

A decorative collage on a teal background. It includes a white-outlined photo of a worker in a yellow safety vest on a wind turbine platform, a photo of a wind farm in rough seas, and several white line-art icons of wind turbines arranged in a cluster.

# Arklow Bank Wind Park 2

## Environmental Impact Assessment Report

Volume II, Chapter 23: Interactions

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## Statement of Authority

Please refer to topic specific chapters of this EIAR for relevant statements of authority.

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## Glossary

Term	Meaning
Arklow Bank Wind Park 1 (ABWP1)	Arklow Bank Wind Park 1 consists of seven wind turbines, offshore export cable and inter-array cables. Arklow Bank Wind Park 1 has a capacity of 25.2 MW. Arklow Bank Wind Park 1 was constructed in 2003/04 and is operated by GE Energy. It remains the first and only operational offshore wind farm in Ireland.
Arklow Bank Wind Park 2 – Offshore Infrastructure	“The Proposed Development”, Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements under the existing Maritime Area Consent (MAC).
Arklow Bank Wind Park 2 (ABWP2) (the Project)	<p>Arklow Bank Wind Park 2 (ABWP2) (the Project) is the onshore and offshore infrastructure. This EIAR is being prepared for the Offshore Infrastructure. Consent for the Onshore Grid Infrastructure and Operations Maintenance Facility has been granted in May and June 2022, respectively.</p> <ul style="list-style-type: none"> <li>• Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements to be consented in accordance with the Maritime Area Consent. This is the subject of this EIAR and will be referred to as ‘the Proposed Development’ in the EIAR.</li> <li>• Arklow Bank Wind Park 2 Onshore Grid Infrastructure (OGI): This relates to the onshore grid infrastructure for which planning approval has been granted.</li> <li>• Arklow Bank Wind Park 2 Operations and Maintenance Facility (OMF): This includes the onshore and nearshore infrastructure at the OMF, for which planning permission has been granted.</li> <li>• Arklow Bank Wind Park 2 EirGrid Upgrade Works: any non-contestable grid upgrade works, consent to be sought and works to be completed by EirGrid.</li> </ul>
Array Area	The Array Area is the area within which the Wind Turbine Generators (WTGs), the Offshore Substation Platforms (OSPs), and associated cables (export, inter- array and interconnector cabling) and foundations will be installed.
Competent Authority (CA)	The authority designated as responsible for performing the duties arising from the EIA Directive as amended. For this application, the Competent Authority is An Bord Pleanála (ABP).
Environmental Impact Assessment (EIA)	An Environmental Impact Assessment (EIA) is a statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council (EIA Directive).
EirGrid	State-owned electric power transmission system operator (TSO) in Ireland and Transmission Asset Owner (TAO) for the Project’s transmission assets.

Term	Meaning
Landfall	The area in which the offshore export cables make landfall and is the transitional area between the offshore cabling and the onshore cabling.
MAC Area	The area in which the Proposed Development is seeking consent. The MAC Area includes the offshore export cable corridors and Array Area.
Maritime Area Consent (MAC)	A consent to occupy a specific part of the maritime area on a non-exclusive basis for the purpose of carrying out a Permitted Maritime Usage strictly in accordance with the conditions attached to the MAC granted on 22nd December 2022 with reference number 2022-MAC-002.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact.
Permitted Maritime Usage	The construction and operation of an offshore windfarm and associated infrastructure (including decommissioning and other works required on foot of any permission for such offshore windfarm).
The Application	The full set of documents that will be submitted to An Bord Pleanála in support of the consent application.
The Developer	Sure Partners Ltd.
The Project	All components of ABWP2 together. That is the Offshore Infrastructure, Onshore Grid Infrastructure, Operations and Maintenance Facility and EirGrid Upgrade Works.
The Proposed Development	Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements to be consented in accordance with the Maritime Area Consent and comprises the development proposed in this application to An Bord Pleanála. This is the subject of this EIAR.

## Acronyms

Term	Meaning
ABWP1	Arklow Bank Wind Park 1
ABWP2	Arklow Bank Wind Park 2
ALAN	Artificial Lighting at Night
BW	Bathing Water
CIA	Cumulative Impact Assessment
CTV	Crew Transfer Vessel
DCCAE	Department of Communications, Climate Action and Environment
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERCoP	Emergency Response Cooperation Plan
FMMS	Fisheries Mitigation and Management Strategy
GVA	Gross Value Added
HWM	High Water Mark
IMO	International Maritime Organization
MW&SQ	Marine Water and Sediment Quality
NIS	Natura Impact Statement
NRA	Navigation Risk Assessment
NSR	Noise Sensitive Receptors
NtM	Notice to Mariners

OREDP	Offshore Renewable Energy Development Plan
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SSC	suspended sediment concentrations
TTS	Temporary Threshold Shift
WTG	Wind Turbine Generator



## Units

Unit	Description
CO <sub>2eq</sub>	Carbon dioxide equivalent
dB	Decibel (unit used to measure the intensity of sound)
ft	Feet
km	Kilometers
m	Metres

## 23 Interactions

### 23.1 Introduction

#### 23.1.1 Overview

- 23.1.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) presents the assessment of the potential impacts of the Arklow Bank Wind Park 2 (ABWP2) Offshore Infrastructure (hereafter referred to as 'the Proposed Development') in relation to interactive effects. Specifically, this chapter considers the potential impact of the Proposed Development below the High Water Mark (HWM) during the construction, operational and maintenance, and decommissioning phases.
- 23.1.1.2 The detailed technical information which underpins the impact assessments presented in this chapter is contained within Chapter 4: Description of Development and within the technical chapters 6 to 22 and their supporting appendixes in Volume III of this EIAR. These chapters provide a detailed characterisation of the physical, biological and human environment of the Proposed Development and the wider western Irish Sea, based on desk-based data sources and/or site-specific surveys, including information on receptors of importance and of conservation value.

#### 23.1.2 Purpose of this chapter

- 23.1.2.1 The primary purpose of the EIAR is outlined in Chapter 1: Introduction. It is intended that the EIAR will provide stakeholders with sufficient information to determine the potential significant impacts of the Proposed Development on the receiving environment.
- 23.1.2.2 In particular, this EIAR chapter:
- Presents the receptor groups considered within the interactions assessment;
  - Presents the potential for effects on receptor groups across the three key project phases (construction, operational and maintenance and decommissioning); and
  - Presents the potential for multiple effects on a receptor group, as presented within the topic specific chapter, to interact to create interactive effects.
- 23.1.2.3 The impact assessment presented within this chapter has taken into account other relevant impact assessments and their associated appendixes in this EIAR contained within:
- Chapter 6: Coastal Processes;
  - Chapter 7: Marine Water and Sediment Quality (MW&SQ);
  - Chapter 8: Airborne Noise;
  - Chapter 9: Benthic Subtidal and Intertidal Ecology;
  - Chapter 10: Fish, Shellfish and Sea Turtle Ecology;
  - Chapter 11: Marine Mammals;
  - Chapter 12: Offshore Ornithology;
  - Chapter 13: Offshore Bats;
  - Chapter 14: Commercial Fisheries and Aquaculture;
  - Chapter 15: Shipping and Navigation;
  - Chapter 16: Civil and Military Aviation;
  - Chapter 17: Seascape, Landscape and Visual Impact Assessment;
  - Chapter 18: Marine Archaeology and Cultural Heritage;
  - Chapter 19: Infrastructure and Other Users;
  - Chapter 20: Air Quality and Climate;

- Chapter 21: Population and Human Health; and
- Chapter 22: Major Accidents and Natural Disasters.

