

Hornsea Offshore Wind Farm

Project Two

Environmental Statement
Volume 2 – Offshore

Chapter 12 **Inter-related Effects (Offshore)**

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SMart Wind Limited

**Hornsea Offshore Wind Farm
Project Two – Environmental Statement**

Volume 2 – Offshore
Chapter 12 – Inter-related effects (Offshore)

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Table of Contents

12	Inter-related Effects	12-1
12.1	Introduction	12-1
12.2	Study Area	12-1
12.3	Planning Policy Context	12-2
12.4	Consultation	12-2
12.5	Data Sources	12-4
12.6	Impact Assessment	12-4
12.7	Summary	12-43
12.8	Conclusion	12-43
	References	12-44

Table of Tables

Table 12.1	Summary of relevant matters raised during Project One for inter-related effects	12-2
Table 12.2	Summary of the key issues raised during Project Two consultation undertaken to date for inter-related effects (offshore)	12-3
Table 12.3	Summary of staged approach to the inter-related effects assessment for Project Two	12-4
Table 12.4	Environmental Statement topics not included in the Project Two inter-related effects assessment	12-5
Table 12.5	Definitions of project lifetime and receptor-led inter-related effects	12-6
Table 12.6	Summary of potential inter-related effects on adjacent coastlines (to Project Two) from individual effects occurring across all phases of the project (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-8
Table 12.7	Summary of potential inter-related effects on benthic and intertidal ecology from individual effects occurring across all phases of the project (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-10
Table 12.8	Summary of potential inter-related effects on fish and shellfish ecology from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-14
Table 12.9	Summary of potential inter-related effects on marine mammals from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-18

Table 12.10	Summary of potential inter-related effects on ornithological receptors from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-22
Table 12.11	Summary of potential inter-related effects on commercial fisheries from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-25
Table 12.12	Summary of potential inter-related effects on shipping and navigation from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-29
Table 12.13	Summary of potential inter-related effects on marine archaeology from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-33
Table 12.14	Summary of potential inter-related effects on seascape and visual resources from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-36
Table 12.15	Summary of potential inter-related effects on infrastructure and other users from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)	12-39

Glossary

Term	Definition
Inter-related effects	Multiple effects on the same receptor arising from Project Two. These occur either where a single effect acts on a receptor over time to produce a potential additive effect or where a number of separate effects, such as noise and habitat loss, affect a single receptor, for example marine mammals.

Acronyms

Acronym	Full term
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
CoCP	Code of Construction Practice
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
ERCoP	Emergency Response Cooperation Plan
FLO	Fisheries Liaison Officer
HVAC	High Voltage Alternating Current
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
MMO	Marine Management Organisation
NPS	National Policy Statement
NPS EN-1	Overarching National Policy Statement for Energy
NPS EN-3	National Policy Statement for Renewable Energy Infrastructure
NTM	Notice to Mariners
PEMMP	Project Environmental Management and Monitoring Plan
PINS	Planning Inspectorate
REWS	Radar Early Warning System
SAR	Search and Rescue
SoS	Secretary of State
VOR	Valued Ornithological Receptor

12 INTER-RELATED EFFECTS

12.1 Introduction

- 12.1.1 This chapter presents the results of the Environmental Impact Assessment (EIA) in respect of the inter-related effects of the proposed Project Two development (namely Subzone 2, the export cable route corridor and the export cable landfall site being the elements of Project Two relevant to this chapter) during its construction, operation and decommissioning on offshore receptors. The assessment of inter-related effects on onshore receptors is presented in Volume 3, Chapter 12: Inter-related Effects (Onshore).
- 12.1.2 Project Two is the second project proposed for development within the Hornsea Zone. The Hornsea Zone is being developed using a phased programme, which divides the zone into subzones. The first of the subzones to be developed was Subzone 1 (Project One), which was granted development consent by the Secretary of State for Energy and Climate Change in December 2014. Subzone 2 (Project Two) is the second of the subzones to be developed. Project Two is similar, both in terms of its nature and location, to Project One. As such, where matters have been discussed and agreed during consultation on Project One, and are applicable to the Project Two EIA, they have been incorporated into this Environmental Statement (see Section 12.4 for further details).
- 12.1.3 The application for development consent for Project Two has been compiled and consulted on by SMart Wind on behalf of 'the Developer'.

Purpose of this Document

- 12.1.4 The primary purpose of the Environmental Statement is to support the Development Consent Order (DCO) application for Project Two under the Planning Act 2008 (the 2008 Act). The Environmental Statement should be read in conjunction with the Non-Technical Summary, which summarises in non-technical language the key issues presented in this report.
- 12.1.5 It is intended that the Environmental Statement will provide statutory and non-statutory consultees with sufficient technical information to complete the examination of the proposed development options and will form the basis of agreement on the content of the DCO and/or Marine Licence conditions (as required).

Purpose of this Chapter

- 12.1.6 This Environmental Statement chapter will:
- Present the receptor groups considered within the inter-related assessment;
 - Present the potential for effects on receptor groups across the three key project phases (construction, operation and maintenance and decommissioning); and
 - Present the potential for multiple effects on a receptor group, as presented with the topic specific chapter, to interact to create inter-related effects.
- 12.1.7 The impact assessment presented within this chapter has taken into account other relevant impact assessments and Technical Reports in this Environmental Statement including:
- Volume 2, Chapter 1: Marine Processes;
 - Volume 2, Chapter 2: Benthic Subtidal and Intertidal Ecology;
 - Volume 2, Chapter 3: Fish and Shellfish Ecology;
 - Volume 2, Chapter 4: Marine Mammals;
 - Volume 2, Chapter 5: Ornithology;
 - Volume 2, Chapter 6: Commercial Fisheries;
 - Volume 2, Chapter 7: Shipping and Navigation;
 - Volume 2, Chapter 9: Marine Archaeology and Ordnance;
 - Volume 2, Chapter 10: Seascape and Visual Resources; and
 - Volume 2, Chapter 11: Infrastructure and Other Users.

12.2 Study Area

- 12.2.1 Due to the differing spatial extent of effects experienced by different offshore receptors, the study area for potential inter-related effects varies according to receptor. The potential inter-related effects considered in this chapter are, therefore, also limited to the study areas defined in each of the topic specific chapters outlined above in paragraph 12.1.7. The rationale for the exclusion of other topics from further inter-related effects assessment is presented in Section 12.5 (see Table 12.4).

12.3 Planning Policy Context

12.3.1 Guidance on the issues to be assessed for offshore renewable energy developments has been obtained through reference to the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a), the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b), the NPS for Electricity Networks Infrastructure (NPS EN-5, DECC, 2011c), and the Marine Policy Statement (MPS).

12.3.2 This chapter of the Environmental Statement has been compiled following advice from PINS on the need to ensure that inter-related effects are fully addressed in any Environmental Statement accompanying a DCO application. This advice was outlined in Advice Note 9 issued by PINS in April 2012 (PINS, 2012a), which states the following in paragraph 3 of page 7:

“The Environmental Statement should not be a series of separate unrelated topic reports. The inter-relationship between aspects of the proposed development should be assessed and careful consideration should be given by the developer to explain how inter-relationships have been assessed in order to address the environmental impacts of the proposal as a whole. It need not necessarily follow that the maximum adverse impact in terms of any one topic impact would automatically result in the maximum potential impact when a number of topic impacts are considered collectively. In addition, individual impacts may not be significant but could become significant when their inter-relationship is assessed. It will be for the developer to demonstrate that the likely significant impacts of the project have been properly assessed.”

12.3.3 Although NPS EN-3 does not specifically contain the word ‘inter-related’ or ‘inter-relationships’, Section 4.2.6 of NPS EN-1 does state that:

“The Infrastructure Planning Commission (IPC) should consider how the accumulation of, and interrelationship between, effects might affect the environment, economy and community as a whole, even though they may be acceptable when considered on an individual basis with mitigation measures in place.”

12.4 Consultation

12.4.1 The Project Two development is similar, both in terms of its nature and location, to Project One. The matters relevant to Project Two which were raised in the formal responses from consultees for Project One and issues identified during pre-application consultation on Project One are set out in Table 12.1 below. All of these matters have been taken forward in the EIA for Project Two and a response on each matter in terms of Project Two is also provided in Table 12.1. Further details on the statutory and non-statutory consultation undertaken for Project Two are set out in the Consultation Report.

Table 12.1 Summary of relevant matters raised during Project One for inter-related effects.

Consultee	Issues raised on Project One which are applicable to Project Two	How/where addressed within Project Two
The Infrastructure Planning Commission (IPC)	Recommends the use of tables to identify and collate the residual impacts after mitigation. This would include the EIA topics, and inter-related and cumulative impacts.	The inter-related assessments for the defined receptor groups are presented in Table 12.6 to Table 12.15.
Rijkswaterstaat (Dutch Ministry of Infrastructure and Environment)	Request transparency in the method and considerations that are used to combine the individual effects.	The impact assessment methodology adopted for the inter-related effects assessment is presented in Section 12.5.

12.4.2 Table 12.2 below provides an overview of key issues raised during consultation to date for Project Two and how these have been addressed in the production of this Environmental Statement chapter. Further information is presented in the Consultation Report.

12.4.3 A Scoping Report was submitted for Project Two to PINS in October 2012 (SMart Wind, 2012). Following consultation, PINS provided a Scoping Opinion in November 2012 (PINS, 2012).

12.4.4 The first phase of consultation for Project Two took place alongside the fourth phase of consultation for Project One during February and March 2013. These consultation phases were synchronised to ensure the process of developing the projects simultaneously was clearly set out and understood.

12.4.5 The Draft Environmental Statement for Project Two was consulted on during the second phase of consultation, which took place during July 2014.

12.4.6 A summary of the key issues raised during consultation for Project Two and how these have been addressed in the production of this Environmental Statement chapter are set out in Table 12.2 below. Advice from the PINS Scoping Opinion received in November 2012 (PINS, 2012b) relating to the inter-related effects is also summarised within Table 12.2.

Table 12.2 Summary of the key issues raised during Project Two consultation undertaken to date for inter-related effects (offshore).

Consultee	Form of response	Stage of Response	Date issue raised	Issues raised	How/where addressed
PINS	Scoping Opinion	Scoping Opinion	November 2012	The Secretary of State (SoS) considers that the Environmental Statement should not be a series of disparate reports and welcomes the intended approach to identify potential inter-related effects for each topic as described in Chapter 4 of the Project Two Scoping Report (SMart Wind, 2012).	This chapter presents this information in Section 12.5. Onshore inter-related effects are presented in Volume 3, Chapter 11.
				The SoS recommends that the Environmental Statement should set out clearly the interpretation of 'significant' in terms of each of the EIA topics. Quantitative criteria should be used where available. The SoS considers that this should also apply to the consideration of cumulative impacts and inter-related effects.	The approach adopted has been to provide a descriptive assessment of the scope for these individual effects to combine, incorporating qualitative and, where reasonably possible, quantitative assessments to potentially create additional effects that may be of greater significance than the individual effects acting in isolation on a given receptor. In practice, quantitative assessment of how individual impacts may interact has not been possible due to lack of a clear, proven method for doing this. Therefore, a qualitative assessment has been undertaken based on the knowledge and experience of the authors.
				The SoS recommends that in order to assist the decision making process, the applicant may wish to consider the use of tables to identify and collate the residual impacts after mitigation on inter-related effects.	The inter-related assessments for the defined receptor groups are presented in Table 12.6 to Table 12.15.
JNCC	Scoping Opinion	Scoping Opinion	5 November 2012	Ecosystem linkages between receptors and determining how impacts on one receptor may influence others, such as impacts to fish which may be important as prey species for birds and marine mammals. We consider that such inter-related effects are likely to be key in interpreting the environmental impacts of Round 3 developments and we therefore welcome the applicant's intention to integrate these aspects as part of the EIA process.	Linkages between receptors are acknowledged and where such linked relationships arise these have been assessed within the individual topic chapters (see paragraph 12.6.10) and for completeness are summarised for each receptor group, where applicable, in Section 12.5 of this chapter.

