8 Human Environment

8.1 Commercial Fisheries

8.1.1 Summary of Effects and Mitigation

8.1.1.1 For the purposes of this assessment, salmon and sea trout fisheries in the Moray Firth are separately addressed to other commercial fisheries, as a result of their being located largely in-river (with the exception of some coastal netting) and being different in nature to the majority of marine commercial fishing activities.

8.1.1.2 This chapter presents an assessment of the likely significant effects of the construction, operation and decommissioning of the three proposed wind farm sites on commercial fisheries.

8.1.1.3 Information supporting this assessment has been collected from a data review and consultation as explained in Chapter 5.1 (Commercial Fisheries).

8.1.2 Summary of Effects

Commercial Fisheries

8.1.2.1 As described in Chapter 5.1 (Commercial Fisheries) and supported in Technical Appendix 5.1 A (Commercial Fisheries Technical Report), the three proposed wind farm sites are principally located on scallop grounds, and to a lesser extent squid grounds. There is a very low level of whitefish activity. The site records moderate levels of fishing activity compared to grounds elsewhere in the Moray Firth, and relatively low levels of activity on a national scale.

8.1.2.2 The construction of Telford, Stevenson and MacColl wind farms will result in increasingly restricted access to fishing grounds within the site as the construction phase progresses. It is likely that all installed infrastructure, including turbines and met masts, will have temporary safety zones (up to 500 m) applied around them during construction. It is not considered, however, that inter array cables will have the same safety zones and the risks associated with fishing in the immediate vicinity of this infrastructure during the construction phase are considered to be outside of acceptable limits. This would result in vessels being excluded from these areas. The residual effect upon commercial fishing activities would be a **moderate** loss of fishing grounds during the construction phase.

8.1.2.3 It is likely that 50 m safety zones will apply to all fully installed turbines and met masts. Outside of these zones it is considered that vessels will regain access to fishing grounds in the operational wind farm once the appropriate post-construction surveys, and if necessary seabed rectification measures, have been undertaken and the safety risk is considered to fall within acceptable limits. The degree to which access is regained is however dependent upon the final design of the three proposed wind farms and the resulting changes to normal fishing practices. The level of effect arising from complete loss or restricted access to fishing grounds in the operational phase therefore remains at **moderate**.

8.1.2.4 It should be noted that the purpose of the construction management programme is also to ensure that the effects described are kept within the significance levels ascribed in this ES throughout both the construction and operational phases of the development.

8.1.2.5 MORL has undertaken a significant programme of early engagement with the fishing industry and is committed to continuing to explore and develop mitigation options in consultation with the industry. At the current time, MORL is proposing to undertake fishing trials using modified scallop dredge gear with a view to identifying enhancements to traditional scallop fishing practices that may be of benefit to both the developer and the scallop fleet, subject to the Scallop Association's continuing interest.

8.1.2.6 MORL will continue to facilitate ongoing dialogue throughout the pre-construction, construction and operational phases of the development, which will continue to discuss the mitigation options under investigation, as well as defining the protocol for engagement during the construction and operation phases.

8.1.2.7 A summary of the Commercial Fisheries effects pre and post mitigation is shown below in Table 8.1-1. In each instance, the effect has been identified. In the instances where the effect is upon fish and shellfish species, the summary table provided in Chapter 7.2 (Fish and Shellfish Ecology) should be referred to.

Table 8.1-1 Commercial Fish Impact Summary

Effect	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction / Decommissioning			
Adverse Effects to Commercial Fish and Shellfish Populations (indirect effect upon commercial fishing activities)	Minor – all target species	None proposed	Minor – all target species
Adverse Effects on Recreational Fish Populations	Minor-moderate (noise)	None proposed	Minor-moderate (noise)
Complete Loss or Restricted Access to Traditional Fishing Grounds	Moderate – scallop fishery Moderate – squid fishery Minor – whitefish fishery	None proposed	Moderate – scallop fishery Moderate – squid fishery Minor – whitefish fishery
Safety Issues for Fishing Vessels	Acceptable for turbines, met masts and gravity base OSPs installed during the construction phase, providing 50 m safety zones are applied	Application of 50 m safety zones for infrastructure installed during the construction phase.	Within acceptable limits
	Outside of acceptable limits for inter array cables	Application of operational safety zones & ongoing consultation to reduce risks to acceptable limits	Within acceptable limits
Increased Steaming Times to Fishing Grounds	Minor – all fisheries	None proposed	Minor – all fisheries
Displacement of Fishing Vessels into Other Areas	Moderate– scallop fishery Moderate – squid fishery Minor – whitefish fishery	None proposed	Moderate– scallop fishery Moderate – squid fishery Minor – whitefish fishery

Effect	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Interference with Fishing Activities	Minor – all fisheries except crab and lobster fishery	Construction management programme	Minor – all fisheries except crab and lobster fishery
	Moderate - crab and lobster fishery		Minor - crab and lobster fishery
Operation			
Adverse Effects on Commercial Fish and Shellfish Populations (indirect effect upon commercial fishing activities)	Minor – all target species	None proposed	Minor – all target species
Adverse Effects on Recreational Fish Populations	Minor	None proposed	Minor
Complete Loss or Restricted Access to Traditional Fishing Grounds	Moderate– scallop fishery Moderate – squid fishery Minor – whitefish fishery	Ongoing development of the mitigation proposals, such as gear modification trials, however at the current time no mitigation has been defined	Moderate– scallop fishery, could be reduced through the gear modification trials Moderate – squid fishery Minor – whitefish fishery.
Safety Issues for Fishing Vessels	Acceptable for fully installed turbines, met masts and gravity base OSPs, providing 50 m safety zones are applied	Application of 50 m operational safety zones	Within acceptable limits
	Within acceptable limits for inter array cables provided appropriate post installation measures are completed	Cable burial and protection and post construction surveys	Within acceptable limits
Increased Steaming Times to Fishing Grounds	Minor – all fisheries	None proposed	Minor – all fisheries
Obstacles on the Seabed Post Construction	Within acceptable limits	Standard industry practice	Within acceptable limits
Displacement of Fishing Vessels into Other Areas	Moderate– scallop fishery Moderate – squid fishery Minor – whitefish fishery	None proposed	Moderate– scallop fishery, could be reduced through the gear modification trials Moderate – squid fishery Minor – whitefish fishery.
Interference with Fishing Activities	Minor – all fisheries	Extension of construction management programme to include operations	Minor – all fisheries

Salmon and Sea Trout Fisheries

8.1.2.8 Effects on salmon and sea trout fisheries will occur if the ecology of the species is negatively affected as a result of the construction / decommissioning and operational phases of the three proposed wind farm developments. This is fully discussed in Chapter 7.2 (Fish and Shellfish Ecology). In general terms, effects on salmon and sea trout are expected to be of **minor** significance, with the exception of construction noise, which has been assessed to be of **minor-moderate** significance.

8.1.2.9 The impact assessment on these salmon and sea trout has taken a precautionary approach, where conservation assumptions have had to be made due to the lack of current knowledge on the use that these species may make of the area of the three proposed wind farms during the construction phase.

8.1.2.10 In general terms, the likely effects of the construction phase on fish and shellfish species have been assessed to be of minor significance. An exception to this is construction noise, which has been identified as having potential to result in significant effects (above minor) namely cod, herring, salmon and sea trout.

8.1.2.11 The impact assessment (Chapter 7.2: Fish and Shellfish Ecology) on these species has taken a precautionary approach, where conservative assumptions have had to be applied as a result of the uncertainty surrounding currently available information on the use that these species may make of the area of the three proposed wind farms during the construction phase.

8.1.2.12 In order to mitigate this uncertainty, MORL is committed, in consultation with Marine Scotland and the relevant fisheries stakeholders, to undertake additional survey work and monitoring with the objective of increasing the confidence in this impact assessment and identifying whether mitigation is required and, if so, to define feasible measures in order to reduce the significance of the likely effects.

8.1.2.13 Some surveys, such as the sand eel (a key prey species for other fish species) survey, were undertaken in consultation with Marine Scotland pre-application during their optimal survey periods the results of which are included in Chapter 7.2 (Fish and Shellfish Ecology). Due to the seasonal nature of these surveys, MORL expects that specific surveys and monitoring will be defined and implemented at the appropriate time of year in consultation with Marine Scotland and other stakeholders.

8.1.2.14 Due to the limited current knowledge in relation to their migration routes in Scottish coastal waters and the use that they may make of the development area, an assessment of effects on salmon and sea trout is based on the conservative assumption that all fish originating from all rivers flowing into the Moray Firth will use the development area during their life stages in the marine environment.

8.1.2.15 A summary of the Salmon and Sea Trout Fisheries effects pre and post mitigation is shown below in Table 8.1-2.

Table 8.1-2 Salmon and Sea Trout Impact Summary

Effect	Receptor	Pre-Mitigation effect	Mitigation	Post-Mitigation effect
Construction / Decommissioning				
Temporary Disturbance to Seabed	Salmon and sea trout	Negative Minor Probable	None	Negative Minor Probable
Noise	Salmon and sea trout	Negative Minor-Moderate Probable-Unlikely	Monitoring / survey work to increase assessment confidence and / or mitigation measures where required.	Negative Minor-Moderate Probable-Unlikely
Operation				
Loss of Habitat	Salmon and sea trout	Negative Minor Unlikely	None	Negative Minor Unlikely
Introduction of New Habitat	Salmon and sea trout	Negative / Positive Minor Probable	None	Negative / Positive Minor Probable
EMFs	Salmon and sea trout	Negative Minor Probable	Cable protection / burial	Negative Minor Probable
Operational Noise	Salmon and sea trout	Negative Minor Unlikely	None	Negative Minor Unlikely
Changes to Fishing Activity	Salmon and sea trout	Not significant	None	Not significant

8.1.3 Introduction

8.1.3.1 Commercial fishing is defined as any legal fishing activity undertaken for declared taxable profit. This chapter summarises the assessment of the likely significant effects on commercial fishing from the construction, operation and decommissioning of the three proposed wind farm sites: Telford, Stevenson and MacColl.

8.1.3.2 For the purposes of this assessment and in the absence of detailed information on decommissioning schedules and methodologies, it is assumed that any effects derived from the decommissioning phase will, at worst, be of no greater significance than those derived from the construction phase and are likely to be significantly less (e.g. there will be no piling works during decommissioning).

8.1.3.3 An assessment of the likely significant effects of the offshore transmission infrastructure (OfTI) is provided in Chapter 11.1 (Commercial Fisheries).

8.1.3.4 An assessment of the cumulative effects arising from developments in addition to the three proposed wind farm sites is given in Chapter 15.1 (Commercial Fisheries).

8.1.3.5 The following chapters and appendices support this assessment, and can be found as:

- Chapter 5.1 and Technical Appendix 5.1 A (Commercial Fisheries);
- Chapter 7.2 and Technical Appendix 4.3 A(Fish and Shellfish Ecology);
- Technical Appendix 4.3 B (Salmon and Sea Trout Ecology and Fisheries); and
- Chapter 8.2 and Technical Appendix 5.2 D (Shipping and Navigation).

8.1.4 Rochdale Envelope Parameters Considered in the Assessment

8.1.4.1 A worst realistic case scenario for the effects of the three proposed wind farm sites upon commercial fishing activities has identified the wind farm design parameters which will have the greatest potential effect upon the fishing activities described in the baseline (see Chapter 2.2: Project Description).

8.1.4.2 The principal factor in determining the design parameters that will constitute a realistic worst case is the consideration of how the fishing activities described in the baseline will be most affected. This could occur in two ways: the first is the potential for the wind farm developments to cause adverse effects to fish and shellfish populations of commercial importance, and hence result in changes to behaviour or a decline in abundance which will potentially affect the fishery. Whilst this potential effect is briefly summarised within this section, it is fully assessed in Chapter 7.2 (Fish and Shellfish Ecology). Second, there is the potential for the wind farm (i.e. turbines and cabling) to constitute a physical obstacle or risk to the continuation of normal fishing activities as described in the baseline. Accepting that the Fish and Shellfish Ecology assessment will identify the worst case parameters for the first issue, it is the second which determines the parameters of a realistic worst case for commercial fishing activities, and which may result in the identification of design parameters different to those identified as the realistic worst case for incurring effects on species.

8.1.4.3 It should be noted that commercial fishing is not expected to be excluded during construction, with the exception of locations where safety zones are in operation.

8.1.4.4 It should be noted that commercial fishing is not automatically excluded from occurring within operational wind farm sites. In a number of existing operating wind farms, however, 50 m safety zones, extending from the centre point of individual turbines and from which all vessels are prohibited, have been put in place. It is noted, however, that individual skippers may consider it unsafe to continue fishing within the operational wind farm sites, which would result in a complete loss of area from within the three proposed wind farm sites for these vessels.

8.1.4.5 In light of the above, it is therefore considered that infrastructure with the combined biggest footprint poses the most significant physical obstacle to fishing activities. This includes the highest number of turbines with the smallest spacing, and the maximum number of meteorological masts. Infrastructure including inter-array cables will also be assessed in terms of the feasibility of undertaking normal fishing practices.

8.1.4.6 It should be noted that there will be components of the offshore transmission infrastructure which may also be located within the boundaries (or close to the boundaries) of the wind farms. This will include a maximum of 8 OSPs of gravity base foundations and associated infrastructure (inter platform cabling). An assessment of this infrastructure, whilst referenced in this assessment, is fully described in Chapter 11.1 (Commercial Fisheries).

8.1.4.7 The parameters of the wind farm sites' design that constitute a worst case for commercial fishing activities are summarised in Table 8.1-3 below.

8.1.4.8 Consultation with fishing interests identified that a more concentrated, shorter construction period was generally preferred to a longer term construction schedule. It should be noted, however, that this assumes fishing activities could be resumed to some degree within the operational wind farm sites. Furthermore, it is considered that the risks of potential negative interactions between fishing vessels and construction activities are increased over a longer construction period. A maximum construction period of five years is therefore taken as the realistic worst case.

Table 8.1-3 Summary of Worst Case Parameters for Commercial Fishing

Type of Effect	Rochdale Envelope Scenario Assessed
Construction & Decommissioning	
Adverse Effects on Commercially Exploited and Recreational Fish and Shellfish Populations (indirect effect upon commercial fishing activities)	See Chapter 7.2 (Fish and Shellfish Ecology)
Temporary Loss or Restricted Access to Fishing Grounds	Maximum loss of fishing grounds as a result of: • Gravity base foundations of 65 m diameter; • 339 turbines and maximum number of met masts (two); • Diamond layout (irregular spacing); • Minimum spacing between turbines (840 m downwind and 600 m crosswind); • Irregular pattern between MacColl, Telford and Stevenson sites (likely as a result of different size turbines); • Maximum inter array cable length (572 km); • Incomplete installation of inter array cables (i.e. prior to post installation surveys); • Maximum number of construction vessels (six), each with 500 m exclusion zone; and • Maximum number of incomplete infrastructure with safety zones (50 m).
Safety Issues for Fishing Vessels	See Chapter 8.2 (Shipping and Navigation) for further information. Realistic worst case scenario should also recognise the safety risks posed by cables: • Maximum number of turbines (339 turbines); • Maximum inter array cable length (572 km); and • Incomplete installation of inter array cables.
Increased Steaming Times	Maximum number of safety / exclusion zones in the sites, resulting in increased steaming times as a result.
Displacement of Fishing Activity	Maximum disruption to fishing activity within the sites (see 'Temporary loss or restricted access to fishing grounds'), resulting in fishing activity being displaced into other grounds and affecting fishermen in that area – an indirect effect could result in conflict between static and mobile vessels and / or increased competition for a limited source.
Interference with Fishing Vessels	Location of port of construction and maximum number of construction works vessels.

Type of Effect	Rochdale Envelope Scenario Assessed
Operation	
Adverse Effects on Commercially Exploited and Recreational Fish and Shellfish Populations (indirect effect upon commercial fishing activities)	See Chapter 7.2 (Fish and Shellfish Ecology)
Complete Loss or Restricted Access to Fishing Grounds	• Gravity base foundations of 65 m diameter; • 339 turbines and maximum number of met masts (two); • Maximum number of safety zones around infrastructure; • Diamond layout (irregular spacing); • Minimum spacing between turbines (840 m downwind and 600 m crosswind); • Irregular pattern between MacColl, Telford and Stevenson sites (likely as a result of different size turbines); • Maximum inter array cable length (572 km); • Maximum unburied sections of inter array cables protected by mattresses; and • Minimum burial depth of inter array cables.
Safety Issues for Fishing Vessels	See Chapter 8.2 (Shipping and Navigation) for further information. The assessment also recognises the safety risks posed by the inter array cables based upon: • Maximum inter array cable length (572 km); • Maximum unburied sections of inter array cables protected by mattresses; and • Minimum burial depth of inter array cables.
Increased Steaming Times	As per construction.
Obstacles on the Seabed Post-Construction	Any construction related obstacles and changes to seabed conditions, including cable burial and protection.
Displacement of Fishing Activity	Maximum disruption to fishing activity within in the sites (see 'Complete loss or restricted access to fishing grounds'), resulting in fishing activity being displaced into other grounds and affecting fishermen in that area – an indirect effect could result in conflict between static and mobile vessels and / or increased competition for a limited source.
Interference with Fishing Vessels	Location of operation and maintenance port and maximum number of operation and maintenance works vessels.

8.1.5 EIA Methodology

Commercial Fisheries

8.1.5.1 The following section describes the impact assessment methodology for commercial fisheries, which has been applied to the baseline provided in Chapter 5.1 (Commercial Fisheries). In the absence of published guidelines by Marine Scotland regarding the assessment of effects of wind farm developments upon commercial fishing activities, the aspects requiring assessment for the proposed development are as specified in the CEFAS / MCEU (2004) Guidelines. The aspects are as follows:

- Implications for fisheries during the construction phase;
- Implications for fisheries when the development is completed;

- Adverse effect on commercially harvested fish and shellfish populations;
- Adverse effect on recreational fish populations;
- Complete loss or restricted access to traditional fishing grounds;
- Safety issue for fishing vessels;
- Increased steaming times to fishing grounds;
- Obstacles on the sea bed post construction; and
- Interference with fisheries activities.

8.1.5.2 In addition to the above, the following type of effect has been included subsequent to consultation with fishing interests:

- Displacement of fishing activity into other fishing areas.

8.1.5.3 An assessment of the above effects will be separately applied to the construction / decommissioning phases and the operational phase in terms of site specific effects. In the absence of detailed information on the decommissioning schedules and methodologies, it is considered that the likely effects associated with the decommissioning phase will be of no greater significance than those of the construction phase.

Salmon and Sea Trout Fisheries

8.1.5.4 As a result of salmon and sea trout fisheries being either in-river or, to a lesser extent, coastal, it is considered that there will be no direct effects arising from the construction / decommissioning and operation of the three proposed wind farm sites. However, changes to the behaviour of the species in the offshore marine environment could affect coastal and in-river salmon and sea trout fisheries.

8.1.5.5 A full assessment of the likely significant effects upon these species is described in Chapter 7.2 (Fish and Shellfish Ecology), and summarised in 8.1.7 within this chapter.

Assessment Limitations

8.1.5.6 The principal limitation of an assessment of effects upon commercial fishing activities is the potential of the established baseline to change over time. This may be for a number of reasons; fluctuations in landings, changes in legislation and management policies, economic constraints such as fuel costs and crew availability, environmental restrictions such as weather, etc. As a result the scope of the impact assessment undertaken is limited by the baseline identified.

8.1.5.7 As discussed in the baseline (Chapter 5.1: Commercial Fisheries), the king scallop fishery is largely nomadic, with the exception of several smaller and predominantly inshore vessels, variously targeting grounds around the UK. Although it is noted that individual vessels may spend more time in certain regional areas such as the Moray Firth, it is not possible within the scope of this assessment to consider the extent of an effect on a vessel by vessel basis. Instead, scallop grounds affected by the three proposed wind farm sites have been considered within the context of their relative importance to the Moray Firth, as well as to available scallop grounds around the UK.

8.1.5.8 Changes to the behaviour of species of commercial importance in the offshore marine environment, arising from the construction / decommissioning and operation of the three proposed wind farm sites, may indirectly affect commercial fishing activities (including those in-river). An assessment of the likely significant effects upon fish and shellfish species is provided in Chapter 7.2 (Fish and Shellfish Ecology)

and the findings summarised where relevant in this chapter. It should be noted that the methodology used to assess effects on fish and shellfish species (including significance criteria) differs from the one used to assess commercial fisheries, being largely based on the IEEM (2010) guidelines for ecological impact assessment (see Chapter 7.2: Fish and Shellfish Ecology).

8.1.5.9 The impact assessment on salmon and sea trout fisheries is subject to a number of limitations as a result of the lack of current knowledge on the sensitivity of the species to certain types of effects. In addition, as a result of uncertainties in relation to the distribution of these species and the use that they may make of the area of the three proposed wind farm sites, a number of conservative assumptions have been made.

Significance Criteria

8.1.5.10 The significance criteria described below have been used for this assessment. However, the effects of offshore wind farm developments upon commercial fishing activities cannot be easily categorised and as a result, the application of the significance criteria to an assessment of effects is largely qualitative and based upon professional judgement.

8.1.5.11 In the instance whereby the development potentially poses a risk to the health and safety of a fishing vessel and crew, the significance criteria used for the assessment is not applied. Instead, the risk is assessed to be within or outside acceptable limits (a risk is considered outside of acceptable limits if they are greater than those incurred during the course of normal fishing operations). For further details, see Chapter 8.2 (Shipping and Navigation).

8.1.5.12 In instances where the findings from Chapter 7.2 (Fish and Shellfish Ecology) have been summarised, the significance criteria used in that chapter applies.

8.1.5.13 The receptors have been defined by fishery:

- The scallop fishery;
- The squid fishery;
- The whitefish fishery;
- The *Nephrops* fishery;
- The crab and lobster fishery; and
- The salmon and sea trout fishery.

Sensitivity of the Receptor

8.1.5.14 Sensitivities have been defined on this basis. In each instance, the following characteristics are taken into account:

- Adaptability: the ability of the fishery (i.e. vessels) to avoid or adapt to the effect;
- Tolerance: the ability of the fishery (i.e. vessels) to withstand temporarily or permanent effects;
- Recoverability: how well the fisheries recover following exposure to effect; and
- Value: the scale of importance, rarity and relative worth of the fisheries affected.

8.1.5.15 The sensitivity of each fishery has been assessed as low, medium and high, using the following criteria:

- Low sensitivity: no significant change to current fishing practices;

- Medium sensitivity: discernible changes to current fishing practices; and
- High sensitivity: fishing activities are significantly and permanently affected.

8.1.5.16 The general sensitivity of the receptors (fisheries) has been defined using the criteria above and are summarised below. It should be noted that the sensitivity of the fishery may vary with each type of effect, as well as between the construction and decommissioning and operational phases, and as a result are separately described in each instance.

8.1.5.17 The sensitivity of the scallop fishery to the development of the three proposed wind farm sites is considered to be medium on a regional level. Due to the nomadic nature of the majority of the fleet and the availability of scallop grounds around the UK, the sensitivity of the fishery is considered to be low on a national level.

8.1.5.18 The sensitivity of the squid fishery to the development of the three proposed wind farm sites is considered to be medium on a regional level. This takes into account peak annual landings and fluctuations on an annual basis should be noted. Further, it recognises that the Moray Firth squid fishery is important on a national scale.

8.1.5.19 The sensitivity of the whitefish fishery to the development of the three proposed wind farm sites is considered to be low.

8.1.5.20 Due to the sites being located outwith of *Nephrops* grounds, the sensitivity of the *Nephrops* fishery to the development of the three proposed wind farm sites is considered to be low.

8.1.5.21 The sensitivity of the *Nephrops* fishery to the development of the three proposed wind farm sites is generally considered to be very low, although it is recognised that the fishery is more sensitive to potential navigational conflict.

8.1.5.22 The sensitivity of the crab and lobster fishery is generally considered to be low, with the exception of the potential for navigational conflict, when the sensitivity increases to medium.

Magnitude of Effect

8.1.5.23 The magnitude of an effect is considered for each predicted effect on a fishery by fishery basis. In each instance, the following characteristics are taken into account:

- Spatial extent: the area within which fishing vessels (by fishery) are unable to undertake normal fishing activities as a result of the construction / decommissioning and operation of the wind farm and export cables, relative to available fishing grounds;
- Duration: the temporal extent that fishing vessels (by fishery) are unable to resume normal fishing activities as a result of the construction / decommissioning and operation of the wind farm and export cables;
- Frequency: the number of times the effect occurs; and
- Severity: the degree of change.

8.1.5.24 The magnitude of an effect has been assessed as negligible, low medium or high, using the following criteria:

- Negligible: there is no discernible effect upon current fishing practices;
- Low: there is no significant effect upon current fishing practices;

- Medium: discernible effect upon current fishing practices; and
- High: fishing activities are significantly and permanently affected.

8.1.5.25 The significance of an effect is assigned using an assessment of the magnitude of effect and sensitivity of the receptor criteria, and is given in Table 8.1-4 below.

Table 8.1-4 Significance Criteria

		Sensitivity of Receptor		
		Low	**Medium**	**High**
Magnitude	**Negligible**	Not significant	Minor significance	Minor significance
	Low	Minor significance	Minor significance	Moderate significance
	Medium	Minor significance	Moderate significance	Major significance
	High	Moderate significance	Major significance	Major significance

8.1.6 Commercial Fisheries Primary Impact Assessment: Three Proposed Wind Farm Sites

8.1.6.1 The commercial fisheries baseline is described in Chapter 5.1 and is supported by Technical Appendix 5.1 A. A brief summary is provided below.

8.1.6.2 The principal commercial species targeted by gear type within the three proposed wind farm sites are: king scallops by boat dredges, and to a lesser extent squid fishing by demersal gear.

8.1.6.3 As stated in Chapter 5.1 (Commercial Fisheries), the three proposed wind farm sites constitute a moderate proportion of the scallop fishing grounds currently available in the Moray Firth and a small proportion of scallop grounds on a national scale. Although the availability of fishing grounds around the UK is noted, the sensitivity of the fishery assigned is based upon the importance of grounds on a regional level (Moray Firth).

8.1.6.4 The squid fishery in the Moray Firth is targeted by a range of demersal trawl vessels with reconfigured gear. As the baseline indicates, the fishery is seasonal, and landings record high annual variation. Principal fishing grounds are currently inshore along the Moray coast and in the south west of the proposed development. The squid fishery in the Moray Firth is important on a national scale, and the baseline indicates that there is a moderate level of squid fishing within the three proposed wind farm sites.

8.1.6.5 There is a very low level of whitefish activity recorded in the north west of the three proposed wind farm sites, which constitutes only a small proportion of activity in the Moray Firth.

8.1.6.6 In the case of the fishing activities described above, the wind farm sites record moderate levels of activity compared to grounds elsewhere in the Moray Firth, and relatively low levels when compared to fishing grounds on a national scale.

8.1.6.7 In areas outside of the wind farm sites but in the regional area, the principal fisheries in addition to those identified above are the nephrops fishery and the crab and lobster fishery. The nephrops fishery is the most important fishery in the Moray Firth

and moderately important on a national scale. The crab and lobster fishery is principally concentrated in inshore areas, particularly the Caithness coast, where it is of moderate importance on a regional scale.

8.1.6.8 In the case of species' sensitivities to the developments, Chapter 7.2 (Fish and Shellfish Ecology) describes the significance criteria used, which differs from that given in this chapter. As a result, where the findings of the Fish and Shellfish Ecology assessment have been summarised below, the information is presented differently.

8.1.6.9 It should be noted that only those fisheries sensitive to an effect are assessed under each individual effect, in all development stages.

Construction – Commercial Fisheries

Adverse Effects on Commercially Exploited Fish and Shellfish Populations

8.1.6.10 The principal commercial species targeted by gear type within the three proposed wind farm sites are:

- King scallops by boat dredge;
- Squid by modified *Nephrops* trawls and whitefish gear; and
- Haddock by whitefish gear (seine nets and demersal trawls), to a lesser extent.

8.1.6.11 There is the potential for wind farm development to cause adverse effects to fish and shellfish populations of commercial importance, and hence result in changes to behaviour or a decline in species abundance, which may indirectly affect the productivity of the fishery. This is an indirect effect which is briefly discussed within this chapter and fully assessed in Chapter 7.2 (Fish and Shellfish Ecology), and summarised in Table 8.1-5 below.

Table 8.1-5 Summary of Impact Assessment on Principal Commercial Species during Construction and Decommissioning

Effect	Receptor	Sensitivity	Magnitude	Confidence Level	Significance of Effect
Temporary Disturbance to Seabed	All	Low	Small	Probable	Negative Minor
Noise	Haddock	Low	Medium	-	Negative Minor
	King scallops / squid	Low	Small	Unlikely	Negative Minor

Adverse Effects on Recreational Fish Populations

8.1.6.12 There is not considered to be regular or directed recreational fishing activity occurring within the boundary of the three proposed wind farms. It is, however, recognised that there may be effects upon migrating fish species such as salmon and sea trout, which have significant socio-economic importance as recreational fish species. As previously stated, salmon and sea trout fisheries are separately assessed in 8.1.7 within this chapter.

Temporary Loss or Restricted Access to Traditional Fishing Grounds

8.1.6.13 The principal effects of construction considered to incur complete loss or restricted access to fishing grounds during the construction phase are:

- Exclusion zones around construction activities; and
- Installed offshore infrastructure in addition to construction exclusion zones.

8.1.6.14 Safety zones of 500 m are expected to be imposed around construction works, from which all non-construction associated vessels would be excluded. There will be several major construction works requiring 500 m safety zones simultaneously occurring within the three sites, potentially up to 6, or likely fewer over a more extended period (maximum duration of construction is 5 years). This will result in zones within the three proposed wind farm sites from which all types of fishing activity are prohibited for the duration of the construction phase. The seasonality of fishing activity will render these exclusion zones more sensitive depending upon the time of year, with the summer months recording the highest levels of fishing activity overall. However, relative to the size of the site (296 km²), six temporary 500 m exclusion zones constitute a very small area.

8.1.6.15 Infrastructure already partially or completely installed on the seabed in addition to ongoing construction works will further restrict access to, and result in complete loss of, fishing grounds. MORL is likely to apply for operational safety zones of 50 m around infrastructure such as turbines, met masts and OSPs (in the case of gravity base OSPs, the safety zone may be required to be proportionally larger to ensure a sufficient boundary to incorporate the footprint of the infrastructure. The OfTI is fully described in Chapter 11.1: Commercial Fisheries). It therefore follows that fishing opportunities within the three proposed wind farm sites will be increasingly limited as the construction schedule advances. The total number of safety zones would result in a combined exclusion of approximately 1 % of the total site area.

8.1.6.16 A maximum of 572 km of inter array cables will be installed within the wind farm as the construction phase progresses. These cables will be buried where feasible, with sections protected by other means if burial is not possible. It is considered that fishing vessels will not be able to safely fish in the vicinity of these cables until these measures are complete and their 'over-trawlable' status confirmed by post-installation surveys, which would therefore result in loss of fishing grounds throughout the site during the construction phase.

8.1.6.17 The significance of effect resulting in temporary loss or restricted access to fishing grounds during the construction phase takes into account the following:

- The moderate proportion of fishing grounds (by fishery) the three proposed wind farm sites comprise;
- The availability of alternative fishing grounds (by fishery) in the Moray Firth and wider area; and
- Access to all fishing grounds within the three sites will become progressively more restricted as the construction schedule advances.

8.1.6.18 The significance of effect upon each of the receptors identified is provided in Table 8.1-6 below.

Table 8.1-6 Temporary Loss or Restricted Access to Traditional Fishing Grounds

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Temporary Loss or Restricted Access to Fishing Grounds	**Scallop Fishery**	Medium	Negative	Medium	Moderate
	Squid fishery	Medium	Negative	Medium	Moderate
	Whitefish fishery	Low	Negative	Medium	Minor

Safety Issues for Fishing Vessels

8.1.6.19 A maximum of six simultaneous construction events will occur at locations across the site for a maximum period of five years. In line with standard practice, it is expected that construction safety zones of 500 m will be in place around offshore construction activities, from which all vessels, including fishing vessels, will be excluded. Infrastructure that is not fully constructed will be marked and it is likely that a safety zone of 50 m (or a zone commensurate with infrastructure type: i.e. gravity base OSPs) will be put in place around it.

8.1.6.20 Risks to fishing vessels would only occur if infringements of these construction safety zones occurred. It should also be recognised that in line with standard maritime practice, the ultimate responsibility with regards to safety lies with the master of a vessel. Compliance with the safety zones during the construction phase would put the safety risk **within acceptable limits**. These issues are considered further within Chapter 8.2 (Shipping and Navigation).

8.1.6.21 There is the potential for wind farm infrastructure outwith the designated construction safety zones to pose an additional risk to fishing vessels as a result of potentially hazardous interactions with fishing gear. This includes turbines, met masts and OSPs, and inter-array cabling. MORL is likely to apply for safety zones of 50 m around infrastructure such as turbines, met masts and OSPs (in the case of gravity base OSPs, the safety zone may be required to be proportionally larger to ensure a sufficient boundary to incorporate the footprint of the infrastructure), see Proposed Monitoring and Mitigation (see 8.1.8 below). These safety zones would result in a combined exclusion of approximately 1 % of the total site area. Compliance with these zones would put the safety risk from infrastructure installed during the construction phase **within acceptable limits**.

8.1.6.22 A maximum of 572 km of inter array cables will be installed within the wind farm during the construction phase. These cables will be buried where feasible, with sections protected by other means if burial is not possible. It is considered that fishing vessels will not be able to safely fish in the vicinity of these cables until these measures are complete. During the construction phase, therefore, the risks posed to the safety of fishing vessels are considered to be **outside of acceptable limits**.

8.1.6.23 Potential collision risks between wind farm infrastructure and construction works and fishing vessels are discussed in Chapter 8.2 (Shipping and Navigation).

Increased Steaming Time to Fishing Grounds

8.1.6.24 The implementation of safety exclusion zones during the construction phase could result in some short term increases in steaming distances and times, and therefore higher operational costs for fishing vessels. There may be a maximum of six construction vessels, resulting in six 500 m safety exclusion zones. It is also likely that there will be additional 50 m safety zones applied to infrastructure installed during

the construction phase within the site, which will increase in number as the construction schedule advances.

8.1.6.25 The significance of effect resulting in temporary loss or restricted access to fishing grounds during the construction phase takes into account the following:

- The very discrete sea area restricted by safety zones; and
- The location of the three proposed wind farm sites outside of 12 nm and outside of principal steaming routes.

8.1.6.26 In light of the above, the reduced sensitivity of the fisheries in respect of this type of effect should be noted. The significance of increased steaming times to fishing grounds is provided in Table 8.1-7 below.

Table 8.1-7 Increased Steaming Times to Fishing Grounds

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Increased Steaming Time to Fishing Grounds	**Scallop Fishery**	Low	Negative	Low	Minor
	Squid fishery	Low	Negative	Low	Minor
	Whitefish fishery	Low	Negative	Low	Minor

Displacement of Fishing Vessels into Other Areas

8.1.6.27 Concerns were raised during consultation with fishermen and their representatives that any loss or restricted access to fishing grounds as a result of the wind farm development, could result in increased competition for grounds outside of the site. This might result in either conflict between vessels competing for the same resource, or between different fishing methods (i.e. static and towed gear vessels).

8.1.6.28 The extent of displacement will be a function of the temporary loss or restricted access to traditional fishing grounds during the construction phase. The significance of displacement of fishing vessels to other areas is provided in Table 8.1-8 below.

Table 8.1-8 Displacement of Fishing Vessels into Other Areas

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Displacement of Fishing Vessels into Other Areas	**Scallop Fishery**	Medium	Negative	Medium	Moderate
	Squid fishery	Medium	Negative	Medium	Moderate
	Whitefish fishery	Low	Negative	Medium	Minor

Interference with Fishing Vessels

8.1.6.29 All of the likely effects included in this assessment could cause interference to fishing activities. An additional effect to be considered is the potential for navigational conflicts arising between fishing vessels and construction vessels transiting to and from the site. This could include the fouling of static gear markers, buoys and dhans (marker flags) and towed gear vessels being required to alter towing direction. As a result, this interference has the potential to affect fishing vessels operating in the regional area. Due to the mobility of towed gear and the static position of creel

gear for periods of several days, the crab and lobster fishery is considered to be of increased sensitivity to this type of effect.

8.1.6.30 The magnitude of effect depends upon the location of the construction port, which at the current time is unknown. As a result, a conservative assumption has assumed that transit routes will be in the vicinity of static and towed gear grounds. Principal fisheries identified in the wider regional area are also assessed.

8.1.6.31 The significance of the interference to fishing vessels identified is provided in Table 8.1-9 below.

Table 8.1-9 Interference to Fishing Vessels arising from Navigational Conflicts

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Interference to Fishing Vessels arising from Navigational Conflicts	**Scallop Fishery**	Low	Negative	Low	Minor
	Squid fishery	Low	Negative	Low	Minor
	Whitefish fishery	Low	Negative	Low	Minor
	Nephrops fishery	Low	Negative	Low	Minor
	Crab and lobster fishery	Medium	Negative	Medium	Moderate

Operation – Commercial Fisheries

8.1.6.32 The effects described below should be considered in the context of the operational life of the three proposed wind farm sites, currently estimated to be 25 years in design life. Trends in fishing activities are difficult to establish on a yearly basis, and an assessment of the potential scale of an effect over this period is therefore unrealistic. The impact assessment provided below is based on the current baseline, and the potential of this to change should also be recognised.

Adverse Effects on Commercially Exploited Fish and Shellfish Populations

8.1.6.33 The principal commercial species targeted by gear type within the three proposed wind farm sites are: king scallops by boat dredge, squid by modified Nephrops trawls and whitefish gear and, to a much lesser extent, haddock by whitefish gear (seine nets and demersal trawls). There is the potential for the operational wind farm to cause adverse effects to fish and shellfish populations of commercial importance, and hence result in changes to behaviour or a decline in species abundance, which may indirectly affect the productivity of the fishery. This is an indirect effect and whilst the potential effect is briefly discussed within these paragraphs, it is fully assessed in Chapter 7.2 (Fish and Shellfish Ecology) and summarised below.

8.1.6.34 A summary of the effects on the principal target species in areas relevant to the three proposed wind farm sites (king scallops, squid and haddock) is given in Table 8.1-10 below. In general terms, effects on these species are predicted to be **minor** (see Chapter 7.2: Fish and Shellfish Ecology).

Table 8.1-10 Summary of Impact Assessment on Principal Commercial Species during Operation

Effect	Receptor	Sensitivity	Magnitude	Probability	Significance of effect
Loss of Habitat	All	Low	Negligible	Unlikely	Negative Not significant
Introduction of New Habitat	All	Low	Small	Probable	Negative / Positive Minor
EMFs	Haddock	Low	Small	Unlikely	Negative Minor
	King scallops, squid	Low	Small	Unlikely	Negative Minor
Operational Noise	All	Low	Small	Unlikely	Negative Minor
Changes to Fishing Activity (i.e. changes to fishing activity as a result of wind farm development which may affect fish and shellfish populations)	All	Low	Negligible	-	Not significant

8.1.6.35 Taking into account the findings of Chapter 7.2 (Fish and Shellfish Ecology), and accepting that there may be short term species displacement effects which may have a limited indirect effect upon catch rates, it has been assumed that the indirect effects upon commercial fishing will not be greater than those identified in the table above.

Adverse Effects on Recreational Fish Populations

8.1.6.36 There is not currently considered to be regular or directed recreational fishing activity occurring within the boundary of the proposed development. It is however, recognised that there may be effects from the operational wind farm upon migratory fish species such as salmon and sea trout, which have significant socio-economic importance as recreational fish species. As previously stated, effects upon salmon and sea trout fisheries are separately assessed in 8.1.7 of this chapter.

8.1.6.37 There is the possibility that a recreational fishery may develop within the three proposed wind farm sites during the operational phase, depending upon available recreational fish populations. It is however recognised that there is currently little evidence for such an activity developing within existing wind farms.

Complete Loss or Restricted Access to Traditional Fishing Grounds

8.1.6.38 Existing legislation does not currently prohibit fishing from occurring within operational wind farm sites. It is likely that safety zones of 50 m around infrastructure such as turbines, met masts and OSPs will be applied for (in the case of gravity base OSPs, the safety zone may be required to be proportionally larger to ensure a sufficient boundary to incorporate the footprint of the infrastructure. Offshore transmission infrastructure is fully described in Chapter 11.1: Commercial Fisheries). The total number of safety zones would result in a combined exclusion of approximately 1 % of the total site area.

8.1.6.39 The post-construction status of inter array cables will be buried where feasible and protected elsewhere. Post construction surveys will be undertaken to assess the seabed status in the immediate vicinity of construction and installation activities. In the event that seabed rectification procedures are required, and where practicably feasible, the appropriate measures will be undertaken to ensure that the seabed is returned to an acceptable standard for fishing practices to be safely resumed.

8.1.6.40 As identified in the worst case design parameters, the minimum spacing distance between turbines is 840 m downwind and 600 m crosswind. Specifications of scallop gear provided by a sample of fishermen have estimated a maximum of 60 m total gear width during normal fishing practices (pers. comm. Scallop fisherman, 2011). The maximum gear width of the largest recorded demersal trawler targeting squid has identified a maximum gear spread between otter doors of 92 m (pers. comm. Whitefish and squid fisherman, 2011). Given these parameters, and taking into account the minimum spacing, it is considered that some degree of access will be regained within the operational sites, particularly in the case of the smaller vessels in the fleet.

8.1.6.41 It is however noted that individual skippers, particularly those operating bottom towed gear, may consider it unsafe to continue fishing within the operational wind farm sites because of the presence of infrastructure, which would result in a complete loss of area from within the three proposed wind farm sites for these vessels.

8.1.6.42 The significance of effect resulting in complete loss or restricted access to fishing grounds during the construction phase takes into account the following:

- The moderate importance of fishing grounds the three proposed wind farm sites comprise;
- The availability of alternative fishing grounds in the Moray Firth and wider area;
- The small area of seabed permanently lost as a result of infrastructure and associated safety zones; and
- The potential for access to fishing grounds to be regained within the sites.

8.1.6.43 The significance of effect upon each of the receptors identified is provided in Table 8.1-11 below.

Table 8.1-11 Complete Loss or Restricted Access to Fishing Grounds

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Complete Loss or Restricted Access to Fishing Grounds	**Scallop Fishery**	Medium	Negative	Medium	Moderate
	Squid fishery	Medium	Negative	Medium	Moderate
	Whitefish fishery	Low	Negative	Medium	Minor

Safety Issues for Fishing Vessels

8.1.6.44 MORL is likely to apply for safety zones of 50 m around infrastructure such as turbines, met masts and OSPs (in the case of gravity base OSPs, the safety zone may be required to be proportionally larger to ensure a sufficient boundary to incorporate the footprint of the infrastructure. Offshore transmission infrastructure is fully described in Chapter 11.1: Commercial Fisheries). The total number of safety zones would result in a combined exclusion of approximately 1 % of the total site area.

8.1.6.45 The post-construction status of inter array cables will be buried where feasible and protected elsewhere. Post construction surveys will be undertaken to assess the seabed status in the immediate vicinity of construction and installation activities, including inter array cables. In the event that seabed rectification procedures are required, and where practicably feasible, the appropriate measures will be undertaken to ensure that the seabed is returned to an acceptable standard for fishing practices to be safely resumed (see 8.1.8 below: Proposed Monitoring and Mitigation). Subject to the satisfactory outcome of post construction surveys, the safety risks to fishing vessels, including from inter array cables, is considered to be **within acceptable limits**.

8.1.6.46 It is noted that individual skippers, particularly those operating bottom towed gear, may consider it unsafe to continue fishing within the operational wind farm sites because of the presence of infrastructure. Although MORL will endeavour to facilitate continued access to fishing grounds within the sites, it is possible that an individual assessment of safety risks during the operational phase may be different to that provided here.

8.1.6.47 Potential collision risks between wind farm infrastructure during the operational phase and fishing vessels are discussed in Chapter 8.2 (Shipping and Navigation).

Increased Steaming Time to Fishing Grounds

8.1.6.48 Chapter 8.2 (Shipping and Navigation) considered that there is good prospect for fishing vessels to navigate within the operational wind farm sites. As a result, the effect upon steaming distances and times of fishing vessels is not considered to be significant, as shown in Table 8.1-12 below.

Table 8.1-12 Increased Steaming Times to Fishing Grounds

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Increased Steaming Time to Fishing Grounds	**Scallop Fishery**	Low	Negative	Low	Minor
	Squid fishery	Low	Negative	Low	Minor
	Whitefish fishery	Low	Negative	Low	Minor

Obstacles on the Seabed Post Construction

8.1.6.49 There is the potential for obstacles to be left on the seabed post construction, which could result in damage to, or loss of fishing gears, as well as representing a safety hazard. Offshore works such as construction vessels' anchoring, jack up legs or cable trenching can produce seabed obstructions which can cause fishing net fastenings and damage to fishing gears.

8.1.6.50 Offshore policy (IMO, 1996) prohibits the discarding of objects or waste at sea. The reporting and recovery of any accidentally dropped object is also required. In addition, post-construction and installation seabed surveys, and if necessary the appropriate seabed rectification measures, will be undertaken to ensure seabed conditions are returned to an acceptable standard.

8.1.6.51 Provided there is compliance to obligatory standards by contractors, and the appropriate post construction and installations measures are taken, the effect is considered to be **within acceptable limits**.

Displacement of Fishing Activity into Other Areas

8.1.6.52 The fisheries identified within the wind farms are limited in the grounds they are able to target elsewhere in the regional area, principally by the availability of target species and their habitat requirements, and for which fishing areas in the regional area have been defined (see Chapter 5.1: Commercial Fisheries).

8.1.6.53 The extent of displacement will be a function of the temporary loss or restricted access to traditional fishing grounds during the construction phase, and as a result the significance of effect for this applies. This takes into account the following:

- The moderate importance of fishing grounds the three proposed wind farm sites comprise;
- The availability of alternative fishing grounds in the Moray Firth and wider area;
- The small area of seabed permanently lost as a result of infrastructure and associated safety zones; and
- The potential for access to fishing grounds to be regained within the sites.

8.1.6.54 Table 8.1-13 below gives the significance of effect for each of the receptors identified within the three proposed wind farm sites.

Table 8.1-13 Displacement of Fishing Activity into Other Areas

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Displacement of Fishing Activity into Other Areas	**Scallop Fishery**	Medium	Negative	Medium	Moderate
	Squid fishery	Medium	Negative	Medium	Moderate
	Whitefish fishery	Low	Negative	Medium	Minor

Interference to Fishing Activities

8.1.6.55 In addition to the effects included in this assessment, an additional effect to be considered is the potential for navigational conflicts arising between fishing vessels and operations and maintenance vessels transiting to and from site. This could include the fouling of static gear marker buoys and dhans or, to a lesser extent, towed gear vessels being required to alter towing direction. This interference has the potential to affect more fishing vessels than those operating in the immediate vicinity of the site, depending upon the location of the operations and maintenance port.

8.1.6.56 The magnitude of effect will be partly determined by the location of the operations and maintenance port(s), which at the current time are unknown. As a result, a conservative assumption has assumed that transit routes will be in the vicinity of static and towed gear grounds. However, activity by operations and maintenance vessels will be less than that occurring during the construction phase and furthermore it is considered that codes of conduct between works vessels and fishing vessels will be well established by the completion of construction activities, irrespective of port used. As a result, the sensitivity of the crab and lobster fishery has reduced to low.

8.1.6.57 The significance of the interference to fishing vessels identified is provided in Table 8.1-14 below.

Table 8.1-14 Interference to Fishing Vessels arising from Navigational Conflicts

Effect	Receptor	Sensitivity of Receptor	Positive / Negative Effect	Magnitude of Effect	Significance of Effect
Interference to Fishing Vessels arising from Navigational Conflicts	**Scallop Fishery**	Low	Negative	Low	Minor
	Squid fishery	Low	Negative	Low	Minor
	Whitefish fishery	Low	Negative	Low	Minor
	Nephrops fishery	Low	Negative	Low	Minor
	Crab and lobster fishery	Low	Negative	Low	Minor

8.1.7 Salmon and Sea Trout Fisheries Primary Impact Assessment: Three Proposed Wind Farm Sites

Likely Significant Effects

8.1.7.1 As a result of salmon and sea trout fisheries being either in-river, or to a lesser extent, coastal, there are not considered to be direct effects arising from the construction / decommissioning and operation of the wind farm developments. Indirect effects on the fisheries may however occur if the ecology of these species is adversely affected.

8.1.7.2 It should be noted that the sensitivity of salmon and sea trout fisheries in the Moray Firth and Ugie is dependent upon an assessment of effects upon the species, which is described in Chapter 7.2 (Fish and Shellfish Ecology). It should be noted, however, that the sensitivities of coastal fisheries (the net fisheries) and in-river fisheries (including the inner firth net-and-coble fisheries) may differ: both coastal and in-river fisheries would be affected by the salmon and sea trout not being able to reach their natal rivers as a result of the development of the three proposed wind farm sites. However, coastal fisheries may additionally be sensitive to changes to the behaviour of the species in the marine environment which do not result in their being unable to return to their natal rivers.

8.1.7.3 The effects on fish and shellfish ecology, including salmon and sea trout, are described in Chapter 7.2 (Fish and Shellfish Ecology). The assessment methodology used for fish and shellfish species is based on the IEEM (2010) guidelines for ecological impact assessment, which differs from that used for assessment of effects on commercial fisheries. This is detailed in 7.2.4 of Chapter 7.2 (Fish and Shellfish Ecology). Due to the lack of current knowledge in relation to the migratory behaviour and the use that salmon and sea trout make of the wind farm developments, a conservative assumption has been applied that considers all fish originating from all rivers flowing into the Moray Firth will use the three sites during their life stages in the marine environment.

8.1.7.4 A summary of effects on salmon and sea trout populations derived from the construction, operational and decommissioning phase of the developments is given in Table 8.1-15 below, based on information provided in Chapter 7.2 (Fish and Shellfish Ecology).

8.1.7.5 Effects on salmon and sea trout are, in general terms, expected to be of **minor** significance. An exception to this is the effect derived from construction noise, which has been assessed to be of **minor-moderate** significance.

Table 8.1-15 Summary of Impact Assessment on Natural Stocks of Salmon and Sea Trout

Effect	Receptor	Sensitivity	Magnitude	Confidence Level	Significance of Effect
Temporary Disturbance to Seabed	Salmon and sea trout	Low	Small	Probable	Negative Minor
Noise	Salmon and sea trout	Medium	Small-Medium	Probable-Unlikely	Negative Minor-Moderate
Loss of Habitat	Salmon and sea trout	Low	Negligible	Unlikely	Negative Not significant
Introduction of New Habitat	Salmon and sea trout	Low	Small	Probable	Negative / Positive Minor
EMFs	Salmon and Sea trout	Medium	Small	Probable	Negative Minor
Operational Noise	Salmon and sea trout	Low	Small	Unlikely	Negative Minor
Changes to Fishing Activity (i.e. changes to fishing activity as a result of wind farm development, which may affect fish and shellfish populations)	Salmon and sea trout	Low	Negligible	-	Not significant

Decommissioning

8.1.7.6 In the absence of detailed information on the decommissioning schedules and methodologies of the three proposed wind farms, it is considered that the likely significant effects associated with the decommissioning phase will be of no greater, and probably considerably less, significance than those of the construction phase. The assessment of the effects identified during the construction phase of the developments therefore applies.

8.1.8 Proposed Monitoring and Mitigation

Commercial Fisheries

8.1.8.1 MORL has undertaken a significant programme of early engagement with the fishing industry and is committed to continuing to explore and develop mitigation options in consultation with the industry.

Construction and Operation

8.1.8.2 In line with standard industry practice, dialogue will be ongoing prior to and during the construction phase to ensure that Project information is effectively disseminated to fishermen, as well as allowing for issues to be raised by the fishing community. Working practices will also be agreed to achieve any possible reduction in interference (e.g. standard navigation routes to / from sites).

8.1.8.3 A construction management plan will be defined in consultation with fishing interests which clearly establishes protocol for engagement between the developer and fishermen throughout the construction period. In order for the various fishing sectors to be appropriately represented, as well as the developer and the regulatory body, a working group will be established that facilitates the following:

- Ongoing dialogue between the fishing community and MORL throughout the pre-construction and construction phase;
- Protocol for the navigation of wind farm construction and works vessels to and from the site (i.e. agreement of transit lanes to, where possible given other receptors, minimise interference to fishing activities);
- Established procedures in the event of interactions between wind farm construction and fishing activities (i.e. claims for lost and / or damaged gear);
- Protocol for removal of seabed obstacles post-construction; and
- Engagement on appropriate phasing of construction safety zones dependent on the construction programme.

8.1.8.4 In order for there to be ongoing dialogue between MORL and the fishing industry throughout the operational phase of the wind farm, the working group will continue to provide a forum for ongoing engagement.

8.1.8.5 All infrastructure installed during the construction phase will be marked and lit, in line with standard industry practice, and as further described in 8.2.6 of Chapter 8.2 (Shipping and Navigation). The information will be distributed to fishermen through the agreed channels as defined in the construction management programme.

8.1.8.6 MORL are likely to apply for safety zones around installed infrastructure to prevent interactions with fishing vessels which could pose a safety risk.

8.1.8.7 Cables will be buried to a target depth of 0 to 1 m where it is technically practical to do so. In instances where adequate burial cannot be achieved then cable protection will be installed.

8.1.8.8 Over trawl surveys will be carried out on inter array cables to ensure that the cable burial and protection scheme has been successful.

8.1.8.9 In addition to the above defined mitigation strategy, MORL would like to investigate a number of other opportunities that may appropriately mitigate effects dependent on the development of both industries. This includes ongoing investigations within the offshore renewable industry, and in consultation with the fishing industry, to explore potential modifications to bottom towed scallop fishing gear which may reduce the mutual risk posed by fishing activities within and around operational wind farms. These investigations may result in mitigation to ascertain the effects described above. Trials are anticipated to be carried out during 2012 and if successful discussion will continue.

Salmon and Sea Trout Fisheries

Construction and Operation

8.1.8.10 Likely effects on salmon and sea trout populations are considered of **minor** significance. An exception to this is the effect derived from construction noise, which has been assessed to be of **minor-moderate** significance.

8.1.8.11 In general terms, the likely effects of the construction phase on fish and shellfish species have been assessed to be of minor significance. An exception to this is construction noise, which has been identified as having potential to result in significant effects (above minor) namely cod, herring, salmon and sea trout.

8.1.8.12 The impact assessment (Chapter 7.2: Fish and Shellfish Ecology) on these species has taken a precautionary approach, where conservative assumptions have had to be applied as a result of the uncertainty surrounding currently available information on the use that these species may make of the area of the three proposed wind farms during the construction phase.

8.1.8.13 In order to mitigate this uncertainty, MORL is committed, in consultation with Marine Scotland and the relevant fisheries stakeholders, to undertake additional survey work and monitoring with the objective of increasing the confidence in this impact assessment and identifying whether mitigation is required and, if so, to define feasible measures in order to reduce the significance of the likely effects.

8.1.8.14 Some surveys, such as the sandeel (a key prey species for other fish species) survey, were undertaken in consultation with Marine Scotland pre-application during their optimal survey periods, the results of which are included in Chapter 7.2 (Fish and Shellfish Ecology). Due to the seasonal nature of these surveys, MORL expects that specific surveys and monitoring will be defined and implemented at the appropriate time of year in consultation with Marine Scotland and other stakeholders.

8.1.8.15 In addition to the monitoring / mitigation above, soft start piling will be used during construction with the aim that mobile species are not exposed to the highest noise levels.

Decommissioning

8.1.8.16 None proposed.

8.1.9 Residual Effects – Primary Impact Assessment

Commercial Fisheries

8.1.9.1 The residual effects, after taking into account the mitigation proposed above, are not currently different to those described for pre-mitigation effects, with the exception of 'Interference to Fishing Activities' during the construction phase. The implementation of the construction management programme would reduce the potential for conflict between static fishing gear and construction vessels, and the residual effect during the construction phase as a result would therefore change from **minor / moderate to minor**.

8.1.9.2 It should be noted that the purpose of the construction management programme is also to ensure that the effects described are kept within the significance levels ascribed throughout both the construction and operational phases of the development.

8.1.9.3 Table 8.1-1 above provides a summary of the key findings and residual effects of the three proposed wind farm sites upon commercial fisheries.

Salmon and Sea Trout Fisheries

8.1.9.4 The residual effects are as described prior to mitigation. A summary of the impact assessment is given in Table 8.1-2 above.

8.1.10 Secondary Assessment: Individual Wind Farm Sites

Commercial Fisheries

8.1.10.1 The significance of effect for each of the three proposed wind farm sites has been derived taking into account the following assumptions:

8.1.10.2 Although slight variations in the baseline characteristics across the three proposed wind farm sites have been identified during the period of analysed data, annual variations in the level and location of activity of the principal two fisheries, the scallop and squid fisheries, has required the conservative assumption that activity is broadly uniform across the three sites.

8.1.10.3 Second, although the worst case parameters for each of the three proposed wind farm sites are the same, it is not always the case that an individual site constitutes a third of the effect identified in the primary assessment. Instead, the site specific effect may be proportionally larger than its contribution to the primary assessment.

8.1.10.4 The primary assessment of the safety risks to fishing vessels identified during the construction and operational phases applies to the an assessment on a site by site basis, although in this instance the wind farm design specifications for each site will be a proportion of those given previously. As a result, these have not been taken forward in the secondary assessment.

8.1.10.5 The effects for which a moderate significance was assigned in the primary assessment have been taken forward for the secondary assessment. This specifically relates to:

- Interference to static gear through navigational conflict during the construction phase;
- Temporary loss or restricted access to fishing grounds during the construction phase, and associated displacement; and
- Complete loss or restricted access to fishing grounds during the operational phase, and associated displacement.

Interference to Static Gear through Navigational Conflict during the Construction Phase

8.1.10.6 The potential for interference to static gear through navigational conflict during the construction phase could include the fouling of static gear markers buoys and dhans (marker flags). This interference has the potential to affect fishing vessels operating in the regional area, and particularly in the vicinity of the construction port(s). As previously stated, a conservative assumption has assumed that transit routes will be in the vicinity of static gear grounds. In the case of the secondary assessment, this assumption still applies, however it is considered that the amount of traffic and the frequency of vessels transiting to and from each site will be proportionally reduced.

8.1.10.7 The significance of the interference to static gear through navigational conflict for each individual site is therefore considered to be moderate (sensitivity), negative effect, low (magnitude) and of **minor significance**.

Temporary Loss or Restricted Access to Fishing Grounds during the Construction Phase, and Associated Displacement

8.1.10.8 The temporary loss or restricted access to fishing grounds during the construction phase, and the associated displacement into other areas for each individual wind farm site takes into account:

- The conservative assumption that the baseline characteristics are the same across the three proposed wind farm sites;
- The low proportion of fishing grounds each individual wind farm site comprises relative to the availability of alternative fishing grounds in the Moray Firth and wider area;
- The shorter construction schedule of each wind farm site; and
- Access to fishing grounds will become progressively more restricted as the construction schedule in the individual site advances.