### 23.1.3 Study area

23.1.3.1 Due to the differing spatial extent of effects experienced by different receptors, the study area for potential interactions varies according to topic and receptor. The potential interactions considered in this chapter are, therefore, also limited to the study areas defined in each of the topic specific chapters outlined in section 23.1.2.3.

### 23.1.4 Policy context

23.1.4.1 Planning policy on renewable energy infrastructure is presented in Chapter 2: Policy and Legislation. Topic specific policy is presented in chapters 6 to 22 for the relevant physical, biological and human environment receptors considered within this chapter.

23.1.4.2 Article 3(1) of the Environmental Impact Assessment (EIA) Directive requires that the interaction between the environmental factors (population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and the landscape) is identified, described and assessed in the EIAR. Environmental Protection Agency (EPA) guidance states that 'the interactions between impacts on different environmental factors should be addressed as relevant throughout the EIAR. For example, where it is established in the Hydrology section that there will be an increase in suspended solids in discharged surface waters during construction, then the Biodiversity section should assess the effect of that on sensitive aquatic receptors'.

## 23.2 Data sources

23.2.1.1 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 chapters for the assessment of impacts acting in isolation on the receptor groups. The relevant sections drawn upon in this interactions assessment are presented in the following sections of the EIAR chapters:

- Chapter 6: Coastal Processes (section 6.10 and section 6.11);
- Chapter 7: MW&SQ (section 7.9 and section 7.10)
- Chapter 8: Airborne Noise (section 8.9 and section 8.10);
- Chapter 9: Benthic Subtidal and Intertidal Ecology (section 9.9 and section 9.10);
- Chapter 10: Fish, Shellfish and Sea Turtle Ecology (section 10.9 and section 10.10);
- Chapter 11: Marine Mammals (section 11.9 and section 11.10);
- Chapter 12: Offshore Ornithology (section 12.9 and section 12.10);
- Chapter 13: Offshore Bats (section 13.8)
- Chapter 14: Commercial Fisheries and Aquaculture (section 14.10 and section 14.11);
- Chapter 15: Shipping and Navigation (section 15.9 and section 15.10);
- Chapter 16: Civil and Military Aviation (section 16.9);
- Chapter 17: Seascape, Landscape and Visual Impact Assessment (section 17.10 and section 17.11);
- Chapter 18: Marine Archaeology and Cultural Heritage (section 18.9 and section 18.10);
- Chapter 19: Infrastructure and Other Users (section 19.9 and section 19.10);
- Chapter 20: Air Quality and Climate (section 20.9); and
- Chapter 21: Population and Human Health (section 21.10 and section 21.11).

## 23.3 Impact assessment methodology

23.3.1.1 The following sections present the approach for the interactions assessment for the Proposed Development. For the purposes of this assessment, interactions are defined as ‘multiple effects on the same receptor arising from the Proposed Development. 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. Interactions have therefore been identified for individual effects on each of the key receptor groups across the three project phases (i.e. project lifetime effects), as well as for multiple effects on the same receptor (i.e. receptor-led effects), as defined in Table 23.1.

**Table 23.1: Definitions of project lifetime and receptor-led interactive effects**

Effect type	Definition
Project lifetime effects	Assessment of the scope for effects that occur throughout more than one phase of the project (construction, operational 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 interactive 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.

### 23.3.2 Guidance

23.3.2.1 The approach to the interactions assessment has been developed with specific regard to the following guidelines:

- The Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (EC, 1999); and
- EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022).

### 23.3.3 Approach to assessment

23.3.3.1 The approach to assessing interactions within this chapter has followed a four stage process, as summarised in Table 23.2 and outlined in the sections below. The approach is also outlined in Chapter 5: EIA Methodology.

**Table 23.2: Summary of staged approach to the interactions assessment for the Proposed Development**

Stage	Description
1	Assessment of effects undertaken for individual EIAR topic areas within chapters 6 to 22.
2	Review of assessments undertaken within chapters 6 to 22 to identify 'receptor groups' requiring assessment.
3	Identification of potential interactive effects on receptor groups through review of the topic specific assessments in the EIAR chapters.
4	Assessment undertaken on how individual effects may combine to create interactive effects on each receptor group for: <ul style="list-style-type: none"> <li>• 'Project lifetime effects' (i.e. over the construction, operational and maintenance and decommissioning phases); and</li> <li>• 'Receptor-led effects' (i.e. multiple effects on a single receptor).</li> </ul>

### Stage 1: Topic specific assessments

23.3.3.2 The first stage of the assessment of interactions is presented in each of the individual EIAR chapters (chapters 6 to 22) and comprises the individual assessments of effects on receptors across the construction, operational and maintenance, and decommissioning phases of the Proposed Development.

23.3.3.3 Impacts scoped out of the assessments, as outlined in chapters 6 to 22, have not been considered within the interactions assessment.

### Stage 2: Identification of receptor group

23.3.3.4 Stage 2 involves a review of the assessments undertaken in the topic specific chapters to identify 'receptor groups' requiring assessment within the interactions assessment. The term 'receptor group' is used to highlight that the approach taken for the interactions assessment will not assess every individual receptor assessed at the impact assessment 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:
  - Coastal processes;
  - Air quality and climate; and
  - Airborne Noise Sensitive Receptors (NSRs).
- Biological environment:
  - Benthic subtidal and intertidal ecology;
  - Fish, shellfish and sea turtle ecology;
  - Marine mammals;
  - Offshore ornithology; and
  - Offshore bat activity.
- Human environment:
  - Commercial fisheries and aquaculture;
  - Shipping and navigation;
  - Civil and military aviation and radar;

- Seascape, landscape and visual amenity;
- Marine archaeology and cultural heritage;
- Infrastructure and other users; and
- Population and human health.

23.3.3.5 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 'offshore ornithology') may vary according to the magnitude of impact or 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.

23.3.3.6 In relation to designated sites, the assessment of interactions is central to the assessment of potential effects on the integrity of designated sites and, as such, has already been assessed within the relevant topic specific chapter and within the Natura Impact Statement (NIS). No additional levels of effect are therefore considered to occur at the site level beyond those identified in the individual chapters and the NIS.

### Stage 3: Identification of potential interactions on receptor groups

23.3.3.7 Following the identification of receptor groups, the potential interactive effects on these receptor groups have been identified via review of the impact assessment sections for each topic chapter. The judgement as to which impacts may result in interactive effects upon receptors associated with the Proposed Development was exercised using a precautionary approach and was based on the professional judgement and experience of the project team.