12.5 Data Sources

12.5.1 The baseline environments for the receptor groups considered in this chapter are specific to each receptor group and are, therefore, set out in the relevant topic specific chapters. This chapter draws on the conclusions made within the individual chapter for the assessment of impacts acting in isolation on the receptor groups. The relevant sections drawn upon in this inter-related effects assessment are presented in the following sections of the ES chapters:

- Chapter 1: Marine Processes (Sections 1.5 and 1.6);
- Chapter 2: Benthic Subtidal and Intertidal Ecology (Sections 2.5 and 2.6);
- Chapter 3: Fish and Shellfish Ecology (Sections 3.5 and 3.6);
- Chapter 4: Marine Mammals (Sections 4.5 and 4.6);
- Chapter 5: Ornithology (Sections 5.5 and 5.6);
- Chapter 6: Commercial Fisheries (Sections 6.5 and 6.6);
- Chapter 7: Shipping and Navigation (Sections 7.5 and 7.6);
- Chapter 9: Marine Archaeology and Ordnance (Sections 9.5 and 9.6);
- Chapter 10: Seascape and Visual Resources (Sections 10.5 and 10.6); and
- Chapter 11: Infrastructure and Other Users (Sections 11.5 and 11.6).

12.6 Impact Assessment

Impact Assessment Methodology

12.6.1 The following sections present the approach for the offshore inter-related effects assessment for Project Two, which is also described in Volume 1, Chapter 5: Environmental Impact Assessment Methodology. The following approach to defining inter-related effects should be referred to throughout this chapter:

“Multiple effects upon the same receptor arising from Project Two. These occur either where a single effect acts upon a receptor over time to produce a potential additive effect or where a number of separate effects, such as underwater noise and collision risk, affect a single receptor, for example marine mammals.”

Guidance

12.6.2 The approach to the inter-related effects assessment has been developed with specific regard to the following text (footnote 11, page 7) from PINS Advice Note 9 (PINS, 2012a):

“Inter-relationships consider impacts of the proposals on the same receptor. These occur where a number of separate impacts, e.g., noise and air quality, affect a single receptor such as fauna.”

12.6.3 The approach also serves to accommodate PINS Advice Note 9 (and Scoping Opinion; PINS, 2012b) regarding the need to consider the assessment as a whole and not as a series of unconnected specialist reports.

Approach to Assessment

12.6.4 The approach to assessing inter-related effects within this chapter has followed a four staged process, as summarised in Table 12.3 and outlined below. More details of the approach summarised above and used to develop this chapter are presented in Volume 1, Chapter 3: Environmental Impact Assessment Methodology.

Table 12.3 Summary of staged approach to the inter-related effects assessment for Project Two.

Stage	Description
1	Assessment of effects undertaken for individual Environmental Impact Assessment (EIA) topic areas within Chapters 1 to 11.
2	Review of assessments undertaken within Chapters 1 to 11 to identify ‘receptor groups’ requiring assessment.
3	Identification of potential inter-related effects on receptor groups through review of the topic specific assessments in the Environmental Statement chapters.
4	Assessment undertaken on how individual effects may combine to create inter-related effects on each receptor group for: <ul style="list-style-type: none"> - ‘project lifetime effects’, i.e., during construction, operational and decommissioning phases; and - ‘receptor-led effects’, i.e., multiple effects on a single receptor.

Stage 1: Topic specific assessments

12.6.5 The first stage of the assessment of inter-related effects is presented in each of the individual offshore EIA topic chapters and comprises the individual assessments of effects on receptors across the construction, operation and maintenance and decommissioning of Project Two.

Stage 2: Identification of receptor groups

12.6.6 Stage 2 involved a review of the assessments undertaken in the topic specific chapters to identify 'receptor groups' requiring assessment within the inter-related effects assessment. The term 'receptor group' is used to highlight that the approach taken for the inter-related effects assessment will not assess every individual receptor assessed at the EIA stage, but rather potentially sensitive groups of receptors. The receptor groups assessed can be broadly categorised as those relating to the physical environment, the biological environment and the human environment, as follows:

Physical environment

- Adjacent coastlines (to Project Two).

Biological environment

- Benthic subtidal and intertidal ecology;
- Fish and shellfish ecology;
- Marine mammals; and
- Ornithological receptors.

Human environment

- Commercial fisheries;
- Shipping and navigation;
- Marine archaeology;
- Seascape and visual resources; and
- Infrastructure and other users.

12.6.7 It is important to note that the significance of effects on different receptors in the same receptor group (i.e., different species of birds in 'ornithological receptors') may vary according to the sensitivity of receptors. Therefore, where a number of species have been considered within the assessments in this chapter, a range is provided for significance of effect.

12.6.8 For some other individual topic chapters, an assessment of potential inter-related effects is inherent within the chapter itself and as such, is not covered in this inter-related effect assessment. The topics where this applies are shown below in Table 12.4.

Table 12.4 Environmental Statement topics not included in the Project Two inter-related effects assessment.

Topic ¹	Rationale for exclusion from further inter-related effect assessment
Marine Nature Conservation Sites	The assessment of inter-related effects is central to the assessment of potential effects on the integrity of designated sites and, as such, has already been assessed within the topic specific chapter and within the Habitats Regulations Assessment (HRA) Report for Project Two (SMart Wind, 2014). No additional levels of effect are therefore considered to occur at the site level beyond those identified in the individual chapters and HRA.
Radio communications and television	The assessment presented in Chapter 8: Aviation, Military and Communications, includes the consideration of all potential impact pathways on radio and television broadcast and reception infrastructure. Therefore no additional inter-related effects are considered likely to occur beyond those identified in the specific assessment in Chapter 8: Aviation, Military and Communications.
Aviation	The assessment of potential effects on aviation interests is made across all phases of the development and encompasses all potential inter-related effects on aviation and infrastructure and other users and aviation and Search and Rescue (SAR) operations. No further inter-related effects are considered to occur beyond those identified in the specific assessment given in Chapter 8: Aviation, Military and Communications.

¹ Items listed in the topic column do not necessarily correspond to a specific Environmental Statement chapter. The topic name presented refers to individual topics or receptors within a chapter.

Stage 3: Identification of potential inter-related effects on receptor groups

12.6.9 Following the identification of receptor groups the potential inter-related effects on these receptor groups were identified via review of the impact assessment sections for each topic chapter. The judgement as to which impacts may result in inter-related effects upon receptors associated with Project Two was based on the experience of the project team.

Linked receptor groups

12.6.10 It is important to recognise potential linkages between the topic-specific chapters within this Environmental Statement, whereby effects assessed in each chapter have the potential for secondary effects on any number of other receptors. Examples include:

- Chapter 2: Benthic Subtidal and Intertidal Ecology addresses effects on the benthic habitats and species arising from changes to the physical environment (as described in Chapter 1: Marine Processes);

- Chapter 4: Marine Mammals assesses the effects on marine mammal receptors arising from potential changes in the distribution of fish, which form their principal prey, (as described in Chapter 3: Fish and Shellfish Ecology); and
 - Chapter 6: Commercial Fisheries assesses the effects on commercial fisheries receptors arising from potential impacts on commercial species of fish and shellfish as a result of a combination of effects caused by EMF, suspended sediments, habitat alteration/loss and underwater noise impacts.
- 12.6.11 Where such linked relationships arise these have been fully assessed within the individual topic chapters. This chapter on inter-related effects therefore summarises the consideration of these inter-related effects on linked receptors already set out in the preceding, topic specific chapters.

Stage 4: Assessment of inter-related effects on each receptor group

- 12.6.12 Individual effects on each of the key receptors were identified across the three project phases (i.e., project lifetime effects) as well as the interaction of multiple effects on a receptor (i.e., receptor-led effects), as defined in Table 12.5. This information has been presented within the assessment tables in this chapter (see Table 12.6 to Table 12.15).
- 12.6.13 It is important to note that the inter-related effects assessment considers only effects produced by Project Two and not from other projects which are considered within the cumulative impact assessment sections of each topic chapter.

Table 12.5 Definitions of project lifetime and receptor-led inter-related effects.

Effect Type	Definition
Project lifetime effects	Assessment of the scope for effects that occur throughout more than one phase of the project, (construction, operation and maintenance and decommissioning) to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g., underwater noise effects from construction piling, operational turbines, vessels and decommissioning).
Receptor-led effects	Assessment of the scope for multiple effects to interact to create inter-related effects on a receptor. As an example, multiple effects on a given receptor such as benthic habitats (e.g., direct habitat loss or disturbance, sediment plumes, scour, jack-up vessel use etc.) may interact to produce a different or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

- 12.6.14 The significance of the individual effects, as defined in the topic specific chapters, is presented in the assessment tables for each receptor group (all conclusions for significance of effect for impacts defined in the topic chapters assume successful implementation of mitigation measures where appropriate, i.e., the residual effect has been used). A descriptive assessment of the scope for these individual effects to interact to create a different or greater effect is then undertaken. This assessment incorporates qualitative and, where reasonably possible, quantitative assessments. The assignment of significance of effect to any such inter-related effect is not undertaken, rather, any inter-related effects that may be of greater significance than the individual effects acting in isolation on a given receptor are identified and discussed within this chapter.
- 12.6.15 The inter-related effects assessment ensures that the maximum significant adverse effects for the project (i.e., the maximum adverse scenarios) are presented, noting that individual effects may not be significant but could become significant when their inter-related effect is assessed. Effects of negligible significance or greater (minor, moderate, major) may occur in only one phase of the project life-cycle (e.g., during construction but not operation and maintenance or decommissioning). Where this is the case, it has been made clear that, as a result, there will be no inter-related effects across the project phases. Effects of negligible significance identified in the individual topic assessments have been included since there is the potential for inter-related effects to increase the level (significance) of effect when considered with other sources.

Assessment of Inter-related Effects

- 12.6.16 For each of the receptor groups listed above, the scope for impacts to these receptors to create project lifetime effects over all the project phases and/or receptor-led effects through interacting together on the receptor group in question has been explored and discussed in the following sections.

Physical Environment

Adjacent coastlines to Project Two

- 12.6.17 With respect to physical processes, the only receptor group identified with the potential for inter-related effects are the adjacent Lincolnshire and Norfolk coastlines. The following impacts have been considered within the inter-related effects assessments:
- Changes in sediment transport; and
 - Changes in beach morphology.

12.6.18 Table 12.6 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance and decommissioning of Project Two, and also the inter-related effects (receptor-led effects) that are predicted to arise for adjacent coastlines.

Summary of linked receptor group assessments

12.6.19 As discussed in paragraph 12.6.10, effects on adjacent coastlines as well as on the sediment regime itself, (i.e., from increases in suspended sediment concentrations and sediment deposition above background levels), also have the potential to have secondary effects on other receptors which have been fully assessed in the topic-specific chapters. These receptors and effects are:

- Benthic subtidal and intertidal ecology:
 - potential increases in suspended sediment concentrations and sediment deposition resulting in indirect effects on benthic ecology during construction and decommissioning of minor adverse significance (Chapter 2: Benthic Subtidal and Intertidal Ecology, paragraphs 2.6.54 *et seq.* and 2.6.233 *et seq.*);
 - changes to the wave regime resulting in indirect effects on benthic ecology during operation and maintenance of negligible significance (Chapter 2: Benthic Subtidal and Intertidal Ecology, paragraphs 2.6.161 *et seq.*);
- Fish and shellfish ecology:
 - potential increases in suspended sediment concentrations and sediment deposition resulting in indirect effects of minor adverse significance during construction and decommissioning (Chapter 3: Fish and Shellfish Ecology, paragraphs 3.6.72 *et seq.*, 3.6.97 *et seq.*, 3.6.278 *et seq.* and 3.6.282 *et seq.*);
- Marine mammals:
 - potential increases in suspended sediment concentrations resulting in indirect effects of negligible significance across all project phases (Chapter 4: Marine Mammals, paragraphs 4.6.279 *et seq.*, 4.6.352 *et seq.* and 4.6.407 *et seq.*); and
- Marine archaeology:
 - sediment deposition resulting in indirect effects during construction of negligible significance (Chapter 9: Marine Archaeology, paragraphs 9.6.62 *et seq.*).