8.1.10.9 The significance of the temporary loss or restricted access to fishing grounds for the scallop and squid fisheries in the construction phase, and the associated displacement, is considered to be to be moderate (sensitivity), negative effect, low (magnitude) and of **minor significance**.

Complete Loss or Restricted Access to Fishing Grounds during the Operational Phase, and Associated Displacement

8.1.10.10 The complete loss or restricted access to fishing grounds during the construction phase, and the associated displacement into other areas, for each individual wind farm site takes into account:

- The conservative assumption that the baseline characteristics are the same across the three proposed wind farm sites;
- The small area of seabed permanently lost as a result of infrastructure and associated safety zones in each wind farm site; and
- The potential for access to fishing grounds to be regained within the sites.

8.1.10.11 The significance of the complete loss or restricted access to fishing grounds for the scallop and squid fisheries in the operational phase, and the associated displacement, is considered to be to be moderate (sensitivity), negative effect, low (magnitude) and of **minor significance**.

8.1.10.12 A summary of the secondary assessment is provided in Table 8.1-16 below.

Table 8.1-16 Secondary Assessment Summary

Effect	Telford	Stevenson	MacColl
Construction and Decommissioning			
Interference to Static Gear as a result of Navigational Conflict	Negative Minor	Negative Minor	Negative Minor
Temporary Loss or Restricted Access to Fishing Grounds during the Construction and Decommissioning Phases, and Associated Displacement	Negative Minor	Negative Minor	Negative Minor
Operation			
Complete Loss or Restricted Access to Fishing Grounds during the Operation Phase, and Associated Displacement	Negative Minor	Negative Minor	Negative Minor

Salmon and Sea Trout Fisheries

8.1.10.13 The effects on fish and shellfish ecology, including salmon and sea trout, are described in Chapter 7.2 (Fish and Shellfish Ecology) and summarised in the primary assessment previously. The assessment identified one effect resulting in a moderate significance, relating to construction noise. The findings of the secondary assessment are summarised below:

8.1.10.14 Given the smaller extent of noise effect ranges, and the shorter duration of the impact piling for the separate construction of individual sites, the effect of noise upon salmon and sea trout is assessed to be **negative of minor significance and probable.**

8.1.11 Proposed Monitoring and Mitigation: Secondary / Sensitivity Assessment

8.1.11.1 The mitigation described in the primary assessment applies to the secondary assessment.

8.1.12 Residual Effects: Secondary / Sensitivity Assessment

8.1.12.1 The residual effects are as described in Table 8.1-1 above.

8.1.13 References

Pers. comm. scallop fisherman, 2011

Pers. comm. whitefish and squid fisherman, 2011

IMO (1996) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, and the 1996 Protocol to the Convention. *London Convention*

IEEM (2010) Institute of Ecology and Environmental Management. Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal. Final Document

OSPAR (2008) Background Document on Potential Problems associated with Power Cables other than those for Oil and Gas Activities. OSPAR Commission. Biodiversity Series.

8.2 Shipping and Navigation

8.2.1 Summary

8.2.1.1 This chapter addresses the likely significant effects on shipping and navigation from the three proposed wind farm developments, Telford, Stevenson and MacColl. It covers the effects on shipping and navigation in relation to commercial shipping, recreation, and fishing vessels.

8.2.1.2 The three proposed wind farm sites would have a direct negative effect of **minor** significance, post-mitigation, on the following shipping and navigation receptors:

- Commercial ship routing and collision risk during the construction, operation and decommissioning phases;
- Fishing vessel routing and collision risk during the construction operation and decommissioning phases;
- Recreation vessel routing and collision risk during the construction operation and decommissioning phases;
- Search and Rescue and helicopter operations / access during the operational phase of the three proposed wind farms sites; and
- Vessels marine based radar equipment during the operational phase of the three proposed wind farms sites.

8.2.1.3 The proposed sites are located in an area of relatively low commercial shipping densities with the main shipping route passing at a mean distance of 4 nm north east of the Telford site boundary (the Pentland Firth route). Vessels passing through the proposed sites should be able to pre-plan any revised passages in advance of encountering the wind farms and there is available sea room to re-route around turbines, resulting in a probable **minor** negative effect on commercial shipping voyage distance and time.

8.2.1.4 The change in collision frequency within the three proposed sites was estimated to be small, (given the low baseline risk in the area), supporting a conclusion of a **minor** negative effect on commercial shipping and collision risk and a probability that is unlikely to occur.

8.2.1.5 Comparing the three wind farm layouts, Scenario 2 (see 8.2.3.1 below) has the highest overall passing powered and drifting vessel collision frequency potential, as the indicative layout covers the largest sea area. Structures on the northern edge of the Telford site have the highest individual collision frequencies given the closer proximity to shipping on the Pentland Firth route (the mean route is 4 nm north east of Telford).

8.2.1.6 Fishing vessels were recorded within the MacColl and Stevenson wind farm areas. The worst case fishing vessel to wind farm structure collision risk has been identified as one every 16 years for Scenario 1 (see 8.2.3.1 below), which reflects the maximum target area and fishing continuing in the area. However, based on the sizes of fishing vessel recorded, vessels should be able to navigate within the wind farm areas, and assuming industry standard mitigation (including liaison and information promulgation) a probable **minor** negative effect is predicted from a navigation perspective.

8.2.1.7 There was limited recreational vessel activity recorded within the proposed sites during the baseline maritime surveys. Recreational routing is dependent on sea and weather conditions; therefore routing through the wind farms is not expected to be a frequent event. Overall the effect on recreational vessel routing is probable, but given the low levels of activity and assuming industry standard mitigation (including minimum blade clearance) is expected to be **minor**.

8.2.1.8 In terms of Search and Rescue (SAR) issues, given the relatively low level of incidents in the vicinity of the proposed sites, it is considered unlikely that the proposed wind farms will exacerbate maritime safety risks. Giving account to commitments to meet the MCA MGN 371 guidance and the development of an Emergency Response Cooperation Plan (ERCoP), it is considered that SAR issues can be well managed, resulting in a **minor** effect that is unlikely to occur.

8.2.1.9 The effect on SAR helicopter operations and access will be **minor** and unlikely to occur, based on MGN 371 compliance and development of an ERCoP.

8.2.1.10 Radar interference on marine equipment could be experienced by a small number of commercial vessels (including those routing to Wick) and offshore vessels (associated with Beatrice and Jacky platforms). However, based on the revised routing, interference is predicted to be low. Vessels inbound and outbound from ports in the area are likely to attentive to navigational hazards, therefore it was concluded that the effect on marine radar systems will be likely to occur but of **minor** effect.

8.2.1.11 Table 8.2-1 below summarises the residual effects and mitigation.

Table 8.2-1 Residual Effects and Mitigation for Shipping and Navigation

Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction			
Commercial Shipping	Minor	Industry standard (including ERCoP and information promulgation on construction works). Other mitigations include safety zones.	Minor
Fishing Vessels	Minor	Industry standard (including ERCoP and information promulgation / fisheries liaison on construction works). Other mitigations include safety zones and guard vessels.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP and information promulgation on construction works). Other mitigations include safety zones and guard vessels.	Minor

Operation			
Commercial Shipping	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include consideration of operational safety zones and Marine Control Centre.	Minor
Fishing Vessels	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include consideration of operational safety zones and Marine Control Centre.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP, marking wind farm structures on charts, lighting / buoyage in accordance with NLB and IALA O-139 and turbine lade / mast air draft [22 m]). Other mitigations include consideration of operational safety zones and Marine Control Centre.	Minor
SAR Operations	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include a Marine Control Centre.	Minor
SAR Helicopter Operations	Minor	Industry standard (including ERCoP / emergency rotor shut-down, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include a Marine Control Centre.	Minor
Radar Interference on Marine Equipment	Minor	None	Minor
Decommissioning			
Commercial Shipping	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation on construction works). Other mitigations include safety zones.	Minor
Fishing Vessels	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation / fisheries liaison on decommissioning works). Other mitigations include safety zones and guard vessels.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation on construction works). Other mitigations include safety zones and guard vessels.	Minor

8.2.2 Introduction

8.2.2.1 The scope of this chapter is to assess the likely significant shipping and navigation effects that may result from the development of the three proposed wind farms and to identify associated mitigation measures.

8.2.2.2 Effects were identified through a series of hazard identification workshops. The effects are then assessed and a series of mitigation measures and monitoring plans are presented.

8.2.2.3 Consultation with navigational stakeholders was positive with no objections to the proposed sites. Concerns were raised by the Chamber of Shipping and Royal Yacht Association (RYA) regarding initial plans to have floating turbines in the proposed sites. However, it should be noted that this concept was taken out of the Rochdale Envelope, alleviating the potential risks associated with floating turbines.

8.2.3 Rochdale Envelope Parameters Considered in the Assessment

8.2.3.1 The 'worst realistic case' Rochdale Envelope for the shipping and navigation assessment consists of three provisional layouts of the maximum number of wind farm structures. The three indicative layouts / scenarios used in the assessment are described below:

- Scenario 1 included the maximum number of wind turbine generators (339) in an indicative diamond layout, using 3.6 MW turbines in Telford, 5 MW in Stevenson and 5 MW in MacColl;
- Scenario 2 consists of 291 turbines in an indicative diamond layout, using 5 MW turbines in Telford, 5 MW in Stevenson and 5 MW in MacColl; and
- Scenario 3 consists of 249 turbines in an indicative grid layout, using 5 MW turbines in Telford, 5 MW in Stevenson and 7 MW in MacColl.

8.2.3.2 Table 8.2-2 below summarises the Rochdale envelope scenarios considered within the shipping and navigation impact assessment.

Table 8.2-2 Rochdale Envelope Scenario Considered within Assessment of Potential Impacts on Shipping and Navigation

Type of Effect	Rochdale Envelope Scenario Assessed
Construction & Decommissioning	
Increased Level of Vessel Activity with the Proposed Sites (irrespective of layout, foundation types and subsea cabling) **(1,355 vessel movements per construction period)**	• Construction vessel collision with another vessel on-site; • Construction vessel collision with structure; • Construction vessel collision with passing vessel en route to or from site; • Construction vessel encounters (jack-ups or anchors on) underwater obstruction (e.g. cable, pipeline etc.); • Construction vessel jacks-up or anchors onto unexploded ordnance; • Man overboard during personnel transfer operations; and • Dropped object during major lifting operations.
Re-Routing of Shipping (commercial vessels, fishing and recreation vessels) in the Area due to Construction Vessels	Maximum loss of navigable sea area based on: • Maximum number of construction vessels and associated support traffic within the proposed sites.

Type of Effect	Rochdale Envelope Scenario Assessed
Operation	
Re-Routing of Shipping in the Area	Maximum loss of navigable sea area based on: • Placement of largest WTG jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW);
Re-Routing of Shipping in the Area	• Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six x AC and two x DC).
Passing Powered Ship Collision	Collision between passing vessel and fixed structure within the wind farm (turbines and / or substation): • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in proposed sites (eight) (six AC and two DC).
Passing Drifting Ship Collision	Collision between drifting vessel and fixed structure within the wind farm (turbines and / or substation): • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC); and • Results presented will be based on the worst case results.
Fishing Vessel Collision	Collision between fishing vessel and fixed structure within the wind farm (turbine and / or substation): • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC).
Recreation Vessel Collision	Collision between recreational vessel and fixed structure within the wind farm (turbines and / or substation) and turbine rotor blade impact with yacht mast: • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Maximum turbine blade air draft at Highest Astronomical Tide (HAT) will be 22 m; • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC).

Type of Effect	Rochdale Envelope Scenario Assessed
Search and Rescue (SAR) Operations	Maximum loss of navigable sea area for SAR operations, based on: • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC).
Helicopter Operations	Helicopter operations impacted by: • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sties (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC).
Radar Interference	Radar interference on marine radar systems and potential decreased detection capability of smaller vessels due to turbines and substations masking targets (it is assumed that a larger number of structures will be worse than a smaller number of bigger structures): • Placement of largest turbine jacket foundation of 45 x 45 m diameter topside / above sea level; • Maximum number of turbines installed in the proposed sites (339 = 1.5 GW); • Placement of largest substation foundation of 100 x 100 m diameter topside / above sea level; and • Maximum number of substations installed in the proposed sites (eight) (six AC and two DC).

8.2.4 EIA Methodology

8.2.4.1 The methodology used to assess the likely significant effects of the proposed wind farm developments principally follows the Maritime Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371 M+F) (2008) and Department of Energy Climate Change (DECC) Risk Assessment Methodology (2005). Further details on the guidance used in this assessment can be found in Chapter 5.2 (Shipping and Navigation).

8.2.4.2 The baseline assessment (see Chapter 5.2: Shipping and Navigation) allowed higher risk areas to be identified through the maritime traffic survey, desk-based research and consultation. Following this, a Formal Safety Assessment (FSA) was carried out in-line with the International Maritime Organisation (IMO) FSA process (2007) and DECC guidance.

8.2.4.3 The risk assessment includes the following:

- Hazard log and risk ranking;
- Quantified navigational risk assessment for selected hazards;
- Base case present shipping and future case shipping risk levels assessed for selected hazards;

- SAR review; and
- Assessment of mitigation measures.

8.2.4.4 Risk analysis was carried out on the higher risk scenarios to investigate the selected hazards in more detail. This allows more attention to be focused upon the high risk areas to identify and evaluate the factors which influence the level of risk with a view to their effective management. Plate 8.2-1 below presents an overview of the methodology applied during the shipping and navigation EIA, which principally follows the DECC risk assessment template and IMO FSA guidelines.

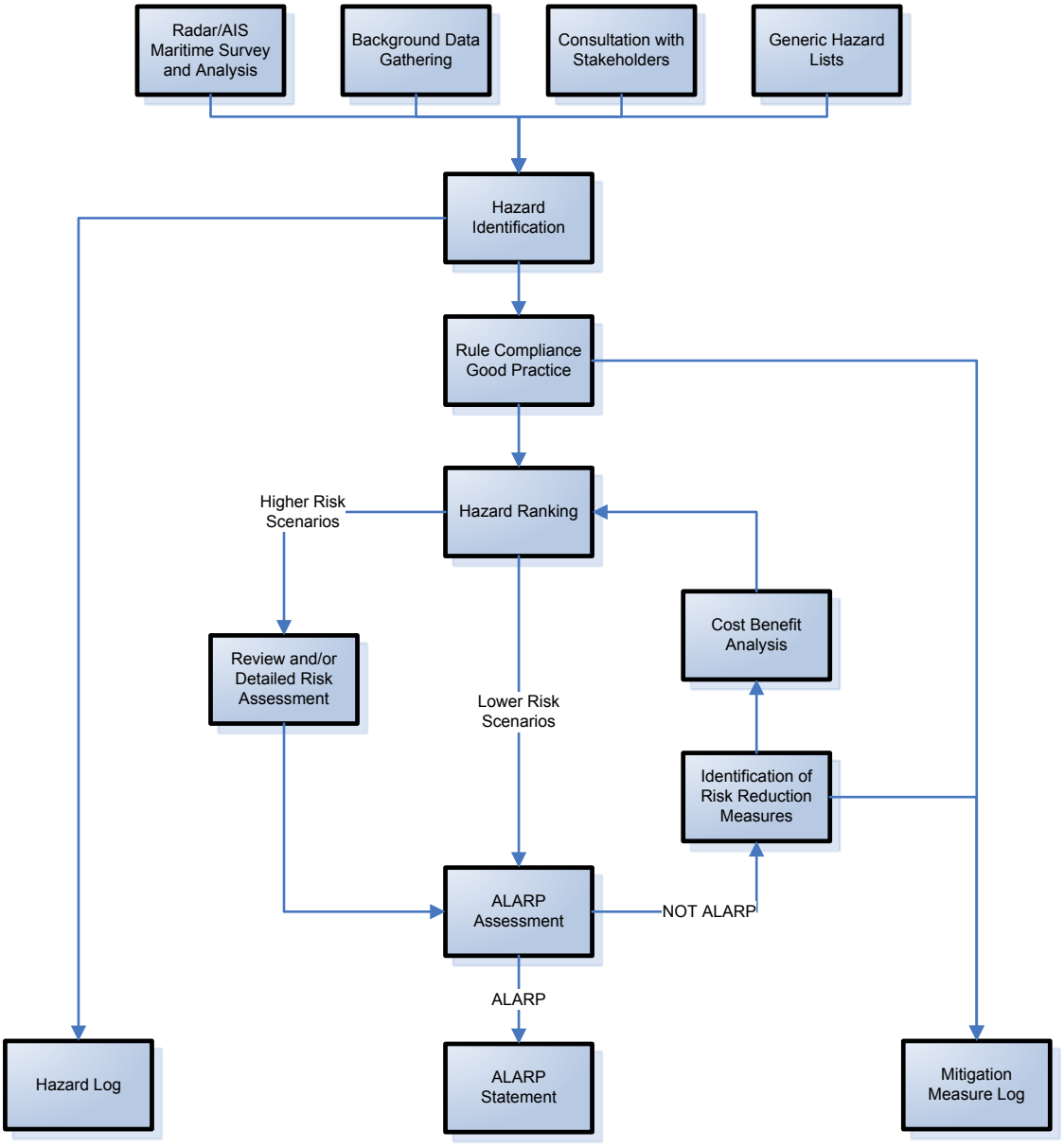

Plate 8.2-1 Overview of Methodology for the Risk Assessment

8.2.4.5 The baseline vessel activity and navigational features in the vicinity of the three proposed wind farm sites are described in Chapter 5.2 (Shipping and Navigation). The baseline study identified the shipping and navigation receptors that may be affected by the proposed wind farm developments.

8.2.4.6 The main part of this impact assessment covers the likely significant effects on shipping and navigation in relation to commercial, recreation and fishing vessels. Search and Rescue (SAR) resources, SAR helicopter operations and radar impacts are assessed for the operational phase of the Project.

8.2.4.7 For each shipping and navigation receptor, it is assumed that industry standard mitigation measures will be put in place given requirements of the developer to meet MGN 371 guidance and lighting / marking as advised by Northern Lighthouse Board (NLB) based on International Association of Lighthouse Authorities (IALA) standards (IALA, 2008). Mitigation measures are discussed in detail in 8.2.6 below, including both industry standard and best practice measures.

Significance Criteria

8.2.4.8 The likely significant effects on shipping and navigation from offshore wind farm development cannot be easily categorised, hence the application of significance criteria to an assessment of effects is, as a result, subjective.

8.2.4.9 In terms of the effects on shipping and navigation from developing the proposed sites, results are presented in risk estimates, in quantitative terms for the modelled scenarios.

8.2.4.10 Following the hazard workshop ranking and identification of higher risk scenarios, the effects on the shipping and navigation receptors for different phases of the Project are assessed using the significance terminology as described below:

- **Not significant**. Impacts that are slight and negligible in terms of vessel navigation / routing, collision risk and response to marine incidents;
- **Minor significance**. Impacts which are of some effect, but generally small in magnitude in terms of vessel navigation (e.g. minor deviation), collision risk and response to marine incidents;
- **Moderate significance**. Impacts which are of some effect, but moderate in magnitude in terms of vessel navigation (e.g. moderate deviation), collision risk and response to marine incidents; and
- **Major significance**. Impacts which are of greater effect and majorly significant in magnitude, in terms of vessel navigation (e.g. large deviations), collision risk and response to marine incidents.

8.2.5 Primary Impact Assessment: Three Proposed Wind Farm Sites

Hazard Review Workshops

8.2.5.1 A Hazard Review workshop was held in Inverness on 6th July 2011 attended by local maritime stakeholders, including Inverness Harbour, Cromarty Firth Port Authority (CFPA), Moray Council and the NLB. An offshore operator's Hazard Review workshop was also carried out in Aberdeen on 7th July 2011.

8.2.5.2 The key maritime hazards associated with the proposed sites were identified at the workshops and the associated scenarios prioritised by risk level. Within each scenario, vessel types were considered separately to ensure the risk levels were assessed for each and the control options were identified on a type-specific basis, e.g. risk control measures for fishing vessels differ to those for commercial ships.

8.2.5.3 The ranking of the risks associated with the various hazards was carried out using a risk matrix, as presented in Table 8.2-3 below.

8.2.5.4 The frequency bands are ranked from low frequency (negligible) to high frequency (yearly). In terms of consequences, the definition is based on the impact to people, property, environment and business (negligible to major). A full description of the definitions and examples can be found in Technical Appendix 5.2 A. A description of the risk matrix regions is provided in Table 8.2-4 below.

Table 8.2-3 Risk Ranking Matrix

Consequence						
	5					
	4					
	3					
	2					
	1					
		1	2	3	4	5
		Frequency				

Table 8.2-4 Risk Matrix Description

Risk Region	Risk	Description
Light	Broadly Acceptable Region (Low Risk)	Generally regarded as insignificant and adequately controlled. Nonetheless the law requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
Medium	Tolerable Region (Intermediate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
Dark	Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

8.2.5.5 As well as ranking the hazard by expected risk, based on the estimated frequency versus most likely consequence, the worst case risk and subsequent consequence was also ranked in order to capture scenarios with a particularly high worst case risk.

8.2.5.6 The following list of hazards were reviewed, with the information recorded using Anatec's Hazard Log Software:

- Fishing vessel collision;
- Commercial ship (powered) collision;
- Recreational vessel collision;
- Drifting ship collision;
- Fishing gear interaction with inter-field cabling;
- Fishing gear interaction with export cable;

- Fishing gear interaction with substructures;
- Vessel anchoring on or dragging anchor over subsea equipment; and
- Vessel-to-vessel collision due to avoidance of site or work vessels in area.

8.2.5.7 The following generic industry hazards were also identified for the development but not discussed in detail:

- Attendant vessel collision with structure;
- Man overboard during work activities at site;
- Dropped object during work activities at site; and
- Deliberate unauthorised boarding or mooring to structure.

8.2.5.8 Other general hazards associated with the construction, decommissioning and maintenance phases, such as dropped object, man overboard and helicopter crash, were added following the workshops to create a preliminary Hazard Log for the Project.

8.2.5.9 In addition, the offshore operators' workshop discussed the impact on tug and supply vessel access to offshore platforms in the area (Beatrice and Jacky).

8.2.5.10 Offshore support vessels use a route with a mean position approximately 0.5 nm south of the proposed sites, approaching the Beatrice and Jacky platforms from Aberdeen and Peterhead. A small deviation around the southern tip of the proposed sites might be required, which is unlikely to be significant in terms of increased mileage (Technical Appendix 5.2 D: Navigation Risk Assessment).

8.2.5.11 Overall, the hazard review workshop concluded that no risks were unacceptable (high risk). A total of three risks were ranked within the tolerable (intermediate risk) As Low as Reasonably Practicable (ALARP) region based on the probable outcome whilst three were ranked as tolerable based on the worst case outcome. Further information can be found in Technical Appendix 5.2 D.

8.2.5.12 The hazards ranked as tolerable based on probable outcome were:

- Man overboard during transfer to / from turbine or working alongside turbine;
- Attendant Wind Farm vessel collision with Wind Farm structure; and
- Fishing vessel collision with structure.

8.2.5.13 These incidents generally involve vessels and persons working at the site as opposed to third parties.

8.2.5.14 The five additional hazards ranked as tolerable based on worst case outcome were:

- Dropped object during construction, decommissioning or major maintenance;
- Vessel-to-vessel collision due to avoidance of site;
- Commercial ship powered collision;
- Fishing gear interaction with inter-field cabling; and
- Fishing gear interaction with export cable.

8.2.5.15 Several of the worst case outcomes involve third party vessels and were therefore selected for further risk analysis (See Technical Appendix 5.2 D). It was noted that

many of the causes are general maritime accident causation factors outside the control of the developers.

8.2.5.16 Further details on all hazards identified (including area, phase of operation, causes, risk ranking, risk control and mitigation measures) are recorded in the NRA Hazard Log (see Technical Appendix 5.2 A).

Construction

8.2.5.17 In general, whilst the same effects are relevant as during the operational phase, there are additional effects associated with the construction phase of the Project that requires risk control measures.

8.2.5.18 In terms of the main navigational receptors, the overall effects associated with the proposed sites have been identified and discussed for the construction phase of the Project.

Effect on Commercial Ship Routing

8.2.5.19 There will be an increased level of vessel activity within the proposed sites during the construction phase (including jack-ups / barges, mothership(s) and transfer vessels). Construction traffic could lead to an increase in vessel-to-vessel encounters in the area from the baseline conditions. However, given the low level of activity in the area, the increase in traffic will have a **minor**, direct negative impact on the risk of ship-to-ship collision that is considered unlikely to occur.

8.2.5.20 Based on the analysis of the shipping data, it is considered that commercial vessel activity in close proximity to the proposed sites is low, as vessels pass well to the north east of the Project areas (mean route position is approximately 4 nm north east of the Telford boundary). In addition, there will be 500 m safety / exclusion zones in place around construction work activities. Information regarding safety zones will be promulgated to users in the area through Notices to Mariners.

8.2.5.21 The main routes that will be affected during construction works are the north east to south west shipping route to / from Wick used by approximately one vessel every 10 days and a low trafficked route that passes through the western part of the Eastern Development Area (routing from Moray Firth to Northern Norway / Russia).

8.2.5.22 Offshore vessels headed to the Beatrice and Jacky Oil Fields are likely to increase passing distance from construction works in the southern part of the proposed sites, i.e. MacColl, with a minimum deviation of approximately 0.5 nm (from the current route).

8.2.5.23 As shipping levels outwith the main Pentland Firth route are low, there is available sea room for deviations around construction works, resulting in a minor direct increase in collision risk. Overall, given the available sea room and the low baseline traffic volumes on the closest routes, there will be a probable **minor** negative impact from constructing the wind farms.

Effect on Fishing Vessels

8.2.5.24 Fishing vessels could be affected during the construction phase of the proposed sites as 500 m exclusion / safety zones are expected to be implemented during turbine installation. From the maritime surveys, a number of fishing vessels (less than 30 m in length) were recorded within MacColl and Stevenson areas.

8.2.5.25 Local fishing vessels will be aware of construction works at the proposed sites through Notices to Mariners and fisheries liaison. As the fishing vessels recorded in the area are relatively small in size, it is likely that they will be able to navigate around construction activities when fishing or steaming between ports.

8.2.5.26 Given the available sea room around the Project areas and size of fishing vessels recorded in the baseline assessment, there will be a probable **minor**, direct negative impact from construction activities in a navigation and routing perspective.

8.2.5.27 A detailed assessment of commercial fishing activities can be found in Chapter 8.1 (Commercial Fisheries).

Effect on Recreational Vessels

8.2.5.28 During the baseline maritime surveys, approximately seven recreational vessels (non-AIS) were recorded passing through the area of the proposed sites, with the majority of tracks headed in a north by north west and south by south west direction (on average courses to / from Wick).

8.2.5.29 Recreational vessels should be able to pass between the construction works in suitable conditions (i.e. during good visibility and calm sea conditions), as well as being able to pass south west (inshore) and north east (offshore) of the wind farm developments. Based on the activity review, this is not expected to be a frequent event and hence there will be a probable **minor**, direct negative effect on recreational vessels during the construction phase.

Operation

8.2.5.30 A revised ship routing pattern following construction of the MacColl, Telford and Stevenson offshore wind farms, has been estimated based on the review of the baseline shipping data and information recorded during the hazard workshop. Four risk assessments were carried out as outlined below and detailed in Technical Appendix 5.2 D:

- Base Case without wind farm level of risk;
- Base Case with wind farm level of risk;
- Future Case without wind farm level of risk; and
- Future Case with wind farm level of risk.

8.2.5.31 The following scenarios were investigated in detail:

- Vessel-to-vessel collisions; and
- Vessel-to-wind farm structure collisions (powered and drifting).

8.2.5.32 The overall effects associated with the proposed sites in terms of shipping and navigation, SAR resources, SAR helicopter operations and radar effects are assessed for the operational phase of the Project.

Effect on Commercial Ship Routing

8.2.5.33 The main effect on shipping during the operational phase of the Project is the displacement of ships on the route passing through the MacColl and Telford wind farms on approach / departure from Wick.

8.2.5.34 In addition, offshore vessels heading to Beatrice and Jacky platforms will also increase passing distance to the south of the MacColl wind farm, as identified during the baseline assessment.

8.2.5.35 The current position of the two main routes recorded during the survey is presented in Figure 8.2-1, Volume 6 b.

8.2.5.36 One vessel every ten days was recorded on the Wick route, and ships are predicted to pass the proposed sites at a distance in the order of 1 to 11.5 nm during the operational phase of the Project. There is sufficient sea room to the north of Telford wind farm for vessels to make this alteration.

8.2.5.37 Emergency Response and Rescue Vessels (ERRVs) and supply vessels headed to the Beatrice and Jacky Oil Fields are likely to increase passing distance south of the operational MacColl wind farm, to approximately 1 nm from the current route.

8.2.5.38 A small number of vessels were recorded over longer term data collection and currently pass through the western part of the proposed sites (between the Moray Firth and northern Norway / Russia). The vessels on this infrequently used route are likely to pass west of the Beatrice Development Area, with only a small deviation required.

8.2.5.39 The current and predicted routing of ships around the proposed sites once operational is presented in Figure 8.2-2, Volume 6 b.

8.2.5.40 Overall, it is considered that commercial shipping will be able to pre-plan any revised passage in advance of encountering the area of the proposed sites and there will only be a minor increase to voyage distance and time. Given the low levels of shipping on the affected routes, and assuming industry standard mitigation will be in place; a probable **minor**, direct negative effect on commercial ship routing is predicted.

Effect on Commercial Shipping Collision Risk

8.2.5.41 The baseline vessel-to-vessel collision risk level, pre-wind farm development, is in the order of one major collision in 2,360 years and modelling the revised traffic pattern (with the three proposed wind farms), the collision risk was estimated to increase to one major collision in approximately 2,140 years.

8.2.5.42 The change in collision frequency due to the proposed sites was estimated to be relatively low, 8.2 x 10^{-6} per year (2 % increase), supporting a conclusion of a low effect on commercial shipping and collision risk (See Technical Appendix 5.2 D).

8.2.5.43 In terms of an errant vessel under power deviating from its route to the extent that it comes into proximity with structures within the proposed sites, it is not considered to be a probable event (worst case collision return period for Scenario two of one every 132,000 years). This is low compared to the historical average of 5.3 x 10^{-4} per installation-year for offshore installations on the United Kingdom Continental Shelf (UKCS) (One in 1,900 years).

8.2.5.44 The worst case drifting collision risk has been identified as one every 418,000 years (Scenario 2). Drifting collisions are assessed to be less frequent than powered collisions, which is reflective of historical data. There have been no reported 'passing' drifting ('Not under Command') ship collisions with offshore installations on the UKCS in over 6,000 operational years. Whilst a number of drifting ship incidents

are recorded each year in UK waters, most vessels have been recovered in time, (e.g. anchored, restarted engines or taken in tow.)

8.2.5.45 Comparing the three proposed wind farm layouts, Scenario two has the highest overall passing powered and drifting vessel collision frequency, as this indicative layout covers the largest sea area. Structures on the northern edge of the Telford site have the highest individual collision frequencies given the closer proximity to shipping on the Pentland Firth route (although the mean route is still 4 nm north east of Telford).

8.2.5.46 Overall, through the baseline data, consultation and risk models, a **minor**, direct negative effect is predicted on commercial shipping and collision risk given the low levels of traffic / baseline risk and the small change in collision risk during the operational phase of the wind farms. This effect is considered unlikely to occur.

Effect on Fishing Vessels

8.2.5.47 Based on the analysis of fishing data, a relatively high density of fishing activity was recorded within the Stevenson and MacColl wind farm areas. The worst case fishing vessel to wind farm structure collision risk has been identified as one every 16 years for Scenario 1. Based on comparisons with historical fishing vessel collision incidents, the estimated collision frequency is high and reflects the maximum target area (largest sea area used in Scenario 1). It also assumes the fishing vessel density following wind farm development will remain the same as current levels.

8.2.5.48 In terms of fishing vessel navigation, the effect on vessels steaming by the site to fishing grounds can be considered similar to other passing vessels (i.e. commercial vessels). However, it is noted that there is good prospect for fishing vessels to navigate within / between the turbines and proposed wind farm sites, due to the smaller size of vessels and the spacing between turbines. The decision to do this will lie with the skipper who will be responsible for assessing the risks associated with navigating in proximity to and through an offshore wind farm. This decision is likely to be based on the type and size of fishing vessel and sea, weather and visibility conditions at the time.

8.2.5.49 It was concluded through qualitative and quantitative assessment, that there will be a probable **minor**, direct negative effect on fishing vessels (assuming industry standard mitigation as presented in 8.2.6 below).

Effect on Recreational Vessels

8.2.5.50 The air clearance between turbine rotors and sea level conditions at Highest Astronomical Tide (HAT) will not be less than 22 m, as recommended by the MCA. This minimises the risk of interaction between rotor blades and yacht masts.

8.2.5.51 Two of the proposed sites are intersected by a 'medium use' cruising route between Wick and north eastern Scottish marinas. Vessels should be able to pass between turbines in suitable conditions (i.e. during good visibility and calm sea conditions), as well as being able to pass inshore and offshore of the wind farm areas.

8.2.5.52 RYA and Cruising Association (CA) consultation (See Tables 5.2-1 to 5.2-3 in Chapter 5.2: Shipping and Navigation) highlighted that sailing yachts can be pushed into the MORL Zone by the tide when sailing north (towards the Pentland Firth). However, it was noted that the development area was not busy in terms of recreational vessels as more popular routes are off the Caithness and Moray coastlines.

8.2.5.53 Based on the activity review, a small number of vessels intersected the proposed sites. However, dependant on sea and weather conditions, it is not expected to be a frequent event. Overall, a **minor**, direct negative effect (assuming industry standard mitigation) is predicted on recreational vessel routing (voyage distance and time).

Effect on Search and Rescue

8.2.5.54 The Moray Firth Round 3 Zone and the proposed wind farm sites within it lie within the Scotland and Northern Ireland Search and Rescue region with the nearest rescue coordination centre located at Marine Rescue Coordination Centre (MRCC) Aberdeen. It is noted under the revised MCA SAR proposals, 'Consultation on Revised Proposals for Modernising the Coastguard' (MCA, 2011), the Aberdeen centre will become a Marine Rescue Sub Centre (MRSC).

8.2.5.55 In the event of an emergency arising within or adjacent to the proposed sites, the first response will be from the developer / operator, (both emergency tug and initial evacuation / SAR activity). If the initial emergency response is unsuccessful, search and rescue would be carried out by Royal National Lifeboat All-weather Life Boats (ALBs) (from either Wick or Buckie and / or SAR helicopter from Lossiemouth (effect on SAR helicopter operations is discussed in paragraphs 8.2.5.58 to 8.2.5.62 below).

8.2.5.56 A review of historical incidents indicated that the accident levels in the vicinity of the proposed sites have tended to be low. Therefore, given the relatively low level of incidents in the area it is considered unlikely that the operational phase of the proposed sites will exacerbate maritime safety risks in the area or affect SAR operations / access.

8.2.5.57 Giving account to the design features associated with the proposed sites and the commitment to meet the MCA MGN 371 guidance and industry best-practice, including the development of an Emergency Response Co-operation Plan (ERCoP) (pre-construction); it is considered that SAR issues can be well managed. Therefore, it is anticipated that there will be a **minor**, direct negative effect on SAR which is unlikely to occur.

Effect on Helicopter Operations

8.2.5.58 There is the potential for the operational phase of the proposed sites to affect SAR helicopters, including SAR helicopter access.

8.2.5.59 The proposed wind farm sites will be designed to satisfy the following requirements for emergency response in the event of a SAR, operation in or around the wind farms (as per MGN 371 guidance - MCA, 2008):

- The turbine shall have high contrast markings (dots or stripes) placed at 10 m intervals on both sides of the blades to provide helicopter pilots with a hover-reference point; and
- All SAR helicopter bases will be supplied with an accurate chart of all the offshore wind farm structures and their GPS positions.

8.2.5.60 It is noted that there could be the possibility that SAR response may only be possible from surface units (lifeboats) due to restrictions on helicopter access in a wind farm. However, to aid helicopter SAR, there are specific requirements to allow safe helicopter operations within wind farms and close to, or over, wind turbine generators:

- If winching is to take place to / from a turbine (this evacuation method is considered a last resort due to safety risks), the blades will be feathered and the rotor brakes applied (where feasible blades should be pinned);
- The nacelle should be rotated so that the blades are at 90° off the wind with the wind blowing on to the left side of the nacelle e.g. if wind is blowing from 270°, the nacelle will need to be rotated to right so that the hub is facing 360°;
- In poor visibility or at night, any lighting on turbines may be required to be switched on or off - at the discretion of the helicopter pilot; and
- For safe operation of SAR helicopters within and around wind farms, it is crucial that the turbines are detectable to airborne radars (at a safe range) and that the aircraft crew, using radar, can discriminate between individual turbines.

8.2.5.61 It is also noted that there is the possibility for wind farm structure(s) and the onshore Moray Firth operations and maintenance base to have a helipad installed.

8.2.5.62 In terms of SAR helicopter operations / access, based on the MGN 371 guidance and industry best-practice, including the development of an ERCoP, any negative effect on SAR helicopter operations can be well managed, resulting in a **minor** direct effect from the proposed wind farms which is considered unlikely to occur.

Effect on Marine Radar Systems

8.2.5.63 Trials on the effects of offshore wind farms on marine radar systems have been carried out at North Hoyle (MCA and QinetiQ, 2004) and Kentish Flats (BWEA, 2007). The results of the North Hoyle and Kentish Flats trials indicate that the onset range from the wind turbine structures of false returns is about 1.5 nm, with a progressive increase in the impact of the effects on radar to about 500 m.

8.2.5.64 A number of sailing, fishing and other vessels bound for Wick pass inside the 1.5 nm range from turbines at which radar interference effects could be experienced, however, upon wind farm development, vessels heading to / from Wick are likely to pass at approximately 1.5 nm north of turbines, thereby subject to a small level of interference.

8.2.5.65 Radar interference could also be experienced by offshore vessels heading to the Beatrice and Jacky platforms as the 500 m turbine buffer from MacColl (indicative layouts in Scenario 1 to 3) intersects offshore vessels tracks. Consultation with the Oil & Gas operators noted that Wind Cat support vessels approach Beatrice and Jacky platforms from Buckie; therefore navigation from the south will not be significantly affected due to the wind farm developments.

8.2.5.66 A small number of vessels identified during the baseline assessment, including those on the Wick and offshore routes will be subject to a low level of radar interference; however, based on the revised routing patterns, radar interference is predicted to be minor.

8.2.5.67 In addition, AIS information can be used to verify the targets of larger vessels, generally ships above 300 tonnes and fishing vessels over 45 m in length, (by 2014, all fishing vessels 15 m in length or greater will be required to carry AIS – EU Directives 2009/17/EC and 2002/59/EC).

8.2.5.68 Vessels inbound and outbound from ports in the area (e.g. Wick, Moray Firth and Pentland Firth) are also likely to be attentive to navigational hazards in the area (i.e. the Beatrice / Jacky Oil Fields and Beatrice Demonstration Turbines). It is noted

that structures within the proposed sites could also be used to aid navigation in the area. In addition, NLB will advise on the aids to navigation for the sites (i.e. on turbines as well as associated offshore structures within and around the sites as well as advising on any additional buoyage requirements in the general area).

8.2.5.69 Overall it was concluded that there will be a **minor**, direct negative effect on vessels marine radar systems that is considered likely to occur.

Decommissioning

8.2.5.70 The effects associated with decommissioning the proposed sites are anticipated to be similar in nature and extent to those identified during the construction phase.

8.2.5.71 A decommissioning programme in line with standard requirements will be developed and this is likely to lead to a revision of the existing ERCoP and associated safety procedures.

8.2.5.72 With regards to effects on shipping and navigation this will also include consideration of the scenario where on decommissioning and on completion of removal operations, an obstruction is left on site (attributable to the wind farm structures) which is considered to be a danger to navigation and which it has not proved possible to remove.

8.2.5.73 Such an obstruction may require to be appropriately marked until such time as it is either removed or no longer considered a danger to shipping and navigation, the continuing cost of which would be met by the developer / operator.

8.2.6 Proposed Monitoring and Mitigation

8.2.6.1 Mitigation and safety measures will be applied to the proposed sites appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA).

8.2.6.2 The specific measures to be employed will be selected in consultation with the MCA Navigation Safety Branch and other relevant statutory stakeholders where required.

8.2.6.3 During the construction, operation and decommissioning phases of the developments, a number of industry standard mitigation measures will be in place and these are listed below:

- Marine Aids to Navigation (AtoNs) will be provided in in accordance with NLB requirements, which will comply with IALA standard O-139 on the Marking of Offshore Wind Farms (IALA, 2008);
- Marking of wind farm structures (and cabling) on appropriate scale admiralty charts by the United Kingdom Hydrographic Office (UKHO);
- Promulgation of information and appropriate liaison. This ensures information on the wind farm projects and special activities is circulated in Notices to Mariners, Navigation Information Broadcasts and other appropriate media to allow vessels to effectively and safely navigate around the proposed sites;
- The SAR ERCoP will be developed and put in place for the construction, operation and the decommissioning phases of the wind farm developments; and
- An Active Safety Management System (ASMS) will be developed to ensure the effective co-ordination of emergency response at the proposed sites. It will be designed to ensure that the risks related to marine operations (construction, operation / maintenance and decommissioning) specific to the Project are managed carefully and over the long term.

Construction

8.2.6.4 During the construction phase, Notices to Mariners, Radio Navigational Warnings, NAVTEX and / or broadcast warnings as well as Notices to Airmen will be promulgated in advance of any proposed works, where required.

8.2.6.5 Safety zones will be in place around each turbine and construction vessels during the construction phase in order to minimise disruption to mariners and other users of the sea. These 500 M exclusion zones would be applied for in line with DECC guidance (DECC, 2011.) Guard vessels may be used to monitor passing vessels and warn / record any safety zone infringements.

8.2.6.6 Safety Zones are likely to be established on a 'rolling' basis, covering only those areas of the wind farms in which such activities are actually taking place at a given time. Once that activity has been completed in that specific location, the safety zone will then 'roll on' to cover the next specific location within the site in which such activity is taking place.

Operation

8.2.6.7 During the operational phase of the Projects it is expected that a Marine Control / Coordination Centre will be developed to monitor and coordinate marine activities in and around the site. Such a centre will meet the requirements outlined in MGN 371:

- The Marine Control Centre, or mutually agreed single contact point, will be manned 24 hours a day;
- The Marine Control Centre operator, or mutually agreed single contact point, will have a chart indicating the GPS position and unique identification numbers of each of the wind farm structures.
- All MRCCs / MRSCs will be advised of the contact telephone number of the Marine Control Centre, or single contact point (and vice versa);
- All MRCCs / MRSCs will have a chart indicating the GPS position and unique identification number of each of the wind farm structures (turbines and offshore substations);
- All search and rescue helicopter bases will be supplied with an accurate chart of all the wind farm structures and their GPS positions; and
- The Civil Aviation Authority (CAA) shall be supplied with accurate GPS positions of all wind farm structures for civil aviation navigation charting purposes.

8.2.6.8 As well as monitoring and recording the movements of company vessels working in the proposed sites, the Marine Control Centre can monitor passing vessel observed to stray into the operational safety zones through AIS and CCTV.

8.2.6.9 During the operation of the proposed sites 50 m operational safety zones around the turbines may be applied for, unless experience during the construction phase presents evidence that such zones may not be required.

8.2.6.10 In addition, large maintenance vessels could be present at the proposed sites during the operational phase. The need for 500 m construction safety zones will be assessed based on experience during construction and the length of time and type of maintenance activities. Consented safety zones will also be marked on admiralty charts of the area.

Decommissioning

8.2.6.11 The mitigation measures associated with decommissioning the proposed sites are anticipated to be similar to those identified for the construction phase; however measures will also be dependent on the method of decommissioning (i.e. complete removal of structures or obstructions remaining).

8.2.6.12 A decommissioning programe in line with standard requirements will be developed and this is likely to lead to a revision of the existing ERCoP and associated safety procedures.

8.2.6.13 Promulgation of information and appropriate liaison will be carried out prior to decommissioning works and 500 m 'rolling' safety zones are expected to be in place around each turbine and major construction vessel.

8.2.7 Residual Effects – Primary Impact Assessment

8.2.7.1 The effects of the proposed sites have been minimised as industry standard risk control measures will be put in place during the development and operation of the offshore wind farms.

8.2.7.2 These mitigation measures (8.2.6 above) will further serve to reduce the impact of the developments and ensure the Project conforms to regular requirements and industry good practice. A description of residual effect, mitigation and post-mitigation effect is presented in Table 8.2-1 at the start of this chapter.

8.2.8 Secondary Assessment: Proposed Individual Wind Farm Sites

8.2.8.1 A secondary assessment has been carried out on the proposed individual wind farm sites, given the potential for different effects and significance to arise for shipping and navigation in respect of the individual sites.

8.2.8.2 The effects on shipping and navigation receptors are presented in the following paragraphs, with significance summarised in Table 8.2-5 below. It is noted that significance criteria is the same as that applied in the primary assessment, see 8.2.4 above.

Telford Wind Farm Site

Effect on Commercial, Fishing and Recreation Vessels

8.2.8.3 The Telford site is located in the northern section of the Eastern Development Area. The indicative worst case layout assessed the largest number of turbines (139), which cover the largest area of the site. Turbine spacing between rows (NNW / SSE) is approximately 0.5 nm (926 m). Given the proximity of the site to shipping on the Pentland Firth route (approximately 4 nm), Telford has the highest collision risk of the three sites. The highest turbine collision frequencies are on the outer edge of Telford, and the inner turbines are generally more shielded from ship-to-turbine collisions.

8.2.8.4 In terms of collision risk, given the available sea room south of the Telford site and the relatively low density of close passing vessels (i.e. under 3 nm), the change in ship-to-ship collision frequency is considered to be **minor**.

8.2.8.5 The maritime surveys recorded approximately one vessel every ten days on the Wick route, consisting of coastal tankers and a small number of fishing and recreation vessels. Commercial, fishing and recreation vessels using the low use route to Wick

will deviate north or south of the Telford site to pass the turbines at a safe distance (i.e. 1 to 1.5 nm from the nearest turbines). There is sufficient sea room to make this change and there will not be a significant increase in the vessel collision risk. Overall, the deviation on approach and departure from Wick is not considered to be significant in terms of routing distance and voyage time / fuel cost. Given the available sea room and minor deviation required for passing vessels, a negative, direct effect of **minor** significance is predicted for commercial vessels.

8.2.8.6 For fishing and recreation vessel routing and collision risk, the effect is considered to be **negligible**, given the available sea room in the area.

Effect on Search and Rescue

8.2.8.7 Historical accident levels in the vicinity of the Telford site have tended to be low. Therefore, the operational phase of site is unlikely to exacerbate maritime safety risks in the area or affect SAR operations / access. The overall effect on SAR is considered to be **minor**.

Effect on Helicopter Operations

8.2.8.8 The Telford site will be designed to satisfy the requirements for emergency response in the event of a SAR operation in or around the wind farms (as per MGN 371 guidance - MCA, 2008). In terms of SAR helicopter operations / access, based on MGN 371 and industry best-practice, (including the development of an ERCoP) any effect on SAR helicopter operations can be well managed, resulting in a **minor** effect.

Effect on Marine Radar Systems

8.2.8.9 A number of commercial, fishing and recreation vessels bound for Wick pass inside the 1.5 nm range from turbines at which radar interference effects could be experienced. However, upon development of Telford, vessels heading to / from Wick are likely to pass at approximately 1.5 nm north of turbines, thereby subject to a small level of interference. Given the low traffic volumes on the Wick route, the effect on marine radar systems is considered to be **minor**.

Stevenson Wind Farm Site

Effect on Commercial, Fishing and Recreation Vessels

8.2.8.10 The Stevenson site is located in the centre (west) of the Eastern Development Area. The worst case indicative layout assessed, consisted of the largest number of turbines (139), with approximately 0.5 nm (926 m) of spacing between rows (NNW / SSE). Turbines in the Stevenson site are generally located away from the main commercial shipping routes in the area; hence, the Stevenson site has the lowest collision frequency.

8.2.8.11 Given the low level of commercial shipping passing through the site and the available sea room in the area, the Stevenson site will not have a significant effect on commercial vessel collision risk and routing (**negligible**).

8.2.8.12 The maritime surveys recorded a number of fishing vessels in the south of the Stevenson site, and during construction / major maintenance phases, transiting vessels maybe required to deviate north or south of the area. There is available sea room in the area for fishing vessels to deviate and there is likely to be a negative, direct effect of **minor** significance.

8.2.8.13 In a similar way for fishing activity, recreation vessels maybe required to deviate around construction / major maintenance works when heading to / from Wick. Given the available sea room and temporary nature of the works, a negative effect of **minor** significance is predicted for recreation vessel collision risk, routing distance and voyage time.

Impact on Search and Rescue

8.2.8.14 Historical accident levels in the vicinity of the Stevenson site have tended to be low (low traffic volumes). Therefore, the operational phase is unlikely to exacerbate maritime safety risks in the area and the overall effect on SAR is considered to be **minor**.

Effect on Helicopter Operations

8.2.8.15 The Stevenson site will be designed to satisfy emergency response (as per MGN 371 guidance - MCA, 2008). In terms of SAR helicopter operations / access, based on MGN 371 and industry best-practice, (including the development of an ERCoP) any effects on SAR helicopter operations can be well managed, resulting in a **minor** effect.

Effect on Marine Radar Systems

8.2.8.16 Low traffic levels were recorded during the shipping surveys within the Stevenson site. Therefore, it was concluded that there will be a **negligible** effect on vessels marine radar systems.

MacColl Wind Farm Site

Effect on Commercial, Fishing and Recreation Vessels

8.2.8.17 The MacColl site is located in the southern section of the Eastern Development Area. The worst case indicative layout consists of the highest number of turbines (139), located in the south eastern area of the site and turbine spacing between rows (NNW / SSE) is approximately 0.5 nm (926 m).

8.2.8.18 Turbines in the southern area of the site, are located in closer proximity to offshore support traffic supporting the Beatrice and Jacky Fields, hence there is a higher collision frequency (relatively as the collision frequency for the entire site is low) for turbines on southern tip. Offshore vessels will deviate approximately 1 to 1.5 nm south of MacColl, where there is available sea room. Overall, the increase in collision risk and routing distance is considered not to be significant (**minor** significance).

8.2.8.19 In addition, one vessel every ten days was recorded on the Wick route which passes through the MacColl site. Commercial, fishing and recreation vessels using the low use route to Wick will deviate north or south of the MacColl site to pass the turbines at a safe distance (i.e. 1 to 1.5 nm from the nearest turbines). There is sufficient sea room to make this change and there will not be a significant increase in the vessel collision risk. Overall, the deviation on approach and departure from Wick is considered to be **minor** in terms of routing distance and voyage time impacts.

8.2.8.20 The maritime shipping survey recorded fishing vessel activity within the southern part of the MacColl site. Fishing vessel collision risk will increase for vessels operating within the MacColl site (dependant on construction, operational and decommissioning safety zones). The effect on these vessels (whilst fishing and during transit between fishing grounds and port) is considered to be **minor** given the available sea room in the area.

8.2.8.21 For recreation vessel routing and collision risk, the effect is considered to be **negligible**, as a low recreational vessel activity was recorded during the shipping surveys and the available sea room in the area for vessel deviations.

Effect on Search and Rescue

8.2.8.22 Historical accident levels in the vicinity of MacColl have tended to be low. The operational phase of the wind farm is unlikely to exacerbate maritime safety risks in the area and the effect on SAR is considered to be **minor**.

Effect on Helicopter Operations

8.2.8.23 The MacColl site will be designed to satisfy emergency response (as per MGN 371 guidance - MCA, 2008). In terms of SAR helicopter operations / access, based on MGN 371 and industry best-practice, including the development of an ERCoP, any effects on SAR helicopter operations can be well managed, resulting in a **minor** effect.

Effect on Marine Radar Systems

8.2.8.24 Radar interference could also be experienced by offshore vessels heading to the Beatrice and Jacky platforms as the 500 m turbine buffer from MacColl intersects offshore vessels tracks recorded during the surveys. It is considered that given the sea room to the south of the site, navigation will not be significantly affected, with a **negligible** effect on marine radar systems.

Secondary Assessment Summary of Effects

8.2.8.25 Table 8.2-5 below presents the summary of effects for the secondary assessment on the individual sites, relative to the shipping and navigation receptors.

Table 8.2-5 Secondary Assessment Summary of Effects

Effect	Telford	Stevenson	MacColl
Construction and Decommissioning			
Commercial Shipping	Minor	Negligible	Minor
Fishing Vessels Routing	Negligible	Minor	Minor
Recreation Vessels	Negligible	Minor	Negligible
Operation			
Commercial Shipping	Minor	Negligible	Minor
Fishing Vessels	Negligible	Minor	Minor
Recreation Vessels	Negligible	Minor	Negligible
SAR Operations	Minor	Minor	Minor
SAR Helicopter Operations	Minor	Minor	Minor
Radar Interference on Marine Equipment	Minor	Negligible	Negligible

8.2.9 Sensitivity Assessment

8.2.9.1 A sensitivity assessment has been carried out on different permutations of the proposed wind farms, as there is the potential for different cumulative effects to arise and uncertainty over the order at which the sites will be constructed. Significance for shipping and navigation receptors is based on the same criteria used in the primary and secondary assessments. The permutations of the sensitivity assessments are as follows:

- Telford plus Stevenson;
- Telford plus MacColl; and
- Stevenson plus MacColl.

8.2.9.2 As noted in the secondary assessment, given the low historical accident levels in the vicinity of the sites (and wind farm permutations in the sensitivity assessment), the operational phase is unlikely to exacerbate maritime safety risks in the area or affect SAR operations and helicopters. Therefore, the effect on SAR and helicopter operations / access is considered to be **minor** for each wind farm combination, i.e. the same effect as for the primary / base case assessment.

Telford plus Stevenson Sites

Effect on Commercial, Fishing and Recreation Vessels

8.2.9.3 The Telford site is located approximately 4 nm from the Pentland Firth shipping route and therefore has relatively higher collision frequency than Stevenson. Turbines within the Stevenson site are located in an area of low shipping density and cumulatively the Telford turbines will present a small level of shielding from both powered and drifting ship-to-turbine collisions. Overall, the increase in collision risk for shipping from both sites is considered to be of **minor significance** as the sites are outwith the main shipping lanes.

8.2.9.4 Commercial, fishing and recreation vessels using the low use route to Wick will deviate north or south of the Telford and Stevenson sites, passing the turbines at a safe distance (i.e. 1 to 1.5 nm). Overall, a **minor** effect on vessel routing and voyage time is predicted for both commercial and non-commercial vessels.

Effect on Marine Radar Systems

8.2.9.5 A number of commercial, fishing and recreation vessels bound for Wick could be exposed to a small level of radar interference as ships deviate around the two sites. There are low traffic volumes on the Wick route and available sea room to the north (out-with the Pentland Firth route); therefore the effect on marine radar systems is predicted to be **minor**.

Telford plus MacColl Sites

Effect on Commercial, Fishing and Recreation Vessels

8.2.9.6 The northern boundary of the Telford site is located approximately 4 nm from the Pentland Firth shipping route and has a relatively higher collision frequency than MacColl. A small number of turbines within the north eastern edge of the MacColl site are relatively more exposed to both a powered and drifting ship-to-turbine collision. However, the increase in shipping collision risk from both sites is considered to be of **minor significance** as the sites are out-with the main shipping lanes.

8.2.9.7 Commercial, fishing and recreation vessels using the low use route to Wick will deviate north or south of the Telford and MacColl sites, passing the turbines at a safe distance (i.e. 1 to 1.5 nm). Overall, a **minor** effect on vessel routing and voyage time is predicted on commercial and non-commercial vessels.

Effect on Marine Radar Systems

8.2.9.8 Commercial, fishing and recreation vessels associated with the Wick route could be exposed to a small level of radar interference as ships deviate around the two sites. Given the low traffic volume on the Wick route and available sea room to the north (outwith the Pentland Firth route), the effect on marine radar systems is predicted to be **minor**.

Stevenson plus MacColl Sites

Effect on Commercial, Fishing and Recreation Vessels

8.2.9.9 A number of turbines within the north eastern edge of the MacColl site are relatively more exposed to both powered and drifting ship-to-turbine collision as turbines are located approximately 4 nm from the Pentland Firth shipping route. Therefore, turbines in MacColl have a relatively higher collision frequency than Stevenson. However, the increase in shipping collision risk from both sites is considered to be of **minor significance** as the sites are out-with the main shipping lanes (i.e. Pentland Firth route).

8.2.9.10 Commercial, fishing and recreation vessels using the low use route to Wick will deviate north of the MacColl site, passing the turbines at a safe distance (i.e. 1 to 1.5 nm). Overall, a **minor** effect on vessel routing and voyage time is predicted on commercial and non-commercial vessels.

Effect on Marine Radar Systems

8.2.9.11 Vessels associated with the Wick route and offshore vessels supporting the Beatrice and Jacky Fields could be exposed to a small level of radar interference as ships deviate around the two sites. However, given the available sea room to the north and south of the sites; the effect on marine radar systems is predicted to be **minor**.

Sensitivity Assessment Summary of Effects

8.2.9.12 Table 8.2-6 below presents the summary of effects for the sensitivity assessment on the different permutations of sites relative to the shipping and navigation.

Table 8.2-6 Sensitivity Assessment Summary

Effect	Telford + Stevenson	Telford + MacColl	Stevenson + Telford
Construction and Decommissioning			
Commercial Shipping	Minor	Minor	Minor
Fishing Vessels	Minor	Minor	Minor
Recreation Vessels	Minor	Minor	Minor
Operation			
Commercial Shipping	Minor	Minor	Minor

Effect	Telford + Stevenson	Telford + MacColl	Stevenson + Telford
Fishing Vessels	Minor	Minor	Minor
Recreation Vessels	Minor	Minor	Minor
SAR Operations	Minor	Minor	Minor
SAR Helicopter Operations	Minor	Minor	Minor
Radar Interference on Marine Equipment	Minor	Minor	Minor

8.2.10 Proposed Monitoring and Mitigation: Secondary / Sensitivity Assessment

8.2.10.1 The industry standard and best practice mitigation measures are the same as those proposed for the primary assessment in 8.2.6 above.

8.2.11 Residual Effects: Secondary / Sensitivity Assessment

8.2.11.1 The effect of the individual and combined sites has been minimised as industry standard risk control measures will be put in place during the development and operation of the proposed offshore wind farms.

8.2.11.2 These mitigation measures (8.2.6 above) will serve to reduce the effect of the sites and ensure the Project conforms to industry good practice. A description of residual effect, mitigation and post-mitigation effect is presented in Table 8.2-7 below.

8.2.11.3 It is noted that given the size of the individual sites considered within the combined sensitivity assessment, the overall significance for shipping and navigation will be comparable to the primary assessment of residual effects.