#### LINKED RECEPTOR GROUPS

23.3.3.8 It is important to recognise where there are linkages between the topic-specific chapters presented within this EIAR, whereby the effects assessed in one chapter have the potential to result in secondary effects on another receptor. Examples include:

- Chapter 9: Benthic Subtidal and Intertidal Ecology addresses effects on benthic habitats and species arising from changes to the physical environment (as described in Chapter 6: Coastal Processes);
- Chapter 11: Marine Mammals and Chapter 12: Offshore Ornithology addresses the effects on marine mammal and seabird receptors arising from potential changes in the distribution of fish, which form their principal prey (as described in Chapter 10: Fish, Shellfish and Sea Turtle Ecology);
- Chapter 14: Commercial Fisheries and Aquaculture addresses 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 electromagnetic fields (EMF), suspended sediments, habitat alteration/loss and underwater noise impacts (as described in Chapter 10: Fish, Shellfish and Sea Turtle Ecology);
- Chapter 18: Marine Archaeology and Cultural Heritage addresses indirect impacts on the setting of terrestrial cultural heritage assets arising from potential visual impacts (as described in Chapter 17: Seascape, Landscape and Visual Impact Assessment); and
- Chapter 19: Infrastructure and Other Users addresses the effects on recreational diving activities arising from potential increases in suspended sediments and associated deposition (as described in Chapter 6: Coastal Processes).

23.3.3.9 Where such linked relationships arise, these have been fully assessed within the individual topic chapters. This chapter therefore summarises the consideration of these interactive effects on linked receptors already set out in the preceding, topic specific chapters.

23.3.3.10 It should be noted that it is not considered that there are likely to be any receptor led effects from Proposed Development activities combined with other ABWP2 development activities, beyond that already assessed within the Cumulative Impact Assessment (CIA) for each topic. As a result this has not been considered further in this interactions chapter.

#### Stage 4: Assessment of interactions on each receptor group

23.3.3.11 The EPA guidance states that 'it is general practice to include a matrix to show where interactions between effects on different factors have been addressed. This is usually done using the actual headings used in the EIAR. This is typically accompanied by brief text describing the interactions' (EPA, 2022).

23.3.3.12 Individual effects on each of the key receptor groups have been 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 23.1. The assessment of these interactions has been presented in this chapter using a matrix approach, in line with EPA guidance (see Table 23.3 to Table 23.18).

23.3.3.13 It is important to note that the interactions assessment considers only those effects produced by the Proposed Development and not those effects arising from other projects, which are considered within the CIA sections of each topic chapter.

23.3.3.14 Within the interactions matrix for each topic, the significance of the individual effects, as concluded within the topic specific chapters, have been presented for each receptor group. A descriptive assessment of the scope for these individual effects to interact to create a different or greater effect has then been undertaken and presented (see Table 23.3 to Table 23.18). This assessment incorporates qualitative and, where reasonably possible, quantitative assessments. The assignment of significance of effect to any such interactive effect is not undertaken, rather, any interactive 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.

23.3.3.15 The interactions assessment presents and utilises the assessment carried out for both Project Design Options within the relevant chapters of this EIAR, noting that individual effects may not be significant at the topic-specific level but could become significant when their interactive effect is assessed. Effects of imperceptible significance or greater (slight, moderate, major or profound) may occur in only one phase of the project lifecycle (e.g. during the construction phase, but not during the operational and maintenance or decommissioning phases). Where this is the case, it has been made clear that, as a result, there will be no interactive effects across the project phases. Effects of imperceptible significance identified in the individual topic assessments have been included, since there is the potential for interactive effects to increase the level (significance) of effect when considered with other sources.

## 23.4 Assessment of interactions

23.4.1.1 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 a particular receptor group has been explored and discussed in the following sections.

### 23.4.1 Physical environment

#### Coastal processes

23.4.1.2 As presented in Chapter 6: Coastal Processes are not in themselves receptors but are instead 'pathways'. However, changes to Coastal Processes have the potential to indirectly impact other environmental receptors (Lambkin *et al.*, 2009 ). A small number of features have been identified in Chapter 6: Coastal Processes as potentially sensitive Coastal Processes receptors:

- Offshore sandbanks – Arklow Bank and Seven Fathom Bank;
- Designated sites: Wicklow Reef SAC; Magherabeg Dunes and Buckroney-Brittis Dunes and Fen SACs; and
- Coastal receptors below the HWM.

23.4.1.3 The following potential impacts have been considered within the interactions assessment:

- Increased suspended sediment concentrations (SSC) and associated deposition; and
- Presence of infrastructure may lead to changes to tidal currents, wave climate and sediment transport.

23.4.1.4 The project lifetime effects that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Proposed Development are listed in Table 23.3, in addition to receptor-led effects that are predicted to arise for coastal receptors, sandbanks and designated sites.

23.4.1.5 A matrix illustrating where interactions between effects on different factors have been addressed are provided in Table 23.19.

#### SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.1.6 Effects on the sediment regime (i.e. from increases in SSC and sediment deposition above background levels or changes to sediment transport pathways) 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:

- Chapter 7: Marine Water and Sediment Quality;
- Chapter 9: Benthic Subtidal and Intertidal Ecology;
- Chapter 10: Fish, Shellfish and Sea Turtle Ecology;
- Chapter 11: Marine Mammals; and
- Chapter 18: Marine Archaeology and Cultural Heritage.

#### MARINE WATER AND SEDIMENT QUALITY

23.4.1.7 Increased SSC resulting in impacts on marine water and sediment quality during all phases of the Proposed Development of **No Significance** in EIA Terms (Chapter 7: Marine Water and Sediment Quality).

#### BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY:

23.4.1.8 Increased SSC and associated sediment deposition resulting in impacts on benthic ecology during all phases of the Proposed Development of **No Significance** in EIA Terms (Chapter 9: Benthic Subtidal and Intertidal Ecology); and

23.4.1.9 Alteration of seabed habitats arising from effects on Coastal Processes, including changes in wave and tidal regimes resulting in indirect effects on benthic ecology during the operational and maintenance phase, of **No Significance** in EIA Terms (Chapter 9: Benthic Subtidal and Intertidal Ecology).

#### FISH, SHELLFISH AND SEA TURTLE ECOLOGY:

23.4.1.10 Increased SSC and associated sediment deposition resulting in impacts on fish and shellfish receptors (i.e. through avoidance behaviour, physiological effects, effects on eggs and larvae, smothering effects) during all phases of the Proposed Development of **No Significance** in EIA Terms (Chapter 10: Fish, Shellfish and Sea Turtle Ecology); and



23.4.1.11 Alteration of seabed habitats arising from effects on Coastal Processes, including changes in wave and tidal regimes resulting in indirect effects on fish and shellfish receptors during the operational and maintenance phase, of **No Significance** in EIA Terms (Chapter 10: Fish, Shellfish and Sea Turtle Ecology).

#### MARINE MAMMALS

23.4.1.12 Increased SSC and associated sediment deposition resulting in impacts in fish and shellfish community affecting marine mammal prey resources during all phases of the Proposed Development of **No Significance** in EIA Terms (Chapter 11: Marine Mammals).

#### MARINE ARCHAEOLOGY

23.4.1.13 Sediment disturbance and deposition leading to effects on known heritage assets during all phases of the Proposed Development of **No Significance** in EIA Terms (Chapter 18: Marine Archaeology and Cultural Heritage).