Table 12.6 Summary of potential inter-related effects on adjacent coastlines (to Project Two) from individual effects occurring across all phases of the project (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Adjacent Coastlines (to Project Two)				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Changes in the wave regime		Negligible ¹		Potential impacts on adjacent shorelines due to changes in wave regime produced via the interaction of waves with installed project infrastructure (foundations) will only occur in the operation and maintenance phase of the project and as such, no inter-related effects across the project phases are predicted.
Changes in sediment transport and/or beach morphology	Negligible ²	Negligible ³	Negligible ⁴	Potential impacts on the shoreline due to landfall works, such as disruption to sediment transport and changes to beach morphology, will initially arise in the construction phase and then in the decommissioning phase. However, there is also scope for additional impacts during the operation and maintenance phase, however, due to the mitigation measures proposed to bury the cable to sufficient depths to ensure the cable remains buried for the lifetime of the project, these effects have been assessed as negligible in isolation. The scope for a project lifetime inter-related effect is limited as these potential effects will occur as discrete events, of short duration, separated by large periods of time. Therefore, across the project lifetime, the effects on adjacent coastline are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
				Receptor-led effects
	<p>Potential exists for spatial and temporal interactions to arise at the export cable landfall site through a combination of changes in the wave regime and changes in sediment transport and/or beach morphology.</p> <p>The programme of works in the intertidal could take place in up to four phases over a duration of up to five sequential years (limited to duct and cable installation works taking place between April and September). As such, there is potential that foundations may be present within Subzone 2 at the point at which landfall works take place. This leads to the potential for operation and maintenance phase changes to the wave regime to coincide with the timing of the cable installation works at the landfall. However, given the short duration and localised nature of changes to suspended sediment concentrations arising from the landfall works and the predicted negligible effects of changes to the wave climate at the shoreline, it is not considered that there will be any greater impact on the shoreline than that assessed within the individual assessment presented above. As the cable burial depth will be designed to ensure that the cable remains buried for the full lifetime of the project it is concluded that there is no scope for potential impacts from this source to interact with any potential effects associated with changes to the wave regime that may occur due to the operational presence of structures within the subzone. As such, these potential effects are not likely to interact in a way that will result in an effect of any greater significance on the shoreline at the landfall site above that predicted for each individual effect (i.e., negligible significance).</p>			

Paragraph references below are to Chapter 1: Marine Processes.

1. Change in wave regime due to presence of project infrastructure (see paragraphs 1.6.222 to 1.6.240).
2. Installation of export cable at landfall site (see paragraphs 1.6.170 to 1.6.195).
3. Operational presence of export cable at landfall (see paragraphs 1.6.286 to 1.6.293).
4. Removal of export cable at landfall site (see paragraphs 1.6.312 to 1.6.314).

Biological Environment

Benthic subtidal and intertidal ecology

- 12.6.20 For benthic subtidal and intertidal ecology, the following impacts have been considered within the following inter-related assessments:
- Temporary or long term loss or alteration of benthic habitat;
 - Increases in suspended sediment concentration (leading to plume effects and smothering);
 - Contamination due to accidental release of pollutants and re-suspension of contamination from sediments;
 - Colonisation of new hard substrate by epifaunal species;
 - Introduction of non-indigenous species; and
 - Redistribution of fishing pressure.
- 12.6.21 Table 12.7 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for benthic ecology receptors.

Summary of linked receptor group assessments

- 12.6.22 As discussed in paragraph 12.6.10, effects on benthic subtidal and intertidal receptors also have the potential to have secondary effects on other receptors which are fully considered in the topic-specific chapters. These receptors and effects are:
- Fish and shellfish ecology:
 - temporary or long term habitat loss resulting in indirect effects of minor adverse significance (Chapter 3: Fish and Shellfish Ecology, paragraphs 3.6.48 *et seq.*); and
 - Ornithology:
 - changes in prey availability as a result of loss/alteration of subtidal benthic habitats resulting in indirect effects on ornithological receptors of minor adverse significance (Chapter 5: Ornithology, paragraphs 5.6.155 *et seq.*). Changes in prey availability as a result of loss/alteration of intertidal benthic habitats arising from cable installation works at the landfall site are assessed in Volume 3, Chapter 4: Intertidal Ornithology and subsequent inter-related effects are considered in Volume 3, Chapter 12: Inter-related Effects (Onshore).

Table 12.7 Summary of potential inter-related effects on benthic and intertidal ecology from individual effects occurring across all phases of the project (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Benthic and Intertidal Ecology				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Temporary or long term loss or alteration of benthic habitats	Minor adverse ¹	Negligible to minor adverse ²	Negligible to minor adverse ³	When habitat loss or alteration is considered additively across all phases, although the total area of habitat affected is larger, the habitats affected are widespread and are of low to medium sensitivity to disturbance of this nature. Furthermore, all benthic habitats are predicted to recover within a maximum of five years. Therefore, across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increases in suspended sediment concentration (leading to plume effects and smothering)	Minor adverse ⁴		Minor adverse ⁵	As the majority of the seabed disturbance (resulting in highest suspended sediment concentrations/deposition) will occur during the construction and decommissioning phases, with minimal disturbance likely from potential cable reburial (if required) during operation, the interaction across the project life-cycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases.
Contamination due to accidental release of pollutants	Negligible to Minor adverse ⁶	Minor adverse ⁶	Negligible to Minor adverse ⁶	The likelihood for project lifetime inter-related impacts to arise is low given the mitigation measures that will be applied throughout the various project stages (i.e., a Project Environmental Management and Monitoring Plan (PEMMP) during operation and maintenance, a Code of Construction Practice (CoCP) during construction and a Decommissioning Programme during decommissioning) which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Re-suspension of contamination from sediments	Negligible to Minor adverse ⁷		Negligible to Minor adverse ⁸	The majority of sediment disturbance will occur during the construction and decommissioning phases, with minimal disturbance expected from potential cable reburial (should this be required) during operation. Given the low level of offshore sediment contamination, all of the potential residual effects for each phase of the project were deemed not significant. Therefore, across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Colonisation of new hard substrate by epifaunal species		Negligible ⁹		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Introduction of non-indigenous species		Minor adverse ⁹		Although the operation of construction/decommissioning vessels in the area (potentially from countries of origin other than the UK) may facilitate the spread of non-indigenous species across all phases, this effect will predominantly arise during the operational phase as non-indigenous species will require the hard substrate to be in place to provide substrate on which to settle. Therefore, any additional inter-related effect is judged to be of no greater significance than the operational phase effect assessed.

Benthic and Intertidal Ecology				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Redistribution of fishing pressure		Negligible to minor beneficial ¹⁰		Although construction safety zones may result in temporary, localised displacement of fisheries from Subzone 2, this effect will mainly arise during the operational phase as a result of 500 m operational safety zones and as a result of logistical and safety reasons due to the physical presence of the Subzone 2 infrastructure. Although the effect will gradually increase as more of Project Two is constructed, the effect would be fully reversible upon decommissioning and no significant inter-related effects across the project phases are predicted.
				Receptor-led effects
<p>Potential exists for spatial and temporal interactions between the effects arising from habitat loss/disturbance/alteration, increased suspended sediment concentrations, sediment deposition, and contamination effects on benthic habitats during the lifetime of Project Two. As effects associated with the introduction of new hard substrate are highly spatially localised and temporally restricted to the operation phase, the potential for interaction with other effects is deemed unlikely.</p> <p>Therefore, based on current understanding, and expert knowledge, the greatest potential for inter-related impacts is predicted to arise through the following:</p> <ul style="list-style-type: none"> a) the interaction of direct (both temporary and permanent) habitat loss /disturbance from foundation installation/jacking-up/anchor placement/scour and indirect habitat loss due to sediment deposition; and b) the interaction of contamination due to accidental release of pollutants and re-suspension of contaminants from sediments. <p>With respect to interaction (a), these individual impacts were assigned a significance of negligible or minor adverse as standalone impacts and although potential combined impacts may arise (i.e., spatial and temporal overlap of direct habitat disturbance), it is predicted that this will not be any more significant than the individual impacts in isolation. This is because the combined amount of habitat potentially affected would be very limited (typically restricted to Subzone 2), the biotopes affected are widespread across the southern North Sea and, where temporary disturbance occurs, full recovery of the benthos is predicted. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.</p> <p>With respect to interaction (b), the likelihood for accidental release of contaminants is low in both the offshore and intertidal environments given the mitigation measures proposed across each phase of the development. Levels of contamination in offshore sediments were found to be relatively low and in both the offshore and intertidal environments, the potential for the dispersion and dilution of contaminants is predicted to be high. These impacts were assigned a significance of negligible or minor adverse as standalone impacts and it is concluded that the significance of effect produced by these interactions will be no greater than the individual effects assessed in isolation (i.e., negligible to minor adverse).</p>				

Paragraph references below are to Chapter 2: Benthic Subtidal and Intertidal Ecology.

1. Installation of foundations, scour protection and disposal of drill arisings / spoil, installation of cables and cable protection, anchor and spud can impacts from vessels (paragraphs 2.6.17 to 2.6.53).
2. Presence of foundations, scour protection, drill arisings, cable protection (see paragraphs 2.6.136 to 2.6.147) and potential cable reburial (if required), anchor and spud can impacts from vessels involved in maintenance (paragraphs 2.6.180 to 2.6.192).
3. Removal of project structures, cables and cable protection and anchor and spud can impacts from vessels (paragraphs 2.6.224 to 2.6.232).
4. Installation of cables and foundations (including, seabed preparation and disposal of drill arisings) (paragraphs 2.6.54 to 2.6.96).

5. Removal of project structures and cables (paragraphs 2.6.233 to 2.6.241).
6. Accidental release from construction and installation vessels/vehicles during: construction (paragraphs 2.6.115 to 2.6.135); operation and maintenance (paragraphs 2.6.193 to 2.6.209); and decommissioning (paragraphs 2.6.257 to 2.6.259).
7. Installation of foundation structures (including sea bed preparation and disposal of drill arisings) and cable laying (paragraphs 2.6.97 to 2.6.114).
8. Removal of project structures (paragraphs 2.6.244 to 2.6.249).
9. Presence of foundations, scour protection and cable protection (paragraphs 2.6.148 to 2.6.160).
10. Implementation of 500 m operational safety zones around offshore substations and physical presence of Subzone 2 infrastructure (paragraphs 2.6.210 to 2.6.223).

Fish and Shellfish Ecology

12.6.23 For fish and shellfish ecology, the following impacts have been considered within the inter-related assessment:

- Temporary or long term loss of fish and shellfish habitats, including feeding, spawning and nursery habitats;
- Increases in suspended sediment concentration (leading to plume effects and smothering);
- Underwater noise leading to injurious and behavioural impacts on fish and shellfish receptors;
- Introduction of hard substrates creating new reef habitat;
- Electromagnetic field (EMF) emissions leading to behavioural effects;
- Redistribution of fishing pressure; and
- Contamination due to accidental release of pollutants and re-suspension of contamination from sediments.

12.6.24 Table 12.8 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance phase, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for fish and shellfish receptors.

Summary of linked receptor group assessments

12.6.25 As discussed in paragraph 12.6.10, effects on fish and shellfish ecology also have the potential to have secondary effects on other receptors and these effects are fully considered in the topic-specific chapters. These receptors and effects are:

- Marine mammals:
 - change in distribution/abundance of prey species resulting in indirect effects on marine mammal receptors of minor adverse significance (Chapter 4: Marine Mammals, paragraphs 4.6.289 *et seq.*, 4.6.382 *et seq.* and 4.6.411 *et seq.*);
- Ornithology:
 - loss/change in distribution of prey resources resulting in indirect effects on ornithological receptors of negligible or minor adverse significance (Chapter 5: Ornithology, paragraphs 5.6.344 *et seq.*);

- Commercial fisheries:
 - potential impacts to commercially fished species of fish and shellfish resulting in indirect effects of minor adverse significance on fishing fleets (Chapter 6: Commercial Fisheries, paragraphs 6.6.70 *et seq.*, 6.6.139 *et seq.* and 6.6.175 *et seq.*).