Table 8.2-7 Residual Effects Summary

Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction			
Commercial Shipping	Minor	Industry standard (including ERCoP and information promulgation on construction works). Other mitigations include safety zones.	Minor
Fishing Vessels	Minor	Industry standard (including ERCoP and information promulgation / fisheries liaison on construction works). Other mitigations include safety zones and guard vessels.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP and information promulgation on construction works). Other mitigations include safety zones and guard vessels.	Minor
Operation			
Commercial Shipping	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139).	Minor

Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
		Other mitigations include consideration of operational safety zones and Marine Control Centre.	
Fishing Vessels	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include consideration of operational safety zones and Marine Control Centre.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP, marking wind farm structures on charts, lighting / buoyage in accordance with NLB and IALA O-139 and turbine lade / mast air draft [22 m]). Other mitigations include consideration of operational safety zones and Marine Control Centre.	Minor
SAR Operations	Minor	Industry standard (including ERCoP, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include a Marine Control Centre.	Minor
SAR Helicopter Operations	Minor	Industry standard (including ERCoP / emergency rotor shut-down, marking wind farm structures on charts and lighting / buoyage in accordance with NLB and IALA O-139). Other mitigations include a Marine Control Centre.	Minor
Radar Interference on Marine Equipment	Minor	None	Minor
Decommissioning			
Commercial Shipping	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation on construction works). Other mitigations include safety zones.	Minor
Fishing Vessels	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation / fisheries liaison on decommissioning works). Other mitigations include safety zones and guard vessels.	Minor
Recreation Vessels	Minor	Industry standard (including ERCoP, a decommissioning programme and information promulgation on construction works). Other mitigations include safety zones and guard vessels.	Minor

8.2.12 References

BWEA, 2007. Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm.

DECC, 2005. Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind farms, Version Date: 7th September 2005.

DECC, 2007. Guidance Notes: Applying for Safety Zones around Offshore Renewable Energy Installations.

IALA, 2008. O-139 - The Marking of Man-Made Offshore Structures, Edition 1.

IMO 2007. Consolidated text of the Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process. (MSC / Circ.1023−MEPC / Circ.392) (14th May 2007).

MCA, 2005. Offshore Wind Farm Helicopter Search and Rescue Trials undertaken at the North Hoyle Wind Farm.

MCA 2008. Marine Guidance Note 371 (M+F), Offshore Renewable Energy Installations (OREI): Guidance on Navigational Practice, Safety Issues and Emergency Response Issues.

QinetiQ and MCA, 2004. Results of the EM Investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle Wind Farm.

The Royal Yachting Association, 2008. UK Coastal Atlas of Recreational Boating; Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast. Updated GIS Layers 2010.

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8.3 Military and Civil Aviation

8.3.1.1 A desk-top study has been undertaken using comprehensive aviation documentation and charts to complete the impact assessment on the effects of the three proposed wind farm sites (Telford, Stevenson and MacColl) during the construction, operation and decommissioning phases of the development. Information supporting the assessment is drawn from a review of data contained within the UK Integrated Aeronautical Information Publication (UK IAIP) and the Military Aeronautical Information Publication (Mil AIP) and consultation with helicopter operators and NATS En Route Plc.

8.3.1.2 Radar performance and propagation modelling has been undertaken to determine the likely detection of proposed turbines from the region's civil and military radar infrastructure, the results of which can be found in Technical Appendix 5.3 C.

8.3.1.3 This chapter presents an assessment of the likely significant effects of the construction, operation and decommissioning of the three proposed wind farm sites on aviation and radar stakeholders.

8.3.1.4 Information supporting this assessment has been collected from a data review and consultation with relevant stakeholders, as explained in Chapter 5.3 (Military and Civil Aviation), and from information contained within the following appendices:

- Technical Appendix 5.3 A (Moray Firth Offshore Wind Farm: Initial Aviation Assessment Report; November 2010, Spaven Consulting Report No. 10/283/MOR/4);
- Technical Appendix 5.3 B (Beatrice and Moray Offshore Wind Farms Helicopter Impact Assessment: Document Reference; Spaven Consulting Report No. P1492D003); and
- Technical Appendix 5.3 C (Osprey Radar Propagation Modelling Results: Document Reference 7420 005).

Summary of Effects and Mitigation

8.3.1.5 The following receptors were identified:

- NERL - Allanshill Primary Surveillance Radar (PSR) supporting Civil Air Traffic Control (ATC) and En-route operations;
- MoD Air Surveillance and Control Systems (ASACS) – Buchan Air Defence Radar (ADR) supporting UK Air Defence operations and training;
- MoD ATC – Lossiemouth PSR used to provide navigational services to aircraft inbound to and outbound from the airfield, to military aircraft operating over the Moray Firth;
- Highlands and Islands Airports Ltd (HIAL) Wick Airport regarding potential effects on aircraft flight patterns and procedures;
- Helicopter Main Routes – HMR X-Ray used by helicopters transiting between Aberdeen, via Wick to the Atlantic Rim offshore installations west of the Shetland Islands;
- Helicopter Approach Procedures to offshore platforms; and
- Minimum Safe Altitude, which is the lowest altitude set in areas to ensure separation between aircraft and known obstacles.

The summary of the effects is shown at Table 8.3-1 below.

Table 8.3-1 Summary of Pre-Mitigation and Residual Effects

Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction			
NERL Allanshill PSR	Not Significant	N / A	Not Significant
ASACS Buchan ADR	Not Significant	N / A	Not Significant
RAF Lossiemouth PSR	Not Significant	N / A	Not Significant
Wick Airport	Not Significant	N / A	Not Significant
HMR X-Ray	Not Significant	Notification of physical obstructions to NATS Aeronautical Information Service (AIS) for addition in to appropriate aviation related documentation and on to aviation mapping. i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure.	Not Significant
Offshore Installations	Significant Construction infrastructure may present a physical obstruction hazard to aircraft operating in the area of the three developments.	Notification of physical obstructions to NATS AIS for addition in to appropriate aviation related documentation and on to aviation mapping. i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure.	Not Significant
Minimum Safe Altitude	Significant Construction infrastructure may present a physical obstruction hazard to aircraft operating in the area of the three developments.	Notification of physical obstructions to NATS Aeronautical Information Service (AIS) for addition in to appropriate aviation related documentation and on to aviation mapping, i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure.	Not Significant

Operation			
NERL Allanshill PSR	Significant PSR systems can be affected by the presence of wind turbines. These turbines can degrade the efficiency of the air traffic control radar service being provided in the region of the three proposed wind farm sites.	The results of radar propagation modelling has identified that the three developments are theoretically detectable by this radar and will have an operational effect on this stakeholder. Mitigation will remove the turbine radar returns from the Air Traffic Control display. Implementation and integration of technical mitigation solution will be agreed prior to construction.	Not Significant
ASACS Buchan ADR	Significant Turbines in coverage of the Buchan PSR could shield the radar from genuine aircraft targets and / or hide genuine aircraft targets from the ASACS controller. Any of these effects would affect the controller's ability to provide a safe service to aircraft and use the radar data to monitor the UK air picture.	The results of radar propagation modelling has identified that the three developments are theoretically detectable by this radar and will have an operational effect on this stakeholder. Mitigation if required will most likely be in the form of modifications or upgrade to the T92 Air Defence Radar. Implementation and integration of technical mitigation solution will be agreed prior to construction.	Not Significant
RAF Lossiemouth PSR	Significant PSR systems can be affected by the presence of wind turbines. These turbines can degrade the efficiency of the air traffic control radar service being provided in the region of the three proposed wind farm sites.	The results of radar propagation modelling has identified that the three developments are theoretically detectable by this radar and will have an operational effect on this stakeholder. Mitigation will remove the turbine radar returns from the Air Traffic Control display. Implementation and integration of technical mitigation solution will be agreed prior to construction.	Not Significant
Wick Airport	Not Significant	N / A	Not Significant
HMR X-Ray	Not Significant While there may be an effect due to the inability to use HMR X-Ray in icing conditions due to the presence of turbines, an overland HMR is already used and would be available.	Notification of physical obstructions to NATS Aeronautical Information Service (AIS) for addition in to appropriate aviation related documentation and on to aviation mapping, i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure.	Not Significant

Offshore Installations	Significant Analysis in Appendix 5.3 B (worst case scenario – Wick meteorological data) indicates that, with no mitigations applied, the net effect of the three proposed developments would be to prevent approximately eight flights per annum to the Beatrice field, over and above the six flights prevented by existing constraints. (Total flights per annum - approximately 260 flights). There may be an additional effect on the integrity of offshore platform safety cases where emergency scenarios are based on the use of helicopters to facilitate evacuation procedures.	Update helicopter operators of commissioned turbines and update Airborne Radar Approach (ARA) procedures according to those turbines which are operational.	Not Significant
Minimum Safe Altitude	Significant Construction infrastructure may present a physical obstruction hazard to aircraft operating in the area of the three developments.	Notification of physical obstructions to NATS AIS for addition in to appropriate aviation related documentation and on to aviation mapping. i.e. location of constructed turbines.	Not Significant
Decommissioning			
NERL Allanshill PSR	Not Significant	Mitigation remains in operation whilst any turbines remain operational.	Not Significant
ASACS Buchan ADR	Not Significant	Mitigation remains in operation whilst any turbines remain operational.	Not Significant
RAF Lossiemouth PSR	Not Significant	Mitigation remains in operation whilst any turbines remain operational.	Not Significant
Wick Airport	Not Significant	N / A	Not Significant
HMR X-Ray	Not Significant	Notification of physical obstructions to helicopter operators. i.e. location / movement and maximum height of decommissioning infrastructure.	Not Significant
Offshore Installations	Significant Decommissioning infrastructure may present a physical obstruction hazard.	Update helicopter operators of decommissioned turbines. Review of existing mitigation measures.	Not Significant
Minimum Safe Altitude	Significant Decommissioning infrastructure may present a physical obstruction hazard.	Notification of physical obstructions to helicopter operators. i.e. location / movement and maximum height of cranes.	Not Significant

8.3.2 Introduction

8.3.2.1 The potential effects of wind turbines on aviation interests have been widely publicised. There are two dominant scenarios that lead to objection from aviation stakeholders:

- Physical obstruction: turbines can present a physical obstruction at or close to an aerodrome or other landing / take-off point; and
- Radar / air traffic services: turbine clutter appearing on radar display can affect the safe provision of air traffic services as it can mask unidentified aircraft from the air traffic controller and / or prevent him from accurately identifying aircraft under his control. In some cases, radar reflections from the turbines can affect the performance of the radar system itself.

8.3.3 Rochdale Envelope Parameters Considered in the Assessment

8.3.3.1 For the assessments of likely significant effects in this chapter, it is presumed that the entirety of the area of each proposed wind farm site will be populated with wind turbines at the maximum tip height of 204 m above Lowest Astronomical Tide (LAT). A larger area of detectable turbines irrespective of their size will create a larger area of clutter / radar degradation leading to a greater effect on the provision of navigation services.

8.3.4 EIA Methodology

8.3.4.1 A list of potential aviation stakeholders were identified in accordance with Civil Aviation Authority CAA publication CAP 764 and considers the en-route and other radar systems and aerodromes within operational range of the proposed three proposed wind farm sites. The identification stage also considered military areas of operation including, tactical training and danger areas. For each identified stakeholder, the physical obstruction and radar effect, and then subsequently the operational effect of any identified obstruction effect and the effect of turbines being detectable by each identified radar system, were considered. The operational effect pays heed to, but is not limited to, consideration of: the orientation of approach and departure flight paths, physical safeguarding of flight, types of aircraft flying into the aerodrome, airspace characteristics and flight procedures (as published in the UK Integrated Aeronautical Information Package (IAIP) and Military Aeronautical Information Package (Mil AIP).

8.3.4.2 Effects have been informed by the results of a desktop assessment and consultation with reference to the existing evidence base regarding effects of offshore wind farm development.

8.3.4.3 The magnitude criteria of the likely effects on aviation and radar receptors is assessed using the following method and terminology:

- Negligible - No effect on this receptor;
- Low – Receptor able to continue operations with standard mitigation in place;
- Medium - Receptor able to continue safe operations but with some restrictions or non-standard mitigation measures in place; and
- High - Receptor unable to continue safe operations or safe provision of air navigation services (radar) in the presence of the wind turbines. Technical and / or operational mitigation of the effect is required.

8.3.4.4 For an aviation assessment, each of the following receptors has a high sensitivity to any effects, given their safety critical function:

- NERL Allanshill PSR;
- ASACS Buchan ADR;
- RAF Lossiemouth PSR;
- HIAL Wick Airport;
- HMR X-Ray;
- Offshore Installations; and
- Minimum Safe Altitude.

8.3.4.5 Given their safety critical function, any predicted effect upon aviation stakeholders which results in restricted activities or has the potential to affect aviation or navigation abilities is regarded as unacceptable and therefore significant. The following approach identified in Table 8.3-2 below is used and summarises the assessment of significance.

Table 8.3-2 Significance Assessment Matrix

		Sensitivity of Receptor		
		Low	**Moderate**	**High**
Magnitude of Effect	**Negligible**	Not significant	Not significant	Not significant
	Low	Significant	Significant	Significant
	Medium	Significant	Significant	Significant
	High	Significant	Significant	Significant

8.3.5 Primary Impact Assessment: Three Proposed Wind Farm Sites

8.3.5.1 The development of turbines within the three proposed wind farm areas has the potential to affect a number of aviation stakeholders:

- Potential concerns may be raised with regard to the effect of wind farms within the three development areas upon NERL radar and operations and other users of radar data supplied by NERL. The three proposed wind farms shall be assessed for potential effect on identified NERL radars;
- The MoD has raised potential concerns about the effect of the three proposed wind farms upon the radar and operations provided by the MoDs ASACS Force in support of the defence of the UK. The three proposed wind farms shall be assessed for potential effect on identified ASACS Air Defence radars;
- The MoD has raised potential concerns about the effect of the three proposed wind farms upon the radar and operations provided by the MoDs ATC service providers. The three proposed wind farms shall be assessed for potential effect on identified ATC radars;
- The three proposed wind farms could present a physical obstruction to traffic following instrument approach procedures to HIAL Wick Airport;

- Potential concerns have been raised by Offshore Helicopter Stakeholders regarding the effects of turbines within the three proposed wind farms upon the operations in support of the Oil and Gas Industries in the region; and
- The potential exists that the three proposed wind farms will present a physical obstruction to aviation operations in the area with regard to the minimum safe altitude which is set in areas to ensure separation between aircraft and known obstacles.

NERL Allanshill PSR

Construction

8.3.5.2 The infrastructure required in the turbine construction processes will have **no significant effect** on the NATS Allanshill PSR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar.

Operation

Radar and Operational Impact

8.3.5.3 NERL uses the Allanshill PSR to support their provision of navigational services (both a Traffic Service and a Deconfliction Service) to aircraft operating between the UK and mainland Europe and to those overflying the UK Flight Information Region (FIR). In facilitating this task, a number of established airways (UN583 and UL619) cross the three proposed wind farm sites.

8.3.5.4 Surveillance data from Allanshill is also used by other air traffic service providers such as the MoD and Aberdeen Airport. Military ATC Units are based in NERL Control Centres to facilitate the control of aircraft that require ATC services outside the civil airspace structure. Aberdeen Airport is responsible for the provision of navigational services to aircraft operating on Advisory Route W4D. NERL have a contracted responsibility to provide appropriate PSR coverage to support this task.

8.3.5.5 At a minimum distance of 60 km (32 nm), the three proposed wind farms are within the operational range of the Allanshill PSR.

8.3.5.6 The air traffic controller is responsible for maintaining typically 5 nm lateral separation between aircraft. Where line of sight to a PSR exists, turbines may appear as genuine aircraft targets and could mask genuine aircraft responses. The radar may also be de-sensitised by its clutter processing within the sector containing turbines meaning that real aircraft targets may disappear from radar. At an anticipated maximum height of 204 m to blade tip, the three proposed wind farms are anticipated to cause clutter to be presented on radar displays.

8.3.5.7 The magnitude of the effect is therefore high. The sensitivity of the receptor is high. This effect has therefore been assessed as **significant**. Radar propagation modelling has been undertaken (Technical Appendix 5.3 C,) and the interaction of radar with wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Decommissioning

8.3.5.8 Turbine decommissioning processes will have **no significant effect** on the NERL Allanshill PSR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar.

MoD ASACS Buchan ADR

Construction

8.3.5.9 The infrastructure required in the turbine construction processes will have **no significant effect** on the ASACS Buchan ADR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar.

Operation

Radar and Operational Impact

8.3.5.10 The MoD through their ASACS Force is responsible for compiling a Recognized Air Picture to monitor the airspace in and around the UK in order to launch a response to a potential airborne threat. This is achieved through the utilisation of a network of long-range radars, some of which are located along the east coast of the UK.

8.3.5.11 ASACS radar resources are used in support of training exercises on an almost daily basis. Temporary Reserved Area (TRA) 008B is established above the three development sites from FL 195 up to FL 245. D712D within the northern Managed Danger Area (MDA) complex is established from FL 245 up to FL 660. Distinct areas within the northern MDA are activated when required. Promulgated activities within these areas include Air Combat and training exercises and supersonic flight. ASACS Units using radar data supplied from the Buchan Air Defence radar are responsible for navigation services and support to aircraft activity within the TRA 008B and D712D when active.

8.3.5.12 At a minimum distance of 87 km (46 nm), the three proposed wind farm sites are within the operational range of ASACS ADR located at Buchan. At a maximum height of 204 m to blade tip, turbines within the Telford Wind Farm are likely to be intermittently detectable by the Buchan PSR. Turbines within the north east of the MacColl Wind Farm are also likely to be intermittently detectable. Additionally, radar modelling (Technical Appendix 5.3 C) predicts that turbines along the eastern border of the Stevenson Wind Farm may also be intermittently detectable by the Buchan ADR.

8.3.5.13 Turbines in coverage areas of Buchan ADR could shield the radar from genuine aircraft targets and / or hide genuine aircraft targets from the ASACS controller. These direct and permanent effects would affect the controller's ability to provide a safe service to aircraft in support of training exercises and use the radar data to monitor the UK air picture for Air Defence purposes.

8.3.5.14 The magnitude of the effect is therefore high. The sensitivity of the receptor is high. This effect has been assessed as **significant**. Radar propagation modelling has been undertaken (Technical Appendix 5.3 C) and the interaction of radar with wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Decommissioning

8.3.5.15 Turbine decommissioning processes will have **no significant effect** on the Buchan ADR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar. Radar propagation modelling has been undertaken (Technical Appendix 5.3 C) and the interaction of radar with wind turbines is well understood, therefore there is a low uncertainty in this assessment.

MoD RAF Lossiemouth PSR

Construction

8.3.5.16 The infrastructure required in the turbine construction processes will have **no significant effect** on the RAF Lossiemouth PSR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar.

Operation

Radar and Operational Impact

8.3.5.17 RAF Lossiemouth not only provides navigational services to aircraft approaching and departing the airfield, they are responsible for the provision of such services to aircraft in the Moray Firth region. This includes aircraft operating on HMR X-Ray and some aircraft operating on the lower levels of Advisory Route W4D.

8.3.5.18 At a minimum distance of 33.5 km (18 nm), the three proposed wind farm sites are within the operational range of Lossiemouth PSR. At a maximum height of 204 m to blade tip, the three proposed wind farm sites will theoretically be detectable by the Lossiemouth PSR. This direct, permanent effect will hamper the operators' ability to distinguish actual aircraft returns from those created by the wind farms and degrade the safety and efficiency of the services being provided.

8.3.5.19 The magnitude of the effect is therefore high. The sensitivity of the receptor is high. This effect has been assessed as **significant**. Radar propagation modelling has been undertaken (Technical Appendix 5.3 C) and the interaction of radar with wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Decommissioning

8.3.5.20 Turbine decommissioning processes will have **no significant effect** on the Lossiemouth PSR system. The static nature of the infrastructure is such that it will not be processed and presented onto control displays by the radar. Radar propagation modelling has been undertaken (Technical Appendix 5.3 C) and the interaction of radar with wind turbines is well understood, therefore there is a low uncertainty in this assessment.

HIAL Wick Airport

Construction

8.3.5.21 The northern boundary of the Telford Wind Farm is located 25.8 km (13.9 nm) south east of Wick Airport. Instrument Flight Rules traffic inbound to Wick from the south east mainly route via Advisory Route W4D. In the area within a 25 nm radius of Wick

Airport, the Minimum Sector Altitude (the lowest altitude to which aircraft can safely descend while maintaining 1,000 ft vertical separation from all terrain and obstacles within the 25 nm radius) is 1,800 ft above mean sea level. Further descent below 1,800 ft is not authorised until the aircraft is established on the final approach track, which is more than 5 nm from the northern boundary of the Telford wind farm development area.

8.3.5.22 During lift operations, crane tips could temporarily exceed turbine tip heights. However, the current MSA of 1,800 ft will continue to provide well in excess of the required minimum 1,000 ft vertical separation over the turbines and construction infrastructure. Consequently, the construction infrastructure will have no effect on Wick Airport instrument flight procedures.

8.3.5.23 The magnitude of effect is categorised as negligible. The sensitivity of this receptor to this effect is considered high and therefore the effect is assessed as **not significant**.

8.3.5.24 The approach procedures and MSA are well understood, therefore there is a low uncertainty in this assessment.

Operation

8.3.5.25 The maximum tip height of any turbines will be 204 m (670 ft). The current MSA of 1,800 ft will therefore continue to provide well in excess of the required minimum 1,000 ft vertical separation over the turbines. Consequently, the three proposed wind farm sites will have no effect on Wick Airport instrument flight procedures.

8.3.5.26 The magnitude of effect is categorised as negligible. The sensitivity of this receptor to this effect is considered high and therefore the effect is assessed as **not significant.**

Decommissioning

8.3.5.27 During lift operations, crane tips could temporarily exceed turbine tip heights. However, the current MSA of 1,800 ft will continue to provide well in excess of the required minimum 1,000 ft vertical separation over the turbines and construction infrastructure. Consequently, the decommissioning infrastructure will have no effect on Wick Airport instrument flight procedures.

8.3.5.28 The magnitude of effect is categorised as negligible. The sensitivity of this receptor to this effect is considered high and therefore the effect is assessed as **not significant**.

HMR X-Ray

8.3.5.29 Consultation with helicopter operators in the Moray Firth confirmed that aircraft routinely operate along HMR X-Ray between 2,000 ft (610 m) and 3,000 ft (914 m), depending on prevailing meteorological conditions. This altitude band is sufficient to prevent any helicopters operating on the HMR from coming into direct physical conflict with wind turbines within the wind farm sites under normal operating conditions.

8.3.5.30 The construction of turbines within 2 nm either side of the route of HMR X-Ray will have the potential to restrict operations below the routine operational altitudes when icing conditions exist. The ability of a helicopter to operate at the expected altitudes would be dependent upon the 0° isotherm (icing level); the presence of turbines within the MacColl development may preclude the aircraft from operating on days of low cloud base if the 0° isotherm was at 3,000 ft or below.

Construction

8.3.5.31 Turbine construction infrastructure will present a physical obstruction for helicopters operating on the section of HMR X-Ray between Aberdeen and Wick Airports. The magnitude of effect is categorised as negligible due to the sufficient separation distances involved and the existence of a current overland route which is already used in icing conditions. The sensitivity of this receptor is high. The above effect is assessed as **not significant**. Helicopter operations in the area are well documented and the interaction between helicopters operations and wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Operation

Physical Obstruction Impact

8.3.5.32 The magnitude of effect is categorised as negligible due to the sufficient separation distances involved and the existence of a current overland route which is already used in icing conditions. The sensitivity of this receptor is high. The above effect is assessed as **not significant**. Helicopter operations in the area are well documented and the interaction between helicopters operations and wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Decommissioning

8.3.5.33 Turbine decommissioning infrastructure will present a physical obstruction for helicopters operating on the section of HMR X-Ray between Aberdeen and Wick Airports. The magnitude of effect is categorised as medium. The sensitivity of this receptor is high. The above effect is therefore assessed as **significant.** Helicopter operations in the area are well documented and the interaction between helicopters operations and wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

Offshore Installations

Construction

Physical Obstruction

8.3.5.34 Turbine construction infrastructure could be considered as physical obstructions and infringe the minimum obstacle clearance criteria of 1,000 ft on helicopter approaches to the offshore oil platforms. The minimum obstacle clearance dictates the height at which helicopters can transit in the region of the three wind farms and the height that instrument approaches to offshore platforms commence. The magnitude of effect is therefore considered high. The sensitivity of this receptor is high. The above effect is assessed to be **significant.**

Operation

Physical Obstruction

8.3.5.35 Turbines could be considered as physical obstructions and infringe the minimum obstacle clearance criteria of 1,000 ft on helicopter approaches to the offshore oil platforms. The minimum obstacle clearance dictates the height at which helicopters can transit in the region of the three developments and the height that instrument approaches to offshore platforms commence.

Airborne Radar Impact

8.3.5.36 Wind turbine development within 9 nm (16.7 km) of offshore oil and gas installations has the potential to affect Instrument Flight Procedures to such installations in poor weather conditions. Many helicopters operating in the Moray Firth region are fitted with airborne weather radar. This weather radar can be used to conduct an instrument approach to offshore platforms in poor visibility. The radar is designed to display weather phenomena, such as rain, as well as obstacles such as the oil or gas platform and wind turbines. There is potential for the volume of targets generated by wind turbines, platforms and weather, to hamper a flight crew's ability to correctly distinguish the location of the required destination platform. Furthermore during the approach to an installation, all radar contacts (including radar contacts that are turbines) have to be avoided laterally by at least 1 nm.

8.3.5.37 There are helidecks established on Beatrice platforms A, B and C (all 6 nm or more from the three proposed wind farm sites). Whilst there is no permanently established helideck on the Jacky platform (3.7 nm from the three proposed wind farm sites), there is a capability to establish one if required.

8.3.5.38 The current operators and owners of the Beatrice (and Jacky) platforms have provided the following indicative flight schedules to each of the platforms (Technical Appendix 5.3 B):

- Beatrice Alpha – three flights per week throughout the year, totalling 156 flights per annum;
- Beatrice Bravo – three visits by an engineering team every month with flights to drop-off and collect the team – six flights per month or 72 per annum;
- Beatrice Charlie – two visits by an engineering team every three months with flights to drop off and collect the team – 16 flights per annum; and
- Jacky – when a jack-up is present (expected for six to eight weeks per annum) there will be two flights per week – maximum 16 flights per annum.

8.3.5.39 There are two existing wind turbines within the Beatrice field which are located to the south east of the Beatrice A platform. These two turbines already constrain instrument approaches into the Beatrice A platform where restrictions exist between the 130° and 190° radials out to 3 nm (5.6 km) from the platform.

8.3.5.40 The Telford Wind Farm is in excess of 9 nm from the nearest of the platforms (Jacky) and consequently outside the individual platform consultation zones. The Stevenson Wind Farm is within the 9 nm consultation zones of the Beatrice A and B platforms. The MacColl Wind Farm is within the 9 nm consultation zones of the all four platforms.

8.3.5.41 In the absence of mitigation, anticipated numbers of flights likely to be prevented from reaching the platforms because of wind turbines within the three proposed wind farm sites have been calculated as follows (Technical Appendix 5.3 B):

- Beatrice Alpha – approx. three to four flights per annum;
- Beatrice Bravo – approx. three flights per annum;
- Beatrice Charlie – negligible; and
- Jacky – approx. one flight per annum.

8.3.5.42 The magnitude of effect is therefore considered low owing to the small number of flights which will be affected. The sensitivity of this receptor is high. The above effect is assessed to be **significant.** Helicopter operations in the area are well documented and the interaction between helicopter operations and wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

8.3.5.43 Note: Discussions between MORL and the Offshore Installation Stakeholders is ongoing to establish the acceptability of the expected increased effect of the three development wind farms over that of the effect of existing constraints.

Decommissioning

8.3.5.44 As with the construction phase, turbine decommissioning infrastructure could be considered as physical obstructions and infringe the minimum obstacle clearance criteria of 1,000 ft. The minimum obstacle clearance dictates the height at which helicopters can transit in the region of the three wind farms and the height that instrument approaches to offshore platforms commence. The magnitude of effect is therefore considered high. The sensitivity of this receptor is high. The above effect is assessed to be **significant.**

8.3.5.45 There may be an additional effect on the integrity of offshore platform safety cases where emergency scenarios are based on the use of helicopters to facilitate evacuation procedures.

8.3.5.46 Consultation with the platform operators has confirmed that the primary abandonment strategy is by boat, and helicopters are used as a secondary evacuation measure. Consequently, the magnitude of the effect is considered low. The sensitivity of the receptor is high. The above effect is assessed to be **significant.** Helicopter operations in the area are well understood. Therefore, there is a low uncertainty in this assessment. However, the effect is highly unlikely to occur.

Minimum Safe Altitude

Construction

Physical Obstruction

8.3.5.47 The minimum safe altitude (MSA) for aircraft operations in Instrument Meteorological Conditions (IMC), essentially poor weather, in the Moray Firth region is 1,500 ft (457 m). This allows for a minimum of 1,000 ft (305 m) clearance between aircraft and known en-route obstacles (the highest point of the Beatrice platform complex). The MSA dictates the height at which instrument approaches to offshore platforms commences and is therefore relevant to the Helicopter Main Route assessment and Helicopter Approaches Procedures to Offshore Platforms. The maximum tip height of

proposed turbines of the three developments will be 204 m (670 ft). Therefore, the MSA in the area of the developments will be required to be raised to 1,700 ft to ensure that a minimum of 1,000 ft vertical separation between the anticipated turbine tip height and aircraft is maintained.

8.3.5.48 The magnitude of effect is categorised as low as it will be possible to continue operations on HMR X- Ray and will not affect the Offshore Installations. The sensitivity of this receptor to this effect is considered high. The above effect is assessed to be **significant.** Helicopter operations in the area are well documented and the interaction between helicopter operations and wind turbines is well understood, therefore there is a low uncertainty in this assessment and the effect is considered probable to occur.

8.3.5.49 Turbine construction processes will have a significant effect on the MSA in the area of the three proposed wind farms.

Operation

8.3.5.50 The MSA will be raised from the point of the first turbine being installed, and as such the effect will continue to be **significant.**

Decommissioning

8.3.5.51 The MSA will be raised from the point of the first turbine being installed and as such the effect will continue to be **significant** until the last turbine has been decommissioned.

8.3.6 Proposed Monitoring and Mitigation

NERL Allanshill PSR

Construction

8.3.6.1 No mitigation required until the first turbine is operational.

Operation

8.3.6.2 NERL have stated that where they have redundancy from overlapping radar cover from their en-route radars, they would be prepared to consider blanking the radar that detects a particular wind turbine site, provided the remaining two do not detect the site and provide an adequate base of radar cover. However, these conditions do not exist in the area of the three proposed wind farms; the Inverness Airport PSR may be considered to have the lowest base of radar cover and will not detect the turbines of the three developments. The base of coverage of the NERL Perwinnes PSR, located near Aberdeen is anticipated to be approximately 1,550 m amsl (5,085 ft) and not considered adequate to support NERL operations.

8.3.6.3 Raytheon (the manufacturers of the NERL radar systems) have developed a technical mitigation which may be applicable for the three wind farms although this is subject of further analysis. This, and alternative mitigation measures are being discussed with NERL and MORL are pursuing an agreement to mitigate the effect on the Allanshill PSR. Meetings to discuss mitigation are scheduled to take place between NERL and MORL in June 2012.

8.3.6.4 With agreed mitigation, the magnitude of the effect is reduced to negligible. The sensitivity of the receptor is high. This residual effect has been assessed as **not significant.** There is medium uncertainty associated with the technical mitigation as it has not to date been implemented for En Route radar systems.

Decommissioning

8.3.6.5 Mitigation remains in operation whilst any turbines remain operational.

MoD ASACS Buchan ADR

Construction

8.3.6.6 No mitigation required.

Operation

8.3.6.7 While the Lockheed Martin TPS-77 ADR is the only current mitigation accepted by MoD for the effects of wind turbines on Air Defence radar, the Buchan T92 radar is the baseline version from which the TPS-77 is derived, and which has been continually updated. The Buchan ADR has also been subject to these updates and is understood to have broadly the same capability as the TPS-77. The TPS-77 is the mobile (tactical) model of the AN / FPS-117 radar.

8.3.6.8 Therefore, it is recommended that the MoD is engaged to determine if the T92 radar has capabilities in common with the TPS-77 which may be used to mitigate all elements of the three proposed developments, or be modified to achieve mitigation.

8.3.6.9 Note that a meeting has recently been held with the MoD to discuss a way forward with regard to resolving the effect on the Buchan ADR and consultation is ongoing.

8.3.6.10 Provided mitigation is available, the magnitude of the effect can be reduced to negligible; the sensitivity of the receptor is high, so the effect would be then assessed as **not significant.** There is medium uncertainty with the mitigation as the T92 has not been trialled to determine performance in the vicinity of wind farms. There is however high confidence and low uncertainty in the TPS-77 radar as mitigation, as this radar is implemented as mitigation for the Greater Wash Round 2 offshore wind farms.

Decommissioning

8.3.6.11 Mitigation remains in operation whilst any turbines remain operational.

MoD RAF Lossiemouth PSR

Construction

8.3.6.12 No mitigation required.

Operation

8.3.6.13 The MoD has stated a requirement for 'seamless integration' to be an integral factor in the acceptability of any technical in-fill mitigation solution for ATC radar. An in-fill solution involves the removal of PSR data where radar clutter is anticipated in the

vicinity of a wind farm, and replacing it with an alternate radar source which is not affected by radar clutter. Two such technologies are being demonstrated in Q2 and Q3 of 2012, and the MoD are a key stakeholder in this process through the Aviation Management Board under the Aviation Memorandum of Understanding, signed by DECC, DfT, MoD, RenewableUK, CAA and NERL to demonstrate the willingness to resolve aviation issues for wind farm development. Although still in their Research and Development phases, there are potential options that are anticipated to be available to mitigate the effects of the three proposed wind farm sites and will have undergone extensive factory and in-field acceptance testing before the three wind farms commence construction.

8.3.6.14 Integration of any PSR mitigation solution remains the key challenge, and it is understood that the potential in-fill options will include bespoke radar system integration solutions. However, if required, MORL would agree the precise supplier details of a separate integration system during the Mitigation Implementation phase of the Project.

8.3.6.15 Note: A meeting with the relevant subject matter experts within the MoD to discuss a way forward to resolving the effect on the Lossiemouth PSR will take place in June 2012.

8.3.6.16 With agreed mitigation, the magnitude of the effect is therefore reduced to negligible. The sensitivity of the receptor is high. This effect has been assessed as **not significant.**

Decommissioning

8.3.6.17 Mitigation remains in operation whilst any turbines remain operational.

HIAL Wick Airport

Construction

8.3.6.18 No mitigation required.

Operation

8.3.6.19 No mitigation required.

Decommissioning

8.3.6.20 No mitigation required,

HMR X-Ray

Construction

8.3.6.21 The MSA will be raised to 1,700 ft as soon as the first turbine is erected, which is below the lowest altitude at which HMR X-Ray is flown. Therefore the only mitigation will be required for icing conditions, when helicopters would have to fly at lower levels and therefore this will not be possible in the presence of wind turbines. Mitigation already exists in the form of an overland route which is used by helicopters that are not equipped with icing capabilities, and consequently there will be no significant effect on HMR X-Ray because of the three proposed wind farms.

8.3.6.22 Notification of physical obstructions to NATS Aeronautical Information Service (AIS) will be required, i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure. Lighting of obstacles will be in accordance with Article 220 of CAP 393 Air Navigation: The Order and the Regulations.

8.3.6.23 The magnitude of effect is categorised as negligible due to the sufficient separation distances involved between the MSA and the base of HMR X-Ray, and the existence of a current overland route which is already used in icing conditions. With mitigation the effect on this receptor is considered **not significant.**

Operation

8.3.6.24 The MSA will be raised to 1,700 ft following the development of the three developments, which is below the lowest altitude at which HMR X-Ray is flown. Therefore the only mitigation will be required for icing conditions, when helicopters would have to fly at lower levels. There already exists an overland route which is used by helicopters which are not equipped with icing capabilities, and consequently there will be **no significant effect** on HMR X-Ray as a result of the three proposed wind farms.

8.3.6.25 The magnitude of effect is already categorised as negligible due to the sufficient separation distances involved between the MSA and the base of HMR X-Ray, and the existence of a current overland route which is already used in icing conditions, and with mitigation the effect on this receptor is still considered **not significant.**

Decommissioning

8.3.6.26 Notification of physical obstructions to NATS Aeronautical Information Service (AIS) will be required, i.e. location of constructed turbines and location / movement and maximum height of construction infrastructure. Lighting of obstacles will be in accordance with Article 220 of CAP 393 Air Navigation: The Order and the Regulations. With mitigation the effect on this receptor is considered **not significant.**

Offshore Installations

Construction

8.3.6.27 As with mitigation for HMR X-Ray, notification to NATS Aeronautical Information Service (AIS) of constructed turbines and location / movement and maximum height of construction traffic will be required. With mitigation the effect on this receptor is considered **not significant.**

Operation

8.3.6.28 Owing to the complexity of the aviation issues with regard to helicopter operations to offshore installations and the requirement to propose a mitigation which considers the cumulative effects of the three proposed wind farm sites in conjunction with the Beatrice Offshore Wind Farm, the mitigation measures are still under discussion with the relevant aviation stakeholders.

8.3.6.29 In the absence of mitigation, the magnitude of the effect on the anticipated numbers of flights likely to be prevented from reaching the platforms because of wind turbines within the three proposed wind farm sites is considered low owing to the small number of flights which will be affected. A number of mitigation options

are being discussed with the Moray Firth helicopter operators, (as detailed in Technical Appendix 5.3 B) and an acceptable mitigation solution for operation flights and safety cases will be agreed prior to construction. With the implementation of an agreed mitigation solution, the magnitude of the effect is reduced to negligible. The sensitivity of the receptor is high. This effect has been assessed as **not significant**.

Decommissioning

8.3.6.30 Notification to NATS Aeronautical Information Service (AIS) of constructed turbines and location / movement and maximum height of construction traffic will be required. With mitigation the effect on this receptor is considered **not significant.**

Minimum Safe Altitude

Construction

8.3.6.31 For the assessments of likely significant effects in this chapter with regard to aviation and radar, the worst case scenario of wind turbines at their maximum planned tip height of 204 m above Lowest Astronomical Tide (LAT) has been used across the entirety of the three proposed developments. Consequently, when the first turbine is constructed, the MSA will need to be raised to 1,700 ft to allow a minimum 1,000 ft vertical clearance between aircraft and the turbines. Updates to aviation charts and other relevant documentation will reflect this change.

8.3.6.32 The magnitude of effect is already categorised as low. However, with mitigation the sensitivity of this receptor is therefore considered **not significant.**

Operation

8.3.6.33 MSA would be raised when the first turbine is constructed and relevant documentation will already therefore reflect this change; therefore no further mitigation is required.

8.3.6.34 MSA should be lowered to ensure a minimum 1,000 ft separation against highest remaining obstruction in the area. The magnitude of the effect is negligible and therefore the residual effect is **not significant**.

8.3.7 Secondary Assessment: Individual Sites

8.3.7.1 Secondary assessment of the effects of the individual wind farm sites (Telford, Stevenson and MacColl) on the NERL Allanshill and RAF Lossiemouth PSRs is deemed as not required. The individual development effects and technical mitigation requirements are broadly similar in each instance, and are as described in the Primary Assessment. Secondary assessment of the effects of the individual wind farm sites on HIAL Wick Airport is not required as each of the wind farms have no effect individually.

8.3.7.2 However, the ASACS Buchan ADR is likely to be affected to a lesser extent by the Stevenson and MacColl wind farms due to the smaller area of these two wind farms that are likely to be detectable by this ADR. The technical mitigation solution that would be required to resolve the effect of the Telford Wind Farm can be extended laterally and therefore would be suitable as a holistic solution in respect of the anticipated effect from each of the individual developments. The negative effects on the identified PSR and ADR systems are considered as direct and would be permanent on the commencement of turbine operation.

8.3.7.3 The section of HMR X-RAY between Aberdeen and Wick Airports has the potential to conflict with wind turbines placed within the lateral confines of the MacColl Wind Farm. Not all of the helicopters operating to the Moray Firth platforms are equipped with anti-icing capability; however these aircraft would not fly along or below HMR X-RAY in forecast icing conditions as an overland option is available. Consequently, due to the availability of an alternative overland route when icing conditions exist, an indirect negative effect is assessed. HMR X-Ray does not cross the lateral confines of the Telford and Stevenson Wind Farm areas.

8.3.7.4 The Telford Wind Farm is in excess of 9 nm from the nearest of the platforms (Jacky) and consequently outside the individual platform consultation zones. The Stevenson Wind Farm is within the 9 nm consultation zones of the Beatrice A and B platforms. The MacColl Wind Farm is within the 9 nm consultation zones of all four platforms. The negative effect of the Stevenson and MacColl wind farms is considered as a direct and permanent effect on operations.

8.3.7.5 Secondary assessment of the effect on the area MSA is deemed as not required. When the first turbine in any of the three developments is constructed, the MSA will need to be raised as a result. Assuming the maximum wind turbine blade tip height of 204 m (approximately 670 ft) is selected, the MSA will be raised to 1,700 ft to allow a minimum 1,000 ft vertical clearance between aircraft and the turbines. This effect is assessed as **significant**, and has a direct and permanent negative effect until after decommissioning is complete.

8.3.7.6 The summary of the secondary assessment is at Table 8.3-3 below.

Table 8.3-3 Secondary Assessment Summary

Impact	Telford	Stevenson	MacColl
Construction and Decommissioning			
NERL Allanshill PSR	Not Significant	Not Significant	Not Significant
ASACS Buchan ADR	Not Significant	Not Significant	Not Significant
RAF Lossiemouth PSR	Not Significant	Not Significant	Not Significant
Wick Airport	Not Significant	Not Significant	Not Significant
HMR X-Ray	Not Significant	Not Significant	Significant
Offshore Installations	Not Significant	Significant	Significant
Minimum Safe Altitude	Significant	Significant	Significant
Operation			
NERL Allanshill PSR	Significant	Significant	Significant
ASACS Buchan ADR	Significant	Significant	Significant
RAF Lossiemouth PSR	Significant	Significant	Significant
Wick Airport	Not Significant	Not Significant	Not Significant
HMR X-Ray	Not Significant	Not Significant	Not Significant

Impact	Telford	Stevenson	MacColl
Offshore Installations	Not Significant	Significant	Significant
Minimum Safe Altitude	Significant	Significant	Significant

Sensitivity Assessment

8.3.7.7 A secondary assessment of the effect on the NERL Allanshill and RAF Lossiemouth PSRs was deemed as not required, and therefore a sensitivity assessment is not required. Any combination of the three developments will pose a broadly similar effect on the radar and operations of these receptors. Additionally, the Stevenson and MacColl wind farms are likely to have a lesser total effect in terms of the area of the anticipated radar effects on the Buchan ADR than any combination of the wind farms that includes the Telford Wind Farm.

8.3.7.8 Any combination of the three developments that includes the MacColl Wind Farm is considered to have a permanent, direct but not significant effect on aircraft operating on HMR X-Ray. In addition, a combination of the three developments that includes both the Stevenson and MacColl wind farms will have a permanent, direct but not significant effect on helicopter operations to the existing Beatrice installation complex.

8.3.7.9 Due to the consideration that a secondary assessment of the effect on the area MSA were deemed as not required, a sensitivity assessment is also not required to be completed. Each of the three individual developments would realise the same effect on this receptor.

The sensitivity assessment summaries are in Table 8.3-4, Table 8.3-5 and Table 8.3-6 below.

Table 8.3-4 Sensitivity Assessment Summary

Impact	Telford (3.6 MW) + Stevenson	Telford (3.6 MW) + MacColl
Construction and Decommissioning		
NERL Allanshill PSR	Not Significant	Not Significant
ASACS Buchan ADR	Not Significant	Not Significant
RAF Lossiemouth PSR	Not Significant	Not Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Not Significant	Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant
Operation		
NERL Allanshill PSR	Significant	Significant
ASACS Buchan ADR	Significant	Significant

Impact	Telford (3.6 MW) + Stevenson	Telford (3.6 MW) + MacColl
RAF Lossiemouth PSR	Significant	Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Not Significant	Not Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant

Table 8.3-5 Sensitivity Assessment Summary

Impact	Stevenson (3.6 MW) + Telford	Stevenson (3.6 MW) + MacColl
Construction and Decommissioning		
NERL Allanshill PSR	Not Significant	Not Significant
ASACS Buchan ADR	Not Significant	Not Significant
RAF Lossiemouth PSR	Not Significant	Not Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Not Significant	Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant
Operation		
NERL Allanshill PSR	Significant	Significant
ASACS Buchan ADR	Significant	Significant
RAF Lossiemouth PSR	Significant	Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Not Significant	Not Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant

Table 8.3-6 Sensitivity Assessment Summary

Impact	MacColl (3.6 MW) + Telford	MacColl (3.6 MW) + Stevenson
Construction and Decommissioning		
NERL Allanshill PSR	Not Significant	Not Significant
ASACS Buchan ADR	Not Significant	Not Significant
RAF Lossiemouth PSR	Not Significant	Not Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Significant	Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant
Operation		
NERL Allanshill PSR	Significant	Significant
ASACS Buchan ADR	Significant	Significant
RAF Lossiemouth PSR	Significant	Significant
Wick Airport	Not Significant	Not Significant
HMR X-Ray	Not Significant	Not Significant
Offshore Installations	Significant	Significant
Minimum Safe Altitude	Significant	Significant

Proposed Mitigation – Secondary / Sensitivity Assessment

8.3.7.10 In all cases of assessed effect on aviation operations, the initial identified mitigation solutions are considered to remain as appropriate after considering the secondary / sensitivity assessments.

8.3.8 References

CAP 670 ATS Safety Requirements

CAP 764 CAA Policy and Guidelines on Wind Turbines

Civil Aviation Policy (CAP) 393 Air Navigation: The Order and the Regulations

UK Aeronautical Information Publications (Civil and Military).

8.4 Seascape, Landscape and Visual Receptors

8.4.1 Summary of Impacts

8.4.1.1 The Seascape, Landscape and Visual Impact Assessment (SLVIA) has been undertaken to determine the likely significant effects of the Telford, Stevenson and MacColl wind farms together with the offshore transmission infrastructure on the study area. The assessment is based on the 'worst case' Rochdale Envelope scenario (Scenario 4c) which has the largest turbine height (7 MW, 204 m blade tip) at the densest 5D x 7D spacing throughout the Telford, Stevenson and MacColl sites. Furthermore, it assumes that the substructure design will be a jacket type and that eight offshore substation platforms (OSP) will be distributed within or close to the wind farm sites with an OSP close to the site boundaries nearest Caithness and Moray.

8.4.1.2 The assessment assumes clear weather and optimum viewing conditions. Met Office visibility frequency data suggests that the area benefits from good visibility conditions, but that visibility frequency drops sharply at longer distances, such that visibility over 25 km occurs for a limited amount of time. The prevailing visibility and weather conditions combine to reduce the duration and significance of effects of the three proposed wind farm sites to relatively limited periods where views of the three proposed wind farm sites are available. 'Excellent' visibility will be required to see the three proposed wind farm sites from the Moray and Aberdeenshire coastline, at distances over 40 km, which occurs infrequently.

8.4.1.3 The effect of the three proposed wind farm sites is assessed as not significant on landscape / seascape character. Two national seascape units are located within the study area, covering the North Aberdeenshire / Moray Coast and the East Caithness and Sutherland coast, which are both assessed as having a medium-low sensitivity to change. The seascape / landscape assessment has identified that the magnitude of change of the proposed development will be medium, and not significant, on the Coastal Character Areas (CCAs) between Wick and Berriedale; low, and not significant, on the CCAs to the north of Wick; and medium-low, and not significant, on the CCAs to the south of Berriedale. The landscape elements of these CCAs will not be physically altered; changes arise principally through visibility, which may indirectly change the way in which the pattern of elements is perceived. The proposed development will introduce distant offshore wind farm development as a characteristic element on the open sea skyline of these CCAs, but the existing key characteristics of these CCAs will continue to provide their defining characteristics. The effects of the three proposed wind farm sites is assessed as not significant on the landscape designations within the study area, including Gardens and Designed Landscapes (GDLs) and proposed Special Landscape Areas (pSLAs) all of which are located over 34 km from the three proposed wind farm sites.

8.4.1.4 The viewpoint assessment has identified significant effects on seven viewpoints located in the closest section of Caithness between Wick and Dunbeath. These viewpoints are located at distances of 22 to 34 km from the three proposed wind farm sites. In good visibility conditions, the threshold at which significant effects diminish is assessed in the region of 30 to 35 km, depending on the specific characteristics of the view. Significant visual effects arise from the closest locations of the Caithness coast as a result of the three proposed wind farm sites appearing to occupy a significant portion of the sea skyline, where it forms a wide horizontal feature in relation to the seascape in the view, in combination with the vertical effect of the turbines being notable due to the absence of any intervening features or landform between the viewpoints on the coastal edge and the development located in open sea. The assessment assumes clear weather and optimum viewing

conditions. This means that effects that are assessed to be significant may be not significant under different, less clear conditions. The viewpoint assessment has identified that the effect of the three proposed wind farm sites will be not significant on the remaining viewpoints in Caithness to the north of Wick and to the south of Berriedale. In these views, the three proposed wind farm sites will be more distant from the coast and located on the skyline within a part of the broad, open sea views. Generally set apart from the visible landform of the coast, the three proposed wind farm sites will form a single, distinct feature in their own right on the skyline, surrounded by open sea.

8.4.2 Introduction

8.4.2.1 The assessment considers the effect on the seascape and landscape character and the effect on visual amenity (views) of the offshore generating station (OGS) and the offshore transmission infrastructure (OfTI). Seascape effects are an extension of landscape effects, but the emphasis is on other elements that are slightly different or more important at the coast, when defining the character and effects of seascape compared to landscape. The SLVIA methodology is described in full in Technical Appendix 5.4 A and the baseline seascape, landscape and visual receptor resource relating to the OGS and the OfTI is described in Chapter 5.4. The seascape, landscape and visual effects of the onshore aspects of the transmission infrastructure (OnTI) are assessed in Chapter 11.4. Whole Project effects are described in Chapter 12.1: Seascape, Landscape and Visual Receptors. Cumulative effects, arising from the effect of the Project in conjunction with other wind farms, are also considered in Chapter 15.4.

8.4.2.2 Photomontages, panoramic photographs and plan / map figures, which form the visualisation section of the Environmental Statement are bound into one complete A3 document entitled 'Volume 7: Moray Offshore Wind Farm SLVIA Figures'.

8.4.2.3 The SLVIA covers the construction, operational phase and decommissioning of the OGS and the OfTI. The assessment is based on the 'realistic worst case' Rochdale Envelope described in Chapter 2.2 (Project Description). The parameters of the Rochdale Envelope relevant to the SLVIA are described further in 8.4.3 of this chapter.

8.4.2.4 Offshore wind farms tend to give rise to seascape, landscape and visual effects by virtue of a number of attributes specific to both their individual form and to the location and grouping of turbines. These attributes include:

- Strong vertical and horizontal form;
- Movement of turbine blades;
- Grouping within the seascape;
- Location and distance offshore; and
- Relationship to the scale and nature of the existing coastal landscape.

8.4.2.5 These attributes may affect different components of the seascape, landscape and visual environment in different ways, or may combine to result in an effect.

8.4.2.6 The SLVIA does not consider the balance of public attitudes towards wind farms. The assessment concentrates instead on the change that the three proposed wind farm sites will bring to the different attributes of the seascape, landscape and visual environment, on the basis of the magnitude of that change and the sensitivity of the

receptor, as assessed by experts in this field, following industry best practice and in consultation with the relevant stakeholders.

8.4.2.7 The objective of the SLVIA is to identify likely significant effects, to propose mitigation measures for avoiding or reducing them and to determine the significance of residual effects on the seascape, landscape and visual resource.

8.4.3 Rochdale Envelope Parameters Considered in the Assessment

8.4.3.1 The SLVIA is based on the Rochdale Envelope described in Chapter 2.2 (Project Description). The parameters relevant to the SLVIA are set out in this chapter. In compliance with EIA regulations, the likely significant effects of a 'worst case' scenario are assessed and illustrated in the SLVIA.

Zone Capacity Assumptions

8.4.3.2 The maximum capacity of the three proposed wind farms combined will not exceed 1,500 MW. The turbine scenarios considered reflect that deployment.

Wind Turbine Generator Assumptions

8.4.3.3 Height assumptions are made with regards the wind turbine generators (WTG) as shown in Table 8.4-1 below.

Table 8.4-1 Wind Turbine Generators Considered in SLVIA Rochdale Envelope

Rating (MW)	**3.6**	**5**	**7**
Turbine Type	Lowest Rated Turbine for site 1	Lowest Rated Turbine for site 2, 3	The tallest and most numerous turbine for all sites (the 8 MW is of the same dimensions but will be less numerous)
Approximate Hub Height (above LAT) (m)	97	99.5	118
Rotor Diameter (m)	130	135	172
Maximum Tip Height(above HAT) (m)	162	167	204

General Layout Assumptions

8.4.3.4 The following assumptions are made with regards to the layout:

- Turbines will either be laid out in grid spacing, where rows are aligned both down and cross wind, or in a diamond spacing where rows are aligned downwind but are in an offset grid pattern cross wind. These are shown in Plates 2.2.5 and 2.2.6 in Chapter 2.2 (Project Description);
- Cross wind rows will be aligned perpendicular to the predominant wind direction which is 230 degrees plus or minus 10 degrees (with due north as 0 degrees);
- The three proposed wind farm sites combined will either have grid or diamond layouts, but not both;

- In the down wind direction, the assumed turbine spacing is seven times rotor diameter. However, occasional rows may be removed to allow for wind generation and so effective spacing could be larger in some instances;
- For the cross wind direction the assumed turbine spacing is five times rotor diameter;
- Turbines may be installed anywhere within the proposed wind farm sites. However, due to technical or environmental constraints, certain areas within wind farm sites may not be developed. As such, the effective site boundaries for Telford, Stevenson and MacColl may be reduced and those assessed here comprise the maximum site boundaries;
- Within each site (Telford, Stevenson and MacColl) the turbine ratings will be consistent. However, each of the three sites may have different rated turbines. There could be an offset in the rows at the site boundaries caused by the difference in turbine spacing, and;
- The boundaries of Telford, Stevenson and MacColl are fixed.

SLVIA Layouts

8.4.3.5 Five layout scenarios were generated in order to consider the Rochdale Envelope for the SLVIA and to investigate the likely effects of different layouts within the Telford, Stevenson and MacColl sites. The five SLVIA layout scenarios considered in the Rochdale Envelope are shown as follows and in Figure 8.4-1, Volume 7:

- **Scenario 1b**: Telford - 3.6 MW; Stevenson - 5 MW; MacColl - 5 MW:
  - 5D x 7D spacing with diamond layout;
- **Scenario 1c**: Telford - 3.6 MW; Stevenson - 5 MW; MacColl - 5 MW:
  - 5D x 7D spacing with diamond layout;
- **Scenario 2b**: Telford - 3.6 MW; Stevenson - 5 MW; MacColl - 5 MW:
  - 5D x 7D spacing with grid layout;
- **Scenario 3**: Telford - 7 MW; Stevenson - 7 MW; MacColl - 7 MW:
  - 5D x 7D spacing with diamond layout;
- **Scenario 4**: Telford - 7 MW; Stevenson - 7 MW; MacColl - 7 MW:
  - 5D x 7D spacing with grid layout;
- **Scenario 4b**: Telford - 7 MW; Stevenson - 7 MW; MacColl - 7 MW:
  - 6.5D x 10D spacing with grid layout;
- **Scenario 4c**: Telford - 7 MW; Stevenson - 7 MW; MacColl - 7 MW:
  - 5D x 7D spacing with grid layout;
- **Scenario 5**: Telford - 7 MW Array, Stevenson - 5 MW; MacColl - 3.6 MW:
  - 6.5D x 10D spacing with diamond layout;
- **Scenario 5b**: Telford - 7 MW Array, Stevenson - 5 MW; MacColl - 3.6 MW:
  - 6.5D x 10D spacing with grid layout; and
- **Scenario 5c**: Telford - 7 MW Array, Stevenson - 5 MW; MacColl - 3.6 MW:
  - 6.5D x 10D spacing with grid layout.

8.4.3.6 A review of the visibility issues of these layout scenarios was undertaken, including a review of the overall extent of visibility (using Zones of Theoretical Visibility, known as ZTV) and the nature of the appearance of the three proposed wind farm sites in views (using wirelines). This initial assessment process allowed a review of what constitutes the 'worst case', in seascape, landscape and visual terms, and the selection of a particular layout for assessment in the Rochdale Envelope.

8.4.3.7 The following conclusions were drawn from this review:

- Turbine height differences associated with different turbine options are less noticeable at long distances and for the three proposed wind farm sites, it is particularly the horizontal extent and the density / massing / depth of larger numbers of turbines which has comparatively greater impact;
- The layouts with the largest turbines, widest horizontal extent and greater number / density / massing of turbines were considered to be relatively worst case, both in terms of their extent of visibility in the ZTV, and in their appearance in the wire line views;
- The grid layout arrangement was considered to be the visual worst case, as turbine rows are aligned with, and may therefore be viewed as stacking, in views from the closest and hence more sensitive part of the Caithness coast around Sarclet Head (roughly between Wick Bay and Lybster);
- Scenario 4c was considered worst case overall, as it has the largest turbine height and number (7 MW, 204 m tip) at the densest 5D x 7D spacing throughout the Telford, Stevenson and MacColl sites (i.e. largest height turbines with densest spacing);
- Although Scenario 4c resulted in a smaller footprint than Scenario 4b (6.5D x 10D), which fills the footprint of the site boundaries, the turbines in the eastern side of the MacColl site are least visible from Caithness and the denser array and massing of turbines in Scenario 4c had a more notable effect in views;
- In compliance with EIA regulations, the likely worst case scenario, layout Scenario 4c (Figure 8.4-2, Volume 7) is assessed in the SLVIA and illustrated in the photomontages. Additional illustration of other scenarios with different turbine heights or arrays is also provided (Layouts 1c and 5c) for key views;
- Scenario 1c (Figure 8.4-3, Volume 7) is illustrated in the wirelines from key viewpoints to show the smallest height turbines (3.6 MW and 5 MW) with densest spacing (5D x 7D) and the largest overall number of turbines considered. This scenario also illustrates a scenario where there is a 'gap' or 'space' between the sites, which may be required within the parameters of the Rochdale Envelope to allow for turbine wake effects; and
- Scenario 5c (Figure 8.4-4, Volume 7) is illustrated in the wirelines from key viewpoints to show the most varied turbine heights across the site, with 7 MW turbines in the Telford site (closest to Caithness), 5 MW in Stevenson and 3.6 MW in the MacColl site.

