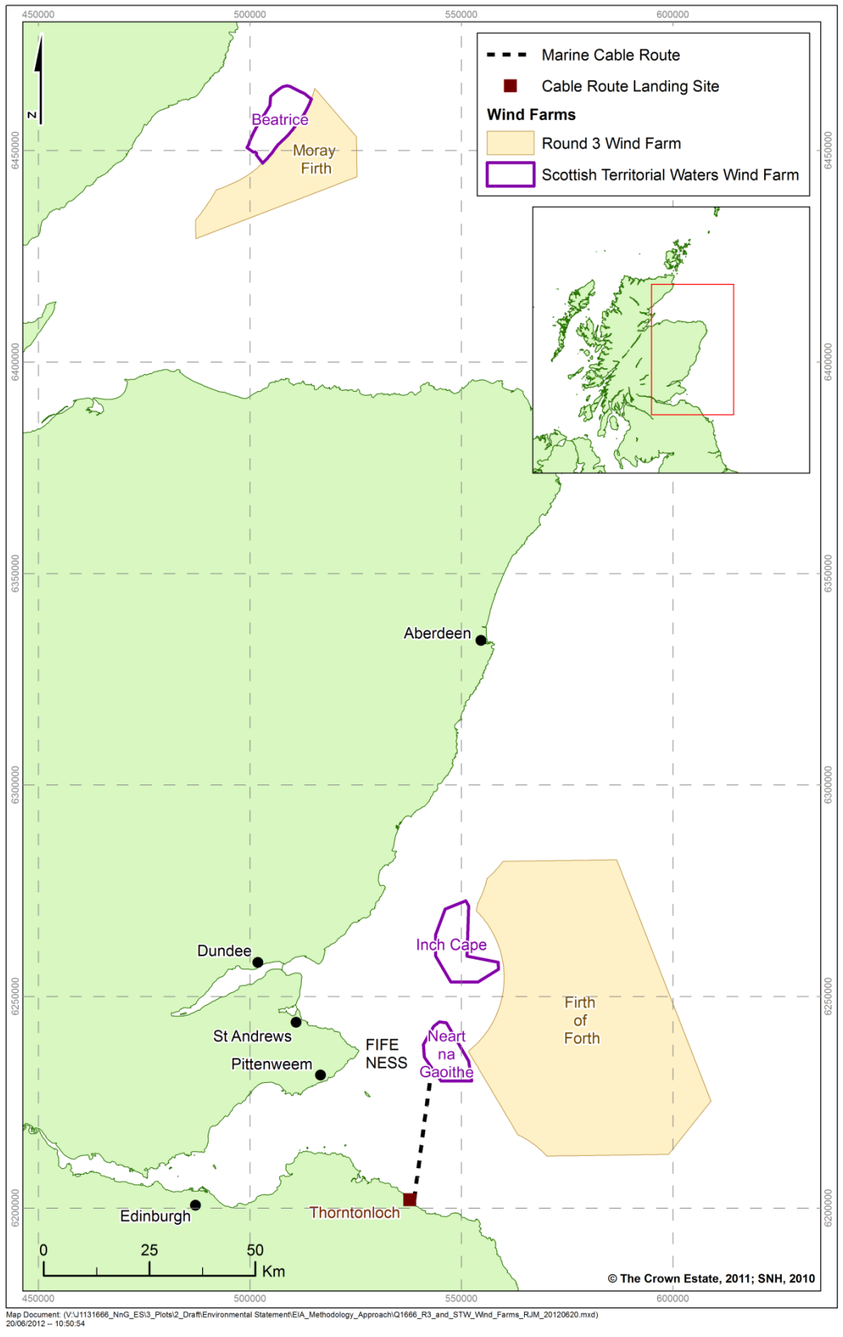

Figure 6.1: Location of FTOWDG and MFOWDG development sites

6.7.1.1 The Forth and Tay Offshore Wind Developers' Group

63 Chaired by The Crown Estate (TCE), the Forth and Tay Offshore Wind Developers' Group (FTOWDG) has been formed to promote and maximise collaboration and cooperative working to assess potential cumulative impacts. The group comprises of Mainstream (as the developer of Neart na Gaoithe), Repsol Nuevas Energias, (the developers of the proposed Inch Cape offshore wind farm) and Seagreen, (the consortium developers of the Firth of Forth Round 3 wind farm zone). Fred Olsen, the developers of the Forth Array offshore wind farm, were also members before the decision was made for the project not to go ahead.

64 As a direct result of this co-operation, the FTOWDG developed a guidance document showing how the group would work together to assess cumulative impacts and guide some aspects of the individual project EIAs. The document 'Scottish Territorial Waters Offshore Wind Farms – East Coast. Discussion Document – Cumulative Effects Assessment' was produced in 2009 and a second version was produced in 2010. These documents define areas where the developers could work collaboratively and how this co-operation should be handled, outlining a range of approaches to considering cumulative and in-combination impacts and are included in Appendix 6.2 and 6.3.

65 Chapter 5: Project Description provides a description of the Firth of Forth and Tay wind farm developments and their project specific Rochdale Envelopes.

6.7.2 Consideration of In-Combination Impacts

66 Within the Firth of Forth region, there are various industries that may cause in-combination impacts. These include shipping, port development, subsea cables, aggregate extraction programmes, and military activities. Other receptor specific in-combination activities such as commercial fishing as an in-combination impact on fish and shellfish populations are also considered. These are included for assessment where relevant to the specific receptor.

6.7.3 The Cumulative and In-Combination Impact Assessment Approach

67 A common approach across all topic areas and individual receptors is to adopt similar methodologies for assessing project level and combined impacts. For certain topics and receptors, particularly those with high vulnerability, regional studies and impact assessments are being carried out to further define cumulative impacts. Thus for each topic one of three approaches is being taken:

- Sharing standard methodologies for impact assessment across project EIA programmes;
- Engaging a single contractor to carry out the necessary topic surveys for all individual EIAs to ensure consistency; or
- Engaging a contractor to carry out regional assessments and studies in addition to project level work.

68 The Rochdale Envelope approach has also been adopted to provide a basis for assessment at this level with a Rochdale Envelope being developed for each relevant individual project included within the cumulative impact assessment.

69 The approach to assessing cumulative and in-combination impacts, including consideration of the onshore aspects of the project where applicable and recommendations and information from the FTOWDG is provided on a topic by topic basis in individual chapters in this ES. Descriptions of other proposed offshore wind farm developments in the Firths of Forth and Tay are provided in Chapter 5: Project Description. The cumulative and in-combination impacts will be assessed in the same way as the site specific impacts, as described above.

6.8 References

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Appendices

Appendix 6.1: Scoping Opinion

Appendix 6.2: Scottish Territorial Waters Offshore Wind Farms – East Coast –Discussion Document – Cumulative Effects

Appendix 6.3: Scottish Offshore Wind Farms – East Coast – Discussion Document – Approach to Cumulative Effects Assessment