Table 12.8 Summary of potential inter-related effects on fish and shellfish ecology from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Fish and Shellfish Ecology				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Temporary or long term loss of fish and shellfish habitats, including feeding, spawning and nursery habitats	Minor adverse ¹	Negligible ²	Minor adverse ³	When habitat loss (temporary and long term) or alteration is considered additively across all phases of the project, although the total area of potential fish/shellfish spawning, feeding and nursery habitat affected is larger, similar habitats are widespread within the southern North Sea. Furthermore, the majority of disturbance during the operation and maintenance phase will be highly localised with little repeat disturbance and the habitats affected are predicted to recover. Therefore, across the project lifetime, the effects on fish and shellfish receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increases in suspended sediment concentration (leading to plume effects and smothering)	Minor adverse ⁴		Minor adverse ⁵	Project lifetime inter-related effects are unlikely as the majority of seabed disturbance (resulting in highest suspended sediment concentrations/deposition) will be during the construction and decommissioning phases with minimal disturbance likely from any potential cable reburial that may be required during the operation and maintenance phase. Receptors and associated spawning/nursery habitats potentially affected by increased suspended sediment concentrations and deposition will have recovered in the intervening period between the construction and decommissioning phases. Therefore, across the project lifetime, the effects on fish and shellfish receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Underwater noise leading to injurious and behavioural impacts on fish and shellfish receptors	Minor adverse ⁶	Negligible ⁷	Negligible ⁸	The majority of disturbance from underwater noise (resulting in greatest potential for injury or behavioural effects) is predicted to result from piling during the construction phase. Noise associated with the operation and maintenance and decommissioning phases was assessed to result in effects of negligible significance with little potential for physiological damage or behavioural effects to fish and shellfish. Therefore, across the project lifetime, the effects on fish and shellfish receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Introduction of hard substrates creating new reef habitat		Minor beneficial ⁹		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
EMF emissions leading to behavioural effects		Minor adverse ¹⁰		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Redistribution of fishing pressure		Negligible to minor beneficial ¹¹		Although construction safety zones may result in temporary, localised displacement of fisheries particularly from Subzone 2, this effect will mainly arise during the operation and maintenance phase as a result of 500 m operational safety zones and as a result of logistical and safety reasons due to the physical presence of the Subzone 2 infrastructure. As such there will be no inter-related effects across the project phases.

Fish and Shellfish Ecology

Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Contamination due to accidental release of pollutants	Negligible to minor adverse ¹²	Minor adverse ¹²	Negligible to minor adverse ¹²	The likelihood for project lifetime inter-related impacts to arise is low given the mitigation measures that will be applied throughout the various project stages (i.e., PEMMP, CoCP and Decommissioning Programme) which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on fish and shellfish receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Re-suspension of contamination from sediments	Negligible to minor adverse ¹³		Negligible to minor adverse ¹⁴	The majority of sediment disturbance will occur during the construction and decommissioning phases, with minimal disturbance likely from any potential cable reburial that may be required during the operation and maintenance phase. Given the low level of offshore sediment contamination, all of the potential residual effects for each phase of the project were deemed not significant. Therefore, across the project lifetime, the effects on fish and shellfish receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
				Receptor-led effects
<p>Potential exists for spatial and temporal interactions between habitat loss/disturbance/alteration, increased suspended sediment concentrations, sediment deposition, underwater noise, EMF and contamination effects during the lifetime of Project Two. As effects associated with the introduction of new hard substrate are highly spatially localised and temporally restricted to the operation and maintenance phase, the potential for interaction with other effects is deemed unlikely.</p> <p>Therefore, based on current understanding, and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:</p> <ul style="list-style-type: none"> a) The interaction of habitat loss/change (temporary and long term), increased suspended sediment and underwater noise from piling/drilling during the construction phase; and b) The interaction of contamination due to accidental release of pollutants and re-suspension of contaminants from sediments. <p>With respect to interaction (a), these individual impacts were assigned a significance of negligible or minor adverse as standalone impacts and although potential combined impacts may arise, it is important to recognise that some of the activities potentially resulting in combined effects are mutually exclusive. For example, the majority of effects associated with an increase in suspended sediment concentrations and deposition will arise from seabed preparation works for gravity base foundation installation, whereas the majority of noise effects will arise from foundation piling for monopiles or jackets. As these two activities are unlikely to occur concurrently there is little scope for temporal interaction and, therefore, inter-related effects of noise and suspended sediment will more likely arise from activities such as cable installation and sandwave clearance which are predicted to result in much lower increases in suspended sediments. Furthermore, underwater noise (should piling occur) will result in the displacement of mobile fish from areas around foundations which in turn will mean that these species will not be exposed to the greatest predicted increases in suspended sediment concentrations. Therefore effects of greater significance than the individual impacts in isolation (i.e., negligible to minor adverse) are not predicted.</p> <p>With respect interaction (b), the likelihood for accidental release of contaminants is low given the controls that will be applied (e.g., implementation of a CoCP, PEMMP and Decommissioning Programme). In addition, the recorded level of offshore sediment contamination has been found to be unlikely to result in adverse biological effects. As such, with the appropriate measures in place, it is concluded that the significance of effect will be no greater than the individual effects assessed in isolation within the individual assessments (i.e., negligible to minor adverse).</p>				

Paragraph references below are to Chapter 3: Fish and Shellfish Ecology.

1. Installation of foundations, scour protection and disposal of drill arisings / spoil, installation of cables and cable protection, anchor and spud can impacts from vessels (paragraphs 3.6.48 to 3.6.71).
2. Presence of foundations, scour protection, drill arisings, cable protection (see paragraphs 3.6.171 to 3.6.182) and potential cable reburial (if required), anchor and spud can impacts from vessels involved in maintenance (paragraphs 3.6.232 to 3.6.242).
3. Removal of project structures, cables and cable protection and anchor and spud can impacts from vessels (paragraphs 3.6.274 to 3.6.277).
4. Installation of cables and foundations (including, seabed preparation and disposal of drill arisings) (paragraphs 3.6.72 to 3.6.196).
5. Removal of project structures and cables (paragraphs 3.6.274 to 3.6.277).
6. Installation of foundation structures (piling) for turbines/substations and cable laying (paragraphs 3.6.113 to 3.6.137).
7. Presence of operational turbines (paragraphs 3.6.183 to 3.6.195).
8. Removal of project structures (paragraphs 3.6.286 to 3.6.293).
9. Presence of foundations, scour protection and cable protection (paragraphs 3.6.196 to 3.6.212).
10. Presence of inter-array, inter-connector and export cables (paragraphs 3.6.213 to 3.6.231).
11. Operational safety zones and restrictions due to logistical/safety constraints (paragraphs 3.6.254 to 3.6.273).
12. Accidental release from construction and installation vessels/vehicles during: construction (paragraphs 3.6.154 to 3.6.170); operation and maintenance (paragraphs 3.6.243 to 3.6.253); and decommissioning (paragraphs 3.6.319 to 3.6.323).
13. Installation of foundation structures (including sea bed preparation and disposal of drill arisings) and cable laying (paragraphs 3.6.138 to 3.6.153).
14. Removal of project structures (paragraphs 3.6.298 to 3.6.307).

Marine Mammals

- 12.6.26 For marine mammals, the following impacts have been considered within the inter-related assessment:
- Underwater noise leading to physical injury and/or behavioural disturbance;
 - EMF emissions leading to behavioural effects;
 - Increases in suspended sediment concentrations leading to a reduction in foraging ability;
 - Increased vessel traffic leading to vessel strikes (collision); and
 - Accidental pollution leading to effects on marine mammals.
- 12.6.27 Table 12.9 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for marine mammal receptors.

Summary of linked receptor group assessments

- 12.6.28 As discussed in paragraph 12.6.10, marine mammals and fish and shellfish ecology are linked receptor groups and the inter-related effects associated with a change in the distribution and/or abundance of prey species for marine mammals across each phase of the project has been fully assessed in Chapter 4: Marine Mammals (paragraphs 4.6.289 *et seq.*, 4.6.373 *et seq.* and 4.6.397 *et seq.*), with effects of minor adverse significance predicted during the construction phase and effects of negligible significance predicted during the operation and maintenance and decommissioning phases.

Table 12.9 Summary of potential inter-related effects on marine mammals from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Marine Mammals				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Underwater noise leading to physical injury and/or behavioural disturbance	Minor * to moderate adverse** ¹	Negligible ²	Minor adverse ³	Underwater noise will be produced at all stages of the project, from piling and vessel noise during construction, to operation and maintenance vessel noise and activity in the operation and maintenance phase. Although moderate adverse effects (i.e., significant in EIA terms) are predicted in the short to medium term for harbour porpoise and minor to moderate adverse effects are predicted for minke whale as a result of piling in Subzone 2 during construction, the piling events will be temporally discrete and intermittent throughout this phase. Full recovery is predicted for all species in the long term, therefore the negligible effects associated with operational noise are not predicted to increase the level of significance over the whole project lifetime. Furthermore, due to the temporal separation of the noise associated with construction and decommissioning the effects on marine mammals across the project lifetime are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
EMF emissions leading to behavioural effects		Negligible ⁴		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Increases in suspended sediment concentrations leading to a reduction in foraging ability	Negligible ⁵	Negligible ⁶	Negligible ⁷	Project lifetime inter-related effects are unlikely as the majority of disturbance (resulting in highest suspended sediment concentrations/deposition) will be during the construction and decommissioning phases with minimal disturbance likely from potential cable reburial (if required) during the operation and maintenance phase. Due to the short temporal nature of increases in suspended sediment concentrations at each stage of the project and the rapid dispersion of sediments, the effects on marine mammals across the project lifetime are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increased vessel traffic leading to vessel strikes (collision)	Minor adverse ⁸	Minor adverse ⁸	Minor adverse ⁸	The potential for vessel strikes will arise at all stages of the project, resulting in a potential project lifetime effect. However, it is not predicted that the significance of any potential vessel strikes will increase due to the interaction of this impact across all project stages, rather be maintained at the same level throughout the project (with resultant minor adverse significance prediction). Therefore, across the project lifetime, the effects on marine mammals are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Accidental pollution leading to effects on marine mammals	Negligible ⁹	Negligible ⁹	Negligible ⁹	The likelihood for project lifetime inter-related impacts to arise is low given the mitigation measures that will be applied throughout the various project stages (i.e., a CoCP, PEMMP and Decommissioning Programme) which will ensure that the risk of interaction of such effects through time is limited. Therefore, overall, across the project lifetime, the effects on marine mammal receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Marine Mammals				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Loss of and/or contamination of prey resources for marine mammals	Minor adverse ¹⁰	Negligible ¹⁰	Negligible ¹⁰	Impacts to fish and shellfish receptors will not result in an on-going, additive loss of prey, rather an initial loss during the construction phase (i.e., from underwater noise impacts, temporary habitat loss etc.), followed by recovery of areas, leading to no large-scale and long-term loss of prey items. The implementation of a CoCP during construction, a PEMMP in the operation and maintenance phase and a Decommissioning Programme during decommissioning means that the likelihood of accidental spillages will be low. Therefore, the significance of this inter-related effect is not predicted to increase over and above the predictions made for the individual project phases.
				Receptor-led effects
<p>Potential exists for spatial and temporal interactions between underwater noise, EMF, increased suspended sediment concentrations, contamination effects and changes/disturbance of prey resources during the lifetime of Project Two. As effects associated with EMF are highly spatially localised to the immediate vicinity of the cable and are temporally restricted to the operation and maintenance phase, the potential for interaction with other effects is deemed unlikely.</p> <p>The greatest scope for interaction of different effects on marine mammals is during the construction phase, when the most significant impact to marine mammals (i.e., underwater noise from piling) is likely to interact with other impacts. Therefore, based on current understanding, and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:</p> <p>a) The interaction of noise, increased suspended sediments, increased vessel traffic (and collision risk) and disturbance /change to prey species abundance and distribution during the construction phase affecting marine mammals.</p> <p>With respect to interaction (a), with the exception of underwater noise on harbour porpoise and minke whale, these individual impacts were assigned a significance of negligible or minor adverse as standalone impacts and although combined impacts may arise it is important to recognise that some of the activities potentially resulting in combined effects are mutually exclusive and therefore will not interact to produce effects of greater significance. For example, the largest increases in suspended sediment concentrations will, on the whole, arise from seabed preparation works for gravity base foundation installation, whereas the greatest noise effects will arise from foundation piling for monopiles or jackets. As these two activities are unlikely to occur concurrently there is little scope for temporal interaction of the effects and, therefore, inter-related effects of noise and suspended sediment are more likely to arise from activities such as cable installation and sandwave clearance which are predicted to result in much lower increases in suspended sediments thereby reducing the combined effect. Furthermore, underwater noise (should piling occur) will result in the displacement of marine mammals from Subzone 2 which will, in turn, mean that these species will not be exposed to the greatest predicted increases in suspended sediment concentrations and will also be displaced from the areas of highest vessel traffic within Subzone 2. Although displacement effects for marine mammals is unlikely to occur due to installation of the export cable which might increase the potential for the interaction of effects associated with suspended sediments, these effects will be short lived and localised along the cable route corridor. A situation may also arise where any potential disturbance to prey species is offset by the fact that as marine mammals are displaced from areas around piling, the fish that form part of their diet may also be displaced, thus remaining available for marine mammal feeding. Therefore, it is predicted that the interaction of these impacts may act, to some extent, to counter certain potential effects occurring and so effects of greater significance than the individual impacts in isolation are not predicted for marine mammals (i.e., negligible to moderate adverse for cetaceans and negligible to minor adverse for pinnipeds).</p>				

* White-beaked dolphin, grey seal and harbour seal.