Foundation Substructure Assumptions

8.4.3.8 The worst case for the SLVIA assumes that the substructure design will be a jacket substructure. Field survey and experience of the visual effects of existing offshore wind farms suggests that jacket foundations are worst case for visual impacts.

8.4.3.9 The foundation substructures are assumed to have a working platform and tower interface, where the tower connects with the jacket foundation structure. The interface level (above LAT) between the substructure and the WTG is assumed to be

20 m above LAT, which is similar to other projects and a realistic assumption. The jacket foundations are assumed to have four sides and four legs, supported in a lattice tower arrangement. The foundation substructures will be painted yellow for navigational marking.

Offshore Meteorological Mast Assumptions

8.4.3.10 A single offshore met mast will be installed within the boundaries of the three proposed wind farm sites. The met mast tower will be of similar design to the consented MORL met mast with a lattice tower of approximately 100 to 110 m LAT. It is assumed as worst case for the SLVIA that the substructure design will be a jacket substructure.

Offshore Substation Platforms Assumptions (including foundation substructure)

8.4.3.11 Indicative locations of the OSPs have been assumed for the SLVIA; six indicative AC OSPs are within the three proposed wind farm boundaries, with an OSP close to the site boundaries nearest Caithness and Moray, with others evenly distributed through the wind farm sites. Two AC / DC convertor stations are outwith the wind farm sites, up to 2 km to the east or south. The indicative locations of these OSPs assumed for the SLVIA are shown Figure 8.4-2, Volume 7.

8.4.3.12 The OSPs will have a maximum platform length of 100 m, platform width of 100 m and platform height 70 m, for both AC and DC OSPs. The maximum height of 70 m is the total height of the topside structure (the substation 'box') and visible jacket foundations / air gap, above LAT. The SLVIA assumes that the interface level (the height of visible jacket structures above water) is 20 m above LAT and the height of the topside structure is 50 m. The jacket foundations for the OSPs will have four sides and up to 6 legged jacket (AC OSPs) and 8 legged jacket (DC OSPs), supported in a lattice tower arrangement and painted yellow for navigational marking. The effect of the OSPs in the context of the three proposed wind farm sites is assessed in Chapter 11.4 (Seascape, Landscape and Visual Receptors).

Lighting

8.4.3.13 Offshore structures will be marked in order to meet the requirements of navigation and aviation standards. Specific requirements for aviation and navigational lighting will be agreed with the relevant stakeholders post-consent and prior to construction. There are currently no standards on landscape and visual assessment of lighting associated with development. Existing guidance on this issue focuses on mitigation of the effects of night time lighting, such as the 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Engineers, 2005) or 'Lighting in the Countryside – Towards Good Practice' (Countryside Commission, 1997).

8.4.4 EIA Methodology

8.4.4.1 The full methodology used to carry out the SLVIA is described in detail in Technical Appendix 5.4 A.

8.4.4.2 The methodology used to carry out the SLVIA has been developed by Optimised Environments Ltd (OPEN) for the SLVIA of wind farms and accords with current best practice guidance (LI / IEMA, 2002). The methodology for the SLVIA draws on guidance from several other reference documents listed in 8.4.10 of this chapter.

8.4.4.3 The SLVIA for the offshore generating stations has been undertaken within a 50 km radius study area of the Telford, Stevenson and MacColl wind farms as shown in

Figure 5.4-1, Volume 7. The definition of this study area is described in 5.4.1, Chapter 5.4 (Seascape, Landscape and Visual Receptors). The study area is not intended to provide a boundary beyond which the three proposed wind farm sites will not be seen, but rather to define the area within which to assess the likely significant landscape and visual effects of the three proposed wind farm sites and the OfTI.

8.4.4.4 OPEN's methodology for assessing wind farm development is not reliant on the use of a matrix to determine the significance of landscape and visual effects, nor does it define levels of significance. In accordance with the Marine Works (Environmental Impact Assessment) Regulations 2007 and the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 it identifies whether effects are likely to be significant or not. It is however considered useful to include a matrix in the methodology to help illustrate how combinations of sensitivity and magnitude of change can give rise to a significant effect and to provide an understanding as to the threshold at which significant effects may arise. Table 8.4-2 below provides this illustration.

Table 8.4-2 Illustrative Significance Matrix

	Magnitude					
Sensitivity	**High**	**Medium-High**	**Medium**	**Medium-Low**	**Low**	**Negligible**
High	Significant	Significant	Significant	Significant / Not Significant	Not Significant	Not Significant
Medium-High	Significant	Significant	Significant / Not Significant	Significant / Not Significant	Not Significant	Not Significant
Medium	Significant	Significant / Not Significant	Significant / Not Significant	Not Significant	Not Significant	Not Significant
Medium-Low	Significant / Not Significant	Significant / Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
Low	Significant / Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant

8.4.4.5 Effects that are assessed within the dark blue boxes in the matrix are assessed to be significant in terms of the requirements of the EIA Regulations.

8.4.4.6 It should be noted however that those effects that are assessed within the light blue boxes may be significant, or not significant, depending on the specific factors and effect that is assessed in respect of a particular seascape, landscape or visual receptor. In accordance with the Landscape Institute's Guidelines for Landscape and Visual Impact Assessment (GLVIA), experienced professional judgement is applied to the assessment of all effects and reasoned argument is presented in respect of the findings in each case.

8.4.4.7 The assessment assumes clear weather with optimum viewing conditions and assesses the 'worst case' or maximum visual effect in optimum or 'excellent' visibility conditions. This means that effects that are assessed to be significant may be assessed as not significant under different, poorer, visibility conditions. A summary of the impact assessment methodology for the SLVIA is provided in Table 8.4-3 below.

Table 8.4-3 Summary of SLVIA Impact Assessment Methodology

Effect Type Criteria	Sensitivity Criteria	Magnitude Criteria	Significance
Physical Landscape Effects To Determine the Likely Physical Effects of the Three Proposed Wind Farm Sites on Landscape Elements Located on the Site. Landscape Elements are the Component Parts of the Landscape such as Landcover, Hedges and Trees.	The sensitivity of a landscape element is an expression of its value and quality, and the potential for mitigation of the effect as explained below: • The value of a landscape element is a reflection of its importance in the pattern of elements that constitutes the landscape character of the area and the policy or designations that might apply to it; and • The quality of a landscape element is a reflection of its condition and state of repair; and • The potential for mitigation of the effect on a landscape element is a reflection of the degree to which the element can be restored, replaced or substituted. Levels of sensitivity are defined and applied to physical landscape features as – low, medium-low, medium, medium-high and high sensitivity.	The magnitude of change on landscape elements is quantifiable, and will be expressed in terms of the degree to which a landscape element will be removed or altered by the three proposed wind farm sites. Definitions of the levels of magnitude of change are defined as follows: **High** - where the three proposed wind farm sites will result in the complete removal or alteration of a key element of the landscape; **Medium** - where the three proposed wind farm sites will result in the removal of a notable part of an element or a notable alteration to a landscape element; **Low** - where the three proposed wind farm sites will result in the removal of a minor part of an element or a minor alteration to a key landscape element; and **Negligible** - where the change resulting from the three proposed wind farm sites is barely discernible and equates to a 'no change' situation. Intermediate levels of magnitude may also be included.	A significant effect will occur where the degree of removal or alteration of the landscape element is such that the form of the element will be redefined. Where a landscape element has a high sensitivity, a significant effect can occur with a limited degree of removal or alteration. If the landscape element is of lower sensitivity, it may undergo a relatively high level of removal or alteration yet remain as a not significant effect.
Effects on Seascape / Landscape Character To Determine the Likely Effects of the Three Proposed Wind Farm Sites on Seascape / Landscape Character. Seascape / Landscape Character Receptors are the Defined Coastal Character Areas and Landscape Character Types and those Areas that have been Designated for their Recognised Quality or Value in Landscape Planning Terms, such as the Gardens and Designed Landscapes (GDLs).	The sensitivity of a seascape / landscape character receptor is an expression of its ability to accommodate the three proposed wind farm sites as part of its own character or as part of the visual setting or context of the character receptor. This is dependent on the value, quality and existing seascape / landscape character of the receptor. • The value of a seascape / landscape character receptor is a reflection of its importance in terms of any designations that may apply, or as a landscape resource; • The quality of a seascape / landscape character receptor is a reflection of its attributes, such as sense of place and scenic quality, and the extent to which these attributes have remained intact; and • The existing seascape / landscape character of the receptor determines the degree to which the receptor may accommodate the influence of the three proposed wind farm sites.	The magnitude of change on seascape / landscape character receptors is an expression of the scale of the change that will result from the three proposed wind farm sites, and will be dependent on the following variables: • Distance between the seascape / landscape character receptor and the three proposed wind farm sites; • Extent to which the three proposed wind farm sites become a characteristic element or key characteristic of the seascape / landscape character; • Extent of the receptor that will be affected by visibility and, therefore, the influence of the three proposed wind farm sites; • Extent of the three proposed wind farm sites that will be seen; • Position of the three proposed wind farm sites in relation to the principal orientation of the landscape character receptor; • Scale comparisons; • The appearance of the wind farm in relation to its setting; and	A significant effect will occur where the combination of the variables results in the three proposed wind farm sites having a definitive effect on the receptor, so that its landscape character is re-defined by the presence of the three proposed wind farm sites. A not significant effect will occur where the effect of the three proposed wind farm sites is not definitive, and the landscape character of the receptor continues to be defined principally by its baseline characteristics.

Effects on Seascape / Landscape Character (continued)	Levels of sensitivity are defined and applied to seascape / landscape character receptors as – low, medium-low, medium, medium-high and high sensitivity.	• Influences through which the receptor gains its character (such as the degree of development that occurs either within or beyond the boundary of the landscape character receptor). Definitions of the levels of magnitude of change are defined as follows: **High**, the three proposed wind farm sites will result in a major alteration to the baseline characteristics of the seascape / landscape, providing the prevailing influence and / or introducing elements that are substantially uncharacteristic in the receiving landscape. **Medium**, the three proposed wind farm sites will result in a moderate alteration to the baseline characteristics of the seascape / landscape, providing a readily apparent influence and / or introducing elements that may be prominent but are not uncharacteristic in the receiving landscape. **Low**, the three proposed wind farm sites will result in a minor alteration to the baseline characteristics of the seascape / landscape, providing a slightly apparent influence and / or introducing elements that are characteristic in the receiving landscape. **Negligible**, the three proposed wind farm sites will result in a negligible alteration to the baseline characteristics of the seascape / landscape, providing a barely discernible influence and / or introducing elements that are substantially characteristic in the receiving landscape.	
Visual Effects To Determine the Likely Effects of the Three Proposed Wind Farm Sites on Views.	The sensitivity of a view is an expression of its ability to accommodate the three proposed wind farm sites, and is dependent on the importance of the viewpoint, the value of the view, and the nature of the viewer, explained as follows: • The importance of the viewpoint is determined by any recognition that the viewpoint may have, such as being marked on a map or with interpretation. The greater the importance of the viewpoint, the greater its sensitivity is likely to be; and • The value of the view is a reflection of the scenic qualities of the view and will also be increased if it lies within or overlooks a designated area	The magnitude of change on views is an expression of the scale of the apparent change that will result from the three proposed wind farm sites, and is dependent on the following variables: • The distance between the viewpoint and the three proposed wind farm sites; • The context within which the three proposed wind farm sites will be seen; • The extent of the three proposed wind farm sites that will be seen; • The position of the three proposed wind farm sites in relation to the principal orientation of the view; • Scale comparisons; • The appearance of the three proposed wind farm sites in relation to its setting; and	A significant effect will occur where the combination of the variables results in the three proposed wind farm sites having a material effect on the view, so that its appearance is re-defined by the presence of the three proposed wind farm sites. A not significant effect will occur where the appearance of the three proposed wind farm sites is not definitive, and the view continues to

Visual Effects **(continued)**	such as a Regional Scenic Area (which implies a greater value to the visible landscape). The greater the value of the view, the greater its sensitivity is likely to be. The nature of the viewer reflects the occupation or activity of the people who will gain the view. Viewers whose attention is focused on the landscape (For example: walkers) are likely to have a higher sensitivity, as will residents of properties that gain views of the three proposed wind farm sites. Viewers travelling in cars or on trains, or those at work, will tend to have a lower sensitivity as their view is either transient or they are engaged in other activities. Levels of sensitivity are defined and applied to visual receptors as – low, medium-low, medium, medium-high and high sensitivity.	• The proportion of the view that is affected by the three proposed wind farm sites. Other criteria are used in the assessment of the magnitude of change in views from route corridor visual receptors. These are detailed in the full methodology in Technical Appendix 5.4 A. Definitions of the four levels of magnitude of change are defined as follows: **High**, the three proposed wind farm sites will result in a major alteration to the baseline view, providing the prevailing influence and / or introducing elements that are substantially uncharacteristic in the receiving landscape. **Medium**, the three proposed wind farm sites will result in a moderate alteration to the baseline view, providing a readily apparent influence and / or introducing elements that may be prominent but are not uncharacteristic in the receiving landscape. **Low**, the three proposed wind farm sites will result in a minor alteration to the baseline view, providing a slightly apparent influence and / or introducing elements that are characteristic in the receiving landscape. **Negligible**, the three proposed wind farm sites will result in a negligible alteration to the baseline view, providing a barely discernible influence and / or introducing elements that are substantially characteristic in the receiving landscape. Intermediate levels of magnitude may also be included.	be defined principally by its baseline characteristics. In this instance the three proposed wind farm sites may affect the appearance of the view, but this effect will not result in a material change.
Cumulative Effects To Determine the Likely Effect that the Three Proposed Wind Farm Sites would have on Views and Seascape / Landscape Receptors when Seen or Perceived in Conjunction with other Existing, Consented and Proposed Wind Farms	The sensitivity of the seascape / landscape character receptors or visual receptors is the same as when considering the effects of the three proposed wind farm sites.	The cumulative magnitude of change on views is an expression of the degree to which the seascape / landscape character receptors and views will be changed by the addition of the three proposed wind farm sites to wind farms that are already existing, consented or proposed and is dependent on the following variables: • The location of the three proposed wind farm sites in relation to other wind farms; • The extent of the developed skyline; • The number and extent of the wind farm developments; • The turbine size comparison; • The distance of the wind farm from the viewpoint or receptor; and	A significant cumulative effect will occur where the addition of the three proposed wind farm sites to other existing and proposed wind farms will result in a seascape / landscape character or view becoming defined by the presence of more than one wind farm and characterised primarily by wind farms so that other patterns and components are no longer definitive.

Cumulative Effects **(continued)**		• The magnitude of change of the three proposed wind farm sites. Definitions of the four levels of magnitude of change are defined as follows: **High** - where the addition of the three proposed wind farm sites will make an immediately apparent contribution to the cumulative situation in a seascape / landscape receptor or view; **Medium** - where the addition of the three proposed wind farm sites makes a notable contribution to the cumulative situation, and its cumulative addition is readily apparent; **Low** - where the addition of the three proposed wind farm sites will make a minor contribution to the overall cumulative situation, and its cumulative addition is only slightly apparent; and **Negligible** - where the addition of the three proposed wind farm sites will make a negligible contribution to the cumulative situation and its addition equates to a 'no change' situation.	

8.4.5 Proposed Mitigation

8.4.5.1 The likely visual effects of different layout scenarios have been investigated in the absence of embedded mitigation measures as part of the review of the worst case layout scenario for the Rochdale Envelope. This approach has necessitated an assessment of the likely worst case, in which the three proposed wind farm sites are assessed and illustrated at their largest size, in terms of turbine height, number, density and horizontal spread, and with the turbine rows set out in a worst case grid pattern that aligns towards the closest section of the Caithness coast (as illustrated and assessed for Scenario 4c), and no further specific mitigation measures are proposed.

8.4.6 Residual Visual Effects – Primary Impact Assessment

Visibility Frequency

8.4.6.1 The visibility at Wick is measured by an automatic instrument - a Belfort Visibility Sensor, which measures the meteorological optical range approximately equivalent to visibility measured by the contrast of a distant object against its background. There are limitations to how this data can be applied to judgements about wind farm visibility, but the visibility measurements are considered appropriate as an evidence basis for evaluating the visibility of the wind turbines against their background and *'reasonably accurate over a range of visibility'* (Met Office, 2010). The three proposed wind farm sites are located approximately 26 km from Wick at their closest point, therefore the measurements of visibility frequency at this distance are appropriate to reference. The Met Office visibility data (Met Office, 2012) shows that for approximately 91 % of the ten year period between 2002 to 2011 there is visibility up to, but not beyond, 26 km and that visibility over 26 km occurs for approximately 9 % of the time. The Met Office visibility frequency data suggests that the study area benefits from good visibility conditions, but that visibility frequency

drops considerably over longer distances, such that the Developments will only be visible in conditions of 'good', 'very good' and 'excellent' visibility (terms defined by the Met Office[1]) over periods of limited frequency. Short periods of excellent visibility tend to be those which are more influential in terms of people's perception of views and the visibility of distant objects.

8.4.6.2 The assessments made in the SLVIA are based on optimum viewing conditions with clear visibility of the turbines and as such assess the 'worst case' or maximum visual effect in optimum or 'excellent' visibility conditions. The Met Office visibility frequency data suggests that these conditions are only likely to occur for relatively limited periods. It is reasonable to conclude that the prevailing visibility and weather conditions combine to significantly reduce the duration and significance of effects to relatively limited periods when clear views of the three proposed wind farm sites are available. It is also reasonable to conclude that visibility will often be limited to the nearest rows of turbines, and that the full depth of the three proposed wind farm sites will often not be seen, because the visibility frequency at longer distances e.g. over 30 km is low.

Zone of Theoretical Visibility (ZTV)

Blade Tip ZTV

8.4.6.3 The Blade Tip ZTV shows the theoretical extent of potential visibility of the three proposed wind farm sites. It shows the potential visibility of any part of the wind turbines up to its highest point (but not all of the wind turbine would necessarily be seen). The blade tip ZTV for the proposed development is shown in Figure 8.4-5, Volume 7 for the study area, at a wide contextual scale of 1:475,000, and in Figure 8.4-5a and 8.4-5b, Volume 7 for Caithness and Moray / Aberdeenshire separately, at a scale of 1:280,000. The Blade Tip ZTV is also presented in greater detail at 1:100,000 scale in Figure 8.4-10a to Figure 8.4-10e, Volume 7. Visibility of the proposed development is illustrated using five colour bands representing visibility of 1-50, 51-100, 101-150, 151-200 and 201-216 turbine blade tips.

8.4.6.4 The limitations of this ZTV are discussed in Technical Appendix 5.4 A. In general, the ZTV is likely to over-estimate the spatial extent of visibility of the three proposed wind farm sites, due mainly to the use of a 'worst-case' model of the turbines (largest turbine height and spread) and the limitations of the digital terrain model, which takes no account of the complex natural and man-made elements in the onshore parts of the surrounding landscape. It is likely therefore, that actual visibility on the ground is less than that indicated on ZTVs due to the screening effects of surface features and local landforms. While the ZTV indicates the number of turbines theoretically visible, it does not show how much of each turbine is visible and this varies within these bands. For example: an area shown as having visibility of 201 to 216 turbines may be affected by the smallest extremity of the blade tips, or it may gain visibility of 216 'full' turbines. The hub height ZTV (Figure 8.4-6, Volume 7) is used to inform the assessment in these circumstances, as it assists with the identification of areas where only the blade tips of the proposed wind farms will be visible.

[1] Met Office Visibility definitions - http:// www.metoffice.gov.uk/weather/uk/guide/key.html#vis

8.4.6.5 The following assessments of the visibility of the three proposed wind farm sites are made using the Blade Tip ZTV:

- Offshore:
  - Visibility of 201 to 216 turbine blade tips from all of the offshore parts of the study area within approximately 40 km of the three proposed wind farm sites;
  - Visibility levels dropping in bands over 35 km at sea level due to earth curvature, which prevents views of the most distant turbines, such that visibility at sea level at 50 km is of 51 to 100 and 101 to 151 turbine blade tips;
- Caithness:
  - Visibility of 201 to 216 turbine blade tips from majority of Caithness coastal edge between Duncansby Head and Helmsdale at distances of 22 km to 40 km (e.g. Viewpoints 1, 2, 4, 5, 6, 7, 8, 9, 10, 12 and 15);
  - Areas with no visibility of the three proposed wind farm sites limited mainly to Sinclair's Bay, Freswick Bay and smaller locally incised bays;
  - Visibility of 201 to 216 turbine blade tips from immediate hinterland of rising ground inland of the coastal edge (25 to 35 km) becoming scattered and more variable depending on the degree of enclosure / openness provided by landform (e.g. Viewpoint 14);
  - No visibility of the three proposed wind farm sites from the majority of the flat peatlands in the central part of the Caithness study area, with visibility limited by rising landforms near the coast which provide a clear view-shed;
  - The relatively low-lying land in these flat peatlands in respect of the landform pattern has the general effect of visibility being precluded by the surrounding higher ground;
  - Northern part of the Caithness study area has scattered, long distance inland visibility (35 to 50 km), where landform at the coast offers some screening, but there is no definitive inland viewshed and views of the proposed development are filtered gradually across the moorlands / agricultural landscape (e.g. Viewpoint 3 and 13);
  - Southern part of the Caithness study area has elevated inland area of sweeping moorland and lone mountains with scattered long distance visibility (35 to 50 km) of the three proposed wind farm sites over the coastal shelf and Dunbeath Bay (e.g. Viewpoint 11).
- Moray / Aberdeenshire:
  - Visibility of 101 to 150 turbines from Moray coastal edge between Lossiemouth and Findochty at low lying locations in Spey Bay at distances of approximately 45 km (e.g. Viewpoint 16 and 17);
  - Visibility of 151 to 216 turbine blade tips from majority of coastal edge and immediate hinterland between Findochty and Banff at distances of 40 to 50 km (e.g. Viewpoints 18, 19, 21 and 22);
  - Southern part of the Moray study area has elevated inland area of uplands and coastal farmlands with scattered long distance visibility (45 to 50 km) of the three proposed wind farm sites over the Moray / Aberdeenshire coast (e.g. Viewpoint 20); and
  - No visibility of the three proposed wind farm sites from the majority of the coastal lowlands in the western part of the Moray study area, with visibility limited by rising landforms near the coast which provide a clear view-shed.

8.4.6.6 The blade tip ZTV shows the effect of curvature of the earth on the likely visibility of the three proposed wind farm sites, which is relevant to consider in the visibility studies for the three proposed wind farm sites. The influence of earth curvature on visibility is shown as most notable in low lying areas, such as at sea level, whereas with elevation on land, the effects of earth curvature become less pronounced. This is evident in the Blade Tip ZTV, which shows visibility levels dropping in bands over 35 km at sea level, while onshore visibility is determined largely by landform. Curvature of the earth has less influence on visibility from the onshore parts of the study area, because the land is more elevated and affords visibility from higher areas where earth curvature has less effect. The eastern Caithness coastline, in particular, is often formed by high cliffs and coastal shelves, with landform rising inland to higher moorlands and mountains. The viewpoints included in Caithness (Table 8.4-4 below) are generally located at elevations of between 34 and 199 m (AOD), with the exception of lower lying locations at Keiss (12 m) and Wick (13 m), and the elevated summit of Morven (704 m). The full height of the turbines closest to the Caithness coast will be visible from most of the viewpoints, with only a few metres of the lower parts of the jacket foundations of the closest turbines screened behind the horizon due to earth curvature. Curvature of the earth reduces the apparent height of the turbines at greatest distance from the coast, with those furthest away having only a relatively small portion of their towers visible above the skyline. The depth of the layout of the three proposed wind farm sites results in the most distant turbines appearing markedly lower in the view than those to the front of the array. The role of earth curvature was found to be greater for the Moray / Aberdeenshire section of the study area, due to its longer distance from the three proposed wind farm sites and the lower elevations of this coastline.

Horizontal Angle ZTV

8.4.6.7 The 'horizontal angle ZTV' in Figure 8.4-7, Volume 7 measures how much of the horizontal field of view is occupied by the Development, in theoretical views. It is calculated from a grid of receptors in the study area and measures the maximum spread from the furthest left to the furthest right theoretically visible turbine of the three proposed wind farm sites. The information is stored as a horizontal angle in degrees. The horizontal angle ZTV provides a more realistic picture of the likely effect of the three proposed wind farm sites because the results reflect the effect that distance has on the apparent size of the three proposed wind farm sites: a large object up-close has more visual impact than the same sized object further away (all other things being equal). The horizontal angle ZTV is displayed using coloured bands showing incremental degrees of horizontal angle, in order to highlight areas of higher effect.

8.4.6.8 The horizontal angle ZTV shows that the widest horizontal field of view is occupied in close proximity to the Development, particularly within the site itself, where the turbines occupy more than 180 degrees (50 %) of the field of view, and in the areas typically within 10 km from the three proposed wind farm sites, where it will occupy 90 to 180 degrees (25 to 50 %) of the field of view. The ZTV allows the following assessments to be made:

- The horizontal field of view occupied by the three proposed wind farm sites decreases considerably with distance;
- The proposed development will occupy less than 60 degrees of the horizontal field of views from onshore areas in the study area with visibility, and generally less than 50 degrees;

- From the closest section of the Caithness coast around Sarclet Head, the proposed development will occupy 50 to 60 degrees of the horizontal field of view in areas with visibility, at distances between 22 km to 23 km;
- From the area of Caithness coast between Dunbeath and Lybster, and between Sarclet Head and Wick, the three proposed wind farm sites will occupy 40 to 50 degrees of the horizontal field of view in areas with visibility, at distances between 23 km to 32 km;
- From the coastal edge between Dunbeath and Helmsdale, the three proposed wind farm sites will occupy 20 to 40 degrees of the horizontal field of view in areas with visibility, at distances between 32 km to 45 km;
- From the coastal edge between Brough Head and Duncansby Head, the three proposed wind farm sites will occupy 20 to 30 degrees of the horizontal field of view in areas with visibility, at distances between 32 km to 40 km;
- From the hinterland areas between Dunbeath and Wick, the horizontal angle of view occupied by the three proposed wind farm sites in areas with visibility is much more variable, in the range between 0 to 50 degrees, depending on the degree of enclosure / openness provided by inland hills; and
- From the wider inland areas, the horizontal angle of view occupied by the three proposed wind farm sites in areas with visibility is much more limited, in the range between 0 to 20 degrees, depending on the degree of enclosure / openness provided by inland hills.

8.4.6.9 The horizontal angle ZTV provides a more realistic picture of the likely magnitude of the effect of the three proposed wind farm sites as it shows the influence that distance has on the apparent horizontal spread of the three proposed wind farm sites. The ZTV illustrates how the visual effect of the three proposed wind farm sites will diminish with distance; how the three proposed wind farm sites will have less visual effect from distant locations and a greater visual effect from locations at very close proximity. It should be noted that this theoretical measure includes the full angle from the furthest left to the furthest right extent of the proposed development, and that in reality the turbines are sited with visible space / gaps between them, which allow views through the site to the seascape or skyline beyond.

Vertical Angle ZTV

8.4.6.10 The 'vertical angle ZTV' in Figure 8.4-8, Volume 7 measures how much of the vertical field of view is occupied up by the three proposed wind farm sites. The vertical angle ZTV measures how much of the vertical field of view is occupied up by the turbine closest to the Caithness coast. It measures the maximum angle between the lowest to the highest extent of this turbine to illustrate the effect that distance has on the apparent size of the three proposed wind farm sites: a large object up-close has more visual impact than the same sized object further away (all things being equal). The vertical angle ZTV is displayed using coloured bands showing incremental degrees of vertical angle, in order to highlight areas of higher effect.

8.4.6.11 The vertical angle ZTV shows that the highest vertical field of view is occupied in close proximity to the Development, particularly within the site itself, where each turbine occupies more than 90 degrees of the vertical angle in the view and in close locations 204 m (tip height) of the turbines, where each turbine will have a vertical angle of 45 to 90 degrees. Beyond 204 m from any turbine, the vertical angle will be less than 45 degrees. The ZTV is notable for the magnitude at which the vertical angle occupied by the proposed development decreases with distance: between approximately 2 km and 10 km, the vertical angle occupied by the three proposed

wind farm sites drops to 1 to 5 degrees, dropping rapidly with distance, such that over approximately 12 km, the three proposed wind farm sites will occupy 0 to 1 degrees of the vertical angle of views. The vertical angle ZTV shows that, where visible from onshore parts of the study area, the three proposed wind farm sites will only occupy 0 to 1 degrees of the vertical angle of views, indicating that it will have less visual effect from these distant locations due to its small vertical height in views.

8.4.6.12 The vertical angle ZTV provides a more realistic picture of the likely magnitude of effect of the three proposed wind farm sites as it shows the influence that distance has on the apparent vertical height of the three proposed wind farm sites in the view. The ZTV illustrates how quickly the visual effect of the three proposed wind farm sites will diminish with distance; how the three proposed wind farm sites will have less visual effect from distant locations due to its reduced vertical height in the view, and a greater visual effect from locations at very close proximity, which in this case are entirely offshore.

Viewpoint Assessment

8.4.6.13 The visual effects of the realistic worst case scenario of the Rochdale Envelope for the three proposed wind farm sites are assessed in this chapter. The change to the visual resource is assessed during construction, operation and decommissioning of the three proposed wind farm sites and OSPs. Effects are assessed on visual receptors through a viewpoint assessment with representative locations and focuses on:

- Views from residential areas (Wick, Keiss, Lybster, Dunbeath, Navidale / Helmsdale, Lossiemouth, Buckie, Cullen and other locations with scattered rural residences);
- Views from transport routes, roads, railways, ferries (A9, A99, Kirkwall to Aberdeen Ferry);
- Views from designated landscapes (Duncansby Head, Berriedale, Morven);
- Views from publicly accessible historic environment features (Sarclet, Hill O' Many Stanes, Findlater Castle);
- Views from recreational routes, footpaths and cycleways (Duncansby Head, Whaligoe Steps, Morven, Bin Hill); and
- Potential marine based views (Aberdeen to Kirkwall Ferry).

8.4.6.14 The assessment of effects of the three proposed wind farm sites on viewpoints is described as follows in Table 8.4-4. Visual representations have been produced for all viewpoints (Figures 8.4-13 to 8.4-36, Volume 7) and photomontages have been produced for a select number of the viewpoints, to provide a photorealistic representation. In all views, the photomontages include the wind turbines and OSPs. All of the photographs, wirelines and photomontages are shown with a 72 degree field of view. Additionally, single frame photomontages have been included from a selection of key viewpoints in the Highland Council area, agreed with Marine Scotland and The Highland Council. The photographs used for these are taken at a focal length of 50 mm and conform to a 39.6 degree horizontal field of view. Single frame photomontages with a 75 mm focal length are also provided from these key viewpoints. The photographs are centred on the centre point of the Rochdale Envelope. The photographs and other graphic material such as wirelines and photomontages used in this assessment are for illustrative purposes only and the assessments are carried out based on assessor observations in the field.

Table 8.4-4 Assessment of Residual Visual Effects

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
1	**Duncansby Head** **Figure 8.4-13, Volume 7**	• Distance from the three proposed wind farm sites 41.95 km (Telford); • View from trig point near car parking area, accessed from footpath to south of Lighthouse; • Wide panoramic views with focus towards Orkney and the Pentland Firth to the north and to Duncansby Stacks to south; • Simple, expansive sea view over a short foreground of rough grassland landcover; • Rugged, steep cliffs and dramatic coastal edge with stacks and small enclosed bays to the south; • No obvious elements or features in the areas to which the three proposed wind farm sites will relate directly; • Located in CCA 16 - Duncansby Head; • Lies within and overlooks Duncansby Head proposed SLA, thus increasing its scenic value; and • Representative of views obtained by walkers and birdwatchers. ***Sensitivity: medium-high***	**Operation** Distance to the three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in 'excellent'[2] visibility conditions. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the south. Set apart from the visible landform of the headlands and the Beatrice Demonstrator turbines. The three proposed wind farm sites form an isolated, distinct feature in their own right on the skyline, surrounded by open sea. Tips and hubs of 216 turbines (Layout Scenario 4c) theoretically visible. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. Turbines spread across extents of the three proposed wind farm sites so that turbine alignment does not appear discordant at this distance. Less turbine overlapping, particularly of more distant, less visible, southern turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will be located in a seascape with few visible man-made features, but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. The three proposed wind farm sites create an apparent focal feature but due to its separation and distance offshore, do not impinge upon or reduce the distinction of existing foci, such as Duncansby Stacks. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a relatively short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it result in the most distant turbines appearing markedly lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 41.95 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

[2] Visibility definitions (excellent, very good, good, moderate, poor, very poor) provided by the Met Office http: / / www.metoffice.gov.uk / weather / uk / guide / key.html#vis

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
2	**Keiss Pier** **Figure 8.4-14 , Volume 7**	• Distance from the three proposed wind farm sites 34.54 km (Telford); • View from land above Keiss Harbour; • Broad, expansive, large scale view of wide open sea over man-made promontory / pier within cove of wider Sinclair Bay; • Minor focus towards Noss Head with lighthouse on furthest protruding cliff land-form of distant shore of Sinclair Bay; • Narrow, horizontal band of gently undulating land above steep coastline; • Wider view includes existing / under construction wind farms of Achairn, Camster and Flex Hill at distances of 11.49, 15.6 and 26.68 km respectively, above the shallowly undulating landform with some back-clothing by more distant hills; • Visible landform emphasises distinction between sea and sky; • Located in CCA 9 – Sinclair's Bay; • Publicly accessible location on edge of settlement; • Representative of views from settlement of Keiss, residential receptors, walkers, views from nearby public car park and local walking route and users of / visitors to the Harbour; and • No scenic designations. ***Sensitivity : medium - high***	**Operation** Distance to the three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites (primarily Telford plus small number of MacCall turbines) located on skyline extending beyond and behind the headland of Noss Head and Sinclair's Bay taking up a relatively narrow field of view within the within the wide panoramic views of the sea from this location. The three proposed wind farm sites affect the focal point of Noss Head as an enclosing headland to Sinclair's Bay, because there is no apparent space / separation offered by open sea between the three proposed wind farm sites and headland. Tips of 93 turbines theoretically visible (Layout Scenario 4c) with 73 of these also visible to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The three proposed wind farm sites theoretically extend over a horizontal field of view of 5-10 degrees of the wide panoramic views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Very good visibility required for the three proposed wind farm sites to be visible at 34.54 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
3	**Sortat** **Figure 8.4-15 , Volume 7**	• Distance from the three proposed wind farm sites 40.22 km (Telford); • View from near Lyth Arts Centre in Sortat on side of minor road that provides access and links across north-eastern part of Caithness generally serving scattered rural population; • Expansive view across shallowly undulating landscape of mixed agriculture and settlement landscape character type; • Lower lying areas of unimproved rough grassland and boggy ground; • Key features of fore and middle ground are stone wall and minor road; • Intermittent thorn bushes break up the moderately scaled field pattern of the low lying areas; • Moderate and large scale forestry across higher ground; • Representative of views from scattered crofting settlement, residential receptors and minor road; • No views of the sea due to intervening landform and vegetation; • Actual views of other wind farms within the wider area limited by intermediate vegetation although theoretically possible; and • No scenic designations. ***Sensitivity: medium-low***	**Operation** Distance to the three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The three proposed wind farm sites are located on skyline above and beyond rolling landscape with fore and middle ground features that provide some intermediate screening. Appears as an onshore wind farm because sea is not visible. Located separately from the existing wind farms visible within the wider view. Tips of 117 turbines theoretically visible (Layout Scenario 4c) with 9 of these also visible to below hub height. Some turbines (those of MacColl and Stevenson) theoretically visible only as blade tips, which may be missed at this distance and due to intermediate vegetation. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others area seen in their row formations. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Relatively contained feature on horizon, mostly located behind Noss Head. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: low - negligible*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low - negligible***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 40.22 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
4	**Wick Bay** **Figure 8.4-16, Volume 7**	• Distance from the three proposed wind farm sites 26.15 km (Telford); • View from northern edge of Wick Bay, on Scalesburn Road pavement; • Moderately contained fore to middle ground view towards large scale, open seas beyond; • Field of view partially confined and directed by enclosing higher ground around Wick Bay; • Lower land at sea edge modified by man-made elements / sea walls and built form of light houses and pier buildings which create localised focal points; • Impression of industrial past and remnants of important fishing port rather than scenic harbour setting; • Small disused quarry along lower cliff edge; • Steep slopes / cliffs, and sea walls provide the change in level to the higher ground upon which most of the settlement of Wick is located; • Large terraced and individual properties along skyline above bay, including coast guard; • Representative of views from settlement of Wick, residential receptors, users of local roads, piers and beach areas, local walking route to monument and around coast; • Views of existing wind farms in the wider view screened by intermediate built form and vegetation; • Located in CCA 11 – Wick Bay; and • No scenic designations. ***Sensitivity: medium - high***	**Operation** Distance to the three proposed wind farm sites results in the turbines appearing as moderate scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites located on skyline extending beyond and behind the headland of the southern part of Wick Bay (South Head). The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites affect the focal point of South Head as an enclosing headland to Wick Bay, because there is no apparent space / separation offered by open sea. 174 turbines theoretically visible (Layout Scenario 4c) to below hub height. The three proposed wind farm sites will appear to occupy most of visible extent of sea skyline in view from Wick Bay and form a wide horizontal feature in relation to the seascape in the view. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 30-40 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Good visibility required for the three proposed wind farm sites to be visible at 26.15 km to closest turbine. Good visibility at distances over 22 km occurs 23 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
5	**Sarclet (Sarclet Haven Info Board)** **Figure 8.4-17, Volume 7**	• Distance from three proposed wind farm sites 22.96 km (Stevenson); • View from end of minor road leading to informal footpath to Sarclet Haven, with parking / information provided; • Expansive view from slightly elevated coast above cliffs, across rough grassland foreground to wide open seas beyond Sarclet Head; • Open, flat, simple coastline with no existing, valued focal features in the view; • Character of landward area is of small farms and crofts; • Representative of view from scattered properties, minor roads and informal footpath to minor visitor attraction; • Located in CCA 12 – Sarclet Head; and • No scenic designations. ***Sensitivity: medium***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites located on skyline extending beyond and above Sarclet Head. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites appear to occupy wide part of visible extent of skyline in view south east and form a wide horizontal feature in relation to the surrounding seascape. Creates a new prominent focal feature, but due to the lack of valued existing foci, it does not impinge upon, or reduce distinctiveness, of the main features in the existing view. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, (MacColl), southern turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 40-50 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Good visibility required for the three proposed wind farm sites to be visible at 22.96 km to closest turbine. Good visibility at distances over 22 km occurs 23 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
6	**Hill O' Many Stanes** **Figure 8.4-18, Volume 7**	• Distance from three proposed wind farm sites 24.20 km (Stevenson); • Panoramic view from Hill O' Many Stanes, a cultural heritage feature of stone rows believed to be a relic of the Bronze Age; • Foreground shows stones set in rough heather / grass moorland and low scrub; • Middle ground comprises small to medium fields of fenced improved pasture around school and small farms / croft buildings; • Sea is seen beyond this lower coastal area and appears as a large scale expanse up to the sky. The slightly elevated viewpoint allows a greater expanse of sea to be visible than is the case with lower elevated views; • Oil platform seen near to the horizon in the southern part of the view; • Representative of views from minor visitor attraction, scattered residential properties and minor road leading to forest and further properties; • Located in CCA 12 – Sarclet Head; and • No scenic designations. ***Sensitivity: medium to high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites located on skyline extending beyond and above the intermediate land and a narrow strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites create a new prominent focal feature, forming a distinct feature in its own right on the skyline, surrounded by open sea. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites appear to occupy a wide part of the visible extent of skyline in view south east and form a wide horizontal feature in relation to the surrounding seascape. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, (MacColl), southern turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 50-60 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Good visibility required for the three proposed wind farm sites to be visible at 24.2 km to closest turbine. Good visibility at distances over 22 km occurs 23 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
7	**Lybster (end of Main Street)** **Figure 8.4-19 , Volume 7**	• Distance from three proposed wind farm sites 26.67 km (Stevenson); • View from end of Main Street in Lybster showing view across final properties that lie nearer to the coast; • View shows foreground of turning area at end of street with grassed verges, fenced fields and garden boundaries; • Just visible is the edge of one of the properties that follow the strong alignment of the road axis, which runs almost due south from the A99 junction; • Other properties in the view are a short terrace of two-storey local authority built houses and a more modern, detached property in the view towards the three proposed wind farm sites. All set within small gardens and with urban amenities such as boundary walls and pole mounted transmission lines; • Small track leads across agricultural land through field gates; • Close proximity to and directly overlooking the sea, which is expansive and large scale, extending uninterrupted to the sky at a horizon that is level with the roof-line of the single storey property; • Oil platform / installations and Beatrice demonstrator turbines visible as small scale, distant elements on the horizon; • Representative of views from residential properties and parts of settlement of Lybster; • Located in CCA 13 – Lybster Bay; and • No scenic designations. ***Sensitivity: medium-high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites located on skyline extending beyond and above the intermediate land and a narrow strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites create a new prominent focal feature, forming a distinct feature in its own right on the skyline, surrounded by open sea. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites appear to occupy a wide part of the visible extent of skyline in view south east and form a wide horizontal feature in relation to the surrounding seascape. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, southern (MacCall) and northern (Telford) turbines results in some turbines appearing as less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 40-50 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Good visibility required for the three proposed wind farm sites to be visible at 26.67 km to closest turbine. Good visibility at distances over 22 km occurs 23 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
8	**Latheron (A9)** **Figure 8.4-20, Volume 7**	• Distance from three proposed wind farm sites 30.73 km (Stevenson); • View from just inside stone enclosure, close to layby on A9; • Expansive views across narrow strip of farmland to large scale sea beyond and extending from below the viewpoint; • View across rough ground and ruined building enclosed by stone walls; • Middle distance is formed by medium sized, shallowly undulating, smooth, pastoral fields with stone wall boundaries; • Prominent coastal incision crosses view. Made more conspicuous by contrast in vegetation to rough grassland and scrub. Vegetation type continues across steep slopes to sea shore; • Representative of views from settlement of Latheron and nearby Latheron wheel as well as scattered properties, road users and visitors; • Oil platforms and Beatrice Demonstrator offshore wind turbines clearly discernible near to the horizon in clear conditions; • Located in CCA 14 – Dunbeath Bay; and • No scenic designations. ***Sensitivity: medium-high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The three proposed wind farm sites located on skyline extending across the horizon above the intermediate land and a strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites create a new prominent focal feature, forming a distinct feature in its own right on the skyline, surrounded by open sea. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites appear to occupy a wide part of the visible extent of skyline in view south east and form a wide horizontal feature in relation to the surrounding seascape. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, southern (MacCall) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The three proposed wind farm sites theoretically extend over a horizontal field of view of 40-50 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Very good visibility required for the three proposed wind farm sites to be visible at 30.73 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
9	**Dunbeath (nr Heritage Centre)** **Figure 8.4-21, Volume 7**	• Distance from three proposed wind farm sites 33.68 km (Stevenson); • Channelled view along minor road further emphasised by steeply sloping side of Dunbeath Water valley; • Fore to mid-ground, medium to large scale and pastoral in character with some limited dwellings and farmsteads strung out along the road and on higher ground above; • Fenced field boundaries and some unimproved pasture with wetness characteristics; • Visibility of sea beyond is limited by landform so that a lesser extent is visible than from some coastal areas; • Sea is large in scale and expansive with distant skyline difficult to discern from the sea in certain weather conditions; • Distant oil platforms and Beatrice Demonstrator turbines visible on horizon as small scale elements; • Representative of views from settlement of Dunbeath, residential receptors, visitors to Heritage Centre / tourist information, beach and around coast; • Located in CCA 14 – Dunbeath Bay; and • No scenic designations. ***Sensitivity: medium - high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. The three proposed wind farm sites theoretically extend over a horizontal field of view of 30-40 degrees of the views available. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites located on skyline extending across the horizon above the intermediate dry stone wall and a strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites will appear to occupy most of visible extent of sea skyline in view eastwards and form a wide horizontal feature in relation to the seascape in the view. This will occur within the main focus of this view and will be apparent, particularly to north bound road users. The three proposed wind farm sites create a new prominent focal feature, forming a distinct feature in its own right on the skyline, surrounded by open sea. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of southern (MacColl) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing slightly lower in the view than those to the front of the array. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Very good visibility required for the three proposed wind farm sites to be visible at 33.68 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
10	**Berriedale (A9)** **Figure 8.4-22, Volume 7**	• Distance from three proposed wind farm sites 36.07 km (Stevenson); • Viewpoint taken at junction with minor road off A9 at Newport on stretch of A9 between Berriedale and Borgue; • Expansive panoramic view across sea, perpendicular to direction of travel along A9, ahead of travellers approaching A9 from Newport. Sense of arrival into Dunbeath Bay as view opens out to the north; • Foreground of road and dry stone wall boundary wall. No middle ground visible due to wall, however, beyond lies a narrow expanse of improved pasture down to rough grassland over mounded coastal strip above shoreline (visible around and over wall); • Shallow profile of sea extends out to skyline where sky and sea merge in certain weather conditions. Visible near horizon as small components of the view are oil platforms and the Beatrice Demonstrator Turbines; • Representative of views from scattered residential properties, bus stop and travellers on A9 and other minor roads; • Located in CCA 14 – Dunbeath Bay; and • Viewpoint located within Berriedale Coast pSLA. ***Sensitivity: medium-high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The vertical field of view of the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites located on skyline extending across the horizon above the intermediate dry stone wall and a strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. This will occur within the main focus of this view and will be apparent, particularly to north bound road users. The three proposed wind farm sites theoretically extend over a horizontal field of view of 30-40 degrees of the views available. 216 turbines theoretically visible (Layout Scenario 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view and an inconsistent image and rhythm of turbines across the view. Less turbine overlapping, particularly of southern (MacColl) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing slightly lower in the view than those to the front of the array. ***Magnitude of change: medium-low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium-low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect** Very good visibility required for the three proposed wind farm sites to be visible at 36.07 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

11	**Morven** **Figure 8.4-23, Volume 7**	• Distance from three proposed wind farm sites 48.92 km (Stevenson); • Viewpoint taken from rocky summit of Morven (706 m AOD), the highest peak in Caithness and classified as a Graham. Likely to be of interest locally / regionally, rather than nationally; • Summit most easily ascended from the east so that views in this direction available during much of walk, once sufficient elevation attained. Morven often walked in conjunction with other peaks to the east; • Panoramic views in all directions with distant views to the Cairngorms to the south and round to take in the western highlands offering impressive views over these mountain ranges; • View east with substantial area of fore and middle ground containing further moderately high concave / smoothed undulating / rocky hills including the Scarabens, Sron Gharbh, Smean and the distinctive conical rock outcrop of Maiden Pap. Large scale landscape of smoothed rock and heather moorland; • Lower elevations surround hill forms with well-defined valleys of Berriedale Water and Langwell Water (out of view to south) having some improved pasture and forestry blocks, minor access roads and limited scattered settlement;	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical field of view of the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located largely below skyline within a part of the open sea views that lie to the east. The location of the turbines below the horizon reduces their effect on the view. The three proposed wind farm sites are partially located behind the Scarabens and other summits in the group, and will appear to add a distant focal feature behind these existing focal features in the view towards the sea. The three proposed wind farm sites theoretically extend over a horizontal field of view of 20-30 degrees of the wide panoramic views available in all directions. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 204 of these also visible to below hub height. The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites form a distinct feature in its own right below the skyline, surrounded by open sea. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others towards the edges of the array seen in their row formations Less turbine overlapping, particularly of southern (MacCall) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites will extend from relatively close to the two existing Beatrice Demonstrator turbines and in another part of the view from the loose grouping of other existing wind farms, these man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. The elevated angle of view and the depth of the layout of the three proposed wind farm sites within it results in the arrangement of the layout of turbines being more legible than in other views from lower elevations. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 48.92 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

11	**Morven** **Figure 8.4-23, Volume 7** **(continued)**	• More distant views contain settled coastal strip of crofting landscape and villages. The wind farms at Buolfruich, Causeymire, Flex Hill and Camster (under construction) and the mast on Ben a' chielt lie within the open moorland / forested areas further to the north; and • Sea beyond high ground and coastal strip is a component of distant view that provides a simple backdrop to the hills and coastal area to the fore. • Located in Lone Mountains terrestrial LCT; and • Viewpoint is located within proposed SLA – Flow Country and Berriedale Coast, SAWL. • **Sensitivity: medium to high**		

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
12	**Navidale** **Figure 8.4-24, Volume 7**	• Distance from three proposed wind farm sites 44.61 km (MacColl); • Elevated location above A9 and coastal areas of settlement; • Expansive, large scale, rural view with fenced large to medium sized fields across coastal shelf; • Sea extends widely across the background of the view and is large in scale with some oil platforms near to the horizon; • Sky and sea merge in certain weather conditions; • Northern extent of seaward view restricted by upland area of Creag Thoraraidh, which comes close to the coast and is a large, smooth, conical hill with a heather moorland and rough grassland summit and side slopes to a rugged coastal area; • Representative of views from settlements of Navidale, East Helmsdale and Helmsdale; • Located in CCA 15 – Helmsdale to Berriedale Coastal Shelf; and • No scenic designations. ***Sensitivity: medium to high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The three proposed wind farm sites theoretically extend over a horizontal field of view of 20-30 degrees of the wide panoramic views available. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the east. Set apart from the visible landform of the headlands but integrated with the Beatrice Demonstrator turbines. The vertical field of view of the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. Tips and hubs of 216 turbines theoretically visible (Layout Scenario 4c). The turbines appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites form a distinct feature in its own right on the skyline, surrounded by open sea. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of southern (MacCall) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array The distance of the three proposed wind farm sites from this viewpoint results in this being less apparent than occurs in views from closer viewpoints. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites will extend (from the two existing Beatrice Demonstrator turbines) these man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a relatively short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. ***Magnitude of change: medium-low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium-low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 44.61 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
13	**Catchory** **Figure 8.4-25, Volume 7**	• Distance from three proposed wind farm sites 38.84 km (Telford); • Shallowly undulating, medium to large scale terrain of northern Caithness; • Largely pastoral in landuse in areas of better soil with some rough, grass / peat moorland apparent in lower, wetter areas; • Scattered settlement of small farms and crofts associated with network of minor roads; • Other infrastructure includes pole mounted transmission lines, the masts at Thrumster and the gas installation near Wick; • Coniferous forestry visible on the slopes around Tannach Hill and nearer the viewpoint in low ground near Loch Winless; • Some small areas of deciduous trees and broken hedgerows; • Relatively small (3 turbine) wind farms of Bilbster and Achairn visible to the south east with Bilbster partially backclothed by the higher ground and forestry beyond; • Camster wind farm (under construction visible in wider view on skyline. Causeymire wind farm screened by intermediate vegetation	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline above and beyond rolling landscape with distant skyline features providing some intermediate screening. Appears as an onshore wind farm because sea is not visible. Most visible turbine blades set apart from the existing wind farms visible within the wider view adding further wind farm visibility to a different part of panorama. Turbines are seen as partial or complete blades moving to appear intermittently above the lower parts of the horizon in the vicinity of the tall gas canisters of the Wick gas installation. Tips of 106 turbines theoretically visible (Layout Scenario 4c) with 19 of these also visible to below hub height. Some turbines (those of Stevenson) theoretically visible only as blade tips, which may be missed at this distance and due to intermediate vegetation. MacColl turbines entirely screened by intermediate landform. The three proposed wind farm sites will extend wind farm influence into a further part of the views to those already affected by this type of development. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect** Very good visibility required for the three proposed wind farm sites to be visible at 38.84 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
13	**Catchory** **Figure 8.4-25, Volume 7** **(continued)**	• Visibility of primarily blades of the Causeymire wind farm (11.29 km) to the south west and of full turbines of the Camster wind farm (under construction) further south (8.68 km); • Located in Mixed Agriculture and Settlement LCT; • Representative of some scattered residential receptors and views from minor roads; and • No scenic designations. • **Sensitivity: medium**		

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
14	**Minor Rd, south side of Stemster Hill** **Figure 8.4-26, Volume 7**	• Distance from three proposed wind farm sites 33.55 km (Stevenson); • View taken from minor road connecting A9 and A99; • Viewpoint located in moorland on gradual rise which affords views over hills towards coast; • View characterised by moorland and forestry with sea forming detached background feature; • Located in LCT 2 – Moorland Slopes and Hills; • Landscape appears open with some sense of remoteness; • View will be experienced by road users travelling through this landscape. There is some opportunity for walking in the forest in the vicinity of the viewpoint; • Views in other directions contain blade tips of Buolfruich wind farm and blade tips and some limited hubs of the Camster wind farm (under construction); and • There are no scenic landscape designations. ***Sensitivity: medium-low***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites located on skyline extending beyond and above the intermediate, rolling, large scale moorland and forestry, and further to the south, a very narrow strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The northern turbines may appear to be located on the land, which may create some visual confusion. The three proposed wind farm sites theoretically extend over a horizontal field of view of 30-40 degrees of the views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 205 of these also visible to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, southern (MacCall) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale – in terms of both the landscape and seascape areas of the view, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. ***Magnitude of change: medium-low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium-low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect** Very good visibility required for the three proposed wind farm sites to be visible at 33.55 km to closest turbine. Very good visibility at distances over 30 km occurs 3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
15	**Whaligoe Steps** **Figure 8.4-27, Volume 7**	• Distance from three proposed wind farm sites 23.11 km (Stevenson); • View taken from visitor attraction of Whaligoe Steps - 365 man-made steps cut into cliff to access small port; • Framed view extends out to sea with headlands visible to the left and to the right; • Open, uniform view of the sea with no valued focal points in existing view out to sea; • The wider view presents the coastline as the key characteristic of the view with the sea forming the background setting; • The dramatic drop of the cliffs and their exposed rocky faces draw the viewer's attention; • Located in CCA 12 – Sarclet Head; • Sarclet Head comprises hard coastal shore with irregular rocky coastline of Old Red Sandstone cliffs; • View will be experienced by tourist visitors / walkers using this route and will focus predominantly on the coastline; and • There are no scenic landscape designations. ***Sensitivity: medium – high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in very good weather conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites located on skyline extending beyond and above the intermediate land and a narrow strip of sea. The three proposed wind farm sites take up large horizontal extents of field of view containing open water skyline, reducing its simplicity and the contrast with the more complex landward area. The three proposed wind farm sites appear to occupy wide part of visible extent of skyline in view south east and form a wide horizontal feature in relation to the surrounding seascape. Creates a new prominent focal feature, but due to the lack of valued existing foci, it does not impinge upon, or reduce distinctiveness, of the main features in the existing view. The three proposed wind farm sites theoretically extend over a horizontal field of view of 50-60 degrees of the views available. 216 turbines theoretically visible (Layout 4c) to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of slightly more distant, (MacColl) southern turbines and northern (Stevenson) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having a lesser section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. ***Magnitude of change: medium*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: medium***	**Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible. **Likelihood of effect** Good visibility required for the three proposed wind farm sites to be visible at 23.11 km to closest turbine. Good visibility at distances over 22 km occurs 23 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
16	**Lossiemouth, Harbour** **Figure 8.4-28, Volume 7**	• Distance from three proposed wind farm sites 45.8 km (MacColl); • View taken from Harbour Wall at Lossiemouth Harbour; • Located within CCA 18 – Spey Bay; • Lossiemouth lies between hard coastal shore to the left and soft coastal shore to the right; • Open sea and skyline is prevailing feature in uniform, simple view; • Caithness coastline and hill profiles form distant backdrop to open sea of the Moray Firth; • View towards the three proposed wind farm sites is part of a wider view which takes in Lossiemouth Harbour on the coastal edge; • View representative of worst case view from public domain in Lossiemouth as experienced by locals and visitors; • Long distance from nearest turbine reduces the sensitivity of this viewpoint; and • There are no scenic landscape designations. ***Sensitivity: medium***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on the skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with majority of these visible to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of southern (MacColl) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The distance of the three proposed wind farm sites from this viewpoint results in this being less apparent than occurs in views from closer viewpoints. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only blade tips visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. Most of the turbines are sufficiently distant to be visible only as blades as the hubs are hidden by the curvature of the earth. ***Magnitude of change - low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change - low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, long term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 45.8 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
17	**Buckie, Cliff Terrace** **Figure 8.4-29, Volume 7**	• Distance from three proposed wind farm sites 44.23 km (MacColl); • View taken from Cliff Terrace affording elevated view towards harbour and industrial development; • Harbour acts as main focus in the view with sea forming background feature; • Industrial development presents less attractive character than in other coastal settlements; • Located in CCA 19 – Portgordon to Portknockie; • Buckie located on hard coastal shore with low Old Red Sandstone cliffs evident to the left and right of the view; • View is representative of experience of road-users and pedestrians as well as residents in town who will gain sea view; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium – low***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 138 of these also visible to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of southern (MacCall) and northern (Telford) turbines results in some turbines appearing less dense at the edges of the array. The distance of the three proposed wind farm sites from this viewpoint results in this being less apparent than occurs in views from closer viewpoints. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. Some turbines are sufficiently distant to be visible only as blades as the hubs are hidden by the curvature of the earth. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 44.23 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
18	**Portnockie - Bow Fiddle Rock Info Point** **Figure 8.4-30, Volume 7**	• Distance from three proposed wind farm sites 41.08 km (MacColl); • View taken from the coastal path at the base of the headland to the north-west of Portknockie; • Expansive view of the North Sea available form this viewpoint with few interruptions other than close range rocks; • Open sea characterises this view and acts as main draw although no specific focus is present; • Old Red Sandstone cliffs enclose viewpoint to the south and rocky coastline extends in either direction; • Located within CCA 19 – Portgordon to Portknockie; • View will be experienced by walkers and importance of viewpoint marked by information point; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium – high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The three proposed wind farm sites will be seen immediately behind the foreground rock outcrop and therefore in the same part of the view as this valued landscape feature. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 182 of these also visible to below hub height. Turbine rows and alignment apparent in this view resulting in differing relationships between turbines so that some are aligned behind one another and others are seen in their row formations with further rows appearing beyond creating a stacking effect in parts of the view. Less turbine overlapping, particularly of south western and eastern (MacColl) turbines results in some turbines appearing less dense at the edges of the array. The distance of the three proposed wind farm sites from this viewpoint results in this being less apparent than occurs in views from closer viewpoints. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. Some turbines are sufficiently distant to be visible only as blades as the hubs are hidden by the curvature of the earth. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 41.08 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
19	**Cullen, Viaduct & cycle path** **Figure 8.4-31, Volume 7**	• Distance from three proposed wind farm sites 42.80 km (MacColl); • View taken from elevated viaduct affording views over roof tops to coastal edge; • Focus of the view is the harbour area and surrounding development with sea forming background feature; • Seascape contained by headlands visible in right of view and to the left of view which reduces the expansiveness of the view; • Located in CCA 20 – Cullen Bay; • Coast characterised by Sandy Cullen Bay enclosed on either side by rocky headlands of Old Red Sandstone cliffs; • View representative of views gained by locals and visitors using viaduct cycle path and visiting the harbour, and Cullen residents who gain coastal / sea views; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium – high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The will be seen above the middle ground harbour feature and therefore in the same part of the view. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 200 of these also visible to below hub height. Less turbine overlapping, particularly of south western and eastern (MacColl) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. Some turbines are sufficiently distant to be visible only as blades as the hubs are hidden by the curvature of the earth. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 42.8 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
20	**Bin Hill** **Figure 8.4-32, Volume 7**	• Distance from three proposed wind farm sites 45.53 km (MacColl); • Northern sector of panoramic view looks across upland farmland to north sea coast; • Distinct transition between land and sea, both forming strong horizontal bands; • Visibility of east coast as distant feature in left of view reduces sense of remoteness in the seascape; • Forestry and farmland characterises view with sea forming background feature; • Located within LCT 37 – Upland Farmland; • Man-modified landscape with comercial forestry and intensive arable agriculture characterising the view; • Viewpoint accessed by forestry tracks and representative of views of walkers, probably of interest locally rather than regionally or nationally; • View of Boyndie wind farm to the east in the hills near to the coast; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The will be seen above the middle ground coastal, agricultural and forested low lying land and therefore in the same part of the view. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with all of these also visible to below hub height. Less turbine overlapping, particularly of south western (MacColl) and eastern (Telford and MacColl) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The elevated location of the view ensures that all of the turbines are visible to below hub height. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 45.53 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
21	**Findlater Castle** **Figure 8.4-33, Volume 7**	• Distance from three proposed wind farm sites 43.16 km (MacColl); • View taken from formal viewpoint and information point for Findlater Castle, where access track meets cliff top path; • View projects out from Cliff top location across the immediate enclosed rocky bay to an open and expansive seascape which characterises view; • Remains of Findlater Castle form an existing focal point in the foreground view; • Elevated position and low cover of vegetation accentuates openness of view; • Visibility of coastal headland to left and right of view tempers the influence of the seascape; • Located within CCA 21 – Sandend Bay; • Irregular and rocky coastline of Old Red Sandstone cliffs with shore of pebbly raised beach obscured from view; • View will be experienced by walkers with heightened sensitivity of scenic views; • Importance of viewpoint denoted by formal recognition on OS map data; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium - high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the field of view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The turbines will be seen in the distance beyond the rocky promontory which contains the remains of FIndlater Castle, but due to the distance and separation does not detract from the existing foci of the castle in the foreground view. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the wide panoramic views available. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with all of these also visible to below hub height. Less turbine overlapping, particularly of south western and eastern (MacColl) turbines results in some turbines appearing less dense at the edges of the array. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. The elevated location of the view ensures that all of the turbines are visible to below hub height. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 43.16 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

No	Viewpoint	Baseline Condition and Sensitivity	Magnitude of Change (Layout Scenario 4)	Significance of Residual Effects
22	**Portsoy** **Figure 8.4-34, Volume 7**	• Distance from three proposed wind farm sites 44.82 km (MacColl); • View taken from grassy area between Shore Street and Schoolhedry Street; • View presents open and uninterrupted seascape which extends across 72 degree frame and which has no specific focus; • Viewpoint located on raised headland with rocky shoreline visible in the foreground; • Developed context of Portsoy visible within the remainder of panorama and characterised by harbour and other traditional coastal developments; • Located within CCA 21 – Sandend Bay; • Hard coastal shore characterised by Old Red Sandstone Cliffs and irregular coastal edge of pebbly raised beaches; • View representative of views gained by residents along Portsoys coastal edge and visitors to the harbour and coastal area; • Distance from nearest turbine reduces the sensitivity of this viewpoint to the three proposed wind farm sites; and • There are no scenic landscape designations. ***Sensitivity: medium - high***	**Operation** Distance to three proposed wind farm sites results in the turbines appearing as small scale, vertical features, visible only in excellent visibility conditions. The vertical angle of view occupied by the three proposed wind farm sites theoretically takes up 0-1 degrees of the view. The three proposed wind farm sites are located on skyline within a part of the broad, open sea views that lie to the north. Set apart from any visible landform and the Beatrice Demonstrator turbines. The turbines will be seen above the pier, across an intermediate stretch of water from this location. The three proposed wind farm sites theoretically extend over a horizontal field of view of 10-20 degrees of the view. Tips of 216 turbines theoretically visible (Layout Scenario 4c) with 95 of these also visible to below hub height. Less turbine overlapping, particularly of south western and eastern (MacColl) turbines results in some turbines appearing less dense at the edges of the array. Although this is less noticeable than in closer range views. The three proposed wind farm sites will extend man-made elements to a part of the view that currently has no such features but that is large in scale, a key consideration in a seascape / landscape's ability to accommodate such structures. At this distance the curvature of the earth substantially reduces the apparent height of all of the turbines with those furthest away having only a markedly short section of their towers visible above the skyline or else blades only. The angle of view and the depth of the layout of the three proposed wind farm sites within it results in the most distant turbines appearing lower in the view than those to the front of the array. ***Magnitude of change: low*** **Construction and decommissioning** The worst case scenario of both the construction and decommissioning will be when large numbers of turbines are in place in addition to concentrations of activity in the form of marine vessels and cranes. ***Magnitude of change: low***	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible. **Likelihood of effect:** Excellent visibility required for the three proposed wind farm sites to be visible at 44.82 km to closest turbine. Excellent visibility occurs 0.3 % of the time (over a 10 year period from Wick Airport).