#### INFRASTRUCTURE AND OTHER USERS

23.4.1.14 Increased SSC and associated sediment deposition resulting in impacts on Infrastructure and Other Users receptors during all phases of the Proposed development of **No Significance** in EIA Terms (Chapter 19 Infrastructure and Other Users)

**Table 23.3: Summary of potential interactive effects on coastal receptors, sandbanks and designated sites from the Proposed Development's lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Increased SSC and associated deposition	Imperceptible/ slight	Imperceptible	Imperceptible/ slight	<p>The activities resulting in the highest sedimentation levels within the coastal zone below the HWM will occur during the construction phase, with any effects being of short-term duration and high reversibility. Due to this and the low sensitivity of the receptor to sedimentation, the interaction of these impacts across the stages of the Proposed Development lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases and presented here.</p> <p>During the construction phase, the magnitude of the impact on Arklow Bank is predicted to be of local spatial extent, short-term duration, intermittent and of high reversibility, with a lower magnitude of impact predicted during the operational and maintenance phase. Due to this and the fact that the sandbank is located in an area of strong tidal currents and with an active sediment transport regime, the interaction of these impacts across the stages of the project lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases and presented here.</p>
Presence of infrastructure may lead to changes to tidal currents, wave climate and sediment transport	Not significant in EIA terms	Slight adverse to not significant	Not significant in EIA terms	This effect will only arise during the operation and maintenance phase and as such there will be no interactions between impacts across the project phases.

### Receptor-led effects

The evaluation of SSC and associated deposition examined construction phase activities separately and there is a potential that more than one activity may occur at a given time. For example, seabed preparation may be undertaken at one part of the site whilst inter-array cables are installed in another part. In terms of elevated suspended sediment levels, it should be noted that plumes would not travel towards each other as they are carried by the tide. It is also unlikely that two activities would occur in close proximity simultaneously as the processes are consecutive, for example the site must be prepared prior to foundation installation.

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
<p>In terms of coastal processes receptors, it is only at landfall that impacts from the offshore export cabling activity may occur and would not experience interactive effects should other construction activities occur further offshore at the Array Area. Any SSC increases from bentonite release will be small and rapidly dispersed.</p> <p>There are potential interactions between increased SSC and associated deposition and changes to tidal currents, wave climate, seabed morphology and sediment transport. The changes in tide and wave regimes do not extend to the receptor at Wicklow Reef nor to the coastline, therefore there will be no interaction of these effects at the receptors. Historical analysis of seabed morphological change has not shown any connectivity, in terms of sediment transport, between the sandbank features and the coastline (Partrac, 2022). Any effects due to changes in the Coastal Processes are likely to be limited, both in extent (i.e. largely within the Array Area and Cable Corridor and Working Area) and also in magnitude, with receptors having low sensitivity to the scale of the changes predicted. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.</p>				

## Marine water and sediment quality

23.4.1.15 As a requirement of the Planning and Development Regulations 2001, as amended, and the EPA guidelines (2022), not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

23.4.1.16 A matrix illustrating where interactions between effects on different factors have been addressed is provided in Table 23.19.

23.4.1.17 MW&SQ is not just a receptor in its own right, but also provides impact pathways for other receptors. For example, physiochemical properties of the marine environment, such as temperature, salinity, and contaminant bioavailability, are a pathway for impacts on other receptors. The following features have been identified in Chapter 7: Marine Water and Sediment Quality as potentially sensitive MW&SQ receptors:

- WFD designated water bodies, including bathing waters (BW) and coastal/ transitional waters; and
- Non-designated receptors in the wider marine environment below HWM.

23.4.1.18 The following impacts have been considered within this interaction assessment:

- Deterioration in water quality due to suspension of sediments;
- Release of sediment bound contaminants from disturbed sediments; and
- Accidental release or spills of materials or chemicals.

23.4.1.19 The project lifetime effects that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Proposed Development, and the receptor-led effects that are predicted to arise for WFD water bodies and the wider marine environment are provided in Table 23.4.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.1.20 Effects on water quality (e.g. from increases in SSC or accidental release or spill of materials or chemicals) also have the potential to have secondary effects on other receptors which have been fully assessed in the topic-specific chapters. These receptor pathways are:

### BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY:

23.4.1.21 Increased SSC caused by Proposed Development activities have the potential to alter water clarity (i.e. leading to reduced dissolved oxygen and increased bacterial counts). This reduced water clarity can then cause secondary effects on benthic ecology during all phases of the Proposed Development of **Slight adverse** significance (Chapter 9: Benthic Subtidal and Intertidal Ecology).

23.4.1.22 Accidental release or spills of materials or chemicals caused by the Proposed Development activities have the potential to alter water quality (i.e. contaminant bioavailability). This reduced water quality can then cause secondary effects on benthic ecology during all phases of the Proposed Development from **Not significant** during the O&M phase to **Slight adverse** during the construction and decommissioning phases (Chapter 9: Benthic Subtidal and Intertidal Ecology).

23.4.1.23 The release of sediment bound contaminant from activities disturbing the sediment could lead to an increased contaminant bioavailability with the potential for ecotoxicological effects. However, due to the lack of contaminants found in the project-specific survey, it was considered unlikely that there would be any pathways on benthic communities. Therefore, this pathway was scoped out of the Benthic Subtidal and Intertidal Ecology assessment.

#### FISH, SHELLFISH AND SEA TURTLE ECOLOGY:

- 23.4.1.24 Increased SSC caused by Proposed Development activities have the potential to alter water clarity (i.e. leading to reduced dissolved oxygen and increased bacterial counts). This reduced water clarity can then cause secondary effects on fish, shellfish and sea turtle ecology during all phases of the Proposed Development of **Slight adverse** significance (Chapter 10: Fish, Shellfish and Sea Turtle Ecology).
- 23.4.1.25 Accidental release or spills of materials or chemicals caused by the Proposed Development activities have the potential to alter water quality (i.e. contaminant bioavailability). This reduced water quality can then cause secondary effects on fish, shellfish and sea turtle ecology during all phases of the Proposed Development from **Not significant** during the O&M phase to **Slight adverse** during the construction and decommissioning phases (Chapter 10: Fish, Shellfish and Sea Turtle Ecology).
- 23.4.1.26 The release of sediment bound contaminant from activities disturbing the sediment could lead to an increased contaminant bioavailability with the potential for ecotoxicological effects. However, due to the lack of contaminants found in the project-specific survey, it was considered unlikely that there would be any pathways on fish and shellfish communities. Therefore, this pathway was scoped out of the Fish, Shellfish and Sea Turtle Ecology assessment.