** Harbour porpoise and minke whale.

Paragraph references below are to Chapter 4: Marine Mammals.

1. Installation of turbine and offshore substation foundation structures (piling) (paragraphs 4.6.201 to 4.6.247) and vessel noise (paragraphs 4.6.248 to 4.6.265).
2. Operational turbines (paragraphs 4.6.317 to 4.6.331) and vessel noise (paragraphs 4.6.332 to 4.6.342).
3. Removal of project structures (paragraphs 4.6.397 to 4.6.404).
4. Presence of inter-array, inter-connector and export cables (paragraphs 4.6.358 to 4.6.372).
5. Installation of cables and foundations (including, seabed preparation and disposal of drill arisings) (paragraphs 4.6.266 to 4.6.278).
6. Cable maintenance activities (paragraphs 4.6.352 to 4.6.357).
7. Removal of project structures and cables (paragraphs 4.6.397 to 4.6.405).
8. Vessel activity during construction phase (paragraphs 4.6.248 to 4.6.265), operation and maintenance phase (paragraphs 4.6.332 to 4.6.342) and decommissioning phase (paragraphs 4.6.405 to 4.6.406).
9. Accidental release from construction and installation vessels/vehicles during construction (paragraphs 4.6.289 to 4.6.298); operation and maintenance (paragraphs 4.6.373 to 4.6.381); and decommissioning (paragraphs 4.6.409 to 3.6.410).
10. Impacts to fish and shellfish receptors as marine mammal prey during construction (paragraphs 4.6.299 to 4.6.316), operation and maintenance (paragraphs 4.6.382 to 4.6.396) and decommissioning (paragraphs 4.6.411 to 4.6.413).

Ornithological Receptors

- 12.6.29 A total of 13 valued ornithological receptors (VORs) were identified within Chapter 5: Ornithology and taken through formal ornithological impact assessment. These are fulmar, gannet, Arctic skua, great skua, little gull, lesser black-backed gull, great black-backed gull, , kittiwake, common tern, Arctic tern, guillemot, razorbill and puffin.
- 12.6.30 For these ornithological receptors, the following impacts have been considered within the following inter-related assessments:
- Disturbance and displacement from foraging areas as a result of vessel activity;
 - Direct habitat loss and indirect loss of prey items;
 - Displacement due to presence of turbines;
 - Mortality via collision with turbines blades;
 - Barrier effects preventing clear transit of birds between foraging and breeding sites, or on migration;
 - Attraction to lit structures by migrating birds in particular may cause disorientation, reduction in fitness and possible mortality; and
 - Accidental pollution leading to effects on ornithological receptors.
- 12.6.31 Table 12.10 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for the 13 VORs.
- 12.6.32 Impacts on ornithological receptors at the landfall site (i.e., in the intertidal) are assessed in Volume 3, Chapter 4: Intertidal Ornithology and subsequent inter-related effects on these receptors are considered in Volume 3, Chapter 12: Inter-related Effects (Onshore).

Summary of linked receptor group assessments

- 12.6.33 As discussed in paragraph 12.6.10, ornithological receptors and fish and shellfish receptors are linked and the inter-related effects associated with a change to the prey resources of ornithological receptors has been fully assessed in Chapter 5: Ornithology (paragraphs 5.6.141 *et seq.*, 5.6.344 *et seq.*, 5.6.522 *et seq.*, and 5.6.525 *et seq.*), with effects of negligible to minor adverse significance predicted for all project phases.

Table 12.10 Summary of potential inter-related effects on ornithological receptors from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Ornithological Receptors				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Disturbance and displacement from foraging areas as a result of vessel activity	Negligible to minor adverse ¹	Negligible to minor adverse ²	Negligible to minor adverse ³	Vessel activity in any one given year will be at its peak in the construction phase, reducing in the operation and maintenance phase as major installation vessels leave the site leaving smaller numbers of predominantly smaller crew and supply vessels operating each year. Since impacts on individuals will be intermittent and likely to be relatively brief during all phases these effects are not predicted to be significant. This will result in birds that were subject to disturbance effects during the construction phase returning to the site in the operation and maintenance phase. Overall, across the project lifetime, the effects on ornithological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Direct habitat loss and indirect loss of prey items	Negligible to minor adverse ⁴	Negligible to minor adverse ⁵	Negligible to minor adverse ⁵	Impacts to prey items (i.e., fish and shellfish) will occur predominantly during the construction phase as a result of effects associated with underwater noise from piling, increased suspended sediments and habitat loss. Impacts during the operation and maintenance phase will be limited to changes to physical processes, however, beneficial effects to prey may also arise from a potential reduction in fishing pressure within Subzone 2. The ornithological species demonstrate a high degree of habitat/prey flexibility. Therefore, across the project lifetime, the effects on ornithological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Displacement due to presence of turbines		Negligible to minor adverse ⁶		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Mortality via collision with turbines blades		Negligible to minor adverse ⁷		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Barrier effects preventing clear transit of birds between foraging and breeding sites, or on migration		Negligible to minor adverse ⁸		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Attraction to lit structures by migrating birds in particular may cause disorientation, reduction in fitness and possible mortality		Negligible to minor adverse ⁹		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Accidental pollution leading to effects on ornithological receptors	Negligible to minor adverse ¹⁰	Negligible to minor adverse ¹⁰	Negligible to minor adverse ¹⁰	The likelihood for project lifetime inter-related impacts to arise is low given the mitigation measures that will be applied throughout the various project stages (i.e., a CoCP, PEMMP and a Decommissioning Programme) which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on ornithological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Ornithological Receptors				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
				Receptor-led effects
	<p>Potential exists for spatial and temporal interactions between vessel disturbance, changes to prey, accidental pollution, collision effects, displacement and barrier effects during the lifetime of Project Two. Based on current understanding and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:</p> <ul style="list-style-type: none"> a) The interaction of vessel activity, loss/displacement of prey species and loss of loafing/foraging habitat during the construction phase; and b) The interaction of collision, displacement and barrier effects from the operational turbines. <p>With regards to interaction (a), although there are relatively high peak abundances for some species within the survey area compared to regional populations, it is likely that only birds in close proximity to construction activities will be affected intermittently, over a short-term period. For the potential loss/displacement of prey species, a situation may arise where any loss/displacement of prey items is offset by the fact that, if birds are displaced by construction activities, the fish that form part of their diet may also be displaced. Therefore, the interaction of these impacts may act, to some extent, to counter certain potential effects occurring. As such, effects of greater significance than the individual impacts in isolation (i.e., negligible to minor adverse) are not predicted during the construction phase.</p> <p>With regards to interaction (b), mortality arising from collisions and also from operational displacement are mutually exclusive as a species cannot simultaneously exhibit a high level of avoidance (displacement) and a high level of collision risk. Therefore quantification of inter-related effects is not easily achievable, for example by summing predicted mortality rates for each impact. Whilst impacts may interact for some species, this would not be in such a way as to increase the significance of any of the individual effect significances (i.e., negligible to minor adverse).</p> <p>The potential for receptor-led impacts on populations of non-seabird migrants (i.e., waders and wildfowl), arising from the interaction of offshore collision risk and onshore (intertidal) disturbance, temporary loss of habitats and foraging impacts has also been considered and is assessed in full in Volume 3, Chapter 12: Inter-related Effects (Onshore). Collision mortality numbers for each species were predicted to be very low and it is not anticipated that these impacts will interact in such a way as to increase any of the individual significances of effect (assessed as negligible to minor adverse, as presented within Chapter 5: Ornithology and Volume 3, Chapter 4: Intertidal Ornithology).</p>			

Paragraph references below are to Chapter 5: Ornithology.

1. Construction vessel activity and underwater noise (paragraphs 5.6.98 to 5.6.171).
2. Maintenance activities as well as vessel and helicopter trips to and from the site and accommodation platforms (paragraphs 5.6.494 to 5.6.502).
3. Decommissioning vessel activity and underwater noise (paragraph 5.6.517 to 5.6.524).
4. Direct habitat loss and indirect effects on prey items during construction (see paragraphs 5.6.172 to 5.6.199).
5. Impacts to fish and shellfish during the operation and maintenance phase (see paragraphs 5.6.344 to 5.6.352) and decommissioning phase (see paragraphs 5.6.525 to 5.6.526).
6. Presence of operational turbines (paragraphs 5.6.224 to 5.6.343).
7. Presence of operational turbines with rotating blades (paragraphs 5.6.353 to 5.6.460).
8. Physical presence of turbines and ancillary structures (paragraphs 5.6.461 to 5.6.479).
9. Presence of lighting on operational turbines (paragraphs 5.6.480 to 5.6.493).
10. Vessel activity during construction (paragraphs 5.6.98 to 5.6.140), operation and maintenance (paragraphs 5.6.494 to 5.6.502) and decommissioning phases (paragraphs 5.6.517 to 5.6.521).

Human Environment

Commercial Fisheries

12.6.34 For commercial fisheries, the following impacts have been considered within the inter-related assessment:

- Reduction in access to, or exclusion from, potential and/or established fishing grounds within Subzone 2;
- Reduction in access to, or exclusion from, potential and/or established fishing grounds within the export cable route corridor;
- Displacement from Subzone 2 leading to gear conflict and increased fishing pressure on adjacent grounds;
- Displacement from the offshore export cable route corridor leading to gear conflict and increased fishing pressure on adjacent grounds;
- Displacement or disruption of commercially important fish and shellfish resources;
- Longer steaming distances to alternative fishing grounds;
- Increased vessel traffic leading to interference with fishing activity;
- Gear snagging and obstruction due to seabed objects/ deposits within Subzone 2; and
- Gear snagging and obstruction due to seabed objects/ deposits within the export cable route corridor.

12.6.35 Table 12.11 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for commercial fisheries receptors.

Summary of linked receptor group assessments

12.6.36 As discussed in paragraph 12.6.10, commercial fisheries and fish and shellfish (i.e., those that are targeted commercial species) are linked receptors and the inter-related effects associated with a change to the targeted species of commercial fisheries has been fully assessed in Chapter 6: Commercial Fisheries (paragraphs 6.6.70 *et seq.*, 6.6.139 *et seq.* and 6.6.175 *et seq.*), with effects of minor adverse significance predicted for all project phases.