Visual Effects at Night

8.4.6.15 The turbines and OSPs at the three proposed wind farm sites will be lit in accordance with the International Association of Lighthouse Authorities (IALA) standards and Civil Aviation Authority (CAA) requirements (see Chapters 2.2: Project Description; 8.2: Shipping and Navigation; and 8.3: Military and Civil Aviation for a further discussion of the lighting specifications). As such, there is potential for the three proposed wind farm sites to be visible at night.

8.4.6.16 Due to the collision risk posed by an isolated structure, there is a requirement for the offshore wind turbines to be lit with a white light. These aids to navigation are mounted on the wind turbines, below the lowest point of the arc of the rotor blade (minimum of 22 m above the HAT level). The significant peripheral structures (SPS), i.e. the corner turbines in the layout, are required to be fitted with lights visible from all directions in the horizontal plane, and selected intermediary structures on the periphery of the three proposed wind farms, other than the SPSs, are also recommended to be lit. The Maritime and Coastguard Agency (MCA), through recent guidance notes, also requires that all turbines are marked and fitted with short range lighting, as an active safety management system.

8.4.6.17 Navigational lighting should be visible over a range of not less than 5 nm. As the three proposed wind farm sites are located at distances over 22 km from the coast, turbine navigational lighting at a maximum of 22 m above the HAT will not be visible from low lying areas near sea level along the coast due to earth curvature. At more elevated viewing positions, such as sea cliffs and headlands, the navigational lights may be theoretically visible, but the acuteness or clearness of the lights will be much reduced over long distances and in the variable, maritime atmospheric conditions. Navigation lighting stands out to seafaring vessels over short to medium distances out at sea, up to around 8 km. At distances over 8 km even the brighter lights (corner turbines etc) are likely to be reaching the limit of visual acuity at 22 km, due to the nominal range of the lights recommended. The assessment considers that the effect of navigational lighting of the three proposed wind farm sites will not be significant on onshore visual receptors and viewpoints.

8.4.6.18 The CAA guidance on offshore wind turbine lighting (CAA, 2010) requires offshore wind turbine SPS to be lit with 'medium intensity' (2000 candela) steady red light, positioned as close as possible to the top of the nacelle. Night time visual representations have been included in the assessment to predict and assess the possible effect of lighting of the proposed turbines and the Offshore Substation Platforms (OSPs). Lighting has been simulated using 3Ds Max Software by selecting photometric lights with a lighting intensity of 2000 candela. Lights with a red filter and 2000 candela simulation have been placed on the nacelle of the perimeter turbines of each wind farm site - Telford, Stevenson and MacColl, with additional lights located in the middle of each wind farm site. Lights with a yellow filter and 2000 candela simulation have been placed at each corner of the Offshore Substation Platforms (OSPs). The red CAA lights are assumed to be a steady lighting, but there is a future possibility that the CAA requirement will be interpreted to reflect the use of flashing red lighting. It is likely that, if flashing lighting is deemed appropriate, the flash sequence on each turbine within the same wind farm development would be required to be synchronized. The CAA lights on the existing Beatrice demonstrator turbines have a flashing sequence.

8.4.6.19 Visual representations of night time views from the viewpoints at Wick Bay and Dunbeath (Viewpoints 4 and 12 respectively) are provided in Figures 8.4-16c, Volume 7 (Wick Bay) and 8.4-21c, Volume 7 (Dunbeath). The effect of the three proposed wind farm sites and OSPs at night is assessed from these viewpoints at Wick Bay and Dunbeath as representative locations from settlements and gateway views from the Caithness coast.

Viewpoint 4: Wick Bay

Baseline and Sensitivity to Change

8.4.6.20 The existing night time view from Wick Bay is shown in Figure 8.4-16c, Volume 7. The view is somewhat contained by the South Head of Wick Bay, enclosing higher ground around Wick, and directed to the large scale, open seas beyond. It is evident in the existing view photographs that the night time view of Wick Bay is substantially lit by many features associated with the harbour and town of Wick, including lighting around the harbour, boat lighting, street lighting, lighting associated with houses and buildings in Wick and point features such as the lighthouse. The sea within the harbour area reflects the light from these sources, increasing the influence of lighting in the scene. The open seascape beyond Wick Bay in the view is intrinsically dark, with no lighting evident on the sea skyline in this view from Wick Bay. There is a strong contrast between the developed and lit night time landscape around Wick Bay to the right of the panorama and the undeveloped, distant 'dark' seascape to the left of the panorama. The overall impression of the night time view is of a settled, well-lit industrial harbour town in which lighting has a substantial influence on the existing night time view. The night time view from Wick Bay is likely to be experienced by residents on the north side of Wick Bay, around The Shore and Scalesburn, and by fishermen working or returning to Harbour. The sensitivity of the view from Wick Bay to change resulting from the lighting of the offshore wind turbines and OSPS is assessed as medium.

Magnitude of Change

8.4.6.21 The predicted night time view from Wick Bay is shown in the photomontage representation in Figure 8.4-16 d, Volume 7. The red turbine lights on the nacelle of the perimeter turbines of the three proposed wind farm sites and the lights on the OSPs will be visible in the view. The lights will be visible on the skyline extending beyond the headland of the southern part of Wick Bay (South Head). The position of the three proposed wind farm sites in the view is such that they will introduce lights into the undeveloped, distant 'dark' seascape section of the view, that currently has no lighting, but they will also be seen in the context of the extensively lit night time landscape around Wick Bay. The appearance of the red turbine lights and the yellow lights on the OSPs will appear substantially diminished in the context of the bright foreground lighting around Wick Bay, due to the long distance of the three proposed wind farm sites and OSPs offshore (21.6 km to nearest turbine). Although the lighting introduces lights into a section of dark seascape, the lights are not considered to be obtrusive and due to their relatively low position on the distant skyline, do not impede the view of the night sky. The lights occupy a relatively small portion of the view with additional lighting, in comparison to the existing portion of view which is lit up around Wick and Wick Harbour. The lighting of peripheral turbines results in spaces of skyline within the developed part of the horizon with no lighting. The lights are likely to be viewed with the dark silhouette of the wind turbines and OSPs during the hours around dusk and as point features of light during the darker hours of the night. It will be possible to identify the formation of the turbines with the red CAA lighting, but only in conditions of good and excellent visibility. The magnitude of change of the three proposed wind farm sites and OSPs on the view from Wick Bay at night is assessed as low.

Significance of Effect

8.4.6.22 As the sensitivity of the view from Viewpoint 4 Wick Bay to the type of change proposed is assessed as medium, and the magnitude of change on the view assessed as low, the significance of effect of the three proposed wind farm sites and

OSPs on the view at night is assessed as not significant. This is largely due to the low change from the baseline view, which includes extensive night time lighting around Wick and Wick Harbour, such that the appearance of the red turbine lights and the yellow lights on the OSPs will appear substantially diminished in the context of the existing foreground lighting, and the relatively small portion of the view occupied by new lighting in comparison to the extent of the existing view over Wick Bay which is already lit at night.

Viewpoint 9: Dunbeath

Baseline Conditions and Sensitivity to Change

8.4.6.23 The existing night time view from Dunbeath is shown in Figure 8.4-21c, Volume 7. The view is somewhat channelled out to sea by the landform around Dunbeath Water. Lights from the scattered dwellings, properties on higher ground at the northern edges of Dunbeath and street lights are evident in the baseline view. Visibility of sea beyond is limited by landform so that a lesser extent is visible than from some coastal areas, but the lighting of the distant Beatrice oil platforms and Beatrice Demonstrator turbines are visible on the horizon. The red CAA lighting on the nacelles of the Beatrice demonstrator turbines are visible, with a short flash sequence, and are evident in the existing view photograph in Figure 8.4-21c, Volume 7. The navigational lighting on the Beatrice Demonstrator turbines is not visible. The overall impression of the night time view is of a rural landscape with scattered onshore lighting and an intrinsically dark seascape with limited offshore lighting of the Beatrice demonstrator turbines and Beatrice Oil Rig. The night time view from Viewpoint 9 near Dunbeath is likely to be experienced by residents in Dunbeath and Balnabruich. The sensitivity of the view from Dunbeath to change resulting from the lighting of the offshore wind turbines and OSPS is assessed as medium.

Magnitude of Change

8.4.6.24 The predicted night time view from Viewpoint 9 Dunbeath is shown in the photomontage in Figure 8.4-21d, Volume 7. The red turbine lights on the nacelle of the perimeter turbines of the three proposed wind farm sites and the lights on the OSPs will be visible in the view. The lights will be visible on the skyline beyond Dunbeath Bay. The position of the three proposed wind farm sites in the view is such that they will introduce lights into a largely undeveloped, distant 'dark' seascape, that currently has some limited visible offshore lighting at the Beatrice Demonstrator turbines and Beatrice Oil Rigs. The appearance of the red turbine lights will be of similar intensity to the lights on the Beatrice Demonstrator turbines, with the effect extended over a larger portion of the sea skyline, such that the majority of the sea skyline in the view will be occupied by red turbine lights. The yellow lights on the OSPs will appear similar to the lights on the Beatrice Oil Rigs, with the effect extended to the scattered OSP locations on the skyline amongst the wind turbine lights. The red turbine lights and yellow lights on the OSPs will be substantially diminished due to the long distance of the three proposed wind farm sites and OSPs offshore (33.7 km to the nearest turbine). Although the lighting introduces lights into a section of dark seascape, the lights are an extension of an existing light characteristic of the baseline view and due to their relatively low position on the distant skyline, do not impede the view of the night sky. The lights are likely to be viewed with the dark silhouette of the wind turbines and OSPs during the hours around dusk and as point features of light during the darker hours of the night. It will be possible to identify the formation of the turbines with the red CAA lighting, but only in conditions of good and excellent visibility. The magnitude of change of the three proposed wind farm sites and OSPs on the view from Viewpoint 9 Dunbeath at night is assessed as medium.

Significance of Effect

8.4.6.25 As the sensitivity of the view from Viewpoint 9 near Dunbeath to the type of change proposed is assessed as medium, and the magnitude of change on the view assessed as medium, the significance of effect of the three proposed wind farm sites and OSPs on the view at night is assessed as significant. Although the brightness of the red turbine lights and the yellow lights on the OSPs will appear substantially diminished, and similar in intensity to the existing lighting of the Beatrice Demonstrator turbines and oil rigs, the effect on the night time view is considered significant due to the horizontal spread of the three proposed wind farm sites in the view, which will extend the minor effect of the existing offshore lighting over the majority of the sea skyline in the view.

Conclusions

8.4.6.26 The effect of the three proposed wind farm sites and OSPs at night results mainly from the red CAA lighting located on the nacelle of turbines on the periphery of the three proposed wind farm sites and the yellow lights on the OSPs. The effect of the three proposed wind farm sites and OSPs at night is assessed as not significant from Viewpoint 4 in Wick Bay and significant from Viewpoint 9 near Dunbeath. The effect on the view from Wick Bay is assessed as not significant largely due to the low change from the baseline view, which includes extensive night time lighting around Wick and Wick Harbour. The significant effect on the view from Dunbeath is due to the relatively dark landscape and sea skyline in the baseline view, combined with the horizontal spread of the three proposed wind farm sites, which will extend the effect of the existing offshore lighting over the majority of the sea skyline in the view. It is considered that significant effects of the three proposed wind farm sites and OSPs at night are limited in extent, concentrated to a small geographic area between Wick and Dunbeath, in areas where the baseline views are intrinsically dark and yet the change is experienced in relative frequency by local residents and motorists.

8.4.6.27 In general, lighting is a secondary effect of development and where the effect of the three proposed wind farm sites is assessed as not significant during the day, when the wind turbines are fully visible, they will not have significant effects at night as a result of lighting, when the wind turbines are not visible. The duration of the effect of the lights on receptors is likely to be over a relatively short period, more commonly experienced during evening and morning hours of darkness, around dusk and sunrise. The visual effects of the three proposed wind farm sites and OSPs at night are also limited by the activity of receptors at night. Receptors that experience views at night are generally limited to residents of settlements, rural properties and motorists using the road network. Views from remote rural / coastal locations, beaches, mountains and footpaths etc. are visited infrequently at night. The assessment of night time effects is also based on clear night time viewing conditions, when it will be possible to identify the formation of the turbines with the red CAA lighting, but only in conditions of good and excellent visibility.

Route Corridor Assessment

8.4.6.28 There are numerous route corridors traversing the study area, some of which are associated with urban development while the majority provide access to the wider countryside. There are a larger number of route corridors in the study area and it is not possible, or necessary, to assess the potential effects of the three proposed wind farm sites on every route, however, some of the key routes require consideration in the assessment. The three principal criteria have been considered in determining inclusion of routes in the assessment:

- The extent to which the route traverses the study area or extends across a notable part of it, rather than being just a short stretch;
- The importance of the route in terms of recognition, signage, traffic volume and usage; and
- Consultation feedback from stakeholders regarding particular route corridors.

8.4.6.29 Using these criteria, three major roads are assessed further in Table 8.4-5 below: the A882; A9; and A99. All of the routes in the study area are shown in Figure 8.4-12, Volume 7 in relation to the ZTV. The routes of the A882, A9 and A99 are shown at a larger scale in relation to the ZTV in Figures 8.4-12a to 8.4-12e, Volume 7.

Table 8.4-5 Assessment of Visual Effects on Route Corridors

Route Corridor	Distance from Site	Sensitivity to Change	Magnitude of Change	Significance of Effect
A882 Figure 8.4-12a, Volume 7	24.5 km to 47.5 km (Telford)	Low	• Majority of 23 km route between Wick and Halkirk has no visibility (approximately 18 km of route); • Fleeting sections of visibility of 1 to 50 turbine blade tips from three sections of road (approximately 5 km of route); • Visibility at distances over 33 km from the three proposed wind farm sites (Telford); • Eastbound section of route orientated towards the three proposed wind farm sites; and • The three proposed wind farm sites behind direction of travel on westbound route. **Magnitude of change: low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible
A9 (Brora to Latheron) Figure 8.4-12b, Volume 7	30 km to 50 km (MacColl / Stevenson)	Medium to medium-high (Brora to Latheron section of A9 has direct relationship with the sea / coast)	• Continual, but long distance visibility from deposition coast between Brora and Helmsdale, at distances over 44 km (MacColl); **Magnitude of change: medium – low** (Brora to Helmsdale) • Intermittent, long distance visibility from incised bends in coastal shelf between Helmsdale and Ousdale, at distances over 41 km (MacColl); **Magnitude of change: medium – low** (Helmsdale to Ousdale) • Limited visibility between Ousdale and Berriedale; **Magnitude of change: low** (Ousdale to Berriedale) • Largely continuous visibility between Berriedale and Latheron at distances between 30 to 36 km, with the three proposed wind farm sites oblique to road; and **Magnitude of change: medium** (Berridale to Latheron).	**Brora to Berriedale:** **Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible **Berridale to Latheron:** **Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible

A9 (Latheron to Thurso) Figure 8.4-12c, Volume 7	30 km to 50 km (Stevenson)	Medium – low (Latheron to Thurso section of A9 has little / no relationship with the sea / coast)	• Majority of 37 km route between Wick and Halkirk has no visibility (approximately 36 km of route); • Fleeting section of visibility of 201 to 216 turbine blade tips from one section of road near Upper Latheron (approximately 1 km of route); • Visibility at distances over 30 km from the three proposed wind farm sites (MacColl); • Southbound section of route is oblique to the three proposed wind farm sites; and • The three proposed wind farm sites behind direction of travel on northbound. **Magnitude of change: low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible
A99 (Latheron to Wick) Figure 8.4-12d, Volume 7	22.5 km to 30 km (MacColl / Telford)	Medium	• No visibility between Thrumster and Wick; **Magnitude of change: negligible / no change** (Thrumster to Wick) • No visibility past Lybster; **Magnitude of change: negligible / no change** (past Lybster) • Largely continuous visibility for remainder of route between Latheron and Thrumster at distances between 25 to 30 km, with the three proposed wind farm sites oblique to road; and **Magnitude of change: medium** (Latheron to Thumster).	**<u>Thrumster to Wick and past Lybster:</u> Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible **Latheron to Thrumster:** **Operation** Significant, negative, long term, reversible. **Construction and decommissioning** Significant, negative, short term, reversible
A99 (Wick to John O' Groats) Figure 8.4-12e, Volume 7	25 km to 40 km (Telford)	Medium	• Fleeting sections of visibility of 1 to 216 turbine blade tips interspersed with stretches with no visibility; • Southbound section of route orientated oblique to the three proposed wind farm sites; • The three proposed wind farm sites behind direction of travel on northbound route; • No visibility between John O' Groats and Warth Hill and past Freswick Bay; • Higher visibility as the road passes Nybster and Keiss, but at distance between 32 to 35 km from the three proposed wind farm sites; and • Limited visibility past Sinclair's Bay, from low lying ground, increasing to south of the bay towards Reiss and approach to Wick / Wick Airport. **Magnitude of change: medium-low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible

8.4.7 Residual Landscape / Seascape Effects – Primary Impact Assessment

8.4.7.1 The landscape / seascape effects of the three proposed wind farm sites are assessed in this chapter. The change resulting from the three proposed wind farm sites to the landscape / seascape resource is assessed during construction, operation and decommissioning stages.

8.4.7.2 Effects on landscape / seascape character are manifested where the pattern of elements that characterises the landscape / seascape will be altered by the addition of the Developments to the seascape and where visibility of the Developments may alter the way in which this pattern of elements is perceived.

8.4.7.3 Landscape / seascape character receptors fall into three groups:

- Landscape Character Types (LCTs) (as defined by SNH Terrestrial LCAs);
- Coastal Character Areas (CCAs) (as defined by coastal character assessment); and
- Landscape designations e.g. pSLAs, NSAs.

8.4.7.4 The assessment for each of these groups is described in the following paragraphs of this chapter (Paragraphs 8.4.7.5 to 8.4.7.10, 8.4.7.11 to 8.4.7.15, and 8.4.7.16 to 8.4.7.18 respectively).

Landscape Types

8.4.7.5 The first group of receptors covered in the assessment of effects on landscape / seascape character are the terrestrial landscape types, shown in Figure 5.4-2, Volume 7 and in conjunction with the ZTV in Figure 8.4-9, Volume 7 (context) and Figures 8.4-10a to 8.4-10e, Volume 7 (detail) that cover the study area. The assessment considers the likely significant effects of the three proposed wind farm sites and OfTI on the LCTs in the study area. This assessment was carried out through a desk study and site survey which examined the characteristics of the coastal character areas and the visibility of the three proposed wind farm sites from these coastal character areas, using the ZTV and wirelines.

8.4.7.6 The baseline study and initial assessment identified that LCTs within the study area can be described in three categories:

- Landscape types identified along the coast where the sea or coast provide the defining characteristics.
- Landscape types next to the coast that are influenced by the sea, but the sea and coast do not provide the defining characteristic.
- Landscape types located further inland, which have little or no relationship with the coast, where the sea is not a characteristic element and there is limited / no visibility of the three proposed wind farm sites.

8.4.7.7 The effect of the three proposed wind farm sites and OfTI on LCTs located inland, which have little or no relationship with the coast / sea, and little or no visibility of the three proposed wind farm sites is assessed as not significant because the three proposed wind farm sites cannot become a characteristic element of the landscape character if the sea and / or coast are not characteristic in the baseline and where there is little or no visibility of the three proposed wind farm sites and OfTI. The effect of the three proposed wind farm sites and OfTI is assessed as not significant on the following inland terrestrial landscape types:

- Agricultural Heartland;
- Coniferous Woodland Plantation;
- Flat Peatland;
- Inland Loch;
- Lone Mountains;
- River Valleys;
- Strath;
- Sweeping Moorland;
- Town;
- Uplands; and
- Urban.

8.4.7.8 The assessment has identified that the other LCTs within the study area can be assessed in two categories:

- Landscape types in Moray, Aberdeenshire and Orkney where there is theoretical visibility of the three proposed wind farm sites at distances between 41 km and 50 km; and
- Landscape types in Caithness where there will be visibility of the three proposed wind farm sites at distances of between 22 km and 50 km.

8.4.7.9 The effect of the three proposed wind farm sites on LCTs in Moray, Aberdeenshire and Orkney is assessed as not significant due to the long distance and limited visibility of the three proposed wind farm sites. Although the three proposed wind farm sites may be partially visible at long distances over 41 km offshore on the distant horizon, the three proposed wind farm sites will not become a characteristic element of the landscape types in Moray, Aberdeenshire and Orkney coasts and the existing baseline characteristics will continue to provide the prevailing influence. The effect of the three proposed wind farm sites is assessed as not significant on the following LCTs in Moray, Aberdeenshire and Orkney:

- The Coast: cliffs of the north and south east coasts;
- Coastal Farmland: western coastal farmland;
- Coastal: soft coastal shore;
- Coastal: hard coastal shore;
- Coastal: coastal forest;
- Coastal Lowlands;
- Cliff Landscapes;
- Coastal Basins;
- Coastal Hills and Heath;
- Holms; and
- Low Island Pastures.

8.4.7.10 The effect of the three proposed wind farm sites is assessed further in this chapter for the LCTs in Caithness and Sutherland, which are either defined by, or influenced by, the sea / coast. Although the three proposed wind farm sites are located at long

distances offshore, between 22 km and 50 km from the nearest landscape types, the effect of the proposed development on the key characteristics and perception of these LCTs requires further assessment in this chapter. The effect of the three proposed wind farm sites on the seascape / coastal characteristics of these LCTs are assessed in Table 8.4-6 below.

Table 8.4-6 Assessment of Effects on Landscape Types

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
Caithness and Sutherland (SNH Review No. 103)			
6. Coastal Island	Sea and / or coast provide the defining characteristics: • Uninhabited coastal islands of the Pentland Firth including Island of Stroma and Pentland Skerries. • Wavecut rock platforms, low cliffs and tilted strata have caused the formation of cliffs. • Cliffs within this landscape create a strong and limiting linear edge where experience is dominated by the presence of the land / sea edge. • Wide, open vistas from isolated coastal islands to surrounding seascape and to the mainland coast and Orkney Islands. • Remote and exposed with some wildness attributes associated with sense of isolation, risk associated with accessing islands and elemental coastal processes. **Sensitivity**: medium-high Seascape / coastal characteristics have a defining influence on character. Visibility of the three proposed wind farm sites may change the way in which island character is perceived and the sense of remoteness, but may also relate to the sense of exposure and drama.	• Located approximately 40.4 km from the three proposed wind farm sites (Telford) with no visibility from the Island of Swona and visibility from uninhabited islands of Pentland Skerries. • Limited / no receptors on uninhabited islands to experience the perceived changes resulting from the three proposed wind farm sites. • Key characteristics of the wavecut rocks, low cliffs and strata will continue to provide the prevailing key characteristics. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
8. Coastal Shelf	Sea and / or coast provide the defining characteristics: • Elevated platform, created by a coastal plain of sedimentary rocks, with linear space semi-enclosed by inland hills thus directing views out to sea. • Beach cliffs or dunes along some stretches of the coast tend to limit direct visibility and experience of the coastline from inland areas. • Strongly influenced by the character of open skies and the distinctive coastal light. • Pattern of land use largely relates to the linear space. • Transport corridor / small settlements and often farmed. • Berriedale coast designated as part of proposed SLA. **Sensitivity**: medium-high Seascape / coastal characteristics have a defining influence on character. Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived and the direct relationship of the sea with the coastal shelf, but may also relate to the sense of exposure and linear land use pattern.	• Located approximately 39.4 km from the three proposed wind farm sites (MacColl) with scattered areas of visibility from area between Brora and Helmsdale and limited / no visibility from smaller area near Ousdale. • Elevated platform and enclosure by inland hills directs views to the three proposed wind farm sites out to sea which will include a skyline of offshore wind turbines. • The three proposed wind farm sites are likely to be an external influence on the areas of this landscape type that lie adjacent to the coast. • Perception of the character is experienced frequently by road users along main A9 transport corridor. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** medium-low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
11. Harbour	Sea and / or coast provide the defining characteristics: • Harbours create a focus in the landscape - where the sea abuts the land against high harbour walls. • Mainly located where a glen intersects the coastline or at the edge of a bay. • Most activity within this character type is sea based - the level of this varying. • Rich assortment of experiential characteristics associated with the combination of sea, land and human activity. **Sensitivity**: medium Seascape / coastal characteristics have a defining influence on character. Visibility of the three proposed wind farm sites may change visual focus of harbour, but may also relate to the sea based activity and variety of experiential characteristics.	• Located approximately 23 km from the three proposed wind farm sites (Telford) with visibility from Wick, Latheronwheel, Dunbeath and Helmsdale harbours. • Immediate harbour activity will continue to form the main focus of the landscape type. • Enclosed character at the intersection of glens or edges of a bay tends to enclose and restrict views of the three proposed wind farm sites. • The three proposed wind farm sites relate to the sea based activity of this landscape type, provide further experiential characteristics and increase the influence of the wider sea element. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** medium	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
12. High Cliffs and Sheltered Bays	Sea and / or coast provide the defining characteristics: • Long, narrow, exposed stretches of very high cliffs interrupted by bays at glen intersections. • Stacks, caves, pebbles and collapsed cliffs. • Cliffs within this landscape create a strong and limiting linear edge where experience is dominated by the presence of the land / sea edge. • Views directed along coast and out to sea focusing on islands, rigs and boats. • Backed by moorland or small farms / crofts. Road aligned parallel to coast. • Access and views to coast restricted due to cliffs. • Distinctive coastal light, immense openness, soaring and nesting sea birds, and movement and sound of breaking waves. • Remote and exposed with some wildness attributes associated with sense of isolation, risk associated with accessing cliffs and elemental coastal processes. • Duncansby Head and Berriedale Coast designated as proposed SLA. **Sensitivity**: high Seascape / coastal characteristics have a defining influence on character. Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived and the sense of remoteness of this most north westerly corner of British mainland, but may also relate to the sense of exposure and drama.	• Located approximately 36 km from the three proposed wind farm sites (Telford) with visibility from stretch of coast at Duncansby Head and from longer stretch of coast between Berriedale and Helmsdale. • Narrow character of coastline restricts visibility of the three proposed wind farm sites to narrow stretch at the immediate coastal edge. • Exposure of coastline and direct relationship with the sea increases the perceived effect of the three proposed wind farm sites. • The three proposed wind farm sites will form a new but visually separate focus out to sea, in addition to the stacks, caves and collapsed cliffs views along coast. • Perception of the character is experienced infrequently due to the limited access to the cliffs, gained mainly by walkers on foot. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** **Duncansby Head:** low **Berriedale to Helmsdale:** medium-low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
16. Long Beaches Dunes and Links	Sea and / or coast provide the defining characteristics: • Soft, linear edge to sea. • Wide open space, exposure and extensive visibility. • Simple visual composition. • Dynamic landscape, both physically and experientially. • Recreation / golf links / caravan parks along coastal hinterland. • Generally backed by farmland or settlements. • Pipeline fabrication works interrupts the centre of Sinclair's Bay and extends inland. • Composition and relative prevalence of elements is strongly affected by the northern coastal light. **Sensitivity**: medium-high Seascape / coastal characteristics have a defining influence on character. Visibility of the three proposed wind farm sites may change simple visual composition of low lying bay, but may also relate to the sense of exposure and existing offshore fabrication influences.	• Located approximately 28.6 km from the three proposed wind farm sites (Telford) with limited visibility from small area in northern part of landscape type near Keiss and from hinterland edge. • Noss Head largely screens the three proposed wind farm sites in views from landscape type such that most of the area has no visibility of the three proposed wind farm sites. • The three proposed wind farm sites will not affect the characteristics of the soft linear edge to the coast of this landscape type. • Wide open space with extensive visibility to the sea retained, largely without views of the proposed development. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
18. Mixed Agriculture and Settlement	Landscape type influenced by the sea / coast: • Edged in some places by high cliffs and bays or long beaches, dunes and links. • Open vistas generally edged by the distant horizon of the sea or distinctive profiles of far-away hills. • Clear skies and light allow some sense of direction to be gained from the distinct character of the sea. Sea and coast do not provide the defining characteristics of this landscape type, which is defined by: • Gently sloping landform, rising up to form low hills, or down to create basins and shallow glens. • Open landscape, generally dominated by a horizontal emphasis, with the occasional location of a hill or woodland. • Exposed and bracing, strongly influenced by the clarity of light and air, the sound and feel of the wind. • Complex visual composition due to mix of land use and lines forming key elements, such as the skyline, powerlines, field boundaries and roads. • Open vistas often edged by the distant horizon of the sea. **Sensitivity**: medium Seascape / coastal characteristics have external influence on character. Visibility of the three proposed wind farm sites may increase visual complexity and change the distant horizon of the sea, but may also relate to the sense of exposure, linear elements and horizontal emphasis of the landscape.	• Located approximately 22.4 km from the three proposed wind farm sites (Telford) with visibility from area at Skirza. • Open vistas edged by distant horizon of the sea will include distant skyline of offshore wind turbines. • Clear light is likely to increase the perceived effect of the three proposed wind farm sites. • Proposed development will form a landmark and increase sense of orientation. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
19. Moorland Slopes and Hills	Landscape type influenced by the sea / coast: • The coastline is generally not visible because of the convex slope of the landform. • Variable landform allows distant views of the sea and its bays further along the coast. Sea and coast do not provide the defining characteristics of this landscape type, which is defined by: • Sloping open moorland that usually undulates or gradually rises to form broad hills. • Variable slope of landform creates some pockets of enclosure but broadly this landscape remains overwhelmingly open. • Interlocking arrangement of moorland landform with tops of the hills tending to be spaced far apart and of a similar height; • Generally difficult to discern relative elevation as no one point tends to be more visually dominant than the other, creating numerous minor foci. • Partly located in proposed SLA and SAWL. **Sensitivity**: medium-low Seascape / coastal characteristics have external influence on character. Visibility of the three proposed wind farm sites may change perception of scale and add visual foci, but may also relate to the sense of exposure and broad scale of the landscape.	• Located approximately 30 km from the three proposed wind farm sites (Stevenson) with visibility on the coastal side of landform around Stemster Hill and limited, scattered visibility from the more extensive area around Langwell Forest. • Orientation of landform generally prevents views of the coastline, but allows distant views of the proposed development out to sea. • Key characteristics of the moorland slopes and hills which define this landscape type will continue to provide the prevailing key characteristics. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** medium-low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
20. Open Intensive Farmland	• Landscape type influenced by the sea / coast through characteristics of clear light quality, exposure to extreme weather conditions and extensive views which are augmented in areas near the coast. Sea and coast do not provide the defining characteristics of this landscape type, which is defined by: • Openness and flat or gently sloping landform, with simple composition of elements, principally comprising simple skyline and agricultural land. • At a further level of detail, the landscape contains an ordered pattern of land use, mainly comprising large, regular shaped fields. **Sensitivity**: medium-low Seascape / coastal characteristics have a limited influence on character. Visibility of the three proposed wind farm sites may change the way in which simple composition of elements is perceived, but may also relate to the sense of exposure and ordered landscape pattern.	• Located approximately 22.7 km from the three proposed wind farm sites (Telford) and limited visibility from area to the south of Wick. • Extensive views and clear light are likely to increase the perceived effect of the three proposed wind farm sites. • The three proposed wind farm sites will not affect characteristics of clear light quality and exposure to extreme weather conditions near the coast. • Key characteristics as an area of open intensive farmland with some exposure to coastal influences are retained. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Type Defined or Influenced by the Sea	Baseline Condition and Sensitivity	Magnitude of Change	Significance of Effect
23. Small Farms and Crofts	Landscape type influenced by the sea / coast: • Nature of the sea and the coastline strongly influences the areas that lie adjacent to the coast. • The land division tends to relate directly to the coastal edge. • Influenced by the sea, clarity of coastal light, the activity and sound of the waves, strong wind and sea birds. Sea and coast do not provide the defining characteristics of this landscape type, which is defined by: • Dominated by the occupation and activity of people, who are responsible for a complex variety of different land use characteristics. • Range from clearly ordered crofts, to open and fairly rich, small farms and areas of marginal moorland and ruined properties. • Comprises a number of common elements despite the variation in their arrangement: houses, outbuildings, fields depicted by fences / walls. • Extent of visibility tends to be limited because of screening effect of surface features and sloping landform. • Complex visual composition of different spaces, edges, points and lines. **Sensitivity**: medium Seascape / coastal characteristics have external influence on character. Visibility of the three proposed wind farm sites may increase visual complexity and influence the perception of land division and human scale at the coastal edge, but also relates to the characteristic activity of people and visibility may be limited by the landform.	• Located approximately 22.3 km from the three proposed wind farm sites (Telford) with visibility from area around Nybster and from more extensive stretch of coastline and Hinterland between Sarclet Head and Berriedale. • The three proposed wind farm sites are likely to be an external influence on the areas of this landscape type that lie adjacent to the coast. • Land division is orientated in linear plots aligned out to sea towards the three proposed wind farm sites. • Clear light is likely to increase the perceived effect of the three proposed wind farm sites. • The three proposed wind farm sites will not affect the activity and sounds of the waves and wildlife characteristic at the coast. • Characteristic strong winds provide a rationale for offshore wind farm development. • Landscape elements will not be physically altered; changes arise through visibility, which may indirectly change the way in which the pattern of elements is perceived. **Magnitude of change:** medium	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Coastal Character Areas

8.4.7.11 The second group of receptors covered in the assessment of effects on landscape / seascape character are the coastal character areas (shown in Figure 5.4-4, Volume 7 and in conjunction with the ZTV in Figures 8.4-10 a to 8.4-10 e, Volume 7) that cover the coastal parts of the study area. The assessment considers the likely significant effects of the three proposed wind farm sites on the coastal character areas in the study area. This assessment was carried out through a desk study and site survey which examined the characteristics of the coastal character areas and the visibility of the three proposed wind farm sites from these coastal character areas, using the ZTV and wirelines.

8.4.7.12 The assessment has identified that coastal character areas within the study area can be assessed in three categories:

- Coastal character areas where there will be no visibility of the three proposed wind farm sites;
- Coastal character areas in Moray, Aberdeenshire and Orkney where theoretical visibility of the three proposed wind farm sites at distances between 41 km and 50 km; and
- Coastal character areas in Caithness where there will be visibility of the three proposed wind farm sites at distances between 22 km and 50 km.

8.4.7.13 The effect of the three proposed wind farm sites will not be significant on the coastal character areas which will have no visibility of the three proposed wind farm sites, as follows:

- 4. Island of Stroma;
- 5. Scarfskerry; and
- 6. Gills Bay and John O' Groats.

8.4.7.14 The effect of the three proposed wind farm sites on coastal character areas in Moray, Aberdeenshire and Orkney is assessed as not significant due to the long distance and limited visibility of the three proposed wind farm sites. Although the three proposed wind farm sites may be partially visible at long distances over 41 km offshore on the distant horizon, the three proposed wind farm sites will not become a characteristic element of the coastal character areas along the Moray, Aberdeenshire and Orkney coasts and the existing baseline characteristics will continue to provide the prevailing influence. The effect of the three proposed wind farm sites is assessed as not significant on the following coastal character areas in Moray, Aberdeenshire and Orkney:

- 1. South Ronaldsay;
- 2. Swona Island;
- 3. Pentland Skerries;
- 17. Lossiemouth to Burghead Coast;
- 18. Spey Bay;
- 19. Portgordon to Portnockie Coast;
- 20. Cullen Bay;
- 21. Sandend Bay;
- 22. Boyne Bay; and
- 23. Boyndie Bay.

8.4.7.15 The effect of the three proposed wind farm sites is assessed further in this chapter for the coastal character areas in Caithness where there will be visibility of the three proposed wind farm sites at distances between 22 km and 50 km. The perception of these coastal character areas may be altered as the three proposed wind farm sites have the potential to become a characteristic element or key characteristic of the seascape / coastal character. The effect of the three proposed wind farm sites on the seascape / coastal characteristics of these coastal character areas are assessed in Table 8.4-7 below.

Table 8.4-7 Assessment of Effects on Coastal Character Areas (CCA)

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
7. Duncansby Head	**Maritime influences** • Coast predominantly orientated to the east. • Dynamic coastal influences and processes under continual force from the sea. • Physical and navigational link to the Pentland Firth and coastal waters of Orkney Islands. • Seaward views over Pentland Firth, extending to Dunnet Head and Ornkey Islamds. • Major shipping route passing into Pentland Firth / Orkney Isles with high level of activity, including passenger ferries. Shipping is a common feature seen further out to sea on the horizon. • Clarity of northern light, sense of exposure, and sounds and smell of the sea. **Character of coastal edge** • High Old Red Sandstone Cliffs eroded into angular blocks, with small bays at their base. • Stacks, caves and collapsed cliffs, including the prominent Stacks of Duncansby. • Strong contrast between verticality of cliffs and wide horizon of sea. • Cliffs provide nesting ground for significant bird colonies, which provide distinctive experience. **Character of immediate hinterland** • High moorland hinterland where semi-natural heathland is prevailing landcover. • Settlement is almost entirely absent, with just occasional isolated crofts in hinterland. • Lighthouse located at Duncansby Head is a prominent feature on the headland. • Visitor parking at Duncansby Head and cliff top paths provide access for walkers. • Particularly exposed and remote character, particularly when weather / sea is turbulent. • Elevation of cliffs allows distant views east and north to Pentland Firth and Okney Islands. • Scenic value recognized by local designation (Special Landscape Area).	• Located approximately 35.4 km from the three proposed wind farm sites (Telford) between Duncansby Head and Skirza Head. • Narrow character of coastline restricts visibility of the three proposed wind farm sites to narrow stretch at the coastal edge and immediate hinterland. • Views north over Pentland Firth, to Dunnet Head and Ornkey Islands will not be affected. • Exposure of coastline and direct relationship with sea increases perceived effect of three proposed wind farm sites. • The three proposed wind farm sites will form a new but visually separate focus at distance out to sea. Turbines would not disrupt the appreciation of the physical influences and scale of stacks, caves and cliffs along coastal edge. • The three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea but will also introduce an additional new feature into the seascape. • The three proposed wind farm sites will affect the perception of this area as being remote and 'undeveloped', but this character is experienced infrequently due to the limited access to the cliffs, gained mainly by walkers on foot. • High shipping activity on the horizon reduces apparent change to seascape character. • Character and remoteness of high cliff scenery and views at coastal edge will continue to provide the defining characteristic. **Magnitude of change: low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
	Wildness / isolated coast • Remote and exposed with some wildness attributes associated with sense of isolation, due to absence of settlement, risk associated with accessing cliffs and elemental coastal processes. • Location of headland at extreme north-eastern point of British mainland is a compelling attraction. • Minimal illumination at night. **Sensitivity**: high Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived, the impression of scale, visual foci, and the sense of remoteness of this most north westerly corner of British mainland, but may also relate to the sense of exposure and drama.		

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
8. Freswick Bay and Nybster Coast	**Maritime influences** • Coast predominantly oriented to the south east. • Dynamic coastal influences associated with migration of sand and constantly changing character. • Freswick burn discharges into the sea at Freswick Bay. • Strong exposure means that wind and wave erosion is active on cliffs on both sides of the bay. • Water based recreational beach activities, such as surfing (Skirza Harbour). • Low level of shipping in coastal waters with some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Settlement associated with the sea e.g. fishing village of Skirza. • Open and exposed with clarity of northern light, sense of exposure, and sounds and smell of the sea. **Character of coastal edge** • Low section of rocky coastline with section of sweeping curved sandy beach at Freswick Bay. • Beach materials include shingle derived from wave erosion of nearby sandstone cliffs, and sand derived from the deposition of sandstone, silt from the burn and offshore sources. • Gentle slopes with open and exposed characteristics. Freswick Bay is fully exposed to the east and the south east with some shelter to the north east quarter. • Smooth surface, sandy beach is steeply sloping and dune front has been affected by sand extraction. • Exposed coastline with open views and strong historical associations of castles and cliff top forts and cultural interest of fishing villages. **Character of immediate hinterland** • Settlement in the form of crofts at Nybster and Skirza, a linear fishing village overlooking Freswick Bay. • Freswick House draws attention as a focal point from around Freswick Bay. • Simple field pattern running parallel and at right angles to the coastline. • A99 passes parallel to the coast. • Cultivated fields associated with crofts interspersed with semi-natural heathland.	• Located approximately 32 km from the three proposed wind farm sites (Telford) with visibility from north side of Freswick Bay, Skirza and along coastal edge and immediate hinterland around Nybster, between Ness Head and Keiss. • Ness Head largely screens the three proposed wind farm sites in views from the southern side of Freswick Bay. • South east orientation of coast and land division of linear plots aligned out to sea likely to increase effect of three proposed wind farm sites. • The characteristics and scale of the three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea and winds. • Clear light is likely to increase the perceived effect of the three proposed wind farm sites. • Turbines would not affect the appreciation of the physical influences which shape the coastal edge. • Open vistas edged by distant horizon of the sea will include distant skyline of offshore wind turbines. **Magnitude of change: low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
	Wildness / isolated coast • Although exposed, built features including main road and settlements limit sense of wildness. • Some illumination at night from small farms. Distant Beatrice Oil Platform flarestack and turbines. **Sensitivity**: medium Visibility of the three proposed wind farm sites may influence simple visual composition of low lying bay and influence the perception of land division and human scale at the coastal edge, but may also relate to the sense of exposure and characteristic activity of people which has shaped this landscape.		

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
9. Sinclair's Bay	**Maritime influences** • Coastline curves giving east and south east aspects. • Dynamic coastal influences associated with migration of sand and constantly changing character of the sea and passing weather systems. • Low level of shipping in coastal waters with some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Strongly affected by the northern coastal light. • Inter tidal zone is fairly narrow widening from 150 m to 300 m. • Shape of bay influenced by rock formations to the north and south and the interaction of water which is deep at the south and less deep at the north. The south limb thus acts as a giant groyne. • Metomorphic stone on the beach implies glacial till deposition. • Water based recreational beach activities, e.g. surfing. **Character of coastal edge** • Bay sweeps south in a long elliptical curve, past Castle Sinclair and terminating at Noss Head. • Cliffs are sheer further north, but to the south of Keiss, large white sandy beach and dunes form coastal edge, before a series of cliffs and crags further east around Noss Head. • Wide open space and exposure to the sea. • Beach is an important recreational resource. • Keiss Castle creates prominent focal point feature in the horizontal landscape. • Subtle interlocking of dunes creating low pockets of semi-enclosure. • Strong horizontal emphasis. • Pipeline fabrication works interrupts the centre of the bay and extends inland across Keiss Links.	• Located approximately 26 km from the three proposed wind farm sites (Telford) with visibility from small area in northern part of coastal character area near Keiss. • Noss Head largely screens the three proposed wind farm sites in views from the beaches and dunes of the bay, such that most of the area has no visibility. • The three proposed wind farm sites will not affect the appreciation of the dynamic physical characteristics which define the coastal edge. • Wide open space with extensive visibility to the sea retained, largely without views of the proposed development. • The three proposed wind farm sites will have a limited effect on existing focal points and horizontal emphasis of the bay. Character of large, sweeping, sandy bay will continue to provide defining characteristic. **Magnitude of change: low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
	Character of immediate hinterland • A99 passes parallel to coast. • Sand dunes with underlying shingle spit. • Inland from the main dune zone extends an area of blown sand, triangular in shape and tapering towards the south end where it becomes very narrow. • Species diversity is normal in this area with species diversity increasing inland. • Small village of Keiss to north of the area. • Agricultural land. **Wildness / isolated coast** • Although it is exposed, built features including main road, pipeline fabrication works and dwellings limit the sense of wildness likely to be experienced. • Some illumination at night from small crofts and properties around Keiss and lighthouse at Noss Head. **Sensitivity**: medium-high Visibility of the three proposed wind farm sites may change simple visual composition of low lying bay, but may also relate to the sense of exposure and existing offshore fabrication influences.		

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
10. Noss Head	**Maritime influences** • Strongly affected by the northern coastal light. • Coastal headland orientated to the north and to the east, which defines Sinclair's Bay. • Low level of shipping in coastal waters with some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Water based recreational beach activities, such as surfing (Ackergill). **Character of coastal edge** • Sandstone Cliffs eroded into angular blocks, with small bays at their base. • Stacks, caves and collapsed cliffs. • Strong contrast between verticality of cliffs and wide horizon of sea. • Lighthouse at Noss Head and remains of Castle Sinclair Girnigoe are prominent features. • Visitor parking and cliff top paths allow access for walkers to experience view from Noss Head. **Character of immediate hinterland** • Open intensive farmland. • Horizontal landscape with few vertical features. • Scattered farm dwellings. • High degree of exposure. • Areas of semi-natural rough grassland at Noss Head. • Ordered, regularly shaped fields. • Wick Airport located in the flat expanse of this area with associated visual and aural disturbance. **Wildness / isolated coast** • Rugged, inaccessible coastal cliff terrain. • Cultivated fields, farm dwellings, lighthouse and airport limit sense of wildness likely to be experienced. • Some illumination at night from Wick and Wick airport, distant Beatrice Oil Platform flarestack and wind turbines, visible alongside lighthouse at Noss Head and distant views of lights on the Moray Coast. **Sensitivity**: medium-low Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived, the perception of scale and visual foci of existing headland and point features, but may also relate to the sense of exposure and horizontal emphasis of the landscape.	• Located approximately 23.9 km from the three proposed wind farm sites (Telford) with visibility from southern side of Noss Head between Noss Head and Sealky Head. • No visibility of the three proposed wind farm sites from northern side of Noss Head between Noss Head and Castle Sinclair. • North east orientation of coast likely to reduce effects of three proposed wind farm sites. • The characteristics and scale of the three proposed wind farm sites would not disrupt the appreciation of the physical influences and scale of physical features along coastal edge. • Proposed development will introduce collection of vertical features, but distance offshore reduces vertical impact and wide footprint of site relates to existing horizontal emphasis. • The three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea but will also introduce an additional new industrial and illuminated feature into the seascape. • The three proposed wind farm sites will form a new but visually separate focus at distance out to sea. • Key characteristic as a defining headland to Sinclair's Bay and Wick Bay will continue to provide defining characteristic. **Magnitude of change: medium-low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
11. Wick Bay	**Maritime influences** • Rugged, coastal cliff terrain to north and south of area. • Bay area where Wick River discharges into the North Sea. • Harbour in the bay area with fishing vessels and maritime activity. • Inward looking views across the bay and towards headlands. • Main orientation to the east and south east away from Wick bay. **Character of coastal edge** • Built town environment creating hard edge with water in Wick harbour. • Local coastal roads cutting into and through hills adjoining the coast. • Vertical cliffs to north and south with distinctive bays in south. • Castle of Old Wick prominent ruin and coastal landmark. **Character of immediate hinterland** • Cultivated fields with improved and semi-improved grassland • Residential gardens and industrial areas in Wick. • Rough grassland areas adjacent to the coastline in the north of the area. • Sense of containment within town with open views where there is less dense housing at Staxigoe and small farm holdings in Old Wick. **Wildness / isolated coast** • Coastline is very accessible in this area with many manmade elements in Wick. • Built environment dominant and detracts from the sense of remoteness / wildness. • Vertical cliffs have created inaccessible bays in places. • Extensive illumination at night from immediate town and harbour. Distant Beatrice Oil Platform flarestack and wind turbines along with distant views of lights on the Moray Coast. **Sensitivity**: medium Visibility of the three proposed wind farm sites may change visual focus of bay and occupy contained sea skyline, but may also relate to the sea based activity and variety of experiential characteristics.	• Located approximately 22.8 km from the three proposed wind farm sites (Telford) with visibility from • Immediate harbour activity will continue to form the main focus of the coastal character area. • Enclosed character at the intersection of glens or edges of a bay tends to enclose and restrict views of the three proposed wind farm sites. • The three proposed wind farm sites will appear to occupy most of visible extent of sea skyline from Wick Bay and form a wide horizontal feature in relation to the seascape. • Views of distant offshore wind farm seascape on skyline of Wick Bay likely to become a characteristic element. • The three proposed wind farm sites relate to the sea based activity of coastal character area, provide further experiential characteristics and increase the influence of the wider sea element. • The three proposed wind farm sites have a higher influence on the more open cliffs to north and south of Wick. • Key characteristics of the settlement and harbour of Wick which define this coastal character area will continue to provide the defining characteristics. **Magnitude of change: medium** • Character is experienced frequently from main road and settlements along the coastal edge. • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Key characteristic as a broad, convex headland with strong maritime influences and cultural interest will continue to provide defining characteristics. **Magnitude of change: medium**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
12. Sarclet Head	**Maritime influences** • Broad convex headland with south east orientation towards the sea. • Dynamic coastal influences and processes under continual force from the sea. • Small harbours once gave a safe haven for fishing boats. • Low level of shipping parallel to coast and some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Strong maritime connection with settlements and agricultural land use patterns. • Beatrice platform and wind turbines visible out to sea. **Character of coastal edge** • Rocky coastline with open sea views, vertical cliffs and small enclosed bays / harbours. • Stacks, caves and cliffs, with strong contrast between verticality of cliffs and wide horizon of sea. • Some recreational / visitor opportunity in places, such as Sarclet Haven and Whaligoe Steps. • Exposed coastline with open views and strong historical associations of castles and cliff top forts and cultural interest of fishing villages. **Character of immediate hinterland** • Scattered small farms and crofts adjacent to the coast, occasionally concentrated to form crofting settlements such as Ulbster and Thrumster. • Rough open grassland with gorse scrub in places and small lochs. • A99 runs parallel to coastline. • Settlements and built features appear at even intervals and provide a visual rhythm of foci along coast. **Wildness / isolated coast** • Although it is exposed, built features including main road and settlements limit sense of wildness experienced. • Coastal edge is mainly inaccessible due to vertical cliff faces. • Some illumination at night with Beatrice Oil Platform flarestack and existing turbines visible alongside lighthouses and distant views of lights on the Moray Coast. **Sensitivity**: medium Visibility of the three proposed wind farm sites may increase visual complexity and influence the perception of land division and human scale at the coastal edge, but may also relate to the sense of exposure and characteristic activity of people which has shaped the landscape.	• Located approximately 22.3 km from the three proposed wind farm sites (Telford), it is closest section of Caithness coastline to the three proposed wind farm sites. • Visibility of the three proposed wind farm sites from majority of coastal edge and hinterland, with some localized enclosure provided in small bays and incised coastal features. • South east orientation of coast and linear plots aligned out to sea likely to increase effect of three proposed wind farm sites. • The characteristics and scale of the three proposed wind farm sites are likely to be an external influence on areas that lie adjacent to the coast. • Turbines would not affect the appreciation of the physical influences which shape the coastal edge, but will form a new and visually separate focus at distance out to sea. • Clear light is likely to increase the perceived effect of the three proposed wind farm sites. • The three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea. • Proposed development will introduce collection of vertical features, but distance offshore reduces vertical impact and wide footprint of site relates to existing horizontal emphasis.	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
13. Lybster Bay	**Maritime influences** • Broad, shallowly concave bay with a mainly south east orientation. • Dynamic coastal influences and processes under continual force from the sea. • Small harbour in Lybster Bay with fishing vessels. Low level of shipping parallel to coast and some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Sea more distant from elevation and less immediate due to undulating coastal edge. **Character of coastal edge** • Rocky, undulating coastline with indentations stacks and small enclosed bays. • Lybster Bay formed from confluence of Reisgill Burn and the North Sea. **Character of immediate hinterland** • Scattered small farms and crofts with open fields. • Rough open grassland with gorse and scrub in places. • A99 running parallel to coastline. **Wildness / isolated coast** • Although it is exposed, built features including main road, communications / power lines and dwellings limit the sense of wildness likely to be experienced. • Some areas inaccessible due to vertical cliff faces. **Sensitivity**: medium Visibility of the three proposed wind farm sites may change visual focus of bay and the way in which land / sea edge is perceived, the impression of scale and visual foci, but may also relate to the sense of exposure and sea based activity.	• Located approximately 25.8 km from the three proposed wind farm sites (Telford) with visibility from majority of coastal edge and scattered visibility from hinterland. • Some localised enclosure provided in small bays and incised coastal features. • Southerly orientation of coast likely to decrease effect of three proposed wind farm sites which are oblique to main orientation. • The three proposed wind farm sites are likely to be an external influence on the areas that lie adjacent to the coast. • Turbines would not affect the appreciation of the physical influences which shape the coastal edge, but will form a new and visually separate focus at distance out to sea. • The characteristics and scale of the three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea. • Character is experienced frequently from main road and settlements along the coastal edge. • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Key characteristic as a local, shallowly concave bay with fishing villages amongst rocky coastline will continue to provide defining characteristic. **Magnitude of change: medium**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
14. Dunbeath Bay	**Maritime influences** • Broad, shallowly concave bay with a mainly south east orientation. • Smaller, local bays at Latheronwheel and Dunbeath. • Harbours in the bays with fishing and maritime vessels. Low level of shipping parallel to coast and some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Views across the bays towards headlands and out to sea to the distant horizon. **Character of coastal edge** • Rocky, undulating coastline with elevated views along the coast and across the open expanse of sea. • Sea views framed in places by undulations in the landform and in bay areas. • Coastline includes large number of indentations, stacks and cliffs. • Latheronwheel and Dunbeath Bays formed from the confluence of Latheronwheel Burn and Dunbeath Water • Exposed coastline with open views and strong historical associations of castles, cliff top forts and cultural interest. **Character of immediate hinterland** • Topography rising to form hills adjacent to the vertical cliffs and coastline. • Scattered small farms and crofts with open fields. • Rough open grassland with gorse and scrub in adjacent to cliffs and on hill tops. • Areas of native woodland along steep river valleys and in gardens – most notably at Dunbeath Castle. • A99 running parallel to coastline. **Wildness / isolated coast** • Although it is exposed, built features including main road, communications / power lines and dwellings limit the sense of wildness likely to be experienced. • Some areas inaccessible due to vertical cliff faces. **Sensitivity**: medium Visibility of the three proposed wind farm sites may change visual focus of bay and the way in which land / sea edge is perceived, the impression of scale and visual foci, but may also relate to the sense of exposure and sea based activity.	• Located approximately 27.9 km from the three proposed wind farm sites (Stevenson) visibility from majority of coastal edge and immediate hinterland. • Some localised enclosure provided in small bays and incised coastal features. • South east orientation of coast and land division of linear plots aligned out to sea likely to increase effect of three proposed wind farm sites. • The three proposed wind farm sites are likely to be an external influence on the areas that lie adjacent to the coast. • Turbines would not affect the appreciation of the physical influences which shape the coastal edge, but will form a new and visually separate focus at distance out to sea. • The characteristics and scale of the three proposed wind farm sites could relate well to the expansiveness and exposure of the open sea. • Character is experienced frequently from main road and settlements along the coastal edge. • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Key characteristic as a broad, rocky, concave bay with strong fishing and cultural interest will continue to provide defining characteristic. **Magnitude of change: medium**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
15. Helmsdale to Berriedale Coastal Shelf	**Maritime influences** • Linear coastal shelf with mainly south east orientation. • Bay with harbour at Helmsdale with fishing and maritime vessels. Low level of shipping parallel to coast and some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Rugged coastal terrain with high cliffs. **Character of coastal edge** • Predominantly rocky but 'straight' coastline, backed by a narrow corridor of level land tightly constricted by inland hills and the open sea. • Undulating landscape with a series of small coastal hill formations and glens. • Long stretches of high cliff which are regularly interrupted by the location of a bay, typically corresponding to the intersection of a glen. • Coastal shelves creating semi-enclosed elevated spaces with views out to the sea and a screen of inland hills. **Character of immediate hinterland** • Mixed woodland along glen at Berridale. • Areas of heather moorland interspersed with coniferous woodland plantations. • Large agricultural fields at Ousdale. • Generally sparsely settled with small harbour settlements situated on inlets; and with historic churches, harbours and houses within these settlements forming foci. • Communications / power lines evident along coast. • Exposed coastline with open views and strong historical associations of castles, cliff top forts and cultural interest. **Wildness / isolated coast** • Inaccessible areas due to vertical cliff faces. • Rugged coastal terrain with dynamic coastal influences and processes. • Although it is exposed, built features including main road, communications / power lines and dwellings limit the sense of wildness likely to be experienced. **Sensitivity**: medium-high Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived and the direct relationship of the sea with the coastal shelf, but may also relate to the sense of exposure, linear land use pattern and energy transmission features.	• Located approximately 36.6 km from the three proposed wind farm sites (MacColl) with visibility from majority of coastal edge between Berriedale and Helmsdale. • Some localised enclosure provided in small bays and incised coastal features. Bay at Helmsdale orientated south. • Narrow character of coastline restricts visibility of the three proposed wind farm sites to narrow stretch at the immediate coastal edge. • Exposure of coastline and direct relationship with the sea, with views inland screened by steep hills, increases the perceived effect of the three proposed wind farm sites. • The three proposed wind farm sites will form a new but visually separate focus out to sea, in addition to the focal points along the coastal edge. • The three proposed wind farm sites are likely to have an external influence due to direct relationship of the coastal shelf with the adjacent open sea. • Perception of the character is experienced infrequently due to the limited access to the cliffs, gained mainly by walkers on foot. • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Key characteristic as a linear coastal shelf constricted by inland hills and open sea will continue to provide defining characteristic. **Magnitude of change: medium-low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

CCA	Baseline Condition and Sensitivity	Magnitude of Change	Significance
16. Brora to Helmsdale Deposition Coast	**Maritime influences** • Sense of light influenced by interplay of light and the sea. • Mainly south east orientation. • Low level of shipping parallel to coast and some recreational sailing. Shipping is a common feature seen further out to sea on the horizon. • Sense of space from views out to the sea and across the low lying coastline. **Character of coastal edge** • Low lying coastal edge. • Coastal shelves creating semi-enclosed elevated spaces with views out to the sea and a screen of inland hills. • Sandy beaches from Brora to Lothbeg Point and Sron Rubha na Gaoithe. • Exposed underlying rock with shingle and pebbbles from Sron Rubha na Gaoithe to Portgower and Helmsdale. **Character of immediate hinterland** • Railway line runs adjacent to the coast line with the A9 running parallel and further inland. • Occasional mature deciduous trees beside A9 and along access tracks in small settlements. • Riparian woodland adjacent to burns. • Semi-improved grassland with agricultural fields. • Rough grassland with gorse and scrub on hills. • Small settlement at coastal edge at Portgower. • Communications / power lines evident along coast. **Wildness / isolated coast** • Although it is exposed, built features including rail line, main road, communications / power lines and dwellings limit the sense of wildness likely to be experienced. **Sensitivity**: medium Visibility of the three proposed wind farm sites may change the way in which land / sea edge is perceived and the direct relationship of the sea with the coastal shelf, but may also relate to the sense of exposure and linear land use pattern and energy transmission features.	• Located approximately 45.1 km from the three proposed wind farm sites (MacColl) with scattered visibility from area between Brora and Helmsdale and limited / no visibility from smaller area near Ousdale. • Elevated platform and enclosure by inland hills directs views to the three proposed wind farm sites out to sea which will include a skyline of offshore wind turbines. • The three proposed wind farm sites are likely to be an external influence on the areas that lie adjacent to the coast. • Perception of the character is experienced frequently by road users along main A9 transport corridor. • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Key characteristic as a linear deposition coast constricted by inland hills and open sea will continue to provide defining characteristic. **Magnitude of change: medium-low**	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Landscape Designations

8.4.7.16 The third group of landscape character receptors are designated landscapes, which includes landscape-related planning designations and designated features that have been identified in the baseline study. Such receptors frequently have a particular character that may have contributed to their designation, and this character may be affected by the three proposed wind farm sites and OSPs. The relevant designated areas are shown in Figure 5.4-5, Volume 7, and are shown in conjunction with the ZTV in Figure 8.4-11, Volume 7. These figures also show designated areas that are not considered as specific receptors in the assessment, but are still relevant to the assessment of other landscape character receptors, views and visual receptors. The designated areas shown on the figures are therefore not all included as specific receptors in the assessment of effects on designated areas.