#### MARINE MAMMALS:

- 23.4.1.27 Increased SSC caused by Proposed Development activities have the potential to alter water clarity (i.e. leading to reduced dissolved oxygen and increased bacterial counts). This reduced water clarity can then cause secondary effects on Marine Mammals during all phases of the Proposed Development of **No significance** (Chapter 11: Marine Mammals).
- 23.4.1.28 Accidental release or spills of materials or chemicals caused by the Proposed Development activities have the potential to alter water quality. This reduced water quality (i.e. contaminant bioavailability or oil slicks) can then cause secondary effects on marine mammal ecology during all phases of the Proposed Development of **Slight adverse** significance (Chapter 11: Marine Mammals).
- 23.4.1.29 The release of sediment bound contaminant from activities disturbing the sediment could lead to an increased contaminant bioavailability with the potential for ecotoxicological effects. However, due to the lack of contaminants found in the project-specific survey, it was considered unlikely that there would be any pathways on marine mammals (including indirect effects from benthic or fish and shellfish communities as known food sources). Therefore, this pathway was scoped out of the Marine Mammals assessment.

#### INFRASTRUCTURE AND OTHER USERS:

- 23.4.1.30 Increased SSC caused by Proposed Development activities have the potential to alter water clarity (i.e. leading to reduced dissolved oxygen and increased bacterial counts). This reduction in water clarity can lead to secondary effects on recreational diving sites and recreational fishing activities across all phases of the Proposed Development from **Imperceptible** during the O&M phase to **Slight adverse** during the construction and decommissioning phase (Chapter 19: Infrastructure and Other Users).

**Table 23.4: Summary of potential interactive effects on MW&SQ receptors from project lifetime effects and receptor-led effects.**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Deterioration in water quality due suspension of sediments	Slight adverse	Not significant	Slight adverse	<p>The activities resulting in the highest increase of SSC levels within the coastal zone below the HWM will occur during the construction phase, with any effects being of short-term duration and high reversibility. Due to this and the low to medium sensitivity of MW&amp;SQ receptors to increased SSC, the interaction of these impacts across the stages of the project lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases and presented here.</p> <p>During the construction and decommissioning phases, the magnitude of the impact of increased SSC is predicted to be of local spatial extent, short-term duration, intermittent and of high reversibility, with an even lower (negligible) magnitude of impact on MW&amp;SQ receptors predicted during the O&amp;M phase. This dip in magnitude further prevents any interaction of these impacts to carry across the various stages of the Proposed Development. For example, increased SSC (and potential elevated bacteria) from intensive construction activities is expected to dissipate no longer than 10 hours after cessation of activities. Therefore, it is not anticipated that any potential effects will remain into the O&amp;M activities. Due to this and the fact that the Proposed Development is located in an area of strong tidal currents and with an active sediment transport regime, the interaction of these impacts across the stages of the project lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases.</p>
Release of sediment bound contaminants from disturbed sediments.	Imperceptible to Slight adverse	Imperceptible to Slight adverse	Imperceptible to Slight adverse	<p>The activities resulting in the highest increase of SSC levels, and therefore release of sediment bound contaminants, will occur during the construction phase, with any effects being of short-term duration and high reversibility. Due to this and the negligible to medium sensitivity of MW&amp;SQ receptors to increased SSC, the interaction of these impacts across the stages of the project lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases and presented here.</p>

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
				<p>During the construction and decommissioning phases, the magnitude of the release of sediment bound contaminants is predicted to be of local spatial extent, short-term duration, and intermittent frequency, with an even lower (negligible) magnitude of impact on MW&amp;SQ receptors during the O&amp;M phase. This dip in magnitude further prevents any interaction of these impacts to carry across the various stages of the Proposed Development. For example, only very few sediment-bound contaminant concentrations enter into the dissolved phase, where the vast majority remain adhered to the sediment particles when temporary entering suspension in the water column. As such, the majority of re-suspended contaminants will remain with the sediment during deposition not becoming bioavailable, indicating that any likelihood of impact will dissipate after cessation of activities. Therefore, it is not anticipated that any potential effects from the construction phase will remain into the sequential phases of the Proposed Development. Due to this and the fact that the Proposed Development is located in an area of strong tidal currents and with an active sediment transport regime, the interaction of these impacts across the stages of the project lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases.</p>
Accidental release or spills of materials or chemicals	Imperceptible to Not significant	Imperceptible to Not significant	Imperceptible to Not significant	<p>The likelihood of project lifetime effects arising is low given the factored-in measures that will be applied throughout the various project stages which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on MW&amp;SQ 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.</p>

#### Receptor-led effects

Potential exists for spatial and temporal interactions between increased SSC, release of sediment bound contaminants and accidental release or spills of materials or chemicals effects during the lifetime of the Proposed Development. Based on current understanding, the greatest scope for potential interactions between impacts is predicted to arise through the interaction of increased SSC and associated release of sediment bound contaminants during

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects

the construction phase. These individual impacts were assigned a significance of imperceptible to slight adverse as standalone impacts and although potential combined impacts may arise, it is important to take into consideration the effect-receptor pathways of each effect. The majority of effects associated with increased SSC (Impact 1) and the release of sediment bound contaminants (Impact 2) will arise from seabed preparation works or inter-array cable installation. In the evaluation of increased SSC, construction phase activities were examined separately and there is a potential that more than one activity may occur at a given time. However, it should be noted that resulting sediment plumes would not travel towards each other as they are carried by the tide. It is also unlikely that two activities would occur in close proximity simultaneously as the processes are consecutive, for example the site must be prepared prior to foundation installation. Yet, theoretically, an area subjected to a decrease in water clarity from increased SSC could simultaneously be subjected to the release of sediment bound contaminants caused by the same activities. However, the impact from increased SSC works by reducing water clarity and light penetration into the water column leading to an increase of bacterial mortality. Whereas the impact of the release of sediment bound contaminants works by seabed sediment becoming disturbed into the water column creating the potential for sediment bound contaminants (if any) to become bioavailable to surrounding organisms. Since the Proposed Development is located in an area of strong tidal currents and with an active sediment transport regime, the interaction of these impacts across the stages of the Proposed Development lifecycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases. This is because both Impact 1 and Impact 2 rely on the effect-receptor pathways in question lasting in a given area for an extended period of time. Moreover, sediment plumes are not expected to reach any of the designated coastal or transitional or designated BWs and any combined impact would not act singularly or additively to alter the quality status of these waterbodies. Any effects are likely to be limited, both in extent (i.e. largely within the Array Area and Cable Corridor and Working Area) and also in magnitude, with receptors having no notable sensitivity to the scale of the changes predicted. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.



## Airborne noise

23.4.1.31 As a requirement of the Planning and Development Regulations 2001, as amended, and the EPA guidelines (2022), not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

23.4.1.32 For airborne noise, the following potential impacts have been considered within the interactions assessment:

- Installation of piles causing disturbance to onshore Noise Sensitive Receptors (NSRs); and
- Disturbance from operation of WTGs.

23.4.1.33 Table 23.5 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Proposed Development, and the receptor-led effects that are predicted to arise for NSRs.

23.4.1.34 In terms of inter-related impacts, the only interaction between airborne noise effects will occur with Population and Human Health.

23.4.1.35 A matrix illustrating where interactions between effects on different factors have been addressed is provided in Table 23.19.

**Table 23.5: Summary of potential interactive effects on airborne noise from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Installation of piles causing disturbance to onshore NSRs	Slight	N/A	N/A	This effect will only arise during the construction phase and as such there will be no interactions between impacts across the project phases.
Disturbance from operation of WTGs	N/A	Imperceptible / Not Significant	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between impacts across the project phases.