Table 12.11 Summary of potential inter-related effects on commercial fisheries from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Commercial Fisheries				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Reduction in access to, or exclusion from, potential and/or established fishing grounds	Minor adverse ¹	Minor adverse ²	Minor adverse ³	During all phases of the project, safety zones, and therefore the areas from which commercial fishing will be excluded, will be highly localised. During construction, for example, fishing will be excluded from 500 m safety zones around turbines and platforms. During operation, there will be no formal exclusion of fishing activity except for within the 500 m safety zones around platforms and within temporary 500 m roaming safety zones implemented during major maintenance activities. Although the assessment of effects during the operation and maintenance phase assumes 50 m safe operating distances from turbines for commercial fishing vessels, it is likely that fishing will still be possible within Project Two. Furthermore, the disruption to UK potters along the cable route corridor during construction will reduce during the operation and maintenance phase. Therefore, although there will be a small incremental increase in the area in which fishing may be disrupted as the project is built out, as fishing activity is likely to be able to continue, effects on commercial fisheries across the phases are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Displacement from Subzone 2 leading to gear conflict and increased fishing pressure on adjacent grounds	Minor adverse ⁴	Minor adverse ⁵	Minor adverse ⁶	As discussed above, although fishing may be disrupted and partial exclusion may occur during all phases of the project, it is likely that fishing will still be possible within the Project Two area over the lifetime of the project. Therefore, across the project lifetime, the effects on commercial fisheries are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Displacement from the offshore export cable leading to gear conflict and increased fishing pressure on adjacent grounds	Minor adverse ⁷	Minor adverse ⁸	Minor adverse ⁹	The majority of disturbance (resulting in displacement of fisheries) will be during the construction and decommissioning phases with minimal disturbance likely to arise from maintenance activities (from 500 m safety zones for major maintenance activities) during the operation and maintenance phase. The expected level of significance stated for the construction and decommissioning phases is based upon the reduction in access to, or exclusion from fishing grounds only. Therefore, across the project lifetime, the effects on commercial fisheries are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Displacement or disruption of commercially important fish and shellfish resources	Minor adverse ¹⁰	Minor adverse ¹¹	Minor adverse ¹²	Displacement of commercial fish species is most likely to occur during the construction phase where impacts to fish and shellfish are potentially the greatest (i.e., from underwater noise, habitat disturbance and suspended sediments). During the operation and maintenance phase displacement effects will predominantly arise from EMF effects and, as these effects are highly localised (i.e., within metres of the cables), across the project lifetime, the effects on commercial fisheries are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Commercial Fisheries				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Longer steaming distances to alternative fishing grounds	Minor adverse ¹³	Minor adverse ¹⁴	Minor adverse ¹⁵	Any combined increase in steaming times across all phases, to either avoid safety zones or operational turbines, will not be significant due to the limited scale and duration of safety zones and the fact that fishing vessels will be able to steam through the operational site due to the turbine spacing. Even if vessels avoid the whole site (although there will be no formal operational safety zones, with the exception of 500 m safety zones around offshore platforms), the required deviation has been assessed as minor adverse significance. Rather, it is expected that the significance of this effect will be maintained at the same level throughout the project. As such, across the project lifetime, the effects on commercial fisheries are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increased vessel traffic leading to interference with fishing activity	Negligible to minor adverse ¹⁶	Negligible to minor adverse ¹⁶	Negligible to minor adverse ¹⁶	The majority of vessel traffic (resulting in interference with fishing) peaks during construction and decommissioning. However, with the successful implementation of measures adopted for this development (i.e., use of Fisheries Liaison Officers (FLOs), issue of Notices to Mariners (NTMs) and close liaison with the local vessels), no significant inter-related impact is predicted across the project lifetime. As such, across the project lifetime, the effects on commercial fisheries are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Gear snagging and obstruction due to seabed objects/ deposits within Subzone 2		Minor adverse ¹⁷		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Gear snagging and obstruction due to seabed objects/ deposits within the export cable route corridor		Negligible ¹⁸		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.

Commercial fisheries

Receptor-led effects

Potential exists for spatial and temporal interactions between the majority of the impacts outlined above. However, it should be noted that many of the effects will be mitigated through all project phases via use of mitigation measures such as FLOs, on-going communication via issue of NTMs and undertaking a post-construction debris survey. Therefore, based on current understanding and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:

- a) Reduction in access to fishing grounds and the subsequent increased pressure on adjacent grounds; and
- b) The potential for gear snagging and displacement/disruption of commercially important fish and shellfish resources.

With regards to interaction (a), with the exception of during construction and periods of maintenance, there will be no application for safety zones around turbines and there will be no complete exclusions to mobile or static commercial fisheries throughout any part of the offshore cable route corridor. The minimum spacing between turbines is 810 m between rows at the perimeter (878 m within the array) and 1,323 m between columns and consultation with UK and international commercial fisheries fleets has identified that some fleets may opt to fish within Subzone 2, therefore reducing the potential for displacement of fleets into adjacent grounds. Furthermore, although potting vessels may be required to move pots from the offshore cable route corridor during construction, this will occur only temporarily during the construction phase and with sufficient notice together with a guard vessel where appropriate, to facilitate this process. It is therefore, predicted that any inter-related effect will not be of any greater significance than those already assessed in isolation (i.e., **minor to moderate adverse** significance).

With regards to interaction (b), the proposed mitigation measures will reduce the potential for snagging and the disruption/displacement to commercially important fish and shellfish resources is most likely to occur during the construction phase and impacts are predicted to be temporary. It is therefore, predicted that any inter-related effect will not be of any greater significance than those already assessed individually (i.e., **negligible to minor adverse**).

Paragraph references below are to Chapter 6: Commercial Fisheries.

1. Installation of foundation structures, scour protection and cable installation (paragraphs 6.6.18 to 6.6.54).
2. Physical presence of foundations, scour protection and cable protection (paragraphs 6.6.95 to 6.6.110).
3. Removal of project structures (paragraphs 6.6.167 to 6.6.168).
4. Installation of foundation structures, scour protection and cable installation (paragraphs 6.6.70 to 6.6.79).
5. Physical presence of foundations, scour protection, and cable protection (paragraphs 6.6.116 to 6.6.138).
6. Removal of project structures (paragraphs 6.6.169 to 6.6.170).
7. Installation of foundation structures and scour protection for offshore high voltage alternating current (HVAC) reactive compensation substation, and cable installation (paragraphs 6.6.70 to 6.6.85).
8. Presence of offshore cable and cable protection (paragraphs 6.6.131 to 6.6.138).
9. Removal of project structures (paragraphs 6.6.175 to 6.6.176).
10. Installation of foundation structures, scour protection and cable installation (paragraphs 6.6.80 to 6.6.85).
11. Presence of cables (potential EMF impact) (paragraphs 6.6.139 to 6.6.152).
12. Removal of project structures (paragraphs 6.6.177 to 6.6.178).
13. Installation of foundation structures, scour protection (including offshore HVAC reactive compensation station) and cable installation (paragraphs 6.6.86 to 6.6.94).
14. Presence of foundations/ scour protection/ cable protection (paragraphs 6.6.95 to 6.6.115).
15. Removal of project structures (paragraphs 6.6.179 to 6.6.180).
16. Vessel activity during construction (paragraphs 6.6.86 to 6.6.94), operation and maintenance (paragraphs 6.6.158 to 6.6.164) and decommissioning (paragraphs 6.6.179 to 6.6.180).
17. Presence of foundation structures, scour protection and cable installation (paragraphs 6.6.122 to 6.6.130).
18. Presence of foundation structures for HVAC reactive compensation substation, scour protection and cable installation (paragraphs 6.6.131 to 6.6.138).

Shipping and Navigation

12.6.37 For shipping and navigation, the following impacts have been considered within the inter-related assessment:

- Increase in vessel to vessel collision risk;
- Increase in vessel to structures in Subzone 2 collision risk;
- Increased risk of anchor snagging;
- Diminished emergency response capability (including search and rescue (SAR)) within the southern North Sea;
- Diminished pollution and salvage response capability for emergency responders;
- Deviations to commercial shipping routes;
- Increased vessel to oil and gas platform collision risk;
- Increase in vessel to structure (offshore HVAC reactive compensation substations) collision risk; and
- Electromagnetic interference for vessels using magnetic compasses.

12.6.38 Table 12.12 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for shipping and navigation receptors.

Summary of linked receptor group assessments

12.6.39 As discussed in paragraph 12.6.10, effects on shipping and navigation (i.e., increased vessel activity etc.), due to an increase in vessels numbers also has the potential to have direct effects on marine mammals which has been fully assessed in Chapter 4: Marine Mammals (paragraphs 4.6.248 *et seq.*, 4.6.266 *et seq.*, 4.6.332 *et seq.*, 4.6.343 *et seq.* and 4.6.405 *et seq.*), with effects of minor adverse significance predicted across all project phases.

Table 12.12 Summary of potential inter-related effects on shipping and navigation from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Shipping and Navigation				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Increase in vessel to vessel collision risk	Minor adverse ¹	Minor adverse ²	Minor adverse ³	The scale of effects to shipping progressively increases during construction as the wind turbines and ancillary structures are installed and a greater number of vessels are increasingly displaced. However, the designed in mitigation including an advisory safety zone of up to 1 km around Subzone 2 during construction should reduce the likelihood of collision with construction vessels. The designed in mitigation during construction (i.e., 1 km advisory safety zone around Subzone 2 and 500 m safety zones) and additional proposed mitigation during the operation and maintenance phase (e.g., 500 m safety zones around offshore platforms) will ensure the safety of vessels operating in close proximity to the wind farm. The designed in mitigation of advisory safety zones of up to 1 km around Subzone 2 during decommissioning should reduce the likelihood of collision with decommissioning vessels. Although the temporal effect is lengthened, with the implementation of the proposed mitigation, across the project lifetime, the effects on shipping and navigation are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increase vessel to structures in Subzone 2 collision risk	Minor adverse ⁴	Minor adverse ⁵	Minor adverse ⁶	The scale of effects to shipping receptors progressively increases during construction as the wind turbines and ancillary structures are installed. The frequency of vessels not under command is, however, extremely low and the designed in mitigation, including an advisory safety zone of up to 1 km around Subzone 2 during construction (and decommissioning) and 500 m safety zones around offshore platforms during operation, should reduce the likelihood of collision from a powered vessel. Although the temporal effect is lengthened, with the proposed mitigation implemented, across the project lifetime, the effects on shipping and navigation are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Increased risk of anchor snagging	Minor adverse ⁷	Minor adverse ⁸	Minor adverse ⁹	The potential for anchor snagging will arise during the construction as cables are laid and during the operation and maintenance phases of the project while they are <i>in situ</i> and during decommissioning as they are removed. However, across the project lifetime, the effects on shipping and navigation from anchor snagging are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Diminished emergency response capability (including SAR) within the southern North Sea	Minor adverse ¹⁰	Minor adverse ¹¹	Minor adverse ¹²	Activities occurring within Project Two across all phases of the project could both increase the occurrence of incidents requiring emergency response in the southern North Sea area and diminish the capability of emergency response operations to respond to emergency situations by restricting access. However, the presence of construction, operation and maintenance and decommissioning vessels, as well as the provision of potential safe havens on accommodation platforms and substations, and the requirement for an emergency response cooperation plan (ERCoP) at each project phase, may provide additional emergency response support capabilities that had not previously existed. Therefore, across the project lifetime, the effects on shipping and navigation are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Shipping and Navigation

Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Diminished pollution and salvage response capability for emergency responders	Minor adverse ¹³	Minor adverse ¹⁴	Minor adverse ¹⁵	Activities occurring within Project Two across all phases of the project could both increase the occurrence of pollution incidents occurring and diminish the capability of pollution and salvage operations to respond to emergency situations by restricting access. However, the presence of construction, operation and maintenance, and decommissioning vessels, as well as the requirement for an ERCoP at each project phase may provide additional pollution and salvage response support capability that had not previously existed. Therefore, across the project lifetime, the effects on shipping and navigation are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Deviations to commercial shipping routes		Minor adverse ¹⁶		This effect will predominantly arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Increased vessel to oil and gas platform collision risk		Minor adverse ¹⁷		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Increased vessel to structures (offshore HVAC reactive compensation substations) collision risk	Minor adverse ¹⁸	Minor adverse ¹⁹	Minor adverse ²⁰	The effect will arise during construction when the offshore HVAC reactive compensation substations are installed and will last across all project phases until the structures are decommissioned and removed. The designed in mitigation including the use of safety zones around the offshore HVAC reactive compensation substations will reduce the collision risk. The temporal effect is lengthened however, with the proposed mitigation implemented, across the project lifetime, the effects on shipping and navigation are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Electromagnetic interference for vessels using magnetic compasses.		Minor adverse ²¹		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.

Shipping and Navigation

Receptor-led effects

The potential exists for spatial and temporal interactions between vessel collision risk, vessel to structure allision risk, deviation to shipping routes, diminished emergency response capability and diminished pollution and salvage response capability. The greatest scope for potential inter-related impacts could arise from the following:

- a) The interaction of vessel collision risk and commercial shipping route deviation on shipping receptors;
- b) The interaction of vessel allision risk and commercial shipping route deviation on shipping receptors; and
- c) The interaction of vessel collision risk and vessel to structure allision risk on emergency response/pollution and salvage capabilities.

With regards to interaction (a), the deviation of commercial shipping routes may lead to an increase in vessel to vessel collisions, however this has been fully assessed in the Navigation Risk Assessment (NRA). Whilst impacts to vessels may interact, this would not be in such a way as to increase the significance of any of the individual effect significances (i.e., **minor adverse**).

With regard to interaction (b), impacts to vessels arising from allision with offshore structures and also from deviation of vessels, are mutually exclusive as a vessel will not simultaneously exhibit a high level of displacement from the area and a high level of collision risk with the wind farm structures. Impacts to vessels would not therefore interact.

With regards to interaction (c), the potential for vessel collision risk and allision risk to result in increased pressure on emergency response/pollution and salvage capabilities, is inherent in the assessment of the latter across all phases of the project. As such, effects of greater significance than the individual impacts in isolation (i.e., **minor adverse**) are not predicted.

Paragraph references below are to Chapter 7: Shipping and Navigation.