8.4.7.17 The assessment considers the likely significant effects of the three proposed wind farm sites and OSPs on the landscape designations in the study area. This assessment was carried out through a desk study and site survey which examined the characteristics of the landscape designations and the visibility of the three proposed wind farm sites from these areas, using the ZTV and wirelines.

8.4.7.18 The assessment has identified that two categories of landscape designations located within the study area require assessment:

- Gardens and Designed Landscapes (GDLs);
- Special Landscape Areas (SLA) (proposed).

Gardens and Designed Landscapes (GDLs)

8.4.7.19 The effect of the three proposed wind farm sites and OSPs is assessed further on the GDLs in the study area. The perception of these GDLs may be altered as the three proposed wind farm sites have the potential to become a characteristic element or key characteristic of the seascape / coastal character. The effect of the three proposed wind farm sites and OSPs on the seascape / coastal characteristics of these GDLs are assessed in Table 8.4-8 below.

Table 8.4-8 Assessment of Effects on Gardens and Designed Landscapes

Region	GDL	Distance from Site	Sensitivity to Change	Magnitude of Change	Significance of Effect
Caithness	Castle of Mey	47 km (Telford)	High	None (the three proposed wind farm sites and OfTI are not visible)	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
	Dunbeath Castle	34 km (MacColl)	High	Low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Region	GDL	Distance from Site	Sensitivity to Change	Magnitude of Change	Significance of Effect
Caithness (continued)	Langwell Lodge	38 km (MacColl)	High	Low	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
Morayshire	Cullen House	42 km (Stevenson)	High	Low-negligible	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
	Gordon Castle	48 km (Stevenson)	High	Low-negligible	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
	Gordonstoun	48 km (Stevenson)	High	None (the three proposed wind farm sites and the OfTI are not visible)	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
	Innes House	47 km (Stevenson)	High	None (the three proposed wind farm sites and the OfTI are not visible)	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
Aberdeenshire	Duff House	50 km (Stevenson)	High	None (the three proposed wind farm sites and the OfTI are not visible)	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.

Special Landscape Areas

8.4.7.20 The effect of the three proposed wind farm sites and OSPs is assessed further on the proposed SLAs in the study area. The perception of these pSLAs may be altered as the three proposed wind farm sites and OSPs have the potential to become a characteristic element or key characteristic of the seascape / coastal character.

The effect of the three proposed wind farm sites and OSPs on the special qualities of these pSLAs is assessed in Table 8.4-9 below.

Table 8.4-9 Assessment of Effects on Special Landscape Areas

Proposed SLA	Distance from Site	Sensitivity to Change	Magnitude of Change	Significance of Effect
Flow Country and Berriedale Coast	35 km (Stevenson)	High	**Medium-low** Special qualities of pSLA defined as '*distinctive mountain and moorland skyline'* and, '*exposed peaks, vast openness and intimate glens*'. Special qualities make no reference to coastal qualities, although overview describes Berrideale coast as having a '*series of vantage points from which to enjoy panoramic views out to the north sea*'. • Narrow character of coastline restricts visibility to narrow stretch at the immediate coastal edge. • The three proposed wind farm sites and OfTI will have an external influence on limited part of pSLA where there is a direct relationship with the adjacent open sea. • Key characteristic of Berriedale Coast as a linear coastal shelf constricted by inland hills and open sea will continue to provide defining characteristic.	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
Duncansby Head	38 km (Telford)	High	**Low** • The three proposed wind farm sites and OSPs and OfTI will not affect the views north over Pentland Firth, to Dunnet Head and Orkney Islands. • The three proposed wind farm sites and OfTI form a new but visually separate focus at distance out to sea and will not disrupt the appreciation of the physical influences along coastal edge. • Attraction of headland for visitors to extreme north-eastern point of British mainland will not be affected.	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
Dunnet Head	47 km (Telford)	High	**None** The three proposed wind farm sites and OfTI are not visible from pSLA therefore will result in no change.	**Operation** Not significant, negative, long term, reversible. **Construction and decommissioning** Not significant, negative, short term, reversible.
Loch Fleet, Loch Brora and Glen Loth	46 km (MacColl)	High	**Medium-low** • Elevated platform and enclosure by inland hills directs views to the three proposed wind farm sites and OfTI out to sea which will include a skyline of offshore wind turbines and OSPs.	Not significant

Proposed SLA	Distance from Site	Sensitivity to Change	Magnitude of Change	Significance of Effect
Loch Fleet, Loch Brora and Glen Loth (continued)			• The three proposed wind farm sites and OfTI are likely to have an external influence on limited part of pSLA where there is a direct relationship with the adjacent open sea • Views of distant offshore wind farm seascape on skyline likely to become a characteristic element. • Offshore, distance location ensures that the three proposed wind farm sites and OfTI will not interrupt the main landscape composition formed by a juxtaposition of moorland hills, linear glens, coastal shelf and tidal basin.	

8.4.8 Secondary Assessment and Sensitivity Assessment

8.4.8.1 As MORL is applying for a separate S36 consent for each wind farm, it is necessary to assess the Seascape, Landscape and Visual impacts of each proposed wind farm site (Telford, Stevenson and MacColl) individually. MORL refer to this individual assessment as 'secondary assessment', which is provided in Technical Appendix 5.4 C. A 'sensitivity assessment' is also provided in Technical Appendix 5.4 C to examine the different possible development permutations. This means that the SLVIA assesses all three proposed wind farms as a whole, each wind farm site individually, and combinations of two projects. The sensitivity assessment assesses three potential development scenarios: MacColl + Stevenson; MacColl + Telford and Stevenson + Telford, as the seascape, landscape and visual effects of each scenario are likely to be different.

8.4.9 Conclusions

8.4.9.1 The Seascape, Landscape and Visual Impact Assessment (SLVIA) has been undertaken to determine the likely significant effects of the Telford, Stevenson and MacColl wind farms together with the offshore transmission infrastructure on the study area. The assessment is based on the 'worst case' Rochdale Envelope scenario (Scenario 4c) which has the largest turbine height (7 MW, 204 m blade tip) at the densest 5D x 7D spacing throughout the Telford, Stevenson and MacColl sites. Furthermore, it assumes that the substructure design will be a jacket type and that eight offshore substation platforms (OSP) will be distributed within or close to the wind farm sites with an OSP close to the site boundaries nearest Caithness and Moray.

8.4.9.2 The assessment assumes clear weather and optimum viewing conditions. Met Office visibility frequency data suggests that the area benefits from good visibility conditions, but that visibility frequency drops sharply at longer distances, such that visibility over 25 km occurs for a limited amount of time. The prevailing visibility and weather conditions combine to reduce the duration and significance of effects of the three proposed wind farm sites to relatively limited periods where views of the three proposed wind farm sites are available. 'Excellent' visibility will be required to see the three proposed wind farm sites from the Moray and Aberdeenshire coastline, at distances over 40 km, which occurs infrequently.

8.4.9.3 The effect of the three proposed wind farm sites is assessed as not significant on landscape / seascape character. Two national seascape units are located within the study area, covering the North Aberdeenshire / Moray Coast and the East

Caithness and Sutherland coast, which are both assessed as having a medium-low sensitivity to change. The seascape / landscape assessment has identified that the magnitude of change of the proposed development will be medium, and not significant, on the Coastal Character Areas (CCAs) between Wick and Berriedale; low, and not significant, on the CCAs to the north of Wick; and medium-low, and not significant, on the CCAs to the south of Berriedale. The landscape elements of these CCAs will not be physically altered; changes arise principally through visibility, which may indirectly change the way in which the pattern of elements is perceived. The proposed development will introduce distant offshore wind farm development as a characteristic element on the open sea skyline of these CCAs, but the existing key characteristics of these CCAs will continue to provide their defining characteristics. The effects of the three proposed wind farm sites is assessed as not significant on the landscape designations within the study area, including Gardens and Designed Landscapes (GDLs) and proposed Special Landscape Areas (pSLAs) all of which are located over 34 km from the three proposed wind farm sites.

8.4.9.4 The likely visual impacts of different layout scenarios have been investigated as part of the review of the worst case layout scenario for the Rochdale Envelope. This approach has necessitated an assessment of the likely worst case, in which the three proposed wind farm sites are assessed and illustrated at their largest size, in terms of turbine height, number, density and horizontal spread, and with the turbine rows set out in a worst case grid pattern that aligns towards the closest section of the Caithness coast (as illustrated and assessed for Scenario 4).

8.4.9.5 The ZTV analysis reviewed the theoretical extent of potential visibility of the three proposed wind farm sites. The assessment identified offshore visibility of 201 to 212 turbine blade tips (Scenario 4) from all of the offshore parts of the study area within approximately 40 km with visibility levels dropping in bands over 35 km at sea level due to earth curvature. Visibility from onshore areas in Caithness consists of visibility of 201 to 212 turbine blade tips (Scenario 4) from the majority of the Caithness coastal edge and immediate hinterland between Duncansby Head and Helmsdale at distances of 22 km to 50 km (e.g. Viewpoints 1, 2, 4, 5, 6, 7, 8, 9, 10, 12 and 15). Inland of the coastal hinterland, visibility becomes more scattered and more variable depending on the degree of enclosure / openness provided by landform. The relatively low-lying land of the flat peatlands of Caithness in respect of the landform pattern, has the general effect of visibility being precluded by the surrounding higher ground. The northern part of the Caithness study area has scattered, long distance inland visibility (35 to 50 km), where landform at the coast offers some screening, but there is no definitive inland viewshed. The southern part of the Caithness study area has elevated inland area of sweeping moorland and lone mountains with scattered long distance visibility (35 to 50 km). Visibility from onshore areas in Moray and Aberdeenshire is limited to coastal edge at distances of approximately 45 km and from elevated inland areas of coastal hills at distances of 45 to 50 km.

8.4.9.6 The ZTV analysis also reviewed how much of the horizontal field of view and vertical field of view will be occupied by the three proposed wind farm sites. The assessment identified that the three proposed wind farm sites will occupy 40 to 60 degrees of the horizontal field of views from the closest areas of Caithness with visibility around Sarclet Head between Dunbeath and Wick. While the horizontal extent of the three proposed wind farm sites on the skyline at distances of 22 to 30 km will be notable, the three proposed wind farm sites will have a small vertical height in views at this distance, with the turbines only occupying 0 to 1 degrees of the vertical angle of views from the closest area around Sarclet Head between Dunbeath and Wick.

8.4.9.7 The assessment of visual effects of the three proposed wind farm sites has been assessed further through a viewpoint assessment from representative locations in Caithness and Moray / Aberdeenshire. In general the distance to the three proposed wind farm sites limits the vertical effect of the turbines, which will be visible only in good, clear viewing conditions. The Draft ES assessment assumes maximum effect in clear viewing conditions, but the Final ES assessment will takes into account of the local effects of atmospheric visibility using meteorological data.

8.4.9.8 The viewpoint assessment has identified significant effects on seven viewpoints located in the closest section of Caithness between Wick and Dunbeath. These viewpoints are located at distances of 22 to 34 km from the three proposed wind farm sites. In good visibility conditions, the threshold at which significant effects diminish is assessed in the region of 30 to 35 km, depending on the specific characteristics of the view. Significant visual effects arise as a result of worst case layout being assessed, at maximum height, spread and worst case row alignment. Significant visual effects arise from the closest locations of the Caithness coast as a result of the three proposed wind farm sites appearing to occupy a significant portion of the sea skyline, where it forms a wide horizontal feature in relation to the seascape in the view, in combination with the vertical effect of the turbines being most notable. The vertical effect of the turbines is exacerbated by the lack of any intervening features or landform between the viewpoints on the coastal edge and the development located in open sea. The assessment has identified significant visual effects on the closest section of the A9 between Brora and Latheron and from the A99 between Latheron and Thrumster.

8.4.9.9 The viewpoint assessment has identified that the effect of the three proposed wind farm sites will be not significant on the remaining viewpoints in Caithness to the north of Wick and to the south of Berriedale. In these views, the three proposed wind farm sites will be more distant from the coast and located on the skyline within a part of the broad, open sea views. Generally set apart from the visible landform of the coast, the three proposed wind farm sites will form a single, distinct feature in their own right on the skyline, surrounded by open sea. The turbines will appear in close association to relate simply to the skyline, the large scale seascape and horizontal form of the horizon. The three proposed wind farm sites create an apparent focal feature but due to its separation and distance offshore, generally do not impinge upon or reduce the distinction of existing foci along the general, simple linear coastline. Several viewpoints in the assessment are located inland, where much of the three proposed wind farm sites are located behind the intervening skyline. The viewpoint assessment has identified that the effect of the three proposed wind farm sites will be not significant on viewpoints in Moray and Aberdeenshire, being located at long distances of over 41 km, from where the curvature of the earth reduces the apparent height of all of the turbines, with those furthest away having only a relatively short section of their towers and their blades visible above the skyline.

8.4.9.10 In the realistic worst case scenario, the grid of the turbine rows is aligned towards the closest section of Caithness coast, which results in turbines being aligned behind one another in some parts of the layout and seen in their row formations, creating a stacking effect in parts of the layout, with further rows appearing beyond and behind creating an irregular arrangement in other parts of the layout. The degree to which the turbines in the layout appear to be aligned or irregular is very dependent on the viewing location and the emphasis of the alignments changes as the observer position changes along the coast. The geometric outline of the site boundary results in the turbine groups at the northern and southern edges of the array being viewed less densely than the massing of the central part of the layout and the developed skyline is extended by relatively few turbines at these northern and southern extents of the site. The OSPs will be at a greater distance than the

nearest turbines and will generally be seen within the turbine array. The shorter height but greater massing of the OSPs is likely to make them identifiable as individual features generally located between and behind the turbines, creating a more complex image.

8.4.9.11 The assessment assumes clear weather and optimum viewing conditions. This means that effects that are assessed to be significant may be not significant under different, less clear conditions.

8.4.9.12 Although the assessment has identified that the proposed development will have significant visual effects on the closest section of Caithness between Wick and Dunbeath, the effect of the three proposed wind farm sites is assessed as not significant on landscape / seascape character. Two national seascape units are located within the study area, covering the North Aberdeenshire / Moray Coast and the East Caithness and Sutherland coast, which are both assessed as having a medium-low sensitivity to change. Coastal Character Areas (CCAs) are identified at the regional scale, within the framework of National Seascape Character Types in the study area, which are generally identified as having medium to low sensitivity to change, with several locally higher sensitive CCAs, often recognised by regional landscape designation. The seascape / landscape assessment has identified that the magnitude of change of the proposed development will be medium, and not significant, on the CCAs between Wick and Berriedale; low, and not significant, on the CCAs to the north of Wick; and medium-low, and not significant, on the CCAs to the south of Berriedale. The landscape elements of these CCAs will not be physically altered; changes arise principally through visibility, which may indirectly change the way in which the pattern of elements is perceived. The proposed development will introduce distant offshore wind farm development as a characteristic element on the open sea skyline of these CCAs, but the existing key characteristics of these CCAs will continue to provide their defining characteristics. The effects of the three proposed wind farm sites is assessed as not significant on the landscape designations within the study area, including Gardens and Designed Landscapes (GDLs) and proposed Special Landscape Areas (pSLAs) all of which are located over 34 km from the three proposed wind farm sites.

8.4.10 References

Civil Aviation Authority (CAA), August 2010, Policy Statement - The Lighting of Wind Turbine Generators in United Kingdom Territorial Waters.

Countryside Commission for Scotland, 1970, 1977, Beaches of Caithness and Beaches of Northeast Scotland.

CCW, 2001, Guide to Best Practice in Seascape Assessment.

DTI, 2005, Guidance on the Assessment of the Impact of Offshore Wind farms: Seascape and Visual Impact Report.

Landscape Institute, 2003, Guidelines for the Assessment of Landscape and Visual Impacts: Second Edition.

Landscape Institute, 2011, Use of Photography and Photomontage in Landscape and Visual Impact Assessment, Note 01 / 11.

Met Office, 2010, National Meteorological Library and Archive Fact sheet 17 - Weather Observations Over Land

Met Office, 2012, Met Office Visibility Frequency Analysis report from Wick Airport weather station, based on hourly data from 01/01/2002 to 31/12/2011

SNH, 1997, Banff and Buchan LCA.

SNH, 1998, Caithness and Sutherland LCA.

SNH, 1998, Moray and Nairn LCA.

SNH, 2002, Visual Assessment of Wind farms: Best Practice.

SNH, 2005, An Assessment of the Sensitivity and Capacity of the Scottish Seascape in Relation to Wind Farms.

SNH, 2005, Cumulative Effects of Windfarms (Version 2).

SNH, 2006, Visual Representation of Wind farms Good Practice Guidance.

SNH, 2008, Designing Wind farms in the Landscape.

SNH, 2008, Guidance on Landscape / Seascape Capacity for Aquaculture.

SNH, 2009, Assessing the Cumulative Effects of Onshore Wind Energy Developments, Version 3 Draft for Consultation.

The Highland Council, 2010, Visualisation Standards for Wind Energy Developments.

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8.5 Archaeology and Visual Receptors

8.5.1 Summary of Effects and Mitigation

8.5.1.1 This chapter describes the likely significant effects of the proposed Stevenson, MacColl and Telford Offshore Wind Farms upon both offshore and onshore cultural heritage assets and proposes a strategy to mitigate any such effects. The proposed development may have direct, indirect, and secondary effects upon the physical fabric of offshore assets and may affect the setting of onshore assets. The baseline description is provided in Chapter 5.5 (Archaeology and Visual Receptors) and Technical Appendix 5.5 A.

Summary of Effects

8.5.1.2 The effects on archaeology that were assessed for the three proposed wind farm sites include:

- Likely significant direct and indirect effects on archaeological sites and features (for example: damage to or burial of marine sites and features as a result of the proposed works); and
- Likely significant effects on setting, where the visibility of wind turbines either causes loss of cultural significance or affects the degree to which significance may be appreciated.

Proposed Mitigation Measures and Residual Effects

8.5.1.3 Cultural heritage assets that would be affected will be furnished with a temporary exclusion zone during construction, where the purpose is to preserve in situ any features or deposits of known or potential cultural heritage interest. This will reduce the post–mitigation effects to **negligible**. In order to mitigate against the discovery of previously unrecorded cultural heritage assets a protocol for unexpected archaeological discoveries will be put in place.

8.5.1.4 A summary of the effects is provided in Table 8.5–1 below.

Table 8.5–1 Impact Assessment Summary

Receptor	Pre–Mitigation Effect	Mitigation	Post–Mitigation Effect
Construction			
Recorded Sites such as Known Wrecks	Major	Exclusion Zones	Negligible
Sites of Medium or High Potential Identified in the Geophysical Survey Data	Moderate to Major	Exclusion Zones	Negligible
Unrecorded Cultural Heritage Assets	Unknown	Implementation of WSI and PAD	Negligible
Sites Affected through Changes in Sedimentary Regime	Negligible	None	Negligible

Receptor	Pre–Mitigation Effect	Mitigation	Post–Mitigation Effect
Operation			
Setting of Designated Onshore Receptors	Negligible	None	Negligible
Sites Affected through Changes in Sedimentary Regime	Negligible	None	Negligible
Decommissioning			
Effects arising from the decommissioning of the three proposed wind farm sites are considered to be analogous to, and of no greater significance than, those arising during construction.			

8.5.2 Introduction

8.5.2.1 This chapter describes the likely significant effects of the proposed Telford, Stevenson and MacColl Wind Farms upon both offshore and onshore cultural heritage assets and proposes a strategy to mitigate any such effects. The proposed development may have both direct and indirect effects upon the physical fabric of offshore assets and may affect the setting of onshore assets.

8.5.2.2 The assessment has found that there will be likely significant direct effects on Sites HW1001, 1002, 1004 (identified wreck sites), HW1014 (unknown seabed obstruction) and on Sites HW44; 52, 61, 71, 72, 75–78, 80, 100, 102, 108 and 117 (sidescan sonar targets of medium archaeological potential). In addition to these Sites HW1005 (identified wreck), HW1015 (unidentified obstruction) and HW36, 73 and 74 (sidescan sonar targets of medium potential) may be subject to secondary effects. The assessment also identified moderate potential for the discovery of previously unrecorded cultural heritage assets. In the absence of mitigation the magnitude of these effects could be major to moderate.

8.5.2.3 Cultural heritage assets that would be affected will be furnished with a temporary exclusion zone. This will reduce the post–mitigation effect to negligible. In order to mitigate against the discovery of previously unrecorded cultural heritage assets a protocol for unexpected archaeological discoveries will be put in place. Cultural heritage assets considered in this assessment are listed in a Gazetteer and Concordance (see Technical Appendix 5.5 A). In the interests of clarity offshore cultural heritage assets within the three proposed wind farm sites are referred to by HW numbers issued in the course of the assessment. Onshore assets considered in relation to setting are referred to according to their designation index number (SM: Scheduled Monument; HB: Listed Building). The assessment has been compiled in line with industry best practice and the relevant offshore renewables and marine historic environment guidance. These include:

- Institute for Archaeologists (IfA) guidelines: Standard & Guidance for Archaeological Desk Based Assessment (2011);
- Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (2006);
- COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (2007);
- COWRIE Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (2008);
- COWRIE Guidance for Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector (2010);
- The Crown Estate (2010). Offshore Renewables Protocol for Archaeological Discoveries;

- The Crown Estate (2010). Offshore Renewables Projects Model Clauses for Archaeological Written Schemes of Investigation; and
- Towards a Strategy for Scotland's Marine Historic Environment (Historic Scotland 2009).

8.5.2.4 The scope of the assessment has considered the three proposed wind farms' effects upon the following:

- Designated cultural heritage assets, comprising designated wrecks, scheduled monuments, listed buildings, conservation areas, inventory designed gardens and designed landscapes (IGDLs), inventory battlefields and non–designated cultural heritage assets;
- Undesignated submerged archaeology, including maritime losses such as wrecks, aircraft and their associated debris, and submerged prehistoric remains and palaeoenvironmentally significant deposits; and
- Key onshore assets that are subject to indirect visual effects from the proposed development.

8.5.3 Rochdale Envelope Parameters Considered in the Assessment

8.5.3.1 This assessment presents the maximum likely significant adverse effect as a result of having assessed the realistic worst case development scenario for cultural heritage.

8.5.3.2 Relevant parameters defining the 'Rochdale Envelope' realistic worst case scenario for each likely significant effect on archaeology and visual receptors are presented in Table 8.5–2 below. The parameters selected are drawn from the range of development options set out in Chapter 2.2 (Project Description) insofar as these are relevant to the consideration of potential effects on archaeology and cultural heritage.

Table 8.5–2 Rochdale Envelope Parameter Relevant to the Archaeology and Visual Receptors Impact Assessment

Type of Effect	Rochdale Envelope Scenario Assessed
Construction & Decommissioning	
Net Reduction of Seabed Area	Maximum seabed footprint based on: • 339 turbines (if lowest rated options are installed); and • Placement of gravity base foundations of 65 m diameter; and excavated diameter of 95 m including scour protection (total dredger affected area of 125 m diameter will be noted however). Total area of seabed affected per turbine with "scour protection" (7,087 m^2); when total dredger affected area taken into consideration (12,272 m^2).
Net Effect of Inter–Array Cabling on the Seabed	Maximum effect on the seabed based on: • 572 km maximum cable length; • Ploughing method for installation of cable trenches – 3 m extreme depth and 6 m affected width; • Potential surface laying protection either mattress or rock placement; and • Deployment of up to six anchors of maximum weight 12 Te and dimensions 4.5 m wide by 3.64 m long by 1.7 m high with a shaft of 5.3 m and likely to penetrate 1 m into sediment and nominal 5 m^2 area of seabed disturbance. Anchors to be deployed every 500 m along length of inter–array cables.

Type of Effect	Rochdale Envelope Scenario Assessed
Temporary Seabed Disturbances	Maximum footprint based on: • Total area of spud cans per jack–up barge (assume six legs per barge) = 420 m^2; • Number of visits per installation / decommissioning = two.
Re–Distribution of Fine Sediments	• Fine sediments arising from seabed preparation and installation of 339 gravity base foundations and 572 km of inter–array cabling transported within spring tidal axes.
Operation	
Turbine Height and Layout in Relation to the Setting of Onshore Receptors	• Based on Option 4C (Chapter 8.4: Seascape, Landscape and Visual Receptors) comprising 72 x 7 MW turbines per wind farm, where these would be the tallest option.
Temporary Seabed Disturbances	• Total area of spud cans per jack–up barge (assume six legs per barge) = 420 m^2; and • No. of visits for O&M purposes during life of project (25 years) = five per turbine.
Change in Hydrodynamics	• Net effect in changes in hydrodynamics from the Project.

8.5.3.3 The realistic worst case scenario for wind turbine generator (WTG) foundations takes into account the 'total excavated diameter' (largest area that could be affected including scour protection) since this represents the maximum effect on the seabed and maximum seabed take. While the effect is considered to be temporary, the total 'dredger affected area' will also be noted for effects during construction. The employment of 65 m diameter gravity base foundations is considered to be the worst case scenario.

8.5.3.4 While the three proposed wind farms utilise different heights of turbine for the lowest rated options (3.6 and 5 MW), the highest rated option sees the deployment of 7 / 8 MW turbines for all three sites; this is considered to present the most prominent WTG option. For the purposes of the setting impact assessment 7 MW WTGs has been considered to be the worst case scenario as this would be the most numerous of the higher WTG ratings.

8.5.3.5 Decommissioning activities are also likely to have effects on archaeology receptors but these are regarded as being comparable to those that occur as a result of construction activities.

8.5.4 EIA Methodology

8.5.4.1 The installation of WTGs and their foundations, and inter–array cables, and associated activities including the deployment of construction vessels, has the potential to damage or destroy cultural heritage assets. This may occur either as a result of the design or as an accidental consequence of construction activities, such as the anchoring of vessels involved in installation. The effects may be direct, indirect or secondary. The type and description of effects used for the purpose of the assessment are presented in Table 8.5–3 below.

Table 8.5–3 Cultural Heritage Asset Impact Description

Type of Effect	Description
Direct Effect	Direct effects include direct damage to structures, features, deposits and artefacts, such as the preparation of the seabed during construction (and the reverse for decommissioning), installation of turbine foundations and the installation of inter–array cabling.
Indirect Effect	Indirect effects are those which are not a result of the three wind farms directly and can be associated with other induced changes (For example: changes to wave and tidally induced currents or sediment transport regimes) which can result in increases in erosion of, or disturbance to archaeological sites. Indirect effects also include the disturbance or destruction of relationships between structures, features, deposits, and artefacts and their wider surroundings, such as effects on the setting of onshore and island cultural heritage assets.
Secondary Effect	Secondary effects are those that are not a result of primary development activity such as the installation of a turbine but as a result of secondary activity associated with the primary activity. These might include the effects of the deployment of jack–up legs during construction or anchoring of vessels during construction, operation and decommissioning activities.

Significance Criteria for Physical Effects on Cultural Heritage Assets

Sensitivity

8.5.4.2 The sensitivity of a cultural heritage asset to an effect reflects the level of importance assigned to it. This is the product of a number of factors, including its potential as a resource of archaeological data, its association with significant historical events, its role as a local landmark with cultural associations and its aesthetic value.

8.5.4.3 Official designations applied respectively to cultural heritage assets have been taken as indicators of importance as they reflect these factors. Sensitivity is assigned to undesignated cultural heritage assets according to the professional judgment of the assessor.

8.5.4.4 In determining the magnitude of effect, the values of the asset affected are first defined. This allows the identification of key assets and provides the baseline against which the magnitude of change can be assessed; the magnitude of effect being proportional to the degree of change in the asset's baseline value.

8.5.4.5 The criteria used for defining a cultural heritage asset's sensitivity to direct and indirect physical effects and then assessing the magnitude of those effects is summarised in Table 8.5–4 below.

Table 8.5–4 Sensitivity of Cultural Heritage Assets to Physical Effects

Sensitivity to Impact	Definition
High	• Designated wrecks; • Scheduled monuments; • Category A–listed buildings; • Inventory gardens and designed landscapes; • Inventory battlefields; • Undesignated assets of national importance; • Maritime losses where the position is known and positively identified; and • Targets of high archaeological potetnial identified in the geophysical survey.

Sensitivity to Impact	Definition
Medium	• Category B listed buildings; • Conservation areas; • Targets of medium archaeological potential identified in the geophysical survey; • Obstructions that could be indicative of wreckage or submerged features; and • Undesignated assets of regional importance.
Low	• Category C(S)–listed buildings; • Undesignated assets of local importance; and • Targets of low potential identified in the geophysical survey.
Negligible	• Assets of less than local importance.

Magnitude of Physical Effects

8.5.4.6 The magnitude of the effect may be large, for instance where there is a total loss or major alteration of the cultural heritage asset; medium, the loss or alteration to one or more key elements / features of a cultural heritage asset; or small, where there is a slight but perceptible alteration of the cultural heritage asset. The criteria used for assessing the magnitude of effects on cultural heritage is summarised in Table 8.5–5 below.

Table 8.5–5 Magnitude of Physical Effects on Cultural Heritage Assets

Magnitude of Effect	Definition
High	Total loss or major alteration of the cultural heritage asset.
Medium	Loss of, or alteration to, one or more key elements of the cultural heritage asset.
Low	Slight alteration of the cultural heritage asset.
Negligible	No perceivable alteration to the cultural heritage asset.

Significance Criteria for Operational Effects on Setting

8.5.4.7 During the construction, operation and decommissioning phases of developments, the setting of cultural heritage assets may be affected. There is considerable debate over definitions of setting and approaches to the assessment of setting effects (Lambrick, 2008), with no standardised industry wide approach. As part of its 'Managing Change in the Historic Environment' series, Historic Scotland has produced a guidance note entitled *Setting* (2010). This states that:

"*Setting should be thought of as the way in which the surroundings of a historic asset or place contribute to how it is experienced, understood and appreciated.*"

8.5.4.8 Hence, setting is not simply the visual envelope of the asset in question. Rather, it is those parts of the asset's surroundings that are relevant to the cultural significance of the asset. In general, there will be an appreciable historical relationship between the asset and its setting, either in terms of a physical relationship, such as between a castle and the natural rise that it occupies, or a more distant visual relationship (for example: such as a designed vista or the view from one Roman signal station to another). Some assets' cultural significance will relate to an aesthetic relationship with their surroundings which may result from design or be fortuitous.

8.5.4.9 In such instances, the relevant landscape elements will be considered to form part of the asset's setting. The cultural significance of assets has been considered in terms of the values described in Scottish Historic Environment Policy (SHEP, Historic Scotland 2008, 58) as being:

- Intrinsic – those relating to the fabric of the asset;
- Contextual – those relating to the monument's place in the landscape or in the body of existing knowledge; and
- Associative – more subjective assessments of the associations of the monument, including with current or past aesthetic preferences.

8.5.4.10 Most setting effects will relate to contextual and associative values.

Sensitivity

8.5.4.11 The sensitivity of a cultural heritage asset to changes in its setting can be evaluated in the first instance by reference to any relevant designation, whereby assets designated as nationally important will generally be considered the most sensitive. Consequently, the assessment has focussed on nationally important cultural heritage assets in the study areas which are considered in relation to effects upon setting, with other assets being considered where, in the assessor's professional opinion, there is potential for significant effects or where they have been raised by consultees (Historic Scotland, Highland Council Historic Environment Team (HCHET) and Moray Council). Assets of less than national importance will generally be of no more than medium sensitivity.

8.5.4.12 Following reference to the designation of the asset, sensitivity can be more finely assessed by reference to the importance of the asset's surroundings to its character and value as a cultural heritage asset, and the appreciation of its value. Also taken into account is the extent to which an asset is visible on the ground. Some assets may have a well defined and appreciable setting but the asset itself is barely perceptible. Such assets will generally be less sensitive than those that are readily appreciable.

8.5.4.13 Table 8.5–6 below is a general guide to the attributes of cultural heritage assets of high, medium, low or negligible sensitivity to setting effects. It should be noted that not all the qualities listed need be present in every case and professional judgement is used in balancing the different criteria. As noted above, the guideline criteria have been developed by Headland Archaeology, in the absence of official guidance or a standard methodology.

Table 8.5–6 Sensitivity of a Cultural Heritage Asset to Effects on Setting

Sensitivity	Guideline Criteria
High	The asset has a clearly defined setting that is readily appreciable on the ground and is vital to its significance or the appreciation thereof. The asset will generally be readily appreciable on the ground.
Medium	The asset's significance and the appreciation thereof relate to some extent to its setting. The asset will generally be appreciable on the ground.
Low	The asset's surroundings have little relevance to its significance or the appreciation thereof. The asset is difficult to identify on the ground or its setting is difficult to appreciate on the ground.
Negligible	The asset is imperceptible in the landscape and its significance or the appreciation thereof does not relate to its surroundings.

Magnitude

8.5.4.14 The magnitude of an effect reflects the extent to which relevant elements of the cultural heritage asset's setting are changed by the development and the effect that this has upon the character and value of the asset and the appreciation thereof. Guideline criteria for magnitude defined as high, medium, low or negligible magnitude are described in Table 8.5–7 below. As with other criteria presented, this is intended as a general guide and it is not anticipated that all the criteria listed will be present in every case.

8.5.4.15 The following are guides that are used in the assessment of magnitude of effect.

- **Obstruction of or distraction from key views**. Some assets have been sited or designed with specific views in mind, such as the view from a Roman signal station to an associated fort or a country house with designed vistas. The obstruction or cluttering of such views would reduce the extent to which the asset could be understood and appreciated by the visitor. Developments such as that proposed outside a key view may also distract from them and make them difficult to appreciate on account of their prominence. In such instances the magnitude is likely to be greatest where views have a particular focus or a strong aesthetic character;
- **Changes in prominence**. Some assets are deliberately placed in prominent locations in order to stand out within the surrounding landscape. For example: prehistoric cairns are often placed to be silhouetted against the sky and churches in some areas are deliberately placed on ridges in order to be highly visible. Developments can reduce such prominence and therefore reduce the extent to which such assets can be appreciated;
- **Changes in landscape character**. A particular land use regime may be essential to the appreciation of an asset's function, for instance the fields surrounding an Improvement Period Farmstead are inextricably linked to its appreciation. Changes in land use can leave the asset isolated and reduce its value. In some instances, assets will have aesthetic value or a sense of place that is tied to the surrounding landscape character;
- **Duration of effect**. Effects that are short term are generally of lesser magnitude than those that are long term or permanent;
- **Reversibility of Effects**. Readily reversible effects are generally of lesser magnitude than those that can not be reversed.

8.5.4.16 Effects upon a defined setting will be of greater magnitude than those that affect unrelated elements of the asset's surroundings or incidental views to or from an asset that are unrelated to the appreciation of its value. It should be noted that the assessment of magnitude has been based on the interplay of these factors. No single factor is taken to override other factors, for instance a negative effect that would be of high magnitude will not generally be reduced to low magnitude, simply on the grounds that it is reversible. It should also be noted that whilst a proposed development may be present within the visual envelope of an asset this does not automatically mean there is an effect on the setting of the asset. Where this is the case, the reasoning behind this has been given. As above, the criteria provided have been developed by Headland Archaeology in the absence of official guidance or an accepted methodology.

Table 8.5–7 Magnitude of an Effect on the Setting of a Cultural Heritage Asset

Magnitude	Guideline Criteria
High	The contribution of the setting of the cultural heritage asset to its significance is effectively lost or substantially reduced as a result of the development, the relationship between the asset and its setting is no longer readily appreciable.
Medium	The contribution of the setting of the cultural heritage asset to its significance is reduced appreciably as a result of the development and cannot easily be reversed to approximate pre–development conditions. Relevant setting characteristics can still be appreciated but less readily.
Low	The contribution of the setting of the cultural heritage asset to its significance is slightly degraded as a result of the development, but without adversely affecting the interpretability of the asset and its setting; characteristics of historic value can still be appreciated, the changes do not strongly conflict with the character of the asset, and could be easily reversed to approximate the pre–development conditions.

8.5.4.17 Changes may occur in the surroundings of an asset that neither affects its contribution to the significance of the asset nor the extent to which its significance can be experienced. In such instances it will be considered that there is negligible effect upon setting.

Levels of Significance

8.5.4.18 The significance of an effect on the setting of a cultural heritage asset is assessed by combining the magnitude of the effect and the sensitivity of the cultural heritage asset. The Evaluation of Significance matrix presented in Table 8.5–8 below, provides a guide to decision making, but is not a substitute for professional judgment and interpretation, particularly where the sensitivity or effect magnitude levels are not clear or are borderline between categories. Predicted effects of major or moderate significance are considered significant for the purpose of the impact assessment on cultural heritage.

Table 8.5–8 Significance of Effect on the Setting of a Cultural Heritage Asset

Magnitude	Sensitivity			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible	Negligible	Minor
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Major

8.5.5 Primary Impact Assessment: Three Proposed Wind Farm Sites

8.5.5.1 The baseline assessment (Chapter 5.5: Archaeology and Visual Receptors, and Technical Appendix 5.5 A) established that there are no designated wrecks or other cultural heritage assets with legal designations within the Inner and Outer Study Areas. The report identified six recorded wreck sites, four of which are located within the Inner Study Area (HW1001 to HW1004) and two wrecks within the Outer Study Area (HW1005 & HW1006). Of these sites, four are considered to be 'Live' with known locations, while two are considered to be 'Dead' as they have not been detected by repeated surveys. One UK Hydrographic Office (UKHO) obstruction

(HW1014) was identified within the proposed development Inner Study Area and one UKHO obstruction within the Outer Study Area (HW1015).

8.5.5.2 In addition, the assessment of geophysical data identified three anomalies of high archaeological potential (HW 157; 158 and 159) that correspond with recorded wrecks HW1001, 1002 & 1004); and a further 17 anomalies of medium potential (HW 36; 44; 52; 61; 71; 72; 73; 74; 75; 76; 77; 78; 80; 100; 102; 108 and 117) were identified. All of these receptors are located within the Inner and Outer Study Areas.

Construction

Direct Effects

8.5.5.3 Potential direct effects on cultural heritage assets considered here include those highlighted in Table 8.5–3 above and the effects noted in the Rochdale Envelope (Table 8.5–2 above). The Rochdale Envelope effects considered include net reduction of seabed area; and the net effect of inter–array cabling on the seabed.

8.5.5.4 Sites **HW1001, 1002** and **1004** (identified wrecks) are classified as sites of high sensitivity within this assessment. The magnitude of effect in the absence of mitigation could be high. The significance of effect in the absence of mitigation is therefore regarded as **major**. The associated high potential targets (HW157, 158 and 159) are considered in conjunction with these recorded wrecks.

8.5.5.5 Site **HW1014** (unknown obstruction) is classified as a site of medium sensitivity within this assessment. The potential magnitude of the effect in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

8.5.5.6 Sites **HW44; 52, 61, 71, 72, 75–78, 80, 100, 102, 108 and 117** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

Indirect Effects

8.5.5.7 Potential indirect effects on cultural heritage assets considered here include those highlighted in Table 8.5–3 above and the effects noted in the Rochdale Envelope (Table 8.5–2 above). The Rochdale Envelope effects considered include re–distribution of fine sediments; and temporary seabed disturbances.

8.5.5.8 There is the potential for alterations in sediment transport regimes to have an indirect effect on cultural heritage assets identified above; this might include the further uncovering of known assets or the exposure of unrecorded assets. The possibility of alterations to the tidal regimes leading to long–term effects on patterns of sediment transport within the application area are assessed and reported in Chapters 6.1 and 9.1 (Hydrodynamics: Wave Climate and Tidal Regime) and Chapters 6.2 and 9.2 (Sedimentary, and Coastal Processes). The effects of the three proposed wind farms on sediment transport regimes will persist for the lifetime of the development where sediment transport is less than the potential for natural variability, and therefore the effect is considered to be **not significant**. The predicted effect of changes to the tidal regime as a result of the three proposed wind farms suggest that the effects of the array on currents will persist over the lifetime of the development but are of a very small magnitude, have only a local effect, and do not impact beyond natural variability. The effect is therefore considered to be **not significant**.

8.5.5.9 Potential effects have all been described as of low magnitude. It is therefore considered that there will be no significant effect on cultural heritage assets due to changes to tidal currents or sedimentary regimes as a result of the presence of the three proposed wind farms.

Secondary Effects

8.5.5.10 Potential secondary effects on cultural heritage assets considered here include those highlighted in Table 8.5–3 above and the effects noted in the Rochdale Envelope (Table 8.5–2 above). The Rochdale Envelope effects considered include temporary seabed disturbances.

8.5.5.11 Sites **HW1001, 1002** and **1004** are classified as sites of high sensitivity within this assessment. The associated high potential targets (HA157, 158 and 159) are considered in conjunction with these recorded wrecks. The magnitude of effect in the absence of mitigation could be medium. The significance of effect is therefore regarded as **major**.

8.5.5.12 Sites **HW44; 52, 61, 71, 72, 75–78, 80, 100, 102, 108 and 117** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be medium. The significance of the effect is therefore regarded as **moderate**.

8.5.5.13 Sites **HW1014** and **HW1015** (unknown obstructions) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be medium. The significance of the effect is therefore regarded as **moderate**.

8.5.5.14 Site **HW1005** (located in the 1 km buffer) is classified as a site of high sensitivity within this assessment. The magnitude of effect in the absence of mitigation could be medium. The significance of effect is therefore regarded as major.

8.5.5.15 Sites **HW36, 73** and **74** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The magnitude of effect in the absence of mitigation could be medium. The significance of effect is therefore regarded as moderate.

Operation

Physical Effects

8.5.5.16 Potential secondary physical effects on cultural heritage assets considered here include those highlighted in Table 8.5–3 above and the effects noted in the Rochdale Envelope (Table 8.5–2 above). The Rochdale Envelope effects considered include temporary seabed disturbances.

8.5.5.17 The offshore operation phase may result in secondary effects on the sites of cultural heritage interest identified in the secondary construction effects noted above. Potential effects may include the effects of anchoring of maintenance vessels and associated activities. The identified sites are of high to medium sensitivity and in the absence of mitigation the magnitude is considered to be high to medium. The significance of the potential effect is therefore regarded as **major to moderate**.

8.5.5.18 The potential for indirect effects of the three proposed wind farms on cultural heritage assets through change in hydrodynamics and alterations in sedimentary

regimes is considered to be the same during the operational phase as that highlighted above during construction.

Setting Effects

8.5.5.19 Potential setting effects on cultural heritage assets considered here include those highlighted in Table 8.5–3 above and the effects noted in the Rochdale Envelope (Table 8.5–2 above). The Rochdale Envelope effects considered include turbine height and layout in relation to the setting of onshore receptors.

8.5.5.20 **Borrowston Broch (SM 527)** comprises the scheduled remains of a broch. The broch survives as a low grassy mound with walling exposed in places by erosion. The broch's cultural significance resides primarily in its intrinsic value as a potential source of archaeological data. Its setting is defined as the land immediately surrounding it, as it is this area that its occupants farmed and which the broch was intended to overlook. No specific views are considered relevant to its setting. It is of low sensitivity to effects upon setting.

8.5.5.21 The broch lies some 24.3 km from the wind farms and up to 225 turbines will theoretically be visible from it, depending on weather conditions (see Chapter 8.4: Seascape, Landscape and Visual Receptors). However, this will not affect the relationship between the broch and its setting and it is concluded that there will be a negligible effect upon its setting. Effects are of negligible significance and are considered as **not significant**.

8.5.5.22 **Garrywhin Fort (SM 548)** is a scheduled Iron Age fort comprising a single low rampart with two entrances; one to the south south west and one to the north north east. These are marked by orthostats, which in the past have been mistakenly interpreted as standing stones. There are slight internal features. The fort lies on a steep–sided ridge, which the rampart follows and is a part of the Warehouse Hill palimpsest landscape. The fort has been damaged in places but has clear potential as a source of archaeological data giving it intrinsic value. As a part of a palimpsest landscape it has contextual value. Its appreciable relationship with local topography, which is exploited defensively, and views over the immediate landscape, which its occupants presumably farmed, also contribute to its contextual value. It has no associative value. The fort's setting is therefore defined as the ridge upon which it stands and the adjacent land that it overlooks. There are no specific views that might be considered important to its cultural significance or the appreciation of that significance. The fort is of medium sensitivity.

8.5.5.23 The proposed turbines will be visible at a distance of at least 24 km. This will not affect the extent to which the fort's relationship with its surroundings and, hence, contextual value can be appreciated. The views to the sea that are available from the fort are entirely incidental to the fort's cultural significance. It is therefore concluded that the fort's setting will be unaffected. The effect will be of negligible magnitude and significance and effects will be **not significant.**

8.5.5.24 **Tulloch (Usshilly) Broch and field system (SM 599)** comprises the scheduled remains of a broch, later buildings and extensive areas of post–medieval cultivation. It occupies a low rocky outcrop. The remains of the broch are poorly preserved on the surface. It lies directly north of the **Wag of Forse settlement (SM 2301)** and **Forse House settlement, field system and burnt mound (SM 7242)**. The former comprises a multi–phase Iron Age settlement, which was partially excavated in the 1930s and 1940s. As a result, the walls of the core part of the site area are exposed. Associated features are less clearly visible, however. The latter comprises prehistoric and later settlements and their associated field systems. All three are within an area of low–lying improved land.

8.5.5.25 Individually and collectively, these assets have great intrinsic value as sources of archaeological data regarding the development of the Caithness landscape over at least 2,000 years. They have contextual value in that they together form a palimpsest landscape. Wag of Forse has further contextual value because of its unusual form, which may cast light on the development of Iron Age architecture. It also has associative value because it was excavated by Alexander Curle, a key figure in Scottish archaeology. Their setting is therefore defined individually as the adjacent sites and collectively as the surrounding farmland. No specific views are relevant to an appreciation of their setting. They are of medium sensitivity to setting effects.

8.5.5.26 These assets lie at least 24 km from the wind farms. Whilst they have clear views out to sea and will therefore have clear views of the proposed turbines, this will not affect the contribution of their setting to their cultural significance; the relationships between the assets in question and the surrounding landscape will remain unchanged. The effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.27 **Watenan Broch (SM 696)** is a scheduled Iron Age broch. It is located on the edge of a terrace overlooking Loch Watenan and survives as substantial overgrown walls. A possible cairn is located some 10 m away. The broch has intrinsic value as a potential archaeological data source and, as part of the wider palimpsest landscape that surrounds it, it has contextual value. The terrace upon which its stands and the surrounding land are also relevant to its contextual value as the location at the terrace's edge would have rendered it a prominent feature in the landscape, allowing it to dominate the surrounding farmed land, which is now given over to rough grazing. It has no associative value. The broch's setting is therefore defined as the terrace upon which it stands and the adjacent land that it overlooks. There are no specific views that might be considered important to its cultural significance or the appreciation of that significance. It is of medium sensitivity to setting effects.

8.5.5.28 The broch is approximately 23.7 km from the wind farms at their closest point. Whilst the broch has clear views of the sea and will have similarly clear views of the turbines, it is the more immediate landscape that is relevant to the understanding of its character and cultural significance; views out to sea form only a backdrop to this landscape. The presence of the turbines on the horizon will not affect this relationship and it is concluded that the effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.29 **Watenan Fort (SM 4289)** despite its legal name it is now interpreted as a heavily mutilated burial cairn. It comprises an oval stone–built structure located on a natural rise. It has intrinsic value as a potential archaeological data source, although this is somewhat compromised by the robbing that renders its identification uncertain. It has greater contextual value as a part of the wider palimpsest landscape. The rise upon which it is located is relevant to its contextual value as this prominent location is relevant to an understanding of its inter–relationship with surrounding assets and landscape. It has no associative value. The cairn's setting is therefore defined as the terrace upon which it stands and the adjacent land that it overlooks. There are no specific views that might be considered important to its cultural significance or the appreciation of that significance. It is of low sensitivity to setting effects

8.5.5.30 The cairn is approximately 23.7 km from the wind farms at their closest point. Whilst it has clear views of the sea and will have similarly clear views of the turbines, it is the more immediate landscape that is relevant to the understanding of its character and cultural significance; views out to sea form only a backdrop to this landscape.

The presence of the turbines on the distant horizon will not affect this relationship and it is concluded that the effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.31 **Dunbeath Inver Fort (SM 5073)** is a multi–period scheduled site comprising a prehistoric fort, possibly a broch, post–medieval building and a World War II lookout post. The fort's cultural significance primarily relates to its intrinsic value as an archaeological data source, with particular interest resulting from the multiple phases of activity that are evident. Although the fort is located in a position with striking views along the coast these are incidental, as the fort itself is not readily apparent to the non–specialist. Its setting is therefore defined as the promontory itself and the adjacent fields. No specific views are considered relevant to the appreciation of the fort's setting. It is of medium sensitivity to setting effects.

8.5.5.32 The fort lies some 32 km to the north west of the wind farms at their closest point and all the turbines will be visible from it, depending on weather conditions. However, given the distance, this will not affect the contribution of the fort's surroundings to its cultural significance. It is concluded that the effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.33 **Latheronwheel promontory fort (SM 5182)** is a scheduled prehistoric fort located on a sea–stack. Surface remains are restricted to a rampart and three or four internal scoops. There are slight indications of an outer rampart. The fort's cultural significance primarily relates to its intrinsic value as an archaeological data source. Although the fort is located in a position with striking views along the coast these are incidental, as the fort itself is not readily apparent to the non–specialist. Its setting is therefore defined as the promontory itself and the adjacent fields. No specific views are considered relevant to the appreciation of the fort's setting. It is of medium sensitivity to setting effects.

8.5.5.34 The fort lies some 30.5 km to the north west of the wind farms at their closest point and all the turbines will be visible depending on weather conditions. However, given the substantial distance, this will not affect the contribution of the fort's surroundings to its cultural significance. It is concluded that the effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.35 **Cairn of Get (SM 90048)** is a Neolithic chambered cairn. It is a scheduled monument and a Property in Care. The cairn is of the Orkney–Cromarty type, with a passage leading to a central chamber. It appears as a grass–covered mound in the wider landscape, but from shorter distances the exposed stones of the passage and interior are apparent. The passage opens to the east south east. The cairn is set within high ground with open views to the north east, east, south east and south. It is surrounded by moorland beyond which improved pasture is visible as is modern housing, which is visible to the north east, east and south east. In the distance the sea may be glimpsed.

8.5.5.36 A public footpath, which starts from a small B road, tracks along open moorland (on an east to west alignment) up to the cairn and interpretation board. The cairn was excavated in the 19th century, which allows access and egress to the monument through the passageway. It has been suggested that some chambered cairns were built with reference to views of the sea, but this does not appear to be the case here; the passage and forecourt area are not aligned with the sea.

8.5.5.37 Although excavated in the 19th century, the cairn has intrinsic value as potential source of archaeological data and simply as an example of a Neolithic tomb. It has contextual value as a part of the Yarrows palimpsest landscape. It has no readily

identifiable associative value. The cairn's setting is therefore defined as the terrace upon which it is located and the surrounding moorland in which the palimpsest landscape is located.

8.5.5.38 The cairn's intended relationship with its surroundings is not clear, although it is evident that it is a part of a wider prehistoric landscape. This relationship is not appreciated by a single view, but rather by the visitor moving through the landscape visiting individual monuments and thereby gaining an appreciation of the existence of a relict early prehistoric landscape. It is concluded that the cairn is of medium sensitivity to effects upon setting.

8.5.5.39 The wind farms will be visible at a minimum distance of 23.7 km to the south east of the cairn. When approaching the monument, the development will be behind the visitor and will not form part of the backdrop to the monument. The passage way is aligned slightly to the north of the proposed wind farms so when exiting the monument, the visitor will see the turbines on the distant horizon, but it will not affect the relationship between the cairn and its setting. While the wind farms will represent a new modern element within the seascape it will not affect understanding and appreciation of Cairn of Get's sense of place. It is therefore considered that an impact of at most negligible magnitude will occur. This will constitute an effect of **negligible significance**.

8.5.5.40 **Castle of Old Wick (SM 90065)** is a ruined keep, situated to the south of Wick Bay. It is a scheduled monument and a Property in Care. It stands on a narrow promontory with steep cliffs dropping to the sea below. Based on comparisons with similar structures in Orkney and Scandinavia, it is thought to date to the 12th century. This would make it one of the earliest keeps in Scotland. This early date and long history of occupation gives the castle substantial intrinsic value in terms of its potential to inform understanding of the development of fortifications in Scotland and influences from outside Scotland. It has a clear relationship with the surrounding topography as it has evidently been placed to exploit the promontory for defensive purposes, giving it contextual value. Views of the sea may have been important to the function of the castle as ships hugging the coast would have been clearly visible from it. The location is spectacular; the ruined keep is seen as an isolated block on the promontory against the backdrop of the sea. This gives it associative value and is very important to modern day appreciation of the castle. The castle's setting is defined as the promontory upon which it stands and it is considered to be of high sensitivity to effects upon setting.

8.5.5.41 The car park serving the castle lies to the north of the castle on the opposite side of an inlet. The footpath to the castle runs around the inlet finally approaching the castle from the south west. The results of the site visit indicated that key views in the appreciation of the castle, particularly its associative value, were those from the south west and from the north east, across the inlet. In these views the castle is seen silhouetted and isolated on its promontory. Views to the sea from the castle are restricted to the north and north east.