#### Receptor-led effects

Potential exists for spatial and temporal interactions between the effects arising from installation of piles causing disturbance to onshore NSRs, during the lifetime of the Proposed Development.

Based on current understanding, and expert knowledge, the greatest potential for interactions between impacts is predicted to arise through the interaction of installation of piles causing disturbance to onshore NSRs. The impact of installation of piles was assigned a significance of slight adverse (with mitigation) as a standalone impact and although potential combined impacts may arise (i.e. spatial and temporal overlap of disturbance with cable laying, etc.), it is predicted that this will not be any more significant than the individual impact of installation of piles in isolation during construction. These interactions are predicted to be no greater than the individual effects assessed in isolation.

## Air quality and climate

23.4.1.36 As a requirement of the Planning and Development Regulations 2001, as amended, and the EPA guidelines (2022), not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

23.4.1.37 For Air Quality and Climate the following potential impacts have been considered within the interactions assessment:

- Emissions to atmosphere.

23.4.1.38 Climate change will result in modified climate conditions and an increase in extreme weather events and the adaption of the Proposed Development to these impacts has been factored into the design of the Proposed Development as presented in Volume II, Chapter 4: Description of Development. This adaption is also addressed within Volume II, Chapter 22: Major Accidents and Natural Disasters.

23.4.1.39 Table 23.6 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Proposed Development.

23.4.1.40 A matrix illustrating where interactions between effects on different factors have been addressed is provided in Table 23.19.

**Table 23.6: Summary of potential interactive effects on air quality and climate from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Emissions to atmosphere	Slight adverse	Major beneficial	Slight adverse	Emissions to the atmosphere that will occur during all phases of the development, through activities such as production of materials and operation of machinery, is more than offset by the generation of renewable clean energy throughout the operational lifetime (anticipated to be 36.5 years) of the Proposed Development. Across the project lifetime, these effects 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.
<b>Receptor-led effects</b>				
N/A				

## 23.4.2 Biological environment

### Benthic subtidal and intertidal ecology

23.4.2.1 For Benthic Subtidal and Intertidal Ecology receptors, the following potential impacts have been considered within the interactions assessment:

- Long-term subtidal habitat loss/change;
- Temporary subtidal habitat loss/disturbance;
- Increased suspended sediment concentrations and associated deposition;
- Injury and/or disturbance from underwater noise and vibration;
- Colonisation of hard structures;
- Alteration of seabed habitat arising from effects on physical processes;
- Removal of hard substrates resulting in loss of colonising communities;
- Increased risk of introduction and spread of invasive and non-native species; and
- Accidental pollution.

23.4.2.2 Table 23.7 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning of the Proposed Development, as well as the receptor led effects that are predicted to arise for Benthic Subtidal and Intertidal Ecology receptors.

### SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

#### FISH AND SHELLFISH ECOLOGY:

23.4.2.3 Temporary subtidal habitat loss/disturbance (construction, operational and maintenance and decommissioning phases) or long-term subtidal habitat loss (operational and maintenance phase) resulting in indirect effects on fish, shellfish and sea turtle ecology of **Imperceptible** to **Slight adverse** significance (Volume II, Chapter 10: Fish, Shellfish and Sea Turtle Ecology).

#### OFFSHORE ORNITHOLOGY:

23.4.2.4 Changes in the fish and shellfish community has the potential to indirectly effect ornithology receptors by affecting prey sources. This has been assessed as **Not significant** (Volume II, Chapter 12: Offshore Ornithology).

**Table 23.7: Summary of potential interactive effects on Benthic Subtidal and Intertidal Ecology from project lifetime effects and receptor-led effects.**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Temporary subtidal habitat loss/disturbance	Slight adverse	Not significant	Slight adverse	When temporary habitat loss/disturbance is considered additively across all phases of the project, although the total area of habitat affected is larger than for the individual project stages, similar habitats are widespread within the western Irish Sea. During the operational and maintenance phase, the majority of the disturbance will be highly localised with little repeat disturbance and the habitats affected are predicted to recover. Therefore, across the project lifetime, the effects on Benthic Subtidal and Intertidal 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.
Increased suspended sediment concentrations and associated deposition	Imperceptible to Slight adverse	Imperceptible to Slight adverse	Imperceptible to Slight adverse	The majority of the seabed disturbance (resulting in highest SSC/deposition) will occur during the construction phase. Benthic habitats potentially affected by increased SSC and deposition will have recovered in the intervening period between the different project phases. Therefore, across the project lifetime, the effects on benthic subtidal and intertidal 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.
Injury and/or disturbance from underwater noise and vibration	Slight adverse	N/A	N/A	This effect will only arise during the construction phase and as such there will be no interactions between effects across the project phases.
Long-term subtidal habitat loss/change	N/A	Moderate	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.
Colonisation of hard structures	Slight adverse	Slight adverse	Slight adverse	When colonisation of hard structures is considered additively across all phases of the project, the total area of habitat affected will not be larger than that for the individual project stages due to the

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
				presence of infrastructure that could be colonised remaining <i>in-situ</i> throughout the entire lifetime of the Proposed Development. Therefore, across the project lifetime, the effects on Benthic Subtidal and Intertidal 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.
Alteration of seabed habitat arising from effects on physical processes	N/A	Imperceptible	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.
Removal of hard substrates resulting in loss of colonising communities	N/A	N/A	Slight adverse	This effect will only arise during the decommissioning phase and as such there will be no interactions between effects across the project phases.
Increased risk of introduction and spread of invasive and non-native species	Imperceptible to Slight adverse	Imperceptible to Slight adverse	Imperceptible to Slight adverse	The likelihood of project lifetime effects arising is low given the factored-in measures that will be applied throughout the various project stages which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on Benthic Subtidal and Intertidal 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.
Accidental pollution	Slight adverse	Slight adverse	Slight adverse	The likelihood of project lifetime effects arising is low given the factored-in measures that will be applied throughout the various project stages which will ensure that the risk of interaction of such effects through time is limited. Therefore, across the project lifetime, the effects on Benthic Subtidal and Intertidal 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.

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects

### Receptor-led effects

Potential exists for spatial and temporal interactions between the effects arising from habitat loss/disturbance/alteration and increased suspended sediment concentration and associated sediment deposition on benthic habitats during the lifetime of the Proposed Development.

Based on current understanding, and expert knowledge, the greatest potential for interactions between impacts is predicted to arise through the interaction of long-term subtidal habitat loss/change and temporary subtidal habitat loss/disturbance from foundation installation/jack-up activities/anchor placement/scour, habitat disturbance due to increased suspended sediment concentrations and associated deposition, and alteration of seabed habitat arising from effects on physical processes.

These individual impacts were assigned a significance of imperceptible to moderate 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 the Array Area and Cable Corridor and Working Area), the biotopes affected are widespread across the western Irish Sea and, where temporary disturbance occurs, full recovery of the benthos is predicted. In addition, any effects due to changes in the physical processes are likely to be limited, both in extent (i.e. largely within the Array Area and Cable Corridor and Working Area) and also in magnitude, with benthic ecology receptors having low sensitivity to the scale of the changes predicted.