1. Construction vessels and safety zones (paragraphs 7.8.31 to 7.8.42).
2. Physical presence of offshore structures including wind turbines and offshore substations within Subzone 2 (paragraphs 7.8.191 to 7.8.228).
3. Removal of project structures (paragraphs 7.8.325 to 7.8.326).
4. Partially constructed wind turbine array and offshore substations within Subzone 2 (paragraphs 7.8.43 to 7.8.52).
5. Physical presence of offshore structures including wind turbines and offshore substations within Subzone 2 (paragraphs 7.8.141 to 7.8.169).
6. Removal of project structures (paragraphs 7.8.325 to 7.8.326).
7. Physical presence of partially installed inter-array, inter-connector and export cables (paragraphs 7.8.65 to 7.8.81).
8. Physical presence of inter-array, inter-connector and export cables (paragraphs 7.8.254 to 7.8.266).
9. Removal of cables (paragraphs 7.8.331 to 7.8.332).
10. Construction vessels and construction activities operating 24 hours per day and 500 m safety zones around infrastructure during construction (paragraphs 7.8.82 to 7.8.92).
11. Physical presence, and operation of Project Two (paragraphs 7.8.229 to 7.8.253).
12. Removal of project structures (paragraphs 7.8.327 to 7.8.328).
13. Installation of Project Two infrastructure and construction vessel movements (paragraphs 7.8.93 to 7.8.102).
14. Physical presence of Project Two infrastructure and operation and maintenance vessel movements (paragraphs 7.8.287 to 7.8.298).
15. Removal of project structures (paragraphs 7.8.329 to 7.8.330).
16. Physical presence of offshore structures including wind turbines and offshore substations within Subzone 2 (paragraphs 7.8.123 to 7.8.140).
17. Physical presence of offshore structures including wind turbines and offshore substations within Subzone 2 (paragraphs 7.8.141 to 7.8.169).
18. Installation of both offshore HVAC reactive compensation substations on cable route corridor (paragraphs 7.8.103 to 7.8.122).
19. Physical presence of both offshore HVAC reactive compensation substations on cable route corridor (paragraphs 7.8.254 to 7.8.266).
20. Removal of both offshore HVAC reactive compensation substations on cable route corridor (paragraphs 7.8.339 to 7.8.340).
21. Physical presence of high voltage direct current (DC) export cables (paragraphs 7.8.315 to 7.8.321).

Marine Archaeology

- 12.6.40 Within Chapter 9: Marine Archaeology, a number of archaeological receptors, or heritage assets, were identified within Subzone 2 and the offshore cable route corridor which can be broadly described as either palaeolandscapes or maritime and aviation wrecks
- 12.6.41 For marine archaeology, the following impacts to heritage assets have been considered within the inter-related assessment:
- Direct physical impacts on prehistoric land surfaces;
 - Direct physical impacts on maritime and aviation wrecks; and
 - Indirect impacts on heritage assets from sediment deposition.
- 12.6.42 Table 12.13 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for marine archaeological receptors.

Summary of linked receptor group assessments

- 12.6.43 As discussed in paragraph 12.6.10, marine archaeology and physical processes (i.e., sediment deposition) are linked receptors and the inter-related effects associated with a change to marine archaeological receptors has been fully assessed in Chapter 9: Marine Archaeology (paragraphs 9.6.62 *et seq.*), with effects of negligible significance predicted during construction.

Table 12.13 Summary of potential inter-related effects on marine archaeology from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Marine Archaeology				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Direct physical impacts on prehistoric land surfaces	Minor adverse ¹	Minor adverse ²	Minor adverse ³	The majority of sediment disturbance/removal (resulting in greatest potential effects on prehistoric land surfaces) will be during the construction and decommissioning phases, with minimal disturbance likely from maintenance activities (such as potential cable reburial (if required) during the operation and maintenance phase). Therefore, across the project lifetime, the effects on marine archaeological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Direct physical impacts on maritime and aviation wrecks	Minor adverse ⁴		Minor adverse ⁵	The majority of sediment disturbance/removal (resulting in greatest potential effects on maritime and aviation wrecks) will be during the construction and decommissioning phases, with minimal disturbance likely from maintenance activities (such as potential cable reburial (if required) during the operation and maintenance phase). Therefore, across the project lifetime, the effects on marine archaeological receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Indirect impacts on heritage assets from sediment deposition	Negligible ⁶			This effect will only arise during the construction phase and as such there will be no inter-related effects across the project phases.
				Receptor-led effects
<p>Potential exists for spatial and temporal interactions between direct and indirect impacts to marine archaeological receptors. Based on current understanding and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:</p> <ul style="list-style-type: none"> a) Combined effects on different elements of the historic environment (submerged prehistoric land surfaces and wrecks); and b) The direct physical impact on heritage assets interacting with indirect impacts from sediment deposition which may lead to further damage to the same receptor, via increased exposure. <p>With regards to interaction (a), the mitigation measures proposed for Project Two, which include implementation of Archaeological Exclusion Zones (AEZs) to avoid sites of identified archaeological significance as well as micrositing of turbines to avoid archaeological constraints, will minimise combined effects on different elements of the historic environment. It is therefore, predicted that any inter-related effect will not be of any greater significance than those already assessed in isolation (i.e., minor adverse).</p> <p>With regards to interaction (b), indirect effects associated with sediment deposition from gravity base preparation works will be highly localised to within Subzone 2 (and the offshore HVAC reactive compensation substation) and the implementation of AEZs will minimise the combined inter-related effect so that it will not be of any greater significance than those already assessed in isolation (i.e., negligible).</p>				

Paragraph references below are to Chapter 9: Marine Archaeology.

1. Installation of foundation structures, cables, scour protection and cable protection within Subzone 2 (paragraphs 9.6.31 to 9.6.42 and 9.6.51 to 9.6.62) and within the cable route corridor (paragraphs 9.6.67 to 9.6.80).
2. Maintenance activities including deployment of jack-up vessel spud feet and vessel moorings (paragraphs 9.6.103 to 9.6.113).
3. Foundation cutting/removal and cable removal (paragraphs 9.6.114 to 9.6.121).
4. Installation of foundation structures, cables, scour protection and cable protection within Subzone 2 (paragraphs 9.6.42 to 9.6.50) and within the cable route corridor (paragraphs 9.6.80 to 9.6.87).
5. Foundation cutting/removal and cable removal (paragraphs 9.6.122 to 9.6.128).
6. Seabed preparation prior to gravity base foundation installation within Subzone 2 (paragraphs 9.6.51 to 9.6.62) and within the cable route corridor (paragraphs 9.6.88 to 9.6.92).

Seascape and Visual Resources

- 12.6.44 For seascape and visual resource receptors, the following impacts have been considered within the inter-related assessment:
- Change to the existing present day seascape character through the introduction of new or uncharacteristic elements/features;
 - Change to the existing historic seascape character through the introduction of new or uncharacteristic elements/features; and
 - Change in the existing visual scenario may cause effects on a variety of visual receptors.
- 12.6.45 Table 12.14 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for seascape and visual receptors. The significance of effects presented for this topic for the impacts in isolation, varies due to the differing sensitivity of the various seascape and visual receptors; this applies to each phase of the project.

Summary of linked receptor group assessments

- 12.6.46 Seascape and visual resources are not considered to be linked with any other offshore receptor group considered within the inter-related effects assessment.

Table 12.14 Summary of potential inter-related effects on seascape and visual resources from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Seascape and Visual Resources				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Change to the existing present day seascape character through the introduction of new or uncharacteristic elements/features	Negligible to minor adverse ¹	Negligible to minor adverse ²	Negligible to minor adverse ³	The scale of effects to the present day seascape character progressively increases during construction as the wind turbines and ancillary structures are installed. However, during decommissioning the scale of effects decreases with time as more structures are removed. Although this indicates that there is a potential lengthening of the temporal effect, across the project lifetime, the effects on seascape and visual resources are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Change to the existing historic seascape character through the introduction of new or uncharacteristic elements/features	Minor adverse ⁴	Minor adverse ⁵	Minor adverse ³	The scale of effects to the historic seascape character progressively increases during construction as the wind turbines and ancillary structures are installed. However, during decommissioning the scale of effects decreases with time as more structures are removed. Although this indicates that there is a potential lengthening of the temporal effect, across the project lifetime, the effects on seascape and visual resources are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Change in the existing visual scenario may cause effects on a variety of visual receptors	Negligible to major adverse ⁶ (major adverse for receptors closest to the turbine array (i.e., within ~26 km))	Negligible to major adverse ⁷ (major adverse for receptors closest to the turbine array (i.e., within 1.6 km))	Negligible to major adverse ³ (major adverse for receptors closest to the turbine array)	The scale of effects to visual receptors progressively increases during construction as the wind turbines and ancillary structures are installed. However, during decommissioning the scale of effects decreases with time as more structures are removed. Only those receptors closest to the array are predicted to experience effects of major significance (i.e., significant effects in EIA terms). All operational visual effects are capable of being reversed through the removal of the above sea level elements of Project Two during decommissioning. Although this indicates that there is a potential lengthening of the temporal effect, across the project lifetime, the effects on seascape and visual resources are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Seascape and Visual Resources

Receptor-led effects

Potential exists for spatial and temporal interactions between the direct and indirect impacts to seascape and visual resources outlined above. Based on current understanding and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise through the following:

- a) The interaction of direct and indirect impacts on present day seascape character;
- b) The interaction of direct and indirect impacts on historic seascape character; and
- c) The interaction of impacts on all visual receptors known to be present within the seascape and visual resources study area.

With respect to interaction (a), direct effects on a present day seascape character area may occur when construction/operation and maintenance/decommissioning activities occur directly in the area. Indirect effects may also arise on other seascape character areas as a result of the visual impacts associated with the construction/operation and maintenance/decommissioning activities. However, the significance of the combined direct and indirect effects will not be of any greater significance than the effects when assessed in isolation (i.e., **negligible to minor adverse**).

With respect to interaction (b), direct effects on an historic seascape character area may occur when construction/operation and maintenance/decommissioning activities occur directly in the area. Indirect effects may also arise on other historic seascape character areas as a result of the visual impacts associated with the construction/operation and maintenance/decommissioning activities. However, the significance of these combined direct and indirect effects will not be of any greater significance than the effects when assessed in isolation (i.e., **negligible to minor adverse**).

With respect to interaction (c), combined effects on visual receptors will vary temporally and spatially across the seascape and visual resources study area according to the activities being undertaken. Due to the mobile nature of many of the visual receptors (e.g., people working on fishing vessels, dredging vessels, commercial ferries or commercial vessels), impacts will only occur when those receptors are in the vicinity of/passing by Project Two and therefore the significance varies depending on the receptor's distance to the turbine array with only those receptors closest to the turbine array predicted to experience major effects. Construction effects will cease upon completion of construction and will give way to operation and maintenance phase effects which will be fully reversible when Project Two is decommissioned. Therefore, the significance of these combined effects on visual receptors will not be of any greater significance than the effects when assessed in isolation (i.e., **negligible to major adverse**).

Paragraph references below are to Chapter 10: Seascape and Visual Resources.

1. Installation of foundation structures, cables, scour protection and cable protection (paragraphs 10.6.66 to 10.6.69).
2. Presence of operational turbines (paragraphs 10.6.112 to 10.6.127).
3. Removal of project structures (paragraphs 10.6.215 to 10.6.227).
4. Installation of foundation structures, cables, scour protection and cable protection (paragraphs 10.6.66 to 10.6.69).
5. Presence of operational turbines (paragraphs 10.6.128 to 10.6.155).
6. Installation of foundation structures, cables, scour protection and cable protection (paragraphs 10.6.98 to 10.6.111).
7. Presence of operational turbines (paragraphs 10.6.156 to 10.6.202).

Infrastructure and Other Users

12.6.47 For infrastructure and other users, the following impacts have been considered within the inter-related assessment:

- Physical restriction on space for recreational activity/fishing grounds;
- Impact on existing cables and pipelines from construction, maintenance and decommissioning activities;
- Changes to physical processes resulting in impacts on aggregate resources;
- Physical restriction on space for future oil and gas seismic survey;
- Physical restriction on space for future oil and gas drilling and placing of infrastructure;
- Underwater noise generated by piling acoustically interfering with oil and gas seismic survey operations;
- Potential impact on performance of Radar Early Warning Systems (REWS) on oil and gas platforms from physical presence of turbines; and
- Airborne noise exceeding guidance levels for commercial shipping traffic, recreational vessels, leisure craft, oil and gas platforms and accommodation platforms and onshore residential and recreational receptors.