8.5.5.42 The wind farms will lie a minimum of 22.9 km to the south east. While the wind farms will be visible to a visitor on the approach to the monument, they will be peripheral to views of the castle. Consequently, the sense of isolation that is so important to the keep's sense of place and hence associative value will remain unaffected. It is considered that the effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.43 **The Hill o'Many Stanes (SM90162)** is a prehistoric monument comprising stone rows on an east / west alignment situated on an east–facing slope. The lines are

composed of 200 principal earthfast stones, with a further 540 small stones, set in 22 rows radiating below the crest of a rocky knoll. Further features were recorded in 2003 in the surrounding area, which may relate to the monument. These monuments typically date to the late Neolithic / Early Bronze Age and it is currently thought that the Hill o'Many Stanes is the remains of prehistoric 'observatory'. The monument is promoted by Historic Scotland as a Property in Care and a footpath is maintained around the edge of the monument, together with an interpretation board on the northern periphery of the stones' extent. The monument has extensive views to the north, east and south, which include the Caithness seaboard. This area of Caithness has remained relatively undeveloped, with the surrounding landscape comprising improved fields and dispersed modern houses. The existing Beatrice oil platforms are visible from the monument and do not detract from its appreciation and understanding. The stones have great intrinsic value as a rare example of their kind and as a potential archaeological data source. They have limited contextual value, as their relationship with their surroundings is very poorly understood. They have some associative value because of their association with antiquary research.

8.5.5.44 The east / west alignment of the stones, together with the clear and open views of the seascape to the east, suggests that views towards the sea may have been an important factor in the original siting of the stones. No alignments with specific features are, however, visible and it is probable that the alignments were astronomical. Consequently, the setting of the stones is defined as the hill upon which they are located and, to a lesser extent, the sea to the east. Given the potential astronomical function of the stones, the sky must also be considered to form part of its setting.

8.5.5.45 Although the function of the stone rows is enigmatic, they are a well–known and frequently visited asset and those visiting them are likely to have a strong interest in the relationship of the stones with their surroundings. Given the nebulous nature of this relationship, the stones are considered to be of medium sensitivity to setting effects.

8.5.5.46 The wind farms will lay a minimum of 24.4 km to the south east of the monument, and will form part of the backdrop of the existing seaview, positioned on the horizon. As the wireframe demonstrates (Figure 8.4.18 in Volume 7), the wind farms will leave much of the arc of view clear. While the wind farms will be visible from the monument, they will not obstruct views from the monument to the sea. While the inclusion of the development will add a modern element to the seascape currently visible from this monument, thus altering the current view from the monument, this change will not affect the enjoyment, understanding or cultural significance of the monument. It is considered that there will be a negative effect of negligible magnitude. This is considered to constitute an effect of negligible significance. This is **not significant**.

8.5.5.47 **The Corr (HB 7935)** is a Category A–listed thatched croft complex, built in the 19th century. Its cultural significance primarily relates to its intrinsic value as an excellent example of its kind. The farmhouse is situated on an east facing hillside – the elevated position results in wide reaching views of the surrounding landscape. The site visit demonstrated that The Corr is set within its own localised landscape – associated improved land, outbuildings and other ancillary buildings contribute to the appreciation and understanding of this building. Consequently, its setting is defined as the adjacent fields which are intrinsically liked with its operation as a croft. The croft is of high sensitivity to setting effects.

8.5.5.48 Situated 30 km from the wind farms at their closest point, The Corr will have views of the turbines, but the understanding and appreciation of the building's cultural

significance will remain completely unchanged. The effect will be of negligible magnitude and significance. This is **not significant**.

8.5.5.49 **Dunbeath Castle (HB 7936)** is Category A–listed and comprises a late 16th / early 17th century structure, extensively altered and remodelled in the late 19th century. It was built by the Sinclairs of Dunbeath. Situated on a rocky promontory, the castle is enclosed within a small garden, which forms part of the associated designated designed landscape. Further associated listed buildings are situated to the north–west and include a gatehouse and stables. These buildings will not have views of the development and are not considered further. The castle is approached from the north west by way of a long straight drive. For much of its length, this is either enclosed by trees or in a cutting. As the drive is perfectly aligned upon the castle, the regular cutting frames the castle as the visitor approaches.

8.5.5.50 The castle's intrinsic value relates to its 400 hundred years history during which it has been remodelled several times. Its fabric therefore reflects Scottish history during this period as the building was transformed from a fortification to a comfortable country home. The castle's contextual value relates to the surrounding designed landscape. The designed landscape was laid out in the mid 17th century and its design is entirely determined by the castle, the designer clearly intended to create an approach that is absolutely dominated by the castle, which results in the castle being seen in framed views against the backdrop of the sea. Its contextual value also relates to the nearby Dunbeath Harbour, from where the castle is visible. The harbour was developed by the Sinclairs and the visual relationship is important to the appreciation of the Sinclairs in developing the surrounding area. The castle's associative value relates to its role as the seat of the Sinclairs and as a landscape feature; its white form is prominent against the dark cliffs in views along the coastline and it is generally visible in the wider landscape. The setting of the castle is therefore defined as being the surrounding designed landscape, the cliffs upon which it stands and the seascape that forms a backdrop to the castle, specifically that to the south east of the castle. Key views relating to setting are those along the drive to the castle and those along the coast in which the castle is seen dramatically located on the cliffs.

8.5.5.51 The castle has a clearly defined relationship with its surroundings that is readily apparent on the ground and that is important to all aspects of its cultural significance. It is of high sensitivity to effects upon setting.

8.5.5.52 The wind farms will not affect views along the coastline of the castle, nor will they be visible from the enclosed section of the driveway. However, the turbines will be visible from the castle and its immediate surroundings. The turbines will be at least 33 km to the east of the castle, where they will occupy some 45° of the horizon.

8.5.5.53 The turbines will not be seen as a backdrop to the crucial views of the castle from the drive nor will they interfere with views along the coastline. Instead they will be seen in more incidental views of the sea from the castle and its immediate surroundings. The castle will remain the dominant feature in the designed landscape. It is concluded that the effect will be of negligible magnitude and that this will result in an effect of negligible significance. This is **not significant**.

8.5.5.54 **Forse House Hotel (HB 7946),** which is now a nursing home, is Category B–listed. It has been designed and the surrounding policies (parkland) planted in order to provide it with views south. The wind farms will lie at least 29 km to the south east. Although it lies within the ZTV, in views from its environs (Figure 8.4.20 in Volume 7), the wind farms will be screened from view by adjacent trees. There are no viewpoints from third

locations that might be considered relevant to its setting. Therefore there is **no potential for effects** upon its setting and it is not considered further.

8.5.5.55 **Dunbeath Portomin Harbour (HB 7945)** is Category B–listed. It was built over several phases during the 19th century as a herring and salmon fishing station and comprises a harbour, ice house and other infrastructure. These lie at the mouth of the Dunbeath Water, and steep slopes rise sharply immediately to the north of the harbour. The harbour lies 32.4 km to the west of the wind farms at their closest and the turbines will be screened from view by the steeply rising ground to the north of the river. Consequently there is **no potential for an effect** upon setting and the harbour is not considered further.

8.5.5.56 **The Whaligoe Steps (HB 14070)** are Category B–listed and comprise 330 flagstone steps leading down precipitous cliffs to a fishing quay, which is covered by the same listing. The steps were built in the mid 18th century and renovated in the early 19th century, when the quay was built. The steps and quay are referred to in Sir John Sinclair's 'Account of Improvements'[3] with the site referred to as the 'Creek of Whalego' in 1812. The work included clearing the harbour area of large stones and building a platform for the boats, as well as making stairs in the face of the rock. Fixtures and fittings are still in place, including the original boat winch that was used to pull the boats onto dry land. The associated curing yard (also a Category B–listed building), is situated at the top of Whaligoe Steps. The quay is no longer operational but is instead a popular tourist attraction, which although not actively promoted by the Highland Council (for health and safety reasons) is served by a carpark and a guidebook is available. Halfway down the steps is a viewing platform, where visitors can stop and look out to sea.

8.5.5.57 Whaligoe has intrinsic value as an example of the lengths that the inhabitants of Caithness had to go to exploit the sea owing to the lack of ready natural harbours on the eastern coast. It has contextual value as one of a string of small fishing harbours that take advantage of what little shelter there is. It has associative value because of the strong sense of place that derives from the spectacular location, in which steep cliffs frame a view eastwards out to the featureless North Sea. This helps the visitor appreciate the danger involved in fishing these waters. The site visit demonstrated that while views out to sea contribute towards the current setting of the monument to some degree, the enclosed sheltered inlet and dramatic natural stratigraphy, together with the acoustics audible to the visitor, dominate what can be perceived by a modern visitor as the asset's sense of place. Consequently, the setting of the steps and harbour is defined as the small bay in which they are located, the steep cliffs adjacent and the sea to the east.

8.5.5.58 The proposed wind farms will lie a minimum of 23.6 km to the south east. The ZTV suggests that the quay area will have views of the development (Figure 8.4.27 in Volume 7). However, this does not take into account the local topography; the turbines will be screened from view by the cliffs forming the southern side of the inlet. Consequently, the development will only be visible from the viewing platform (Viewpoint 5) and from the very top of the steps. From both the top of the steps and the viewing platform the turbines will be seen beyond the headland that forms the southern side of the inlet.

8.5.5.59 The surroundings of the steps and quay contribute greatly to its cultural significance and the appreciation thereof. However, it is of only regional importance and it is concluded that it is of medium sensitivity to effects upon setting.

[3] (http://www.ambaile.org.uk/en/item/item_page.jsp?item_id=39085)

8.5.5.60 The turbines will be visible from the top of the steps and the viewing platform at a distance of at least 22 km. Given the turbines' substantial distance from the steps, the cliffs in the foreground will remain the dominant feature in these views and the turbines will not detract from the views' dramatic qualities, which relate to the steep cliffs. The turbines will not be visible from the quay and there will be no question of the view out to sea being closed down or broken up. Consequently, it is concluded that the effect will be of negligible magnitude. The effect will be negative and of negligible significance. This is **not significant**.

8.5.5.61 **Lybster conservation area** takes in the 19th century core of the village of Lybster. This is a planned village laid out by General Patrick Sinclair, which succeeded an earlier settlement. As with many other villages laid out on Caithness' coast in the early 19th century, Lybster was intended to house fishermen and their families and to provide all the necessary facilities for a working community; school, churches, inns etc. These buildings and the houses are arrayed along a long straight street aligned north / south. The associated harbour lies to the west outside the conservation area. The conservation area's cultural significance lies primarily in its intrinsic value, its buildings collectively provide a good example of a planned 19th century fishing village, but it also has contextual value, in that the village is important to the understanding of the rise and decline of the herring industry, and associative value, as the single phase design of the buildings on Main Street results in a striking view southwards along the street to the sea framed by buildings of consistent scale and form. It is concluded that the conservation area is of medium sensitivity to effects upon setting.

8.5.5.62 The wind farms will lie at least 26 km to the east and south east of Lybster. It will not be visible from the heart of the conservation area, owing to the buildings lining along Main Street, but will be visible from ground to the rear of the buildings on the eastern side of the street and, to varying degrees, from the rear of the buildings themselves. Views from public areas will be restricted to the very southern end of Main Street, in which the turbines will be partially visible beyond modern housing. This will not affect the appreciation of the village's cultural significance. There are no views from third locations that are relevant to the appreciation of the village's cultural significance and it is concluded that there will be no impact upon its setting. This is **not significant**.

8.5.5.63 The associated **Lybster Harbour (HB 7954)** lies to the west of the village. It lies in Lybster Bay, which is surrounded by steep cliffs and opens to the south. Although outside the conservation area, the harbour is intrinsically linked to it as the harbour and village are two parts of the same development. The cultural values of the harbour are essentially the same as those of the village. The wind farms lie to the east and south east of the harbour. The ZTV indicates that turbines will be visible, but they will be effectively screened by local topography. There are no views relevant to the appreciation of the harbour's cultural significance in which the turbines will be visible. It is concluded that there will be no effect upon the setting of the harbour. This is **not significant**.

Decommissioning

8.5.5.64 Physical effects arising from the decommissioning of the three proposed wind farm sites are considered to be analogous to those arising in the construction phase and are not discussed further. The effects of decommissioning on the setting of cultural heritage assets will essentially be reversed and are therefore considered to be negligible and not discussed further.

8.5.6 Proposed Monitoring and Mitigation

Construction

8.5.6.1 All sites of cultural heritage interest included in this report will be avoided where possible. At present the following mitigation is proposed:

- Where cultural heritage assets may potentially be subject to direct or secondary effects, infrastructure will be micro–sited and temporary exclusion zones will be implemented to prevent invasive activities, such as WTG and cable installation, and anchoring or deployment of jack–up legs. Exclusion zones of at least 100 m will be established around sites identified as being of high sensitivity in this assessment (HW 1001, 1002, 1004, 157; 158 and 159); while an exclusion zone of a minimum 50 m will be established around those of medium sensitivity (HW1014, 1015, HW 36; 44; 52; 61; 71; 72; 73; 74; 75; 76; 77; 78; 80; 100; 102; 108, 117,1015 and 1016);
- In order to mitigate the risk of damage to any previously unrecorded archaeological remains, a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) will be prepared for the approval of Historic Scotland and HCHET to mitigate construction effects in the event of any unexpected archaeological discoveries during installation (see Technical Appendix 1.3 A: Environmental Management Plan for further detail).

Operation

8.5.6.2 There is potential for effects on cultural heritage assets during operation and maintenance. Temporary exclusion zones will be implemented to prevent invasive activities, such as WTG and cable maintenance, and anchoring or deployment of jack–up legs. Exclusion zones of at least 50 m will be implemented. No mitigation is proposed in relation to setting effects; they will persist through the lifespan of the wind farms and cease upon decommissioning. Operational effects upon setting were assessed as being of at most negligible significance.

Decommissioning

8.5.6.3 As per construction, decommissioning activities will avoid cultural heritage assets through the implementation of temporary exclusion zones. In order to mitigate the risk of damage to any previously unrecorded archaeological remains, a WSI and PAD will be employed during decommissioning.

8.5.7 Residual Effects – Primary Assessment

8.5.7.1 Table 8.5–1 above outlines the likely significant residual effects both pre and post-mitigation.

8.5.8 Secondary Assessment: Individual Sites

Individual Sites – Telford, Stevenson, MacColl (Secondary Assessment)

8.5.8.1 As explained in Chapter 5.5 (Archaeology and Visual Receptors), the three proposed wind farm sites differ in terms of the number and nature of confirmed and potential historical assets located within them. In recognition of the variation, it was considered that a secondary assessment was warranted whereby the effects associated with each individual wind farm are assessed.

Construction

Telford Wind Farm

Direct Effect

8.5.8.2 Sites **HW1001, 1002** and **1004** are classified as sites of high sensitivity within this assessment. The magnitude of effect in the absence of mitigation could be medium. The significance of effect is therefore regarded as **major**. The associated high potential targets (HA157, 158 and 159) are considered in conjunction with these recorded wrecks.

8.5.8.3 Sites **HW61, 75, 76, 100, 102** and **108** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

8.5.8.4 Site **HW1014** (unknown obstruction) is classified as a site of medium sensitivity within this assessment. The potential magnitude of the effect in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

8.5.8.5 Despite pre–mitigation effects (direct effects) being assessed as major, the post–mitigation effects are regarded as **negligible** (see Paragraph 8.5.6.1 above).

Indirect Effect

8.5.8.6 The possibility of alterations to the tidal regimes leading to long–term effects on patterns of sediment transport within the application area are assessed and reported in Chapters 6.1 (Hydrodynamics: Wave Climate and Tidal Regime) and 6.2 (Sedimentary and Coastal Processes). The effects of the wind farm on sediment transport regimes will persist for the lifetime of the development where effects fall within the potential for natural variability, and therefore the effect is considered to be **not significant**. The predicted effect of changes to the tidal regime as a result of the wind farm suggest that the effects of the array on currents will persist over the lifetime of the development but are of a very small magnitude, have only a local effect, and do not impact beyond natural variability. The effect is therefore considered to be **not significant**.

8.5.8.7 Potential effects have all been described as of low magnitude. It is therefore considered that there will be no significant effect on cultural heritage assets due to changes to tidal currents or sedimentary regimes as a result of the presence of the wind farm.

Secondary Effect

8.5.8.8 Sites **HW61, 75, 76, 100, 102** and **108** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

8.5.8.9 Sites **HW1014** and **HW1015** (unknown obstructions) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as **major**.

8.5.8.10 As with direct effects above, the post–mitigation secondary effects are also regarded as **negligible** (see paragraph 8.5.6.1 above).

Stevenson Wind Farm

Direct Effect

8.5.8.11 Sites **HW72, 77, 78** and **80** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as major. Post mitigation effects are assessed as **negligible** (Paragraph 8.5.6.1 above).

Indirect Effect

8.5.8.12 See indirect physical effects above.

Secondary Effect

8.5.8.13 Sites **HW72, 77, 78** and **80** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as major. Post mitigation effects are assessed as **negligible** (Paragraph 8.5.6.1 above).

MacColl Wind Farm

Direct Effect

8.5.8.14 Sites **HW44, 52, 71** and **117** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as major. Post mitigation effects are assessed as **negligible** (Paragraph 8.5.6.1 above).

Indirect Effect

8.5.8.15 See indirect physical effects above.

Secondary Effect

8.5.8.16 Site **HW1005** (located in the 1 km buffer) is classified as a site of high sensitivity within this assessment. The magnitude of effect in the absence of mitigation could be medium. The significance of effect is therefore regarded as major.

8.5.8.17 Sites **HW44, 52, 71** and **117** (sidescan sonar targets of medium potential) are classified as sites of medium sensitivity within this assessment. The potential magnitude of the effects in the absence of mitigation could be high. The significance of the effect is therefore regarded as major.

8.5.8.18 Post mitigation effects are assessed as **negligible** (Paragraph 8.5.6.1 above).

Operation

8.5.8.19 The operational impacts of the three proposed wind farms on setting taken individually are assessed in Table 8.5-9 to Table 8.5-11 below. For the purposes of this

secondary assessment, the realistic worst case scenario has been taken as comprising up to 72 turbines in each site for the 7 MW turbine scenario.

8.5.8.20 In all instances the operation effects of the individual wind farms are of the same magnitude and significance as those identified by the primary assessment.

Table 8.5–9 Telford Setting Effects

Official Reference Number	Site Name and Type	Sensitivity	Magnitude	Significance of Effect
SM 527	Borrowston Broch	Low	Negligible	Not significant
SM 548	Garrywhin Fort	Medium	Negligible	Not significant
SM 599	Tulloch (Usshilly) Broch and field system	Medium	Negligible	Not significant
SM 2301	Wag of Forse settlement	Medium	Negligible	Not significant
SM 7242	Forse House settlement, field system and burnt mound	Medium	Negligible	Not significant
SM 696	Watenan Broch	Medium	Negligible	Not significant
SM 4289	Watenan Fort	Low	Negligible	Not significant
SM 5073	Dunbeath Inver Fort	Medium	Negligible	Not significant
SM 5182	Latheronwheel promontory fort	Medium	Negligible	Not significant
SM 90048	Cairn of Get	Medium	Negligible	Not significant
SM 90065	Castle of Old Wick	High	Negligible	Not significant
SM 90162	The Hill o'Many Stanes	Medium	Negligible	Not significant
HB 7935	The Corr croft	High	Negligible	Not significant
HB 7936	Dunbeath Castle	High	Negligible	Not significant
HB 7946	Forse House Hotel	Not assessed	No effect	No effect
HB 7945	Dunbeath Portomin Harbour	Not assessed	No effect	No effect
HB 14070	The Whaligoe Steps	Medium	Negligible	Not significant
–	Lybster	Not assessed	No effect	Not significant
HB7954	Lybster Harbour	Not assessed	No effect	Not significant

Table 8.5–10 Stevenson Setting Effects

Official Reference Number	Site Name and Type	Sensitivity	Magnitude	Significance of Effect
SM 527	Borrowston Broch	Low	Negligible	Not significant
SM 548	Garrywhin Fort	Medium	Negligible	Not significant

Official Reference Number	Site Name and Type	Sensitivity	Magnitude	Significance of Effect
SM 599	Tulloch (Usshilly) Broch and field system	Medium	Negligible	Not significant
SM 2301	Wag of Forse settlement	Medium	Negligible	Not significant
SM 7242	Forse House settlement, field system and burnt mound	Medium	Negligible	Not significant
SM 696	Watenan Broch	Medium	Negligible	Not significant
SM 4289	Watenan Fort	Low	Negligible	Not significant
SM 5073	Dunbeath Inver Fort	Medium	Negligible	Not significant
SM 5182	Latheronwheel promontory fort	Medium	Negligible	Not significant
SM 90048	Cairn of Get	Medium	Negligible	Not significant
SM 90065	Castle of Old Wick	High	Negligible	Not significant
SM 90162	The Hill o'Many Stanes	Medium	Negligible	Not significant
HB 7935	The Corr croft	High	Negligible	Not significant
HB 7936	Dunbeath Castle	High	Negligible	Not significant
HB 7946	Forse House Hotel	Not assessed	No effect	No effect
HB 7945	Dunbeath Portomin Harbour	Not assessed	No effect	No effect
HB 14070	The Whaligoe Steps	Medium	Negligible	Not significant
–	Lybster	Not assessed	No effect	Not significant
HB7954	Lybster Harbour	Not assessed	No effect	Not significant

Table 8.5–11 MacColl Setting Effects

Official Reference Number	Site Name and Type	Sensitivity	Magnitude	Significance of Effect
SM 527	Borrowston Broch	Low	Negligible	Not significant
SM 548	Garrywhin Fort	Medium	Negligible	Not significant
SM 599	Tulloch (Usshilly) Broch and field system	Medium	Negligible	Not significant
SM 2301	Wag of Forse settlement	Medium	Negligible	Not significant
SM 7242	Forse House settlement, field system and burnt mound	Medium	Negligible	Not significant
SM 696	Watenan Broch	Medium	Negligible	Not significant
SM 4289	Watenan Fort	Low	Negligible	Not significant
SM 5073	Dunbeath Inver Fort	Medium	Negligible	Not significant

Official Reference Number	Site Name and Type	Sensitivity	Magnitude	Significance of Effect
SM 5182	Latheronwheel promontory fort	Medium	Negligible	Not significant
SM 90048	Cairn of Get	Medium	Negligible	Not significant
SM 90065	Castle of Old Wick	High	Negligible	Not significant
SM 90162	The Hill o'Many Stanes	Medium	Negligible	Not significant
HB 7935	The Corr croft	High	Negligible	Not significant
HB 7936	Dunbeath Castle	High	Negligible	Not significant
HB 7946	Forse House Hotel	Not assessed	No effect	No effect
HB 7945	Dunbeath Portomin Harbour	Not assessed	No effect	No effect
HB 14070	The Whaligoe Steps	Medium	Negligible	Not significant
–	Lybster	Not assessed	No effect	Not significant
HB7954	Lybster Harbour	Not assessed	No effect	Not significant

8.5.9 Sensitivity Assessment

8.5.9.1 Sensitivity assessment considering combinations of projects (i.e. Telford and Stevenson, Telford and MacColl, and Stevenson and MacColl) is not required given the negligible effect significance identified in the secondary assessment above.

8.5.10 Proposed Mitigation – Secondary / Sensitivity Assessment

8.5.10.1 Mitigation is as per that proposed in Primary Assessment above.

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8.6 Socio-Economics, Recreation and Tourism

8.6.1 Summary of Effects and Mitigation

8.6.1.1 This chapter presents an assessment of the likely significant effects that the construction, operation and decommissioning of the three proposed wind farms would have on employment and income, tourism and recreation.

Summary of Effects

8.6.1.2 The socio-economic effects that were assessed for the three proposed wind farm sites include:

- The amount of employment and GVA that would be supported as a result of expenditure on the construction, operation and decommissioning of the three proposed wind farms;
- The effect on the levels of leisure and business tourism in the Study Area; and
- The effect on the levels of other recreational activities (surfing, sea-kayaking and walking).

8.6.1.3 The study area is defined as covering the Local Authority areas that border the proposed wind farms; Moray, Highlands, Aberdeenshire. Aberdeen City is also included because of its number of energy-related businesses and proximity to the sites. The effect on tourism is predominantly based on the findings of other assessments, such as Chapter 8.4 (Seascape, Landscape and Visual Receptors), which uses a study area of 50 km from the wind farms.

8.6.1.4 Given that many important design and procurement decisions have not been made to date there is a wide range of potential effects that depend upon who the successful contractors might be or where they might be based. The assessment is based on the Applicant's estimates of how much expenditure would be made and where, under Base and High scenarios. The Base case considers the total value of contracts that have been delivered, or are expected to be delivered, from within each geography, assuming the current supply chain. The High case estimates the total value of contracts that could be secured by firms based in Scotland (and the Study Area) with a stronger supply chain. This assumes that some Scottish-based firms that are not currently in a position to tender for work (but there is good reason to expect them to be in the future) could secure contracts. It is not within the scope of this work to assess any changes in electricity generation activity elsewhere which may occur as a result of the three proposed wind farms.

8.6.1.5 Therefore, despite Base Case and High Case results being shown for employment and GVA, the assessment is undertaken using the Base Case results given the higher degree of certainty than that associated with the High Case.

8.6.1.6 In Scotland, the analysis suggests that the three proposed wind farms would support between 980 and 2,640 jobs *in the peak year* during construction and during the operations phase this would be between 245 and 400 jobs, including indirect employment.

8.6.1.7 The tourism assessment is based on literature, the visual assessment and estimates of the number of visitors to the area. The literature concludes that while a significant minority of tourists prefer landscapes without wind farms, only a very small group changed their intentions about revisiting an area or Scotland. Coupled with the relatively small number of tourists that would be staying within sight of the three

proposed wind farms, the effects on tourism are considered to be minor. A second source of effect is the sensitivity of visitors attracted to watch the marine wildlife and specifically dolphins. Chapter 7.3 (Marine Mammals) indicates that although there may be some short term displacement during construction, this is not significant in the longer term and would not noticeably reduce opportunities for marine wildlife watching.

Proposed Mitigation Measures and Residual Effects

8.6.1.8 As there are no significant negative effects identified in the assessment, there are no mitigation measures and the residual effects are as the assessment conclusions (as shown in Table 8.6-1 below).

Table 8.6-1 Primary Impact Assessment Summary

Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction			
Employment	Major (+)	None	Major (+)
GVA	Major (+)	None	Major (+)
Leisure Tourism	Minor (-)	None	Minor (-)
Business Tourism	Minor (+)	None	Minor (+)
Surfing, Sea-Kayaking and Walking	Negligible	None	Negligible
Operation			
Employment	Major (+)	None	Major (+)
GVA	Major (+)	None	Major (+)
Leisure Tourism	Minor (-)	None	Minor (-)
Business Tourism	Negligible	None	Negligible
Surfing, Sea-Kayaking and Walking	Minor (-)	None	Minor (-)
Decommissioning			
Employment	Major (+)	None	Major (+)
GVA	Major (+)	None	Major (+)
Leisure Tourism	Minor (-)	None	Minor (-)
Business Tourism	Negligible	None	Negligible
Surfing, Sea-Kayaking and Walking	Negligible	None	Negligible

8.6.2 Introduction

8.6.2.1 This section provides details of the methodology used to estimate the likely significant effects that the three proposed offshore wind farms will have on the economies of the study area (Aberdeen, Aberdeenshire, Moray and Highlands), and the rest of Scotland.

8.6.2.2 Given that many important design and procurement decisions have not been made to date, there is a wide range of potential effects. It is not possible or appropriate for this analysis to provide an indication of who the successful contractors might be or where they might be based. The assessment should be considered as indicative of the pattern of expenditure anticipated, but may not reflect actual procurement decisions following competitive bidding.

8.6.2.3 The assessment represents the best estimate, at this time, of the ranges of expenditure and employment that could be supported.

8.6.2.4 The socio-economics, tourism and recreation assessment interacts with assessments for the following receptors and where relevant linkages have been made within the assessment:

- Chapters 3.4 and 6.1 (Hydrodynamics: Wave Climate and Tidal Regime);
- Chapters 4.3 and 7.2 (Fish and Shellfish Ecology);
- Chapters 4.4 and 7.3 (Marine mammals);
- Chapters 5.1 and 8.1 (Commercial Fisheries);
- Chapters 5.2 and 8.2 (Shipping and Navigation); and
- Chapters 5.4 and 8.4 (Seascape, Landscape and Visual Receptors).

8.6.3 Statement of Significance

8.6.3.1 Under the terms of the Environmental Impact Assessment (EIA) the number of jobs and level of Gross Value Added (GVA) that would be associated with the anticipated expenditure on the development, construction, operation and decommissioning of the wind farm, are considered to be significant (positive) in both the Study Area and Scotland. The effects on leisure tourism are assessed as minor, negative and not significant, while the effects on business tourism are likely to be minor, positive. The effects on recreation are generally found to be negligible or minor, negative and not significant for the EIA.

8.6.4 Rochdale Envelope Parameters Considered in the Assessment

8.6.4.1 Relevant parameters defining the 'Rochdale Envelope' for socio-economics, tourism and recreation are presented in Table 8.6-2below.

8.6.4.2 The maximum foreseeable adverse scenario for socio-economics (employment and GVA) relates to the minimum predicted expenditure to deliver 1.5 GW capacity from the three proposed wind farms. Therefore these parameters are based on an indicative layout and outputs from financial models carried out by MORL which are available at the time of witting this assessment. No modelling was undertaken for the 8 MW turbine scenario because at present there is no commercially available pricing information from which predicted expenditure can be calculated.

8.6.4.3 For tourism and recreation the worst realistic case relates to the maximum predicted seascape, landscape and visual effects or maximum number of structures depending on the receptor assessed.

Table 8.6-2 Parameters Relevant to the Socio-Economics, Tourism and Recreation Impact Assessment

Potential Effect	Rochdale Envelope Scenario Assessed
Construction, Operation & Decommissioning	
Employment and GVA	Minimum predicted expenditure to deliver 1.5 GW: • 216 x 7 MW turbines; and • 315 km of inter array cables (total indicative length of cable).
Tourism	Maximum predicted seascape, landscape and visual effect (leisure tourism, excluding dolphin watching): • 216 x 7 MW turbines. Maximum number of substructures (for activities such as business tourism and dolphin watching): • 339 turbines.
Recreation	Maximum predicted seascape, landscape and visual effect for activities such as recreational walking): • 216 x 7 MW turbines. Maximum number of substructures (for activities such as recreational sailing and surfing): • 339 turbines.

8.6.5 EIA Methodology

Geographical Scope

8.6.5.1 With regard to the economic assessment of expenditure associated with the wind farms, the likely effects may be applicable over a wide area. The study area is defined as covering the Local Authority areas that border the proposed site; Moray, Highlands, Aberdeenshire. Aberdeen City is also included because of its number of energy-related businesses and proximity to the site. Assessing any effect beyond these areas is likely to be associated with weaker evidence of effect, although due to the large scale investment associated with this project, the potential employment and GVA that this expenditure supports is also considered for Scotland.

8.6.5.2 In regard to tourism, the assessment is restricted to the four Local Authority areas but because of the importance of the likely significant visual effects, the assessment also considers a zone of 50 km around the proposed sites to be consistent with the study area used in Chapter 5.4 (Seascape, Landscape and Visual Receptors).

Methodological Scope and Limitations

8.6.5.3 There are no specific statutory guidelines or requirements for the assessment of socio-economic, tourism and recreation effects set out by the relevant EIA Regulations, or in any other statutory or advisory guidance on the preparation of EIAs (for details, see Chapter 5.6: Socio-Economics, Recreation and Tourism). Below is a summary of the socio-economics, tourism and recreation methodological scope and limitations of the assessment.

Socio-Economics

8.6.5.4 The scope of the economic element of the assessment is to estimate the significance of the employment and GVA that would be associated with the expenditure made

in the development, construction, operation and decommissioning of the three proposed wind farms. This is commonly referred to as the economic effect.

8.6.5.5 It is not within the scope of this chapter to assess any changes in electricity generation activity elsewhere which may occur as a result of this proposal. For example: it does not consider whether the electricity produced will be replacing other sources (in Scotland or the rest of the UK), what these other sources might be or any employment or GVA that would have been associated with them.

8.6.5.6 In addition, the Projects are expected to receive funding through renewable energy incentives. This has implications for expenditure on other goods and services in the economy and therefore also on employment and GVA. It is not within the scope of this chapter to assess these wider effects.

8.6.5.7 The figures are based on the expenditure estimated by the MORL team and parent companies at the time of the assessment and take into account information received from potential suppliers during MORL's Request for Information (RFI) process. Any changes in these figures (in the total or on the Project phases) will directly change the estimates of both GVA and employment.

8.6.5.8 The results are based on a "best estimate", of the ranges of expenditure and employment that could be supported.

Tourism

8.6.5.9 The tourism assessment is desk-based and has been undertaken using the reports and other literature supplemented with consultations, as detailed in Chapter 5.6 (Socio-Economics, Recreation and Tourism). The likely significant effects on tourism are informed by Chapter 8.4 (Seascape, Landscape and Visual Receptors). Additionally dolphin tourism is a recognised part of the Highland and Morayshire tourism economy. Likely significant effects on the dolphin population are addressed separately in Chapter 7.3 (Marine Mammals).

Recreation

8.6.5.10 Recreational sailing is informed by Chapter 8.2 (Shipping and Navigation).

Assessing the Effect of Project Expenditure

8.6.5.11 The Project's expenditure on elements that are considered part of the Transmission Infrastructure (TI) is excluded from the analysis. These elements are:

- Supply and installation of AC OSPs and AC / DC converter stations;
- Supply and installation of export cables; and
- Supply and construction of an onshore substation.

8.6.5.12 This represents a considerable proportion of the overall budget and has substantial effect on employment and GVA. These elements are presented separately in Chapter 11.6 (Socio-Economics, Recreation and Tourism).

8.6.5.13 The Projects represent a major investment in plant, skills and services. This demand will be met to some extent by businesses based in Scotland, although significant elements are likely to be sourced from elsewhere in the UK and overseas. The extent to which Scottish-based businesses can benefit from this demand will depend on a number of factors, such as their capability, experience, skills, capacity,

competitiveness and the development of the industry which depends on Project certainty (consents, grid and remuneration).

8.6.5.14 In order to assess the work that could be generated in Scotland and in the Study Area, estimates based on the best knowledge to date of the likely expenditure on each sub-phase were made.

8.6.5.15 Given the uncertainties involved, this was done under two scenarios:

- **Base Case** – the total value of contracts that *have been delivered, or are expected to be delivered*, from within each geography, assuming the current supply chain; and
- **High Case** – the total value of contracts that could be secured by firms based in Scotland (and the study area) with a stronger supply chain. This assumes that where Scottish-based firms are not currently in a position to tender for work, (but there is good reason to expect them to be in the future), they are successful.

8.6.5.16 The "worst case scenario" in terms of economic effect is that no Project expenditure is located in the Study Area, meaning no associated GVA or employment effects are delivered. In this case the socio-economic effect would be zero. This has not been modelled because this is not a realistic scenario if the developments were to be granted consent.

8.6.5.17 The Base Case represents what would happen, given what is known about current, potential suppliers and the existing facilities. The Base Case is the basis for a conservative estimate. The supply chain is likely to change over time in response to the opportunities created by these and other proposals. This could be through existing firms positioning themselves to win more work or as a result of new investors. To reflect this potential change in the supply chain, the assessment also models a High Case scenario which reflects the potential for more of the expenditure to be retained in Scotland. The results from the High Case are therefore subject to a higher degree of uncertainty. Therefore, despite Base Case and High Case results being shown for employment and GVA, the assessment is undertaken using the Base Case results given the higher degree of certainty than that associated with the High Case.

8.6.5.18 The expenditure for each of the sub-phases was allocated to each geographical area under the two scenarios, and in each appropriate year.

8.6.5.19 Table 8.6-3 below sets out the wind farm phases and sub phases that were used to build up the expenditure estimates and are the basis on which the employment estimates are made.

Table 8.6-3 Wind Farm Phases and Sub-Phases Used

Phases	Sub-phases included	Timing
Development	Management Site investigation Engineering & grid Met mast EIA **Financial Close**	To mid 2014
Manufacture	Technical and commercial management Supply: turbines, transformers & towers Supply: array cables	To mid 2020

Phases	Sub-phases included	Timing
Construction	Technical and commercial management Installation: Wind turbines Transportation & logistics Onshore assembly Installation: array cable lay Installation: foundations & met mast Testing & commissioning	To mid 2020
Operations and Maintenance	Onshore Facilities Equipment / consumables Insurance Spare parts Maintenance personnel Management / Administration Marine vessels / helicopters Engineering services	From mid 2016
Decommissioning	Decommissioning activity	2045 to 2047

8.6.5.20 In order to estimate the GVA associated with each sub-phase, a ratio of turnover to GVA has been applied to the relevant expenditure values. The Scottish Input-Output Tables (Scottish Government, 2010) have been used to produce ratios of turnover to GVA for the different industries that would be likely to be contracted to carry out this work. Each of the sub-phases of the three proposed wind farms has been mapped to an appropriate industry. The analysis then uses the appropriate ratio to determine the value of GVA that will be generated from the expenditure made for each sub-phase.

8.6.5.21 It is important to acknowledge that the mapping is a 'best fit' exercise because offshore wind activities do not conform readily to these industry groups. The fit between wind farms activities and these industry groups is shown in Technical Appendix 5.6 A.

8.6.5.22 In addition to the direct GVA effects, it is also important to consider the **indirect** and **induced** multiplier effects that the development investment will generate, as described below:

- **Indirect effects** – as suppliers increase output to meet the additional demand for their goods and services, there will also be a resultant increase in demand on their own suppliers and so on down the supply chain; and
- **Induced effects** – as a result of the direct and indirect effects, household incomes will increase in line with the increased employment created by the development directly and throughout the supply chain. A proportion of this increased income will be re-spent on other goods and services.

8.6.5.23 The Scottish Input-Output Tables have been used to identify GVA multipliers for each of the services that will be procured in the Projects' sub-phases. The Study Area multipliers are estimated by adjusting the Scottish values downwards to reflect the smaller geographical area and the more limited supply chain links.

Present Value of GVA Effects

8.6.5.24 In order to compare the direct and indirect GVA that occurs in different years, discount rates are applied in line with HM Treasury guidance (HM Treasury, 2003). A discount rate of 3.5 % is used for the first 30 years and a rate of 3.0 % is used for each subsequent year.

Employment Effects

8.6.5.25 The employment effects are calculated by applying the "employment effect" multiplier values, from Scottish Input-Output Tables, to the expenditure expected in each year and in each geographical area. The multipliers that best fit each of the types of goods and services that will be purchased have been used. This has been done for each phase of the Project, except operations and maintenance and the offshore installation and decommissioning elements, which are likely to require higher levels of capital use.

8.6.5.26 Direct, indirect and induced employment is derived from the Scottish Input-Output Tables as described above.

8.6.5.27 As a further caveat it is recognised that employment opportunities will not exactly match the geographic distribution of the expenditure. Although contracts may be delivered from an office in Aberdeen, the contractor may use employment from elsewhere, but equally contracts awarded to firms based outside the study area or Scotland may use local labour. There is no simple way to anticipate this and the assumption is that, on balance, the employment is supported in the area from where the contractor will "deliver" the work.

Operations and Maintenance Employment

8.6.5.28 The area where it is most difficult to use industry ratios is in operations and maintenance, where much of the expenditure is on the hire or purchase of capital goods (helicopters and vessels) rather than employment. Because of the difficulty categorising this phase, the analysis uses a recent report produced by Oxford Economics for Vestas Offshore (Oxford Economics, 2010) which provides estimates of direct and indirect operations and maintenance employment per megawatt, in the UK. There are likely to be some economies of scale associated with the size of these projects, although the report is based on forecasts which include large scale developments. As a conservative estimate the figures have been reduced by 20 %. This has been applied to reflect the fact that the Oxford Economics / Vestas' figures are an average of all developments. In dealing with a large case, the employment per MW is likely to be slightly below the average because of economies of scale. The figures adopted in this report are shown in below.

Table 8.6-4 Operations and Maintenance Employment - Oxford Economics / Vestas (2010)

	O&M employment per MW	Project MW	Estimated O&M Employment in the UK (Reduced by 20 %)
Direct	0.19	Up to 1,500	228
Indirect	0.16	Up to 1,500	192
Total	-	-	420

Offshore Installation and Decommissioning

8.6.5.29 A large proportion of expenditure on the offshore installation and decommissioning elements requires the hire or ownership of specialist vessels. For this reason the ratio of turnover and GVA to employment is likely to be much higher than for many other phases of the work. To address this, the assessment has used more detailed employment to GVA figures produced by the ONS at four digit SIC level (Office for National Statistics , 2010). These are at a UK level rather than for Scotland. In general the preference has been to use Scottish data which will reflect the ratios found among Scottish suppliers, however, in this case the Scottish "water transport" category is too broad and instead, the study adopts a more accurate heading, albeit from the UK. The classification used is "sea and coastal water transport", which includes vessel services for cable laying and heavy lifting, and gives a value of £141,000 GVA per employee.

8.6.5.30 Given the scale of the Project and contracts, we have also assumed that in the large manufacturing activities (substructures and turbines) the ratio of contract value to employment will be greater than current sector averages in Scotland. This would be a result of economies of scale and better productivity. The ratio of sales to employment for a number of major international contractors active in these markets was estimated from publicly available information. This should be considered a broad estimate as procurement and even design decisions have not yet been made, on this basis the analysis adopts a value of £80,000 GVA per employee

Assessing Significance of Expenditure Effects

8.6.5.31 The assessment of significance of expenditure is based on combining the degree of sensitivity of the receptor to changes in the indicator, with the magnitude of the predicted effects (scale and duration). These effects can be characterised as positive, negative or neutral. These are combined as shown in Table 8.6-5 below to give major, minor or negligible significance.

Table 8.6-5 Matrix of Significance of Effect

	Magnitude			
Sensitivity	Negligible	Low	Medium	High
Low	Negligible	Minor	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Major

8.6.5.32 Any variables with a moderate or greater significance are deemed to be significant within the terms of the EIA assessment.

Significance Criteria

8.6.5.33 The assessment of significance is based on combining the degree of sensitivity of the receptor (i.e. the economy) with the magnitude of the predicted effects (scale and duration). These effects can be characterised as positive, negative or neutral.

Sensitivity of Receptor

8.6.5.34 This criterion considers how sensitive the economy and the relevant sectors are to the effects of the three proposed wind farms. Sensitivity is defined using professional judgement based on the overview of the economy (for example: the levels of unemployment, skills and business capacity).

Magnitude of Effect

8.6.5.35 The magnitude of the effect on the economy and labour market within the study area will depend on a number of factors, primarily the scale and duration of effects. The scale of the effect is assessed directly from the estimates of the number of jobs and the value of GVA that would be supported by the Project's expenditure. The duration relates to the length of time that the effect will last.

8.6.5.36 To determine an overall assessment as to whether the magnitude of effect on employment and GVA is classified as negligible, low, medium or high, the scale and duration of effect are considered together.

8.6.5.37 There is no specific number or guidance that defines whether the magnitude is negligible, low, medium or high and the conclusion is a professional judgement.

Level of Significance

8.6.5.38 Significance has been determined based on the matrix at Table 8.6-5 above. The assessment process aims to be objective and to quantify effects as far as possible. However, some effects can only be assessed through qualitative judgements based on professional experience and previous evidence, where available. There are no quantitative thresholds above or below which an effect can be considered significant or not, and this would vary depending on geography. For example: a significant effect for one business may not be significant at a Study Area or Scottish level. The application of significance here is based on a judgement of the effect on the Study Area, and the reasons for this judgement are set out in the appropriate paragraphs.

Assessing the Significance of Tourism and Recreation Effects

8.6.5.39 There are no official guidelines for assessing the likely significant effect of offshore wind farm projects on tourism and recreation. The focus here is on assessing any effects within the study area rather than on tourism at a UK or Scottish level. The assessment does not seek to quantify, in financial terms, any effect on local tourism businesses. Instead, the approach taken is to:

- Assess the current profile of tourists and visitors who travel to the study area in terms of numbers, spend, activities, reasons for visiting the region and so on;
- Review reports and surveys of how other wind farm developments have affected tourism in other areas of the UK and further afield;
- Identify any direct effects on local tourism 'assets' (e.g. public rights of way, paths, scenic areas or so on) which the new development may cause at the different stages; construction, operation, maintenance and decommissioning;

- Identify indirect effects on local tourism assets. In this case, indirect effects mainly relate to changes in amenity through the permanent or temporary modification of land and seascapes and the visual effect of the wind farms;
- Undertake a number of consultations with tourism stakeholders to understand their views and the likely effect it may have on tourism;
- Assess the likely effects on marine tourism and recreational yachting, covered in Chapters 5.2, 8.2, 11.2 and 15.2 (Shipping and Navigation); and
- Assess the likely effects on other recreation, based on the Visual Assessment as well as evidence from other reports and literature.

Significance Criteria

8.6.5.40 The assessment of significance is based on combining the degree of sensitivity of the receptor to changes in the indicator, with the magnitude of the predicted effects (scale and duration).

Sensitivity to Effects

8.6.5.41 This criterion considers how sensitive tourism (the tourism sector and tourists) are to the wind farm proposals. This is a judgement based on the profile of the sector and informed by the desk research and consultation. This is a qualitative assessment based on professional judgement.

Magnitude of Effect

8.6.5.42 The magnitude of effect is assessed by considering the likely level of effect and the numbers that would potentially be affected. This is determined by the current level of activity and draws upon the conclusions of Chapter 8.4 (Seascape, Landscape and Visual Receptors). There is no specific number or guidance that defines whether the magnitude is negligible, low, medium or high and the conclusion is based on a professional judgement.

Level of Significance

8.6.5.43 The significance of an effect can be characterised as positive, negative or neutral. The level of significance is defined by combining the sensitivity and magnitude as shown in Table 8.6-5 above.

8.6.5.44 Any variables with a moderate or greater significance are deemed to be significant within the terms of the EIA assessment.

8.6.6 Primary Impact Assessment: Three Proposed Wind Farm Sites

8.6.6.1 The paragraphs below assess the effects on the following receptors:

- Employment and GVA;
- Tourists and tourist expenditure; and
- Recreational activity.

8.6.6.2 These paragraphs set out an overview of these receptors and then considers the effects associated with each phase of the developments.

Employment and GVA

8.6.6.3 The paragraphs below use the analysis and methodology described in Chapter 5.6 (Socio-Economics, Recreation and tourism) and the expected investment expenditure information for the three proposed wind farms to construct a series of GVA and employment estimates. To put the figures in context, a general industry estimate for capital expenditure for the development and construction of an offshore wind farm is estimated to be around £3 million per MW (Renewable UK, 2011). The three proposed wind farm developments would generate up to 1,500 MW, giving an indicative capital investment of around £4,500 million (not taking into account the TI).

8.6.6.4 The analysis in the baseline description of the supply chain is reflected in the pattern of expenditure anticipated for the proposed wind farms. The expenditure that is considered likely to be made in Scotland, under the Base Case, matches the analysis of the existing Scottish supply chain. This includes higher proportions of expenditure retained in Scotland from the Project development, construction, operations and decommissioning phases, but with less manufacturing expenditure retained. Under the High Case, the supply chain is assumed to be stronger with potential for greater retention.

8.6.6.5 It is likely that each proposed wind farm will contract with a small number of Tier 1 contractors[4], however, currently there has only been one Tier 1 supplier identified within the study area. The alternative of contracting directly with a larger number of Tier 2 / 3 suppliers[5] is still an option.

8.6.6.6 There is a considerable gap between the Base and High Cases. This is because it is not yet possible to commit to a detailed procurement programme due to the uncertainties in Project infrastructure design and consenting timescales. There are also uncertainties around Project remuneration as a result of the pending Energy Market Reform (EMR) / Finance and the grid connection.

8.6.6.7 It is also important to have received project consents from Marine Scotland before committing to most of the major contracting decisions. Consent according to the Project timeline could reduce some of the risk facing the investment by providing more certainty; this may encourage new and potentially, more local contractors to invest in order to position themselves to secure work.

8.6.6.8 Therefore, despite Base Case and High Case results being shown for employment and GVA, the assessment is undertaken using the Base Case results given the higher degree of certainty than that associated with the High Case.

8.6.6.9 The pattern of anticipated expenditure is shown in Table 8.6-6 below which compares the values provided by MORL with the overall estimates that were used in a report produced by IPA and Scottish Renewables, "Scottish Offshore Wind: Creating an Industry" (IPA / Scottish renewables, 2010).

[4] Tier 1 Supplier: A contractor or manufacturer with a direct relationship with the developer / owner. In terms of offshore wind, depending on the contracting strategy, this could be a turbine manufacturer, an installation vessel owner, or a manufacturer of high voltage equipment. A Tier 1 supplier will have subcontracts with Tier 2, 3, etc. Suppliers.

[5] Tier 2 Supplier: A contractor or manufacturer with a direct relationship with a Tier 1 supplier, and potentially a subcontract with a Tier 3 or 4 supplier. The Tier 2 supplier does not typically have a direct relationship with the developer / owner. In terms of offshore wind, a Tier 2 Supplier could be a supplier of rolled steel for substructures or a supplier of electrical components for substations.

8.6.6.10 The IPA study presents results for four scenarios (A, B, C and D). Scenario A gives a theoretical target for the Scottish offshore wind industry, with a high level of offshore wind Project development and strong supply chain growth. Scenario B assumes that the supply chain still develops significantly but that offshore wind projects are developed over a longer period than in Scenario A. Scenario C is similar to the onshore wind supply chain in Scotland now and under Scenario D, developers find it too capital-intensive to develop sites in deeper waters and equipment is not suited to rougher conditions off the Scottish coast. Table 8.6-6 below compares the proportions of expenditure that are estimated to be retained in Scotland under the two weaker IPA scenarios (C and D) with the Base Case developed by MORL, and the two higher IPA Cases (A and B) with the High Case developed by MORL. The MORL estimates were developed independently but are consistent with the scenarios used in the IPA study.

8.6.6.11 The proportion of expenditure retained in Scotland, by phase and for the Base and High cases, is described below:

- The estimates assume a relatively high proportion of expenditure retained in Scotland in the development phase, some of which has already been made or contracted. Retention of expenditure in Scotland during this phase is expected to be approximately40 % of the total;
- The Base Case assumes a relatively low retention of construction and commissioning (including manufacturing) expenditure in Scotland, reflecting the current supply chain gaps in turbines and cables, but in the High Case includes successful Scottish suppliers of a number of important components. The retention in Scotland could range from 10 % to 30 %. This reflects procurement and design decisions that have yet to be made including the methods and location of assembly;
- Operations and maintenance includes maintenance personnel, marine vessels and helicopters and engineering services. The level of retention in Scotland is expected to be relatively high, ranging from around 20 % in the Base Case to 50 % in the High Case; and
- Decommissioning is more than 30 years away and consideration of potential contractors now is very uncertain. However, the broad estimates are that for the local area retention of expenditure would range from 10 % to 50 % in Scotland.

Table 8.6-6 Comparison of Retention Factors in Scotland Estimated by Developers with Factors Estimated in IPA / Scottish Renewables Study (2010)

Project Phases	IPA (Low Cases C & D)	MORL (Base Case)	IPA (High Cases A & B)	MORL (High Case)
Development	20 %	40 %	50 %	40 %
Construction & Commissioning	7 %	10 %	31 %	30 %
Operational	33 %	20 %	45 %	50 %
Decommissioning		10 %		50 %
All Expenditure		15 %		40 %

8.6.6.12 Based on these figures, there would be a spend of 15 % of the overall expenditure for the three proposed wind farms in Scotland under the Base Case. Under the High Case, there would be a total budget spend of 40 % in Scotland.

8.6.6.13 The difference illustrates the employment opportunity that the investment could provide if Scottish based firms can secure some of the key contracts. This assumes significant investment in the supply chain as well as the Scottish supply chain being competitive.

8.6.6.14 As a further comparator, analysis by for the socio-economic assessment of the Triton Knoll Offshore Wind Farm (Roger Tym & Partners and RPS, 2011), reviewed six offshore wind farm projects in England and Wales and found that an average of just over 20 % of construction expenditure was made in the UK. The Base Case from data provided by MORL indicates 10 % of construction and commissioning expenditure retained in Scotland and 30 % under the High Case. The Base Case is therefore fairly consistent with the evidence of these six cases (under no change to the supply chain), while the High Case represents a significant increase.

Overall Employment Effects

8.6.6.15 Employment has been estimated by dividing the anticipated expenditure by the ratio of output to employment, for each of the categories of expenditure, using the ratios that best fit the type of activity. The ratios used for each type of expenditure and activity are shown in Technical Appendix 5.6 A.

8.6.6.16 Table 8.6-7 and Table 8.6-8 below summarise the projected employment effect of the three proposed wind farms associated with the Base and High Case scenarios. These figures exclude any expenditure related to Transmission Infrastructure (considered separately in Chapter 11.6: Socio-Economics, Recreation and Tourism). In the Base case, the total number of *job years* is anticipated to be 5,350 across the whole lifetime of the Project for the study area. For Scotland as a whole (including the Study Area) this is 10,200 job years.

8.6.6.17 For sensitivity, the High Case has also been modelled. This produces a total number of *job years* of 13,600 across the whole lifetime of the three proposed wind farms in the Study Area. For Scotland as a whole, the optimistic case is 21,800 job years.

Table 8.6-7 Employment Effects in Job Years (Base Case)

	Study Area			**Scotland (including Study Area)**		
	Direct	**Indirect + induced**	**Total**	**Direct**	**Indirect + induced**	**Total**
Construction	600	400	1,000	2,100	1,700	3,800
Operations	2,300	1,900	4,200	3,400	2,700	6,100
Decommissioning	100	50	150	200	100	300
Total	**3,000**	**2,350**	**5,350**	**5,700**	**4,500**	**10,200**

Table 8.6-8 Employment Effects in Job Years (High Case)

	Study Area			Scotland (including Study Area)		
	Direct	Indirect + induced	Total	Direct	Indirect + induced	Total
Construction	3,900	2,200	6,100	6,500	4,500	11,000
Operations	3,700	3,000	6,700	5,200	4,200	9,400
Decommissioning	500	300	800	800	600	1,400
Total	**8,100**	**5,500**	**13,600**	**12,500**	**9,300**	**21,800**

Employment Profile

8.6.6.18 Plate 8.6-1 and Plate 8.6-2 below show the profile of employment in the Base and High Cases for the Study Area and Scotland by year. Although the greatest number of *job years* is generated by the operations and decommissioning activity (because it lasts for 25 years) the construction phase generates a larger number of positions per year for a shorter period (five years).

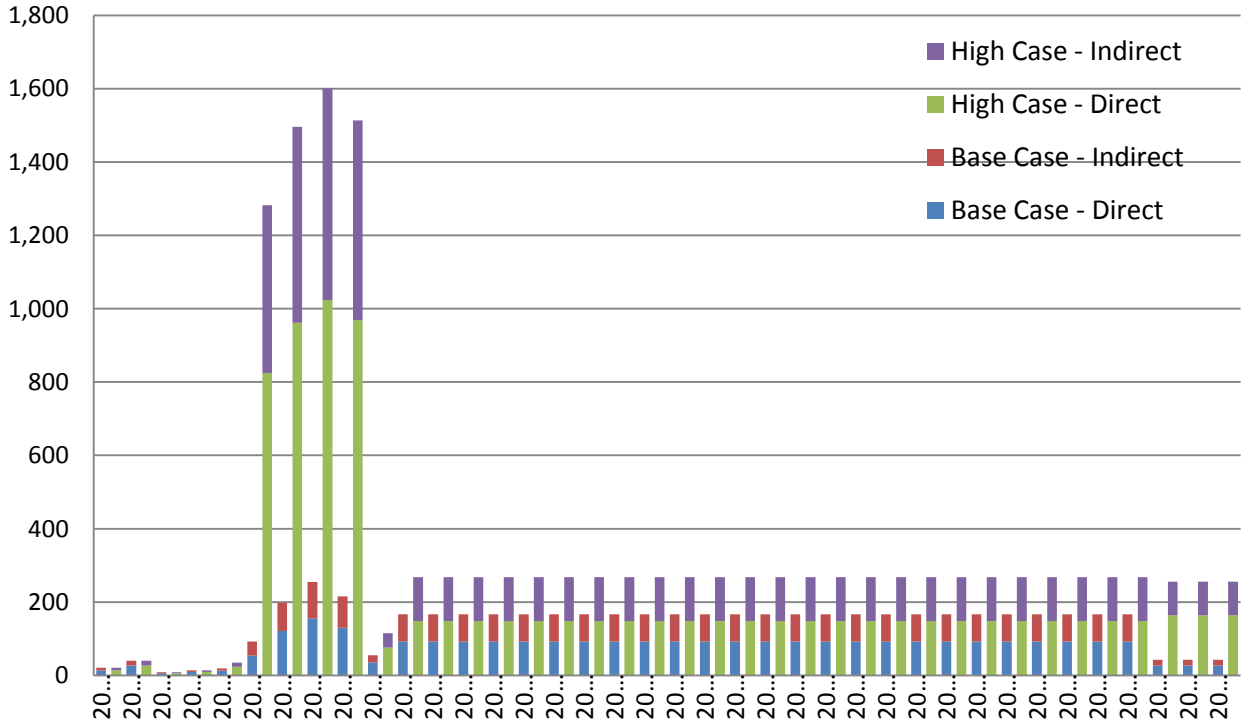

Plate 8.6-1 Study Area Employment by Year – Base Case and High Case (excludes TI)

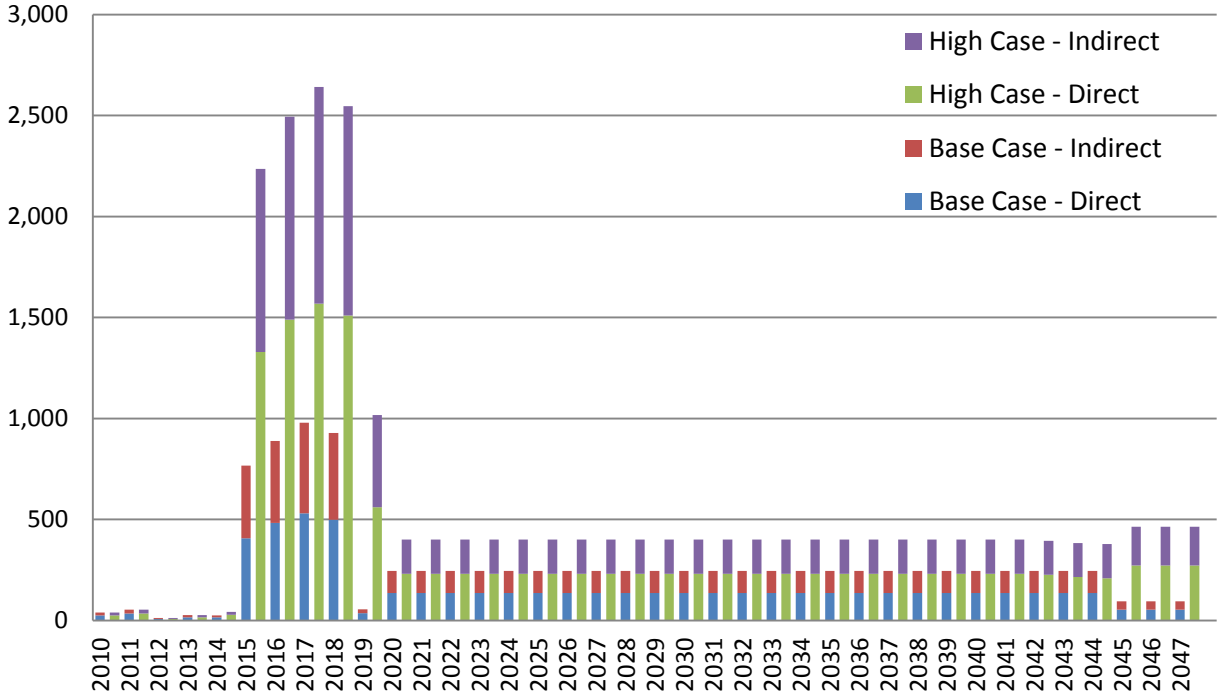

Plate 8.6-2 Scotland (including Study Area) Employment by Year – Base Case and High Case (excludes TI)

Employment During Construction

Construction

8.6.6.19 Within the study area:

- Base Case: during the construction phase, the three proposed wind farms would support 155 jobs directly in the study area at its peak, and a further 99 including the indirect and induced multiplier effects described in 8.6.5 above. This gives 254 in total; and
- High Case: during the construction phase, the three proposed wind farms would support a peak of 1,601 jobs including the indirect and induced multiplier effects.