As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.



## Fish, shellfish and sea turtle ecology

23.4.2.5 For fish, shellfish and sea turtle receptors, the following potential impacts have been considered within the interactions assessment:

- Temporary habitat loss/disturbance;
- Increased suspended sediment concentrations and associated deposition;
- Injury and/or disturbance to fish and shellfish from underwater noise and vibration;
- Injury and/or disturbance to basking shark and sea turtles from increased vessel activities;
- Accidental pollution from vessels, vehicles, equipment and machinery;
- Long term habitat loss;
- Alteration of seabed habitats arising from changes in physical processes; and
- Temporary changes in EMF from subsea electrical cabling.

23.4.2.6 Table 23.8 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning of the Proposed Development, as well as the receptor led effects that are predicted to arise for fish, shellfish and sea turtle receptors.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

### MARINE MAMMALS:

23.4.2.7 Changes in the fish and shellfish community has the potential to indirectly effect marine mammal receptors by affecting prey sources. This has been assessed as **Imperceptible** significance (Volume II, Chapter 11 – Marine Mammals).

### OFFSHORE ORNITHOLOGY:

23.4.2.8 Changes in the fish and shellfish community has the potential to indirectly effect ornithology receptors by affecting prey sources. This has been assessed as **Not significant** (Volume II, Chapter 12: Offshore Ornithology).

### COMMERCIAL FISHERIES:

23.4.2.9 Impacts on commercially exploited fish and shellfish species may result in indirect effects on commercial fisheries receptors. This has been assessed as no greater than **Slight adverse** significance (Volume II, Chapter 14: Commercial Fisheries and Aquaculture).

**Table 23.8: Summary of potential interactive effects on fish, shellfish and sea turtle receptors from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Temporary habitat loss/disturbance	Imperceptible to Slight adverse	Imperceptible to Not significant	Imperceptible to Slight adverse	When temporary habitat loss/disturbance is considered additively across all phases of the project, although the total area of habitat affected is larger than for the individual project stages, similar habitats are widespread within the western Irish Sea. During the operational and maintenance phase, the majority of the disturbance 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.
Increased suspended sediment concentrations and associated deposition	Imperceptible to Not significant	Imperceptible to Not significant	Imperceptible to Not significant	The majority of the seabed disturbance (resulting in highest SSC/deposition) will occur during the construction phase. Receptors and associated spawning/nursery habitats potentially affected by increased SSC and deposition will have recovered in the intervening period between the different project 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.
Injury and/or disturbance to fish and shellfish from underwater noise and vibration	Imperceptible to Slight adverse	Not significant	N/A	The majority of underwater noise will be generated from piling during the construction phase. Receptors potentially affected by underwater noise effects will have recovered in the intervening period between the different project 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.
Injury and/or disturbance to basking shark and sea turtles from increased vessel activities	Not significant	Not significant	Not significant	The majority of the risk of collision to basking shark and sea turtles will occur during construction and decommissioning phases due to the increased levels of vessel traffic. Collisions resulting in death or serious injury are usually caused by vessels moving 7 m/s or faster, whereas with the exception of Crew Transfer Vessels (CTVs), the majority of vessels involved in construction and maintenance operate at slower speeds. The use of a EVMP for vessel crew will minimise potential for collision risk. With the factored-in measures in place and relatively low abundance of basking sharks and sea turtles within the Fish, Shellfish and Sea Turtle Ecology Study Area, the impacts of collision risk 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 from vessels, vehicles, equipment and machinery	Slight adverse	Not significant	Slight adverse	The likelihood of project lifetime effects arising is low given the factored-in measures that will be applied throughout the various project stages 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.
Long term habitat loss	N/A	Imperceptible to slight adverse	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no

interactions between effects across the project phases.

Alteration of seabed habitats arising from changes in physical processes	N/A	Imperceptible to slight adverse	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.
Temporary changes in EMF from subsea electrical cabling	N/A	Slight adverse	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.

### Receptor-led effects

Potential exists for spatial and temporal interactions between habitat loss/disturbance, increased SSC and sediment deposition, underwater noise, EMF and accidental pollution effects during the lifetime of the Proposed Development. Based on current understanding, and expert knowledge, the greatest scope for potential interactions between impacts is predicted to arise through the interaction of habitat loss/change (temporary and long term), increased SSC, underwater noise from piling during the construction phase, and EMF effects during the operational and maintenance phase. These individual impacts were assigned a significance of imperceptible or slight 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 SSC and deposition will arise from seabed preparation works or inter-array cable installation, whereas the majority of noise effects will arise from foundation piling for monopiles which will take place sequentially. Furthermore, underwater noise (generated through piling) 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 SSC. Similarly, any potential behavioural effects as a result of EMF would be likely to occur over the same area as temporary or long-term habitat loss/change effects (i.e. within metres of the cable), and therefore habitat loss/change effects would not be additive to EMF effects. Therefore, effects of greater significance than the individual impacts in isolation are not predicted.

## Marine mammals

23.4.2.10 As a requirement of the Planning and Development Regulations 2001, as amended, and the EPA guidelines (2022), interrelationships between factors must be identified and assessed when assessing the impact of a development on the environment.

23.4.2.11 A matrix illustrating where interactions between effects on different factors have been addressed are provided in Table 23.9.

23.4.2.12 For marine mammals, the following impacts have been identified and considered within the interactions assessment:

- Injury and/or disturbance to marine mammals from underwater noise during pile driving;
- Injury and/or disturbance to marine mammals from vessel activities;
- Changes in fish and shellfish community affecting prey resources;
- Accidental pollution;
- Changes in EMF from subsea electrical cabling;
- Injury and/or disturbance to marine mammals from underwater noise during UXO clearance; and
- Injury and/or disturbance to marine mammals from underwater noise during site surveys.

23.4.2.13 Table 23.9 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise for marine mammals.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.2.14 The interactions between marine mammals and fish and shellfish ecology are summarised below.

## FISH, SHELLFISH AND SEA TURTLE ECOLOGY

23.4.2.15 Changes in the fish and shellfish community affecting marine mammal prey resources resulting in indirect effects on marine mammals that are **Not Significant** in EIA terms (see Chapter 11: Marine Mammals).