12.6.48 Table 12.15 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance, and decommissioning of Project Two and also the inter-related effects (receptor-led effects) that are predicted to arise for infrastructure and other users receptors.

Summary of linked receptor group assessments

12.6.49 As discussed in paragraph 12.6.10, infrastructure and other user receptors and physical processes are linked receptors and the inter-related effects (i.e., a change to the sediment regime) on aggregate receptors has been fully assessed in Chapter 11: Infrastructure and Other Users (paragraphs 11.6.82 *et seq.*, 11.6.202 *et seq.* and 11.6.290 *et seq.*), with effects of negligible significance predicted across all project phases.

Table 12.15 Summary of potential inter-related effects on infrastructure and other users from individual effects occurring across all phases of Project Two (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects).

Infrastructure and Other Users				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Physical restriction on space for recreational activity/fishing grounds	Negligible ¹	Negligible ²	Negligible ³	An advisory safety zone of 1 km around Subzone 2 will restrict recreational activity however due to the distance off shore the recreational activity in the area of Subzone 2 is limited. During operation the advisory safety zone will be lifted and safety zones will only be applied for during major maintenance activity and around the offshore platforms. Recreational activity will therefore be able to continue through the zone. During decommissioning the area will be restricted again by the advisory safety zone during decommissioning activity. Advisory safety zones along the cable route corridor during construction, cable maintenance activity and decommissioning will have the greatest effect on recreational activity in the near shore area however these will be short term and widely spaced in time. Therefore, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Impact on existing cables and pipelines from construction, maintenance and decommissioning activities	Minor adverse ⁴	Minor adverse ⁵	Minor adverse ⁶	Existing cables and pipelines may be affected from the physical crossing of project cables and from restricted access around crossing points resulting from project related construction, maintenance and decommissioning activities. Cable and pipeline crossing and proximity agreements will be developed and implemented with each relevant cable and pipeline operator which will ensure project related risks are minimised. In addition communication with the operators will ensure that periods of maintenance activity are not restricted. Therefore, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Changes to physical processes resulting in impacts on aggregate resources	Negligible ⁷	Negligible ⁸	Negligible ⁹	The majority of the disturbance to physical processes (resulting in highest suspended sediment concentrations/deposition) will be during the construction and decommissioning phases. This in turn has the potential to impact on adjacent aggregate dredging licenced areas although the impact will be localised, short term and intermittent during these phases. Minimal disturbance is likely during the operation and maintenance phase. Therefore, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Infrastructure and Other Users				
Impact type	Residual effects			Inter-related assessment
	Construction phase	Operation and maintenance phase	Decommissioning phase	Project lifetime effects
Physical restriction on space for future oil and gas seismic survey	Minor adverse ¹⁰	Minor adverse ¹¹	Minor adverse ¹²	During construction activity an advisory safety zone of 1 km around Subzone 2 and around cable laying activity along the cable route corridor shall restrict seismic activity. The physical presence of infrastructure within Subzone 2 shall continue to restrict activity throughout the operational phase however seismic activity will not be restricted along the cable route corridor. During the decommissioning phase an advisory safety zone around Subzone 2 shall continue to restrict seismic activity until the decommissioning is complete. Activity will also be restricted along the cable route corridor around decommissioning vessels. The effect can be considered to be continuous across all project phases for Subzone 2 but discontinuous along the cable route corridor. Therefore, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Physical restriction on space for future oil and gas drilling and placing of infrastructure	Minor adverse ¹³	Minor adverse ¹⁴	Minor adverse ¹⁵	Oil and gas drilling activity and placing of infrastructure is restricted by the Project Two Agreement for Lease (AfL) and the potential requirement for safety zones around wells or infrastructure. The AfL area will remain the same across all project phases. The receptors are the operators of the licence blocks within or overlapping with the AfL who may change over the course of the project however they will be made aware of the AfL area. This will be achieved by consultation with the developer and through the Department of Energy and Climate Change requirement on licence applications to identify other users of the sea within the wind farm AfL areas being shown on The Crown Estate maps. Therefore, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Underwater noise generated by piling may acoustically interfere with oil and gas seismic survey operations	Minor adverse ¹⁶			This effect will only arise during the construction phase and as such there will be no inter-related effects across the project phases.
Potential impact on performance of Radar Early Warning Systems (REWS) on oil and gas platforms from physical presence of turbines.		Minor adverse ¹⁷		This effect will only arise during the operation and maintenance phase and as such there will be no inter-related effects across the project phases.
Airborne noise exceeding guidance levels for commercial shipping traffic, recreational vessels, leisure craft, oil and gas platforms and accommodation platforms and onshore residential and recreational receptors	Negligible to minor adverse ¹⁸	Negligible ¹⁹		Airborne noise will be produced at all stages of the project with the exception of decommissioning, but will be greatest as a result of piling and vessel noise during construction. Therefore, the negligible effects associated with operational noise are not predicted to increase the level of significance over the whole project lifetime. Furthermore, due to the temporal separation of the noise associated with construction and operation, across the project lifetime, the effects on infrastructure and other users are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

Infrastructure and Other Users

Receptor-led effects

The potential exists for spatial and temporal interactions between the wide range of impacts generated by Project Two, from changes to marine processes, through application for safety zones during construction, increased vessel activity during construction and operation and maintenance phases, the introduction of a significant number of large structures to the seabed, to interact to create inter-related adverse effects on other users and infrastructure receptors. Based on current understanding and expert knowledge, the greatest scope for potential inter-related impacts is predicted to arise from the following:

- a) The interaction of the physical restriction of seismic survey activity, the interference of project noise with seismic survey activity and the physical restriction of drilling and the placing of infrastructure on the same receptor (oil and gas licence block operator); and
- b) The interaction of the physical presence of turbines within Subzone 2 on REWS and the deviation of shipping routes towards platforms with REWS installed.

With regard to interaction (a) the operator of a licence block will typically conduct seismic activity, drilling and the laying of infrastructure in a progressive order within a licence block. Restriction on seismic activity, physically or due to noise interference, may therefore prevent the potential for drilling and so has an interactive effect. The licence blocks which have the greatest potential to be affected by all three impacts are those located within Subzone 2. The operators of the present licenced blocks within Subzone 2 have confirmed through consultation that they do not require further conventional 3D seismic survey activity. No significant inter-related effect has therefore been identified.

With regards to interaction (b), results of the radar modelling showed that considering the potential effects of the radar, such as direct returns, multipath returns, shadow effects and fluctuating returns, an effect of minor adverse significance was predicted during the operational phase of the project. Vessel rerouting has been assessed in relation to the potential to move the vessels nearer to platforms which use REWS as part of their anti-collision safety systems (see Chapter 7: Shipping and Navigation). Further modelling using the re-routed vessels and consultation with a vessel operator has advised that this effect will not have a significant effect on the REWS on the affected platforms and therefore this effect is considered not likely to interact in a way that will result in an effect of any greater significance than that predicted for each individual effect.

There is also the potential for inter-related effects across the onshore and offshore components of the project on noise receptors. Potential receptors for inter-related effects would be those at the coast (for example coastal (onshore users) and those inshore at sea (offshore users)). The most likely locations for this are at the landfall site. Due to the relative transitory nature of offshore users and the distance of onshore users to the source, as well as the mitigation measures proposed within Volume 3, Chapter 8: Noise and Vibration), these potential effects are not likely to interact in a way that will result in an effect of any greater significance than that predicted for each individual effect.

Paragraph references below are to Chapter 11: Infrastructure and Other Users.

1. Installation of foundation structures, cables, scour protection and cable protection (paragraphs 11.6.39 to 11.6.56).
2. Presence of foundations (and operation and maintenance phase safety zones) (paragraphs 11.6.183 to 11.6.187).
3. Removal of project structures (paragraphs 11.6.290 to 11.6.291).
4. Installation of the inter-array, interconnector and export cables (paragraphs 11.6.67 to 11.6.74).
5. Presence of foundations (and operation and maintenance phase safety zones) (paragraphs 11.6.188 to 11.6.196).
6. Removal of project structures (paragraphs 11.6.292 to 11.6.293).
7. Installation of wind turbines, associated offshore infrastructure and cables (paragraphs 11.6.82 to 11.6.90).
8. Presence of foundations (paragraphs 11.6.202 to 11.6.212).
9. Removal of project structures (paragraphs 11.6.294 to 11.6.295).
10. Installation of wind turbines, associated offshore infrastructure and cables (paragraphs 11.6.91 to 11.6.102 and 11.6.117 to 11.6.127).

11. Presence of foundations and offshore infrastructure (paragraphs 11.6.202 to 11.6.212 and 11.6.220 to 11.6.226).
12. Removal of project structures (paragraphs 11.6.282 to 11.6.283 and 11.6.284 to 11.6.285).
13. Installation of wind turbines, associated offshore infrastructure and cables (paragraphs 11.6.103 to 11.6.116 and 11.6.128 to 11.6.137).
14. Presence of foundations and offshore infrastructure (paragraphs 11.6.220 to 11.6.226 and 11.6.232 to 11.6.258).
15. Removal of project structures (paragraphs 11.6.286 to 11.6.287 and 11.6.288 to 11.6.289).
16. Piling noise and vessel noise (paragraphs 11.6.150 to 11.6.154).
17. Presence of foundations and offshore infrastructure (paragraphs 11.6.282 to 11.6.285).
18. Piling noise and vessel noise (paragraphs 11.6.143 to 11.6.149).
19. Operational noise (paragraphs 11.6.265 to 11.6.281).

12.7 Summary

12.7.1 The tables presented within this chapter assess potential inter-related effects arising from Project Two on a range of receptor groups. Much of the content of these tables has been based upon assessments of individual impacts presented in the topic specific Environmental Statement chapters. The identification of potential inter-related effects has been based on a largely qualitative assessment using expert judgement, and noting that inter-related effects have already been accounted for in many instances within the assessments in the topic specific chapters. The following conclusions arise in the context of physical, biological and human environments.

Physical Environment

12.7.2 Potential inter-related impacts on the adjacent coastlines to Project Two were assessed via a review of the scope for individual impacts on the wave regime, sediment transport and/or beach morphology to interact to create impacts across the lifetime of the project and to combine to result in receptor-led impacts.

12.7.3 This assessment identified that the only potential project lifetime effect is via the works at landfall. However, this potential effect would only occur if the cable became exposed during the operation and maintenance phase. As such, no project lifetime effects of any greater significance than that predicted for each individual effect (i.e., negligible) are predicted. With respect to receptor-led effects, due to the localised and temporally discrete nature of the landfall works there are not anticipated to be any receptor-led effects at the shoreline of greater significance than each individual effect.

Biological Environment

12.7.4 For the benthic and intertidal ecology, fish and shellfish, marine mammals and ornithological features receptor groups, the assessments presented within this chapter conclude that whilst this type of project lifetime effect may arise it is not judged to result in an effect of increased significance over and above the individual project phase effects presented in the individual topic chapters. Overall, it is concluded that whilst there will be an interaction of impacts on these receptor groups, the significance of effect produced by these interactions will be no greater than the individual effects assessed within the individual topic chapters, which typically concluded **negligible to minor adverse (moderate adverse** effects were predicted for some marine mammal species).

Human Environment

12.7.5 For the commercial fisheries, shipping and navigation, marine archaeology, seascape and visual resources, and infrastructure and other users receptor groups the assessments presented within this chapter concludes that whilst this type of project lifetime effect may arise it is not judged to result in an effect of increased significance over and above the individual project phase effects presented in the individual topic chapters. Overall, it is concluded that whilst there will be an interaction of impacts on these receptor groups, the significance of effect produced by these interactions will be no greater than the individual effects assessed within the individual topic chapters, which typically concluded **negligible to minor adverse (major adverse** effects were predicted for a limited number of visual and seascape receptors).

12.8 Conclusion

12.8.1 This chapter has defined the potential inter-related effects considered to arise from Project Two. Project lifetime and receptor-led effects have been defined in order to differentiate two types of inter-related effects that may arise as a result of Project Two.

12.8.2 Based on the detailed assessments presented in the preceding chapters of this Environmental Statement, both project lifetime and receptor-led related effects have been identified. However, based on the low sensitivity of receptors, temporary and small scale nature of effects, availability of alternative habitats, and also factoring in proposed mitigation measures adopted as part of the project, the overall significance of any inter-related effects was not judged to increase above the significance value assessed for individual effects in the topic-specific chapters.

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