8.6.6.20 In Scotland (including the Study Area):

- Base Case: during the construction phase, the three proposed wind farms would support 978 jobs at its peak, including the indirect and induced multiplier effects; and
- High Case: during the construction phase, the three proposed wind farms would support 2,641 jobs in the peak year, including the indirect and induced multiplier effects.

8.6.6.21 Table 8.6-9 below provides a summary of predicted construction employment.

Table 8.6-9 Construction Employment Effects Summary

		Construction Phase (peak employment)		
		Direct	**Indirect + Induced**	**Total**
Study Area	Base Case	155	99	**254**
	High Case	1,024	577	**1,601**
Scotland (including study area)	Base Case	530	448	**978**
	High Case	1,569	1,072	**2,641**

8.6.6.22 Employment is a core measure of economic activity, reflected in the importance attached to rates of employment and unemployment. Levels of unemployment and the availability of employment opportunities are very important for the economic health of communities, the Study Area and Scotland. Changes in employment are therefore considered to be of high sensitivity.

8.6.6.23 In Scotland, the employment associated with the three proposed wind farms would peak at 978 under the Base Case but with a stronger supply chain could reach 2,641 jobs in 2017, during the construction phase.

8.6.6.24 At both the level of the Study Area and in Scotland, for the Base Case, these levels of employment are considered to be of high magnitude.

8.6.6.25 Combining the sensitivity and magnitude assessments, the employment effect associated with the development, construction, operation and decommissioning of the three proposed wind farms under the Base Case would be **major positive** and is therefore considered to be significant in terms of the EIA.

GVA from Construction Expenditure

8.6.6.26 For the study area, it is estimated that the three proposed wind farms will generate a Base Case value of £70 million in GVA during the construction phase, including the multiplier effects, and a High Case value of £399 million. In Scotland, the three proposed wind farms would generate GVA of from £245 million to £705 million, as shown in Table 8.6-10 below.

Table 8.6-10 Construction Phase GVA Effects in £ Millions (2011 prices)

	Study Area			Scotland (including the Study Area)		
	Direct	**Indirect + Induced**	**Total**	**Direct**	**Indirect + Induced**	**Total**
Base Case	47	23	**70**	142	103	**245**
High Case	264	135	**399**	431	274	**705**

8.6.6.27 GVA represents the difference between the value of goods and services produced and the cost of raw materials, from which is paid wages, salaries and profits. It is therefore a core measure of economic wealth. While Aberdeen and Aberdeenshire produce a high level of GVA per head relative to Scotland, the figures for Moray and Highland are lower than the Scottish average. Wages, salaries and income are all important elements in determining quality of life for residents in the study area and in Scotland. Sensitivity to changes in GVA is therefore considered to be high.

8.6.6.28 The magnitude of the GVA generated by the three proposed wind farms, both at the study area level and in Scotland, is judged to be high.

8.6.6.29 Combining the sensitivity and magnitude assessments, the GVA effect associated with the expenditure on the development, construction, operation and decommissioning of the three proposed wind farms under the Base Case is considered to be of **major positive** significance, and therefore significant in terms of the EIA.

Operation

Employment During Operations

8.6.6.30 Within the study area and including the indirect and induced multiplier effects described in 8.6.5 of this chapter:

- **Base Case**: during the operations phase, there are 166 jobs; and
- **High Case**: during the operations phase this would be 267 jobs.

8.6.6.31 In Scotland (including the Study Area) and including multiplier effects:

- **Base Case**: during the operations phase there would be 245 jobs
- **High Case**: during the operations phase this would be around 400 jobs.

8.6.6.32 Table 8.6-11 below provides a summary of predicted operational employment.

Table 8.6-11 Operational Employment Effects in Peak Year

		Operations Phase (peak employment)		
		Direct	**Indirect + Induced**	**Total**
Study Area	**Base Case**	92	74	**166**
	High Case	148	119	**267**
Scotland (including study area)	**Base Case**	136	109	**245**
	High Case	231	169	**400**

8.6.6.33 Sensitivity of employment is considered to be high. At both the level of the Study Area and in Scotland, the levels of employment are considered to be of high magnitude under the Base Case.

8.6.6.34 Combining the sensitivity and magnitude assessments, the employment effect associated with the operation of the three proposed wind farms would be **major positive** effect and is therefore considered to be significant in terms of the EIA.

GVA from Operations

8.6.6.35 Table 8.6-12 below provides a summary of the GVA effects for the study area, Scotland and the rest of the UK. For the study area, it is estimated that the Project will generate £278 million in GVA during operations, including the indirect effects, in the Base Case. In Scotland, the Project would generate GVA of around £427 million during operations, including the indirect and induced multiplier effects in the Base Case.

8.6.6.36 Sensitivity to changes in GVA is considered to be high. The magnitude of the GVA generated by the proposed wind farms, both at the Study area level and in Scotland, is judged to be high in the Base Case.

8.6.6.37 Combining the sensitivity and magnitude assessments, the GVA effect associated with the expenditure on the operation of the wind farms is considered to be of **major positive** significance, and therefore significant in terms of the EIA.

Table 8.6-12 Operations Phase GVA Effects in £ Millions (2011 prices)

	Study Area			Scotland (including the Study Area)		
	Direct	**Indirect + induced**	**Total**	**Direct**	**Indirect + induced**	**Total**
Base Case	191	87	**278**	276	151	**427**
High Case	464	230	**694**	682	394	**1,076**

Decommissioning

Employment During Decommissioning

8.6.6.38 Within the study area and including the indirect and induced multiplier effects:

- **Base Case:** during the Decommissioning phase, there are 42 jobs; and
- **High Case**: during the Decommissioning phase this would be 255 jobs.

8.6.6.39 In Scotland, the figures are a Base case of 94 to a High Case of 464 jobs.

8.6.6.40 Table 8.6-13 below provides a summary of predicted decommissioning employment.

Table 8.6-13 Decommissioning Employment Effects in Peak Year

		Decommissioning Phase (peak employment)		
		Direct	**Indirect + Induced**	**Total**
Study Area	**Base Case**	27	15	**42**
	High Case	163	92	**255**
Scotland (including Study Area)	**Base Case**	54	40	**94**
	High Case	272	192	**464**

8.6.6.41 Sensitivity of employment is considered to be high. At both the level of the Study Area and in Scotland, the levels of employment are considered to be of high magnitude under the Base Case.

8.6.6.42 Combining the sensitivity and magnitude assessments, the employment effect associated with the operation of the three proposed wind farms in the Base Case would be **major positive** effect and is therefore considered to be significant in terms of the EIA.

GVA from Decommissioning

8.6.6.43 Table 8.6-14 below provides a summary of the decommissioning GVA effects for the study area, Scotland and the rest of the UK. For the study area, it is estimated that the expenditure on decommissioning will generate £6 million in GVA under the Base Case, including the indirect and induced effects and £38 million under the High Case. In Scotland, the figures are £14 million and £68 million. The expenditure in Scotland under the Base Case represents 10 % of the total investment and this rises to 50 % under the High Case.

8.6.6.44 Sensitivity to changes in GVA is considered to be high. The magnitude of the GVA generated by the three proposed wind farms, both at the study area level and in Scotland, is judged to be high. Combining the sensitivity and magnitude assessments, the GVA effect associated with the expenditure on the operation of the wind farms is considered to be of **major positive** significance, and therefore significant in terms of the EIA.

Table 8.6-14 Decommissioning Phase GVA Effects in £ Millions (2011 prices)

	Study Area			Scotland (including the Study Area)		
	Direct	**Indirect + Induced**	**Total**	**Direct**	**Indirect + Induced**	**Total**
Base Case	4	2	**6**	9	5	**14**
High Case	26	12	**38**	43	25	**68**

Tourists and Tourist Expenditure

8.6.6.45 The tourism element of the analysis considers the effect of the three proposed wind farms on the volume and value of tourists visiting the study area and Scotland. The analysis distinguishes between two types of effect:

- Direct effects on local tourism 'assets' (e.g. physical changes to public rights of way, paths, scenic areas and so on) which the new development may cause at different stages; construction, operation, maintenance and decommissioning. Direct effects could include factors such as closure or diversion of access to tourism assets or the removal of those assets.

  Because the physical construction of the components will take place on commercial premises and the installation and decommissioning will be offshore, there is not considered to be a direct effect on tourism from the wind farms themselves. However, there is the potential for the offshore installation work to have some effect in relation to sailing. This is covered in Chapter 8.2 (Shipping and Navigation).

- Indirect effects on local tourism assets. In this case, indirect effects mainly relate to changes in amenity through the permanent or temporary modification of land and seascapes and the visual effect of the installations and associated development. There could also be effects as a result of any disturbance or injury to coastal or marine wildlife interests (e.g. for wildlife watching) during construction, operation or decommissioning of the three proposed wind farms.

  The indirect effects are primarily based on any visual effect and on any possible effects that the three proposed wind farms might have on the marine-life that attracts visitors. The following paragraphs review some of the findings of relevant reports.

The Economic Effects of Wind Farms on Scottish Tourism: A Report for the Scottish Government

8.6.6.46 The most relevant research carried out to date is a study for the Scottish Government carried out by Glasgow Caledonian University (Riddington, Harrison, McArthur, Gibson, & Millar, 2008). Although this is based on onshore wind farms, there are useful findings in understanding how the presence of wind farms can affect visitor decisions. The work included a literature review as well as a survey of 390 visitors.

8.6.6.47 From the survey, the study concluded that "the results confirm that a significant minority (20 % to 30 %) of tourists preferred landscapes without wind farms. However of these only a very small group were so offended that they changed their intentions about revisiting Scotland".

8.6.6.48 However the survey also provides some evidence of the scale of changes on behaviour that might be expected. The key element is whether visitors' preferences for unspoilt landscapes translate into a reduced likelihood to visit in the future, which in turn would reduce tourist numbers and expenditure.

8.6.6.49 The survey found that the vast majority (99 %) of those who had seen a wind farm suggested that the experience would not have any effect on their likelihood of visiting the area in the future. The worst case found was where a scenario of extending a wind farm was shown. Under this case visitors, on average, indicated that they would be 2.5 % less likely to return.

8.6.6.50 The survey findings were supported by the results of a literature review in the same study which considered previous research on the economic effect of wind farms on tourism. The review examined some 40 studies in the UK, Ireland Denmark, Norway, the US, Australia, Sweden and Germany. This concluded that "Overall there is no evidence to suggest a serious negative economic impact of wind farms on tourists".

8.6.6.51 It also found a diminishing marginal loss of value associated with increasing the size of wind farms; "Once there has been an intrusion into the scenery, the effect on the value of the landscape of expanding the size of the wind farm is relatively small".

8.6.6.52 In terms of the 'views of respondents by main tourist activity', the report found that walkers are less opposed to wind farms than the norm;

"*There is, however, evidence that - on balance - individuals (tourists or otherwise) place a higher value on the landscape when a wind farm is not included in the view than when it is. This does not mean that this will necessarily influence a tourist's decision to visit that location*."

8.6.6.53 The report concluded that; "over time, hostility to wind farms appears to lessen and they become an accepted even valued part of the scenery, particularly by those closest to them. In some countries an established wind farm appears to be able to act as a tourist attraction in the same way as a hydro-electric power station. Overall, there does not appear to be any robust evidence to suggest a serious negative economic impact of wind farms on tourism."

North Hoyle Offshore Wind Farm—2nd Public Attitude Survey[6]

8.6.6.54 RBA Research was commissioned by npower renewables to conduct a survey to gauge the opinions of residents and visitors in the Rhyl and Prestatyn areas towards

[6] Provided as evidence to a House of Commons Select Committee on Innovation, Universities, Science and Skills (2008)

the North Hoyle Offshore Wind Farm. The research aimed to establish: awareness and knowledge of North Hoyle; opinions about the wind farm; the importance of the sea view; the wind farm's effect on visitor numbers and the degree and nature of people's environmental concerns. A similar survey had been carried out by RBA in March 2003, before the wind farm was in position, and this provided a baseline. Face to face interviews were carried out with a representative cross section of the residents, 100 in Prestatyn and 100 in Rhyl. Visitor interviews were also conducted in both Prestatyn and Rhyl (56 in total). Interviews took place between 1 and 16 June 2004.

8.6.6.55 Support for the North Hoyle Offshore Wind Farm has increased with 73 % of residents now saying they support the Project, compared with 62 % of residents before the wind farm was operational. Five of the residents opposed the wind farm. Seventy-one percent of visitors say they supported the North Hoyle development and none of the 56 visitors interviewed said they opposed the wind farm.

8.6.6.56 Two thirds of residents (67 %) said the presence of the North Hoyle Offshore Wind Farm has had no effect on the number of people visiting or using the area, with people more likely to be saying there had been an increase rather than a decrease in numbers (11 % compared with 4 % who said there had been a decrease).

8.6.6.57 The sea view was as important to residents at the time of the survey as it was before the wind farm was in position; 34 % of residents said it was a main reason for them living in the area (52 % of visitors said it was a main reason for them visiting the area).

Other Examples

8.6.6.58 A VisitScotland commissioned omnibus survey (VisitScotland, 2012) provides some assessment of consumer attitudes to wind farms and their effect on tourism. The study included 2,000 interviews undertaken with a nationally representative UK sample and a further 1,000 interviews in Scotland. Eighty per cent of respondents stated their decision about where to visit or where to stay on a UK holiday or short break would not be affected by the presence of a wind farm. For Scotland residents, 83 % stated their decision would not be affected. The Study relates to wind farms generally and does not allow any analysis of their proximity, scale or whether they are onshore or offshore.

8.6.6.59 For example: Scroby Sands Offshore Wind Farm, located off the coast of Great Yarmouth in Norfolk, has its own seafront visitor centre which has welcomed some 30,000 people through its doors in its first six months of operation. Greater Yarmouth Tourism emphasises the presence of the wind farm in its material and website, saying that "the 30-turbine wind farm on Scroby Sands, 3 km off the coast has become a popular landmark and tourist attraction".

8.6.6.60 A US report, Wind Turbines and Coastal Recreation Demand (Landry, Allen, Cherry, & Withehead, 2011) examined the impact of coastal wind turbines on tourism and recreation. The study was funded by the Appalachian State University Energy Center and used "*travel cost models and combines revealed preference (RP) and stated preference (SP) methods in order to measure the impact of widespread coastal wind farms on the economic value of beach visitation*".

8.6.6.61 A combination of telephone and web survey data was used to assess the effect of coastal wind farms on trip behaviour and site choice for a sample of North Carolina coastal tourists. Overall, it found very little effect of coastal wind turbines on aggregate recreational visitation of residents in the northern coastal counties of North Carolina. Although the research found that beach visitors from the northern

counties in North Carolina were "aversive" to offshore wind farms in close proximity to the beach, for those further out (defined by the study as 4 miles) it did not find a statistically significant effect.

8.6.6.62 An overview of reports carried out in the US by Grand Valley State University in May 2011 (Nordman, 2011) summarised its findings in relation to tourism as:

"Tourism is a crucial part of many coastal economies, but there is no evidence that existing offshore wind farms in Europe support or hinder tourism. Surveys show some tourists may avoid beaches with a view of an offshore wind farm, while other tourists might seek them out. Boat tours may provide another line of business for charter captains."

8.6.6.63 Research by the University of the West of England (University of the West of England, 2004) examined the potential effect of wind farm development in North Devon on tourism. A total of 379 day visitors and tourists were interviewed face-to-face. The vast majority of tourists surveyed in North Devon (87 %) stated that the presence of a wind farm would neither encourage nor discourage them from visiting. Of the remaining 13 %, slightly more would be encouraged to visit because of the presence of a wind farm. The majority of North Devon respondents thought that the wind farm would have no overall effect on the quality of their experience.

8.6.6.64 BWEA prepared a response to the All-Party Parliamentary Group on Tourism (BWEA, 2006) which suggested that the judgment of acceptability based on landscape protection will provide ample safeguard for the protection of tourism. The threshold of landscape protection is more sensitive to wind farm development than tourism. Therefore, if there is deemed to be no damage to landscape at the planning stage, there will be no damage to tourism.

8.6.6.65 Scottish research into the tourism effect of Artfield Fell Wind Farm in Dumfries and Galloway (Scottish and Southern Energy , 2007) found that 83 % of respondents considered that the wind farm had no effect on tourism, 3 % of respondents believed the wind farm to have had a negative effect and 14 % did not know.

8.6.6.66 Dolphin tourism is also a valuable part of the tourism economy and effects on dolphin behaviour, caused by the three proposed wind farms, could therefore have implications for tourism, if it reduced the opportunities to watch dolphins. A study published by Aberdeen University Business School (Aberdeen Centre for Environmental Sustainability (ACES), 2010) estimates that the total *additional* tourism expenditure in Scotland reliant solely on the presence of the east of Scotland bottlenose dolphin population was considered to be £4 million.

Tourism Accommodation within the Immediate Area

8.6.6.67 In order to assess the likely significant effect of the three proposed wind farms on the local tourism industry, tourism accommodation that lies within 50 km of the proposed wind farm sites was identified. The 50 km distance was identified in the Landscape and Visual Assessment as the maximum distance within which the three proposed wind farms would be visible. It is worth noting also that a study carried out for Scottish Natural Heritage (Scott *et al*., 2005) suggests 35 km as the distance beyond which visual effects would be insignificant. It noted that:

"The steering group recommended a seaward outer limit of visual significance of 35 km for seascape units rather than 24 km as a precautionary principle."

8.6.6.68 As described in the baseline, within 50 km, there are 1,057 bed spaces available. Assuming 40 % bed occupancy this represents 150,000 nights. An average

expenditure per night of £53.50 gives a total expenditure of £8.3 million. It is important to stress that only a small proportion of this accommodation would have any view of the wind farms (based on Figure 8.4.5, Volume 7: zone of theoretical visibility).

Business Tourism Effects

8.6.6.69 Tourism Resource Consultants (TRC) carried out an analysis of the business tourism market for Caithness and Sutherland in 2010 (Tourism Resource Consultants, 2010). In relation to the energy sector it concluded that:

"The renewables sector potentially presents a massive opportunity for the C&NS area however the amount of accommodation demand that it will generate is completely unknown and research that we have carried out cannot confirm the level of accommodation demand or even if the sector will need accommodation on an ongoing basis."

8.6.6.70 The analysis goes on to make some broad estimates, based on the experience of Dounreay, where there are around 8 to 16 bed nights generated for each direct job. In other words, for every 100 direct jobs created there would be demand for 800 to 1,600 serviced accommodation bed nights. This is very uncertain and depends on the extent to which the area benefits from additional economic activity and the nature of these jobs.

Construction

Construction Effects on Leisure Tourism

8.6.6.71 Any potential effects of construction on tourism would be indirect resulting from changes in amenity through the modification of seascapes and the visual effect during construction.

8.6.6.72 In relation to the sensitivity of tourism activity to the presence of wind farms themselves, the most detailed study is Glasgow Caledonian University (Riddington *et al.,* 2008) for the Scottish Government, described earlier. It found that only a very small group changed their intentions about revisiting an area or Scotland.

8.6.6.73 There are some contextual elements in considering the findings in relation to this proposal. Firstly, the findings are based on wind farms in general and not offshore projects and there may be differences in how visitors react to changes in seascapes rather than landscapes. Secondly, the distances to offshore wind farms may make them less intrusive than has been assumed in these surveys for onshore wind farms, although the offshore turbines are larger.

8.6.6.74 The second source of effect is the sensitivity of visitors attracted to watch the marine wildlife. This group will be sensitive to changes that reduce the opportunities to do this. Overall, the sensitivity of tourism in the study area to the three proposed wind farms during construction is considered to be low.

8.6.6.75 The magnitude of the effect depends on both the scale of tourism activity that would be subject to any effect and the size of the effect itself. The number of visitors staying within the immediate area of the three proposed wind farms and those on day trips are those that are most likely to be influenced by the visual effect. As described in the baseline, the number of visitors is small relative to the level of tourism within the study area, while the number of recreational day trips to the area is limited by the distances from major centres of population. There will be visitors travelling

north, up the coast, who will see the wind farms, although it is unlikely to cause them to change their travel plans or influence decisions to return.

8.6.6.76 Chapter 7.3 (Marine Mammals) concludes that there may be some short term disturbance during construction (due to piling activities), but that the majority of the dolphins are found outside the noise range that would cause behavioural effects. It is not likely that the number of dolphins displaced would be as large as to effect on the tourists' opportunities to see them. The effect on tourism is therefore considered to be low. The magnitude of the effect for leisure tourism is therefore considered to be low.

8.6.6.77 Combining the sensitivity and magnitude assessments gives **minor, negative significance** and therefore not significant under the EIA.

Construction Effects on Business Tourism

8.6.6.78 During the construction phase there is scope for increases in business tourism, particularly where there is new investment made within the study area. The sensitivity of business tourism within the study area will vary across the geography with some service providers' activities strongly affected (for example: hotels with facilities suitable for businesses that are located close to where there is new manufacturing, construction of installation activity is based). For other parts of the study area the effect may be much weaker.

8.6.6.79 The sensitivity of business tourism within the study area will vary across the geography with some service providers' activities strongly affected and others much less so. Overall, given the scale of the Study Area, sensitivity is considered to be low.

8.6.6.80 The magnitude of the effect is likely to be positive, but modest, depending on the use of local facilities by construction contractors. It is not possible to quantify but an estimate of low magnitude has been made relative to overall tourism activity in the study area.

8.6.6.81 Combining the sensitivity and magnitude assessments gives a **minor, positive significance** and business tourism is therefore not significant under the EIA.

Operation

Operation Effects on Leisure Tourism

8.6.6.82 The operation of the three proposed wind farms is not considered to have any direct effects. Indirect effects include in the effects on tourism of changes in amenity through the modification of seascapes and the visual effect and / or as a result of any disturbance or injury to coastal or marine wildlife interests (e.g. for wildlife watching) during operation.

8.6.6.83 As described for the construction effects, the sensitivity of tourism activity to the presence of wind farms is described in the Glasgow Caledonian University study. This concluded that overall there is no evidence to suggest a serious negative economic effect of wind farms on tourists, although it is important to note that the findings are based on wind farms in general and not offshore projects and there may be differences in how visitors react to changes in seascapes rather than landscapes. The distances to offshore wind farms may make them less intrusive than has been assumed in these surveys for onshore wind farms, although the offshore turbines are larger.

8.6.6.84 The second source of effect is the sensitivity of visitors attracted to watch the marine wildlife. This group will be sensitive to changes that reduce the opportunities to do this. Taken together the sensitivity of tourism in the study area to the operation of the three proposed wind farms is considered to be medium.

8.6.6.85 The magnitude of the effect depends on both the scale of tourism activity that would be subject to the effect and the size and duration of the effect itself. As described for the construction phase, the number of visitors staying within 50 km of the three proposed wind farms is small relative to the level of tourism within the study area.

8.6.6.86 Chapter 7.3 (Marine Mammals) concludes that the three proposed wind farms would have no long term negative effects on dolphins and therefore there would be no impact on the tourists' opportunities to see them. The magnitude of the effect on leisure tourism is therefore considered to be low.

8.6.6.87 Combining the sensitivity and magnitude assessments gives a **minor, negative significance** and therefore not significant under the EIA.

Operation Effects on Business Tourism

8.6.6.88 During the operating phase there is less scope for increases in business tourism relative to the construction phase. Even so, the effect is likely to be positive rather than negative, given possible requirements for accommodation located close to the operations and maintenance facilities.

8.6.6.89 As for the construction phase, the sensitivity of business tourism within the study area will vary across the geography with service providers located closest to the activities more likely to benefit and others much less so. Overall sensitivity is considered to be medium.

8.6.6.90 The magnitude of the effect is likely to be positive but modest, depending on the use of local facilities. An estimate of negligible magnitude has been made, relative to overall tourism activity in the study area.

8.6.6.91 Combining the sensitivity and magnitude assessments results in **negligible significance** and is therefore not significant under the EIA.

Decommissioning

Decommissioning Effects on Leisure Tourism

8.6.6.92 The decommissioning of the three proposed wind farms is not considered to have any direct effects. The majority of work will be offshore or on commercial premises. The possible indirect effects are effects on the level of tourism as a result of changes in amenity through the modification of seascapes and / or as a result of any disturbance or injury to coastal or marine wildlife interests (e.g. for wildlife watching) during decommissioning.

8.6.6.93 The decommissioning work will have a similar effect to the construction phase and the conclusions on sensitivity, magnitude and significance are the same. This is considered to be of **minor, negative significance** and therefore not significant under the EIA.

Decommissioning Effects on Business Tourism

8.6.6.94 During the decommissioning phase the potential for increases in business tourism are relatively unknown given that this would take place 25 years after construction. The methods that will be adopted and the requirement for local facilities may well change in that time.

8.6.6.95 However, as in the construction phase, the sensitivity of business tourism within the study area is considered to be medium. Any effect is likely to be positive, but modest and an estimate of negligible has been made. Combining the sensitivity and magnitude assessments gives **negligible significance** and therefore not significant under the EIA.

Other recreation

8.6.6.96 This includes the effects on surfing, sea kayaking and walking. The effect on fish and is fully discussed in Chapter 7.2 (Fish and Shellfish Ecology), and fishing in Chapter 8.1 (Commercial Fisheries). Recreational sailing is discussed in Chapter 8.2 (Shipping and Navigation).

Construction Effects on Other Recreation

8.6.6.97 The effect on surfing would occur if the construction work affected the quality of the waves or had a significant visual effect and if those participating were sensitive to these changes.

8.6.6.98 The magnitude of the effect is determined by the scale of the effect and the number of people affected. The surfing wave quality is critical to the attraction of a location. A study of Scroby Sands cited in (Marine Scotland, 2011), found that turbines 1.75 km from the coast had a negligible effect on wave quality at the shoreline. The effect of the proposed sites is also likely to be negligible (as described in Chapter 6.1: Hydrodynamics – Wave Climate and Tidal Regime). Therefore the wind farm construction activity is unlikely to have any effect on sea conditions for surfing or kayaking and any effect would be temporary. Magnitude of the effect and its significance is therefore **negligible**.

8.6.6.99 In relation to walking, the Glasgow Caledonian University report (2008) on tourism effects found that, of those engaged in various tourist activities, walkers were less opposed to wind farms than the average in the survey. Sensitivity is therefore judged to be low. The magnitude is determined by the number of people, the scale of the visual effect and its duration. The effect of the three proposed wind farms on seascape, landscape and visual receptors is provided in Chapter 8.4. For construction the effects are short term and therefore likely to have a negligible effect on the amount of recreational walking in the Study Area. Significance is therefore considered to be **negligible.**

8.6.6.100 There is not considered to be any recreational fishing activity within the three proposed wind farm sites (Marine Scotland, 2011). There were no places on the east Caithness and Moray coasts listed in the top 20 most popular launch sites or shore sites for sea angling, with activity in northern Scotland stronger on the west coast (Radford, Riddington, & Gibson, 2009). The effect on fish and is fully discussed in Chapter 7.2 (Fish and Shellfish Ecology), and fishing in Chapter 8.1 (Commercial Fisheries).

Operation Effects on Other Recreation

8.6.6.101 As for the Construction phase, the effect on surfing would occur if the operation affected the quality of the waves or had a significant visual effect and where those participating in recreational activities were sensitive to these changes. As described above there is no evidence that in operation the three proposed wind farms will significantly affect the wave quality at the shoreline and the magnitude of the effect and its significance is therefore **negligible**.

8.6.6.102 Some significant views of the three proposed wind farm sites are predicted from the Caithness coast. Views were also assessed from the Aberdeenshire and Moray coasts, but at a minimum of 42 km from the site, these are not assessed to be significant. A full assessment of the effects of the three proposed wind farm sites on seascape, landscape and visual receptors is provided in Chapter 8.4.

8.6.6.103 Walkers on the coast will be sensitive to changes in views during the operation of the three proposed wind farms and this is considered to be medium. The magnitude of the effect will be low given the number of routes and people affected. Overall, the effect on the levels of recreational walking during operation is of **minor, negative** significance.

8.6.6.104 As per construction, effects on salmon and sea trout fisheries from operation of the three proposed wind farms will occur indirectly if the ecology of the species is negatively affected. This is fully discussed in Chapter 7.2 (Fish and Shellfish Ecology) and Chapter 8.1 (Commercial Fisheries).

Decommissioning Effects on Other Recreation

8.6.6.105 The effects and significance will be the same as for construction.

Other social effects

8.6.6.106 Most of the other social effects are derived from effects on population and the economic and environmental conditions. These include; population, access to services and strength of communities. These are difficult to assess directly, although some elements can be inferred from other aspects of the analysis.

8.6.6.107 These social effects depend heavily on where the economic activity takes place, but there is considerable uncertainty around how much activity will be generated and where. Decisions have yet to be taken on the use of any port(s) in the study area, or the locations for assembly, construction and operation and maintenance activity. It will be of considerable importance to specific communities where these activities are undertaken.

8.6.6.108 The assessment can therefore only be general. The demand for labour and services has the potential to bring positive social changes, through generating income for the area. Income will also be generated indirectly through the supply of some services to contractors and also through the spending of wages and salaries within the local economy. This in turn helps maintain shops, bars, restaurants and other local services within the study area, contributing to quality of life.

8.6.6.109 The baseline estimates suggest that the population within the study area has increased and is expected to increase further over the next 20 years, with the fastest growth in Aberdeenshire. The three proposed wind farm developments are likely to contribute to this by providing employment and encouraging some residents to stay

and bringing others to the area. This would also help maintain the proportion of working age residents in the population, which was expected to fall slightly.

8.6.6.110 Meeting the additional demand of the new offshore projects will be achieved through a mixture of new employees to the labour market, transfers from other lines of work and retraining, and other people moving to Scotland. Given the duration of these projects and the long term opportunities, it will also be important to promote the sector with school children to ensure a future pipeline of skills. Within the Study Area there are opportunities to make use of the relevant skills associated with the oil and gas industry, but growth in that sector, combined with the potential employment around further expansion as well as decommissioning is likely to impact on demand and wage rates.

8.6.6.111 We understand from HIE that there are people with relevant skills who would return to the Highlands if the right jobs were available. The gradual decommissioning of Dounreay and the change of status of RAF Kinloss could also create a pool of labour for the wind farm contractors. Interviews for case studies as part of "Maximising employment and skills in the offshore wind supply chain" (SQW, 2011) for the UK Commission for Employment and Skills reported that ex-military personnel often have the characteristics to cope with long periods of time in difficult working conditions (e.g. rough weather and limited facilities).

8.6.6.112 In the past many new residents have moved to the area to work at the airbases and Dounreay, as well as the fabrication yards, so the towns in the study area are accustomed to accommodating new workers. Whether or not the number is significant enough to affect the lives of these communities, or on the provision of public services, will depend on where activity takes place. However, for some areas the employment opportunities and additional income would be a major benefit for sustaining their communities and ensuring other local businesses and services remain viable.

8.6.7 Proposed Monitoring and Mitigation

8.6.7.1 Only negative effects of moderate significance or above are deemed significant under the terms of the EIA Regulations. From the assessment above there are no negative effects of moderate or greater significance and therefore no mitigation is required.

Enhancements Measures

8.6.7.2 Maximising positive effects or minimising "not significant" negative ones is termed enhancement.

8.6.7.3 Through engagement work, with local communities, their representatives in community councils, local authorities, and the UK and Scottish Parliament, as well as representatives of the UK and Scottish government, MORL is acutely aware of the expectations and aspirations that the development of offshore wind should lead opportunities for local and national economic development.

8.6.7.4 MORL has therefore undertaken steps to engage with the Scottish Government's Energy Division, Marine Scotland, HIE, and SE in order to determine how collaborative working can deliver these aspirations. As a developer, MORL will create a significant new multi-billion pound market for the goods and services required to deliver and operate offshore wind generation infrastructure in the Outer Moray Firth. However, translating that market into local and national economic

growth will be dependent upon the local supply chain being equipped, ready, and well placed to compete.

8.6.7.5 HIE and SE have a strong track record in delivering economic development, are the agencies best placed for supply chain development. In late 2011, MORL shared the preliminary findings of the socio-economic impact assessment with Marine Scotland and the Scottish Government, and as a result of ongoing engagement have developed a pilot project to allow enterprise staff to be embedded within the MORL project team, gaining access to various aspects of the procurement process (with due respect to confidentiality and fair competitive practices).

8.6.7.6 It is anticipated that this joint working will enable the enterprise agencies to undertake focussed development of the supply chain, based on Project specific information, thus allowing those agencies to efficiently maximise local economic opportunity, and move economic effect from base case toward high case.

8.6.7.7 This would have a positive effect on the estimates of retained income and employment within the Study Area and Scotland. These effects will have a direct effect on other social and economic conditions in the Study Area. Greater employment opportunity will generate more income locally and, in turn help to support population, local businesses and the provision of services in some communities.

8.6.8 Secondary Assessment: Individual Wind Farm Sites

8.6.8.1 There has been no further secondary assessment undertaken as there are no differences in / effect significance between the sites.

8.6.8.2 The economic effects generated by the expenditure on the construction, operation and decommissioning of the wind farms does not depend on the sites themselves, but on their scale and resources required to develop them. At this stage there is no clear difference between the plans for the sites and therefore the expenditure allocated for the full development would simply be divided across the three proposed sites.

8.6.8.3 In relation to the tourism and recreation elements of this chapter, the effect of the sites would vary depending on their visibility onshore. Chapter 8.4 (Seascape, Landscape and Visual Receptors) presents detailed assessments for the three proposed wind farms as summarised below:

- MacColl has less effect on landscape and visual receptors in Caithness as it is located further offshore – 29 km at closest point, but often considerably further. MacColl does not have significant effects on landscape and visual receptors in Caithness due to its greater distance offshore and lower magnitude of change;
- Telford and Stevenson have significant effects on the closest visual receptors in Caithness (as assessed for all three proposed wind farm sites in the primary assessment). Telford and Stevenson have a similar effect, being a similar distance offshore and horizontal spread on the skyline;
- Telford and Stevenson have less effect on landscape and visual receptors in Moray / Aberdeenshire, being located further offshore than MacColl (over 49 km from the closest point); and
- MacColl has relatively more effect on landscape and visual receptors in Moray / Aberdeenshire, but is still assessed as having a low magnitude of change to the baseline conditions and assessed as not significant (as assessed for all three proposed wind farms sites in the primary assessment).

8.6.8.4 The tourism and recreation effects from each wind farm on receptors that draw upon conclusions based on the visibility of the wind farms (leisure tourism, walking) will also show similar differences as described above.

8.6.8.5 Despite the small differences between sites highlighted above, no significant changes in the assessments are predicted for each wind farm.

8.6.9 References

BWEA. (2006). The impact of wind farms on the tourist industry in the UK prepared for the All-Party Parliamentary Group on Tourism.

HM Treasury. (2003). The Green Book.

IPA / Scottish renewables . (2010). Scottish Offshore Wind: Creating an Industry.

Landry, C. E., Allen, T., Cherry, T., & Withehead, J. (2011). Wind Turbines and Coastal Recreation Demand. Department of Economics & Center for Sustainable Tourism, East Carolina University.

Marine Scotland. (2011). Economic Assessment of the Short Term Options for Offshore Wind Energy in Scottish territorial Waters: Costs and Benefits to Other Marine Users and Interests.

Nordman, E. (2011). West Michigan Wind Assessment.

Office for National Statistics . (2010). Labour productivity measures from the ABI: 1998 to 2007 Economic & Labour Market Review, Vol. 4, No 5 .

Office for National Statistics. (2005). UK input-output tables.

Oxford Economics. (2010). Analysis of the Employment Effects of the Operation and Maintenance of Offshore Wind Parks in the UK. A Report for Vestas Offshore.

Renewable UK . (2011). Offshore Wind Forecasts of future costs and benefits.

Riddington, G., Harrison, T., McArthur, D., Gibson, H., & Millar, K. (2008). The economic impacts of wind farms on Scottish tourism. Glasgow Caledonian University.

Roger Tym & Partners and RPS. (2011). Socio-Economic impact assessment. Triton Knoll Offshore Wind Farm Limited.

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. F03A).

Scottish and Southern Energy . (2007). Tourism Impact of the Artfield Fell Wind Farm.

Scottish Government . (2010). Input Output Tables 2007 .

Tourism Resource Consultants. (2010). Caithness and Sutherland Serviced Accommodation Needs of Business Tourism.

University of the West of England. (2004). Fullabrook Wind Farm Proposal Evidence of the impact of wind farms on tourism numbers and tourist experience. North Devon Wind Power.

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8.7 Other Human Activities

8.7.1 Impact Assessment Summary

8.7.1.1 This chapter presents an assessment of the likely significant effects of the construction, operation and decommissioning of the three proposed offshore wind farm sites on other human activities (with marine components) in the Moray Firth, along with proposed mitigation measures, where considered necessary.

8.7.1.2 The assessment of effects has been focused on establishing potential for overlaps and, therefore, conflict between activities and operators in both a geographical and temporal context. The potential for the Project to disrupt activity associated with other proposed offshore wind farms and military practice areas is not expected to be significant.

8.7.1.3 Whilst there is no existing oil infrastructure within the proposed wind farm sites, several operators hold licences to explore the potential of licence blocks which overlap with the Telford, Stevenson and MacColl sites. At present, exploration plans are not known. Taking a precautionary approach, the impact assessment assumes that licence holders may wish to explore the licence areas (e.g. undertake seismic survey) during wind farm construction, operation and decommissioning. Construction works and wind farm infrastructure may exclude exploration activities from particular locations and the effect is judged to be of moderate adverse significance. In light of the uncertainty surrounding the plans of licence holders, MORL is committed to ongoing consultation, aiming for co–existence where achievable.

8.7.1.4 There is a potential for unexploded ordnance (UXO) to be encountered on the seabed within each of the three proposed wind farm sites. Construction activities have the potential to disturb UXO and any unplanned detonation may impact upon human health and safety, as well as wind farm infrastructure and equipment. Without mitigation, the consequences of such an effect will be of major adverse significance. MORL are committed to a suite of standard industry measures to minimise risk from UXO, including a pre–construction UXO seabed survey, and the residual effect is therefore not significant.

8.7.1.5 A summary of the primary impact assessment is shown in Table 8.7-1 below.

Table 8.7-1 Primary Impact Assessment Summary

Type of Effect	Pre–Mitigation Effect	Mitigation	Post–Mitigation Effect
Construction / Decommissioning			
Effects on Other Offshore Wind Farms	Not significant	None	Not significant
Effects on Military Practice and Exercise Areas	Not significant	None	Not significant
Effects on Oil Operations and Structures	Minor adverse	Ongoing consultation and co–ordination with operators	Minor adverse
Health and Safety Risk due to Unexploded Ordnance	Major adverse	Pre–construction UXO survey; UXO safety plan	Not significant

Type of Effect	Pre–Mitigation Effect	Mitigation	Post–Mitigation Effect
Operation			
Effects on Other Offshore Wind Farms	Not significant	None	Not significant
Effects on Military Practice and Exercise Areas	Not significant	None	Not significant
Effects on Oil Operations and Structures	Moderate adverse	Ongoing consultation and co–ordination with operators	Moderate adverse
Health and Safety Risk due to Unexploded Ordnance	Not significant	None	Not significant

8.7.2 Introduction

8.7.2.1 The construction, operation and decommissioning phases of the three proposed offshore wind farms have the potential to disrupt or disturb other human activities, or damage existing infrastructure within and adjacent to the proposed wind farm sites. This chapter specifically assesses likely effects upon the following:

- Other offshore wind farm projects;
- Military practice and exercise areas (PEXA);
- Oil and gas activity;
- Subsea cables and pipelines; and
- Unexploded ordnance (UXO).

8.7.2.2 It is judged that the MORL Project will not result in any significant effects upon marine dredging and disposal activities and sites, or telecommunications systems, and so potential effects upon these receptors are not considered any further in the impact assessment that follows. Justification for not taking these forward is provided in Chapter 5.8 (Other Human Activities) of the Environmental Statement (ES). Those projects, activities and infrastructure which are considered in impact assessment are described in Chapter 5.8 (Other Human Activities).

8.7.2.3 Note that likely effects upon the receptors listed below are discussed in detail in separate chapters:

- Chapters 8.1 and 11.1 (Commercial Fisheries);
- Chapters 8.2 and 11.2 (Shipping and Navigation);
- Chapter 8.3 (Military and Civil Aviation); and
- Chapters 8.6 and 11.6 (Socio–Economics, Recreation and Tourism).

8.7.3 Rochdale Envelope Parameters Considered in the Assessment

8.7.3.1 For the purpose of the other human activities impact assessment, a worst realistic case scenario has been defined and is presented in Table 8.7-2 below. In summary it assumes a maximum Project footprint, a maximum number of wind farm structures, and a maximum construction window.

8.7.3.2 The scenario defined below is also applied to the assessment of cumulative effects (see Chapter 15.8: Other Human Activities).

Table 8.7-2 Rochdale Envelope Parameters

Potential Effect	Rochdale Envelope Scenario Assessed
Construction & Decommissioning	
Damage / Disturbance / Disruption of Other Human Activities	Maximum construction seabed footprint of 5.99 km^2 based on: • Total area of spud cans per jack–up barge (assume six legs per barge) = 420 m^2; • Number of visits per installation / decommissioning = two; • Dredge affected area exposed (i.e. not occupied by the turbine foundation and scour material) = 6,600 m^2 per turbine; • 339 turbines (if lowest rated options installed); • Total length of inter array cables = 572 km; • Trench affected width during installation and decommissioning = 6 m; and • Deployment of up to six anchors of maximum weight 12 Te and dimensions 4.5 m wide by 3.64 m long by 1.7 m high with a shaft of 5.3 m and likely to penetrate 1 m into sediment and nominal 5 m^2 area of seabed disturbance. Anchors to be deployed every 500 m along length of inter–array cables. Maximum (rolling) safety zone extent of 500 m around active installation works. Minimum buffer distance between MORL and adjacent Beatrice Offshore Wind Farm site of 600 m. Maximum construction window of up to six years.
Health and Safety Risk Associated with UXO	Maximum construction seabed footprint of 5.99 km^2, as defined above. Maximum construction window of up to six years.
Operation	
Damage / Disturbance / Disruption of Other Human Activities	Maximum seabed footprint of 2.93 km^2 based on: • Placement of gravity base foundations of 65 m diameter = 3,317 m^2 per turbine; • Scour protection material = 3,770 m^2 per foundation; • Cable protection = 2,000 m^2 per turbine; • 339 turbines (if lowest rated options installed). Maximum safety zone extent of 50 m around turbines. Most frequent maintenance schedule, involving regular visits to site by vessel and / or helicopter over the Project lifetime of 25 years.

8.7.4 EIA Methodology

8.7.4.1 The assessment considered the likely significant effects of the Project as described in Chapter 2.2 (Project Description) on other human activities in the marine environment. The scope of the assessment was defined through a process of consultation (see Chapter 5.8: Other Human Activities for a summary of consultation outcomes) with the operators responsible for other activities and infrastructure in the study area, which covers the wider Moray Firth but is focused on activities and infrastructure that have the potential to overlap or be influenced by the Project.

8.7.4.2 In the absence of published guidelines regarding the assessment of effects of wind farm developments upon other human activities, the following assessment criteria have been applied.

8.7.4.3 In determining the magnitude of any given effect, the following have been considered:

- Spatial extent of the effect;
- Duration of the effect; and
- Frequency of the effect.

8.7.4.4 Sensitivity is also defined where appropriate, taking into consideration the:

- Vulnerability of the receptor;
- Recoverability of the receptor; and
- Value / importance of the receptor.

8.7.4.5 The significance of an effect has been assessed by combining the evaluations of the magnitude of a potential effect and the sensitivity of the receptor affected, as indicated in Table 8.7-3 below.

Table 8.7-3 Significance of Effect Matrix

		Sensitivity of Receptor		
		Low	**Medium**	**High**
Magnitude of Effect	**Low**	Not significant	Minor	Minor / moderate
	Medium	Minor / moderate	Moderate	Moderate / major
	High	Moderate	Moderate / major	Major

8.7.4.6 Definitions of significance were rated 'not significant' where no effect is foreseen or where the effect will be indistinguishable from background variation, to 'major significance' where interaction between the MORL Project and other human activities is likely to result in a measurable effect that exceeds acceptable limits or standards. The combination receptor sensitivity and impact magnitude has been used to define the level of significance of an impact, as defined in Chapter 1.3 (Environmental Impact Assessment).

8.7.4.7 MORL has developed a Preliminary Decommissioning Programme (Technical Appendix 1.3 E) but will not finalise its approach to decommissioning until consent is awarded and the details of Project construction are known. At the time of ES preparation it is considered likely that decommissioning will involve the removal of structures above the seabed, whilst subsea cabling is likely to be left in situ at the end of the Project's lifetime. Decommissioning activities are likely to have effects on other human activities but for the purposes of this Environmental Impact Assessment (EIA) they are regarded as being comparable to those that occur as a result of construction activities. As a result, the effects of construction and decommissioning activities on other human activities are considered together.

8.7.5 Primary Impact Assessment: Three Proposed Wind Farm Sites

Construction / Decommissioning

Effects on Other Offshore Wind Farms

8.7.5.1 The proposed Telford and Stevenson wind farm's north eastern boundaries are adjacent to the proposed Beatrice Offshore Wind Farm project and the MORL Project is located several kilometres to the north east of the existing Beatrice Demonstrator Project wind turbines. It is not anticipated that there will be any interaction between the Demonstrator Project and the proposed Telford, Stevenson and MacColl wind farm projects.

8.7.5.2 Similarly, it is considered unlikely that the MORL Project will impact upon activities at the proposed Beatrice Offshore Wind Farm site. Beatrice Offshore Wind Farm Ltd (BOWL) is fully aware of the proposed MORL Project; the BOWL and MORL developers have to date worked cooperatively (e.g. undertaking joint EIA studies) and would intend to continue to do so during wind farm construction, looking for opportunities to work together efficiently. Project programmes indicate that it is possible that the BOWL and MORL projects would be constructed concurrently, though the pre–determined buffer between the two developments and ongoing sharing of information on planned project activities would limit the potential for interaction between the sites and it is considered unlikely that one developer would hinder the other. **No significant effect** is predicted.

Effects on Military Practice and Exercise Areas

8.7.5.3 Portions of the proposed Telford and MacColl wind farm sites lie within danger area D809 (South), which is used by the RAF for a variety of practice flying and firing exercises. There is the potential that the physical presence of vessels involved in the construction of the wind farms could lead to temporary disruption or exclusion of military activity within D809. However, during consultation the Ministry of Defence (MoD) has not highlighted any concerns with regard to D809 and therefore both the sensitivity of the receptor and the magnitude of the effect are considered negligible and there will be **no significant effect**.

Effects on Oil Operations and Structures

8.7.5.4 There is no existing or proposed oil infrastructure within the proposed wind farm sites. There are four abandoned well heads (without safety zones) within the proposed wind farm boundaries. It is expected that the MORL project will not interfere in any way with existing oil infrastructure; **no significant effect** is predicted.

8.7.5.5 Oil and gas licence blocks overlapping with the wind farm sites have been awarded to several operators. Operators are yet to explore the potential of the licence blocks and their exploration plans are currently unknown. Discussion is ongoing with one licence holder, Caithness Petroleum Ltd. MORL has made several attempts to initiate communications with Suncor and Sendero (licences awarded late in MORL EIA process) in order to understand their exploration plans, albeit unsuccessfully to date. Further attempts will be made until communications are established. It is possible that the licence holders may wish to undertake seismic surveys within their licence blocks; if this is the case, survey activity would be excluded from construction locations (and the associated 500 m rolling safety zone) within the wind farm sites. With a low sensitivity (assuming there is a degree of flexibility in terms of when seismic survey is undertaken and a variety of survey techniques that may be employed) and

negligible magnitude (exclusion would be temporary), the likely effect is deemed to be of **minor adverse significance**.

8.7.5.6 Effects associated with vessel access to existing oil and gas infrastructure are addressed in Chapter 11.2 (Shipping and Navigation) and effects upon helicopter access are detailed in Chapter 11.3 (Military and Civil Aviation).

Damage to Subsea Cables

8.7.5.7 The proposed wind farm sites do not overlap with any existing or proposed subsea cables and as such no effect is predicted. The proposed MORL export cable will need to cross subsea cables in order to make landfall; likely effects arising from the export cable are discussed in Chapter 11.8 (Other Human Activities).

Health and Safety Risk due to Unexploded Ordnance

8.7.5.8 There is potential for UXO associated with historic and current military activity to be encountered on the seabed in the area of the wind farms. During construction, activities which will have contact with the seabed, either directly (e.g. jack–up vessel) or via the placement of material (e.g. foundations or scour protection), run the risk of disturbing UXO with potentially damaging and dangerous effects to both employees and equipment. As human life is at risk, receptor sensitivity is considered to be high. Effect magnitude is considered to be medium and the effect is of potentially **major adverse significance**.

Operation

Effects on Other Offshore Wind Farms

8.7.5.9 Activity associated with the operation of the three proposed wind farm sites will be significantly reduced relative to the construction / decommissioning phases. Monitoring and maintenance vessels will require access, with any exceptional maintenance activity likely to have a temporary 500 m exclusion zone imposed around the relevant structure. With a pre–determined buffer between the MORL and BOWL of at least 600 m, it is theoretically possible for there to be an overlap between a temporary exclusion zone close to the proposed MORL boundary with one close to the adjacent BOWL boundary, and vice versa. The potential for two such maintenance events occurring concurrently is considered extremely unlikely and in light of established and ongoing coordination of works by MORL and BOWL, **no significant effect** is predicted.

Effects on Military Practice and Exercise Areas

8.7.5.10 As detailed with the 'construction / decommissioning' effects text, although two of the proposed wind farm sites overlap with a military PEXA, no concerns have been raised by the MoD during consultation with MORL. **No significant effect** is anticipated.

Effects on Oil Operations and Structures

8.7.5.11 As detailed above, the intentions of current oil and gas block licence holders are currently unknown. Should licence holders seek to commence block exploration once the wind farms are operational, it is expected that activities such as seismic survey will be spatially restricted by the presence of turbines with safety zones and inter–array cabling. With a medium sensitivity and magnitude, the potential effect is deemed to be of **moderate adverse significance**.

8.7.5.12 Effects associated with vessel access to existing oil and gas infrastructure are addressed in Chapter 11.2 (Shipping and Navigation) and effects upon helicopter access are detailed in Chapter 11.3 (Military and Civil Aviation).

Damage to Subsea Cables

8.7.5.13 The proposed wind farm sites do not overlap with any existing or proposed subsea cables and as such **no significant effect** is predicted. The proposed MORL export cable will need to cross subsea cables in order to make landfall; likely effects of the export cable are discussed in Chapter 11.8 (Other Human Activities).

Health and Safety Risk due to Unexploded Ordnance

8.7.5.14 The natural processes of the sea, including tidal action, seabed conditions, movement of sand waves, wave action and bad weather, all contribute to the movement of objects on the seabed. Human activities such as seabed trawling will also contribute to the movement of objects and, as such, there is a risk of UXO moving into the MORL wind farm sites. This will have implications for maintenance and repair activities of foundations, inter–array cables and scour protection but the risk is expected to be limited as UXO will have previously been identified during pre–construction surveys. Therefore, **no significant effect** is predicted.

Energy Generation, Air Quality and Emissions Savings

8.7.5.15 Calculations relating to the potential energy generated and CO_2 emissions savings produced from the proposed Telford, Stevenson and MacColl offshore wind farms are presented below. Calculations considered the two wind farm build-out scenarios presented in Chapter 2.2 (Project Description). Scenario A involves the build-out of the three proposed wind farms using the greatest number of turbines to achieve 1,500 MW capacity and Scenario B involves the build-out using the least number of turbines to achieve 1,500 MW. Calculations are based upon an average capacity factor (i.e. the ratio of the actual output of a power plant over a period of time and its potential output if it had operated at full capacity) of 30.79 %, based upon capacity factors reported by DECC for the years 2006 to 2010.

8.7.5.16 Under both scenarios, the potential electricity generated by each proposed 500 MW wind farm is estimated at 1,348,602 MWh / year, or 33,715 GWh over the predicted 25 year lifetime of each wind farm. In total, the three proposed wind farms will generate an estimated 4,045,806 MWh / year, or 101,145 GWh over 25 years.

8.7.5.17 To place these estimates in context, these calculations indicate that the potential electricity generated by both Scenario A and B will be equivalent to the domestic electricity demand of approximately 839,000 and 926,000 households (based on Scottish and UK domestic consumption respectively). The potential electricity generated by the individual 500 MW sites will be equivalent to the demand of approximately 280,000 and 309,000 households based on Scottish and UK domestic consumption respectively.

8.7.5.18 The amount of CO_2 emissions produced during energy production varies with the type of fuel used. Therefore, the potential CO_2 savings from the EDA and its component sites depends on the type of fuel it replaces. The potential CO_2 emissions savings for both scenarios of the EDA and the individual 500 MW sites has been calculated.

8.7.5.19 The EDA is estimated to result in potential CO_2 emissions savings of 3,677,638 tCO_2 per year (i.e. 3.68 $MtCO_2$) and 1,618,322 tCO_2 per year (i.e. 1.6 $MtCO_2$) over coal and

gas fired electricity generation respectively. Electricity production from the individual 500 MW sites will result in potential savings of 1,225,879 tCO_2 per year and 539,441 tCO_2 per year over coal and gas fired electricity generations respectively.

8.7.5.20 Assuming that the EDA is likely to be generating electricity for 25 years, and generation is calculated with a 30.79 % capacity factor, this could result in CO_2 emission savings of 91,940,950 tCO_2 (i.e. 91.94 $MtCO_2$) and 40,458,050 tCO_2 (i.e. 40.46 $MtCO_2$) over coal-fired and gas-fired mix electricity generation respectively overall.

8.7.5.21 The Project will act as a major contributor to the reduction in the amount of $C0_2$ released into the atmosphere and hence help meet targets forming part of Scotland's commitments on climate change action to reduce greenhouse gases. The operational phase of the Project has the potential to also displace gases other than CO_2, such as those associated with acid rain (Sulphur Dioxide (SO_2) and oxides of nitrogen (NO_x)).

8.7.6 Proposed Monitoring and Mitigation

Construction / Decommissioning

8.7.6.1 There are a number of mitigation measures that will be implemented to reduce the risk of any effects on other human activities occurring; these are as follows:

- To ensure the safety of all MORL assets, offshore wind farm infrastructure will not be sited within 50 m of existing abandoned oil well heads.
- MORL will continue to engage with current oil and gas block licence holders in order to firstly understand their exploration plans, and secondly to limit any conflicts of interest and achieve co–existence where possible. MORL is actively engaged in ongoing discussions at industry level with RenewableUK, Oil and Gas UK, and the Department of Energy and Climate Change (DECC), which are aiming to develop a protocol by which any conflicts of interest between the offshore wind, oil and gas industries may be amicably resolved.
- Although the Health & Safety at Work Act 1974 and the Construction (Design and Management) Regulations 2007 do not specifically require a dedicated UXO assessment, there is an obligation on those responsible for intrusive works to ensure that a comprehensive threat assessment is undertaken and risk mitigation measures are implemented with regard to all hazards on site. MORL will ensure that all practicable mitigation measures to minimise the risk of health and safety incidents associated with UXO are fully developed prior to construction. A UXO site survey will be undertaken prior to construction and site safety instructions will be prepared in the event that an item of UXO is located. All contractors' staff will be given munitions awareness briefings prior to and during the construction work. Should suspected items of UXO be discovered, their location will be accurately mapped and recorded for future assessment and possible removal / disposal or remediation in situ by a specialist contractor. The MoD and emergency services will also be consulted as appropriate.

Operation

8.7.6.2 As per mitigation during construction and decommissioning phases, MORL will continue to engage with oil and gas operators to achieve co–existence where possible.

8.7.7 *Residual Effects – Primary Assessment*

8.7.7.1 A summary of the primary impact assessment is shown in Table 8.7-4 below.

Table 8.7-4 Primary Impact Assessment Summary

Type of Effect	Pre–Mitigation Effect	Mitigation	Post–Mitigation Effect
Construction / Decommissioning			
Effects on other offshore wind farms	Not significant	None	Not significant
Effects on Military Practice and Exercise Areas	Not significant	None	Not significant
Effects on Oil Operations and Structures	Minor adverse	Ongoing consultation and co–ordination with operators	Minor adverse
Health and Safety Risk due to Unexploded Ordnance	Major adverse	Pre–construction UXO survey; UXO safety plan	Not significant
Operation			
Effects on Other Offshore Wind Farms	Not significant	None	Not significant
Effects on Military Practice and Exercise Areas	Not significant	None	Not significant
Effects on Oil Operations and Structures	Moderate adverse	Ongoing consultation and co–ordination with operators	Moderate adverse
Health and Safety Risk due to Unexploded Ordnance	Not significant	None	Not significant

8.7.8 *Secondary Assessment: Individual Sites*

8.7.8.1 Each of the three proposed offshore wind farm sites are subject to potential UXO risk, and all overlap to some extent with licensed oil and gas blocks. At present there is insufficient information (i.e. presence / location of UXO and therefore UXO threat not yet confirmed by survey, and intentions of oil and gas block licence holders unknown despite initial consultation) with which to differentiate the Telford, Stevenson and MacColl wind farms and therefore inform secondary assessment. No secondary assessment has been undertaken.

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