**Table 23.9: Summary of potential interactive effects on marine mammals from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Injury and/or disturbance to marine mammals from underwater noise during pile driving	Auditory injury (PTS): Not Significant to Slight adverse  Behavioural disturbance: Imperceptible to Slight adverse	N/A	N/A	This effect will only arise during the construction phase and as such there will be no interactions between effects across the project phases. In addition, factored-in measures will be implemented to reduce the risk of injury occurring during construction thereby reducing the potential for long-term effects on individuals.
Injury and/or disturbance to marine mammals from vessel activities	Injury: Not Significant  Disturbance: Slight adverse	Injury: Not Significant  Disturbance: Slight adverse	Injury: Not Significant  Disturbance: Slight adverse	Consideration of collision risk and disturbance from vessel activities during the construction, operational and maintenance, and decommissioning phases of the Proposed Development is presented in Chapter 11: Marine Mammals. The potential for injury from collision and/or disturbance effects will arise at all stages of the Proposed Development, resulting in a potential project lifetime effect. However, it is not predicted that the significance of any potential effects will increase due to the interaction of this impact across all project stages, rather be maintained at the same level throughout the lifetime of the Proposed Development. 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.
Changes in fish and shellfish community	Not Significant	Not Significant	Not Significant	Impacts to fish and shellfish receptors will not result in an ongoing, additive loss of prey, over the project lifetime. Rather there may be an initial decrease in prey availability 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 the factored-in measures (e.g. an EMP and MPCP to reduce

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
affecting prey resources				accidental pollution (Volume III, Appendix 25.1: Environmental Management Plan) and avoidance of key habitats through layout refinement) will reduce the risk of significant effects on sensitive fish and shellfish receptors. Therefore, the significance of this interaction between effects is not predicted to increase over and above the predictions made for the individual project phases.
Accidental pollution	Slight adverse	Slight adverse	Slight adverse	The likelihood for project lifetime interactions between impacts to arise is low given the factored-in measures that will be implemented throughout the various stages of the Proposed Development (i.e. an EMP and MPCP (Volume III, Appendix 25.1: Environmental Management Plan)), 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 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.
Changes in EMF from subsea electrical cabling	N/A	Imperceptible	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases. Any effects are likely to be very small scale and localised with very limited potential for effects on individuals over the operational phase of the Project.
Injury and/or disturbance to marine mammals from underwater noise during UXO clearance	Auditory injury (PTS): Not Significant to Slight adverse Behavioural disturbance:	N/A	N/A	This effect will only arise during the construction phase and as such there will be no interactions between effects across the project phases. In addition, factored-in measures will be implemented to reduce the risk of injury occurring during construction thereby reducing the potential for long-term effects on individuals.

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
	Slight adverse			
Injury and/or disturbance to marine mammals from underwater noise during site surveys	Auditory injury (PTS): Not Significant Behavioural disturbance: Slight adverse	N/A	N/A	This effect will only arise during the construction phase and as such there will be no interactions between effects across the project phases. In addition, factored-in measures will be implemented to reduce the risk of injury occurring during construction thereby reducing the potential for long-term effects on individuals.

### Receptor-led effects

Potential exists for spatial and temporal interactions between the impact types listed above during the lifetime of the Proposed Development.

The greatest scope for interaction of different effects on marine mammals is during the construction phase, when underwater noise from piling is likely to interact with other impacts, specifically increased vessel traffic (both noise disturbance and collision risk) and changes in the fish and shellfish community affecting marine mammal prey resources. These individual impacts were assigned a significance of Not Significant / Imperceptible to Slight adverse significance as standalone impacts.

It is however important to recognise that some of the activities during the construction phase potentially resulting in combined effects are mutually exclusive and therefore will not interact to produce effects of greater significance. Specifically:

- Underwater noise (generated through piling, UXO clearance, and site surveys) will result in the displacement of marine mammals from areas within the Array Area where piling is occurring which will, in turn, mean that these individuals will not be exposed to additional displacement from the presence of vessels where they occur within the displacement ranges associated with disturbance from piling noise;
- Underwater noise disturbance from foundation installation, UXO clearance, site surveys, and vessels will result in displacement of marine mammals resulting in a reduced risk of collision with vessels; and
- Any potential disturbance to prey species may, to some extent, be offset on the basis that as marine mammals are temporarily displaced from areas around activities that generate underwater noise, some of the fish that form part of their diet may also be temporarily displaced to similar areas. It is therefore predicted that the interaction of these impacts may act, to some extent, to counter certain potential combined effects occurring and so effects



Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects

of greater significance than the individual impacts in isolation are not predicted for marine mammals during the construction phase of the Proposed Development. During the operational and maintenance phase, impacts associated with EMF are highly spatially localised to the immediate vicinity of the cable, therefore the potential for interaction with other impacts (such as disturbance from vessel movements, accidental pollution, and underwater noise) is deemed unlikely. The significance of effect on marine mammals during the operational and maintenance phase will not be of any greater significance than the effects when assessed in isolation (i.e. Imperceptible / Not Significant to Slight adverse).

## Offshore Ornithology

23.4.2.16 The following potential impacts have been considered within the interactions assessment:

- Disturbance and displacement;
- Indirect disturbance and displacement resulting from changes to prey species and habitats;
- Collision risk; and
- Barrier effects.

23.4.2.17 Table 23.10 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise for offshore ornithology receptors.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.2.18 The interactions between offshore ornithology and fish, shellfish and sea turtle ecology are summarised below.

### FISH, SHELLFISH AND SEA TURTLE ECOLOGY:

23.4.2.19 Impacts on fish and shellfish receptors are assessed in Chapter 10: Fish, Shellfish and Sea Turtle Ecology (i.e. through avoidance behaviour, physiological effects, effects on eggs and larvae, smothering effects) during all phases of the Proposed Development and no significant impacts were identified. Therefore no significant interactions exist between offshore ornithology and fish, shellfish and sea turtle ecology.

**Table 23.10: Summary of potential interactive effects on offshore ornithology receptors from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Disturbance and Displacement				
Red-throated diver	Moderate adverse	Not significant	Moderate adverse	Vessel activity in any one given year will be at its peak in the construction phase, reducing in the operational 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 operational and maintenance phase. Overall, across the lifetime of the Proposed Development, 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.
Guillemot	Not significant	Not significant	Not significant	
Razorbill	Not significant	Not significant	Not significant	
Gannet	N/A	Not significant	N/A	
Indirect disturbance and displacement resulting from changes to prey species and habitats				
Seabirds	Not significant	Not significant	Not significant	Impacts to prey species (i.e. fish and shellfish) will be at their maximum during the construction phase as a result of effects associated with underwater noise from piling, increased suspended sediments and habitat loss. The offshore export cable installation will result in a highly localised impact. Following construction, prey species will be expected to rapidly return to previous levels and indeed may exceed them due to potential aggregation around structures. As a result, 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.
Collision risk				
Arctic tern	N/A	Not significant	N/A	

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Black-headed gull	N/A	Not significant	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the phases of the Proposed Development.
Common tern	N/A	Not significant	N/A	
Common gull	N/A	Not significant	N/A	
Common tern	N/A	Not significant	N/A	
Gannet	N/A	Not significant	N/A	
Great black-backed gull	N/A	Not significant	N/A	
Kittiwake	N/A	Not significant	N/A	
Little gull	N/A	Not significant	N/A	
Barrier effects				
Seabirds	N/A	Not significant	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the phases of the Proposed Development.

### Receptor-led effects

Potential exists for spatial and temporal interactions between disturbance and displacement, indirect disturbance and displacement resulting from changes to prey species and habitats, collision risk, and barrier effects during the lifetime of the Proposed Development. Based on current understanding and expert knowledge, the greatest scope for potential interactions to occur is predicted to arise through the following:

- The interaction of direct disturbance and displacement of seabirds and indirect effects due to changes in prey species distributions during the construction phase; and
- The interaction of impacts due to collision risk, displacement and barrier effects during the operational and maintenance phase.

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 anticipated that direct displacement will only occur in close proximity to construction activities (e.g.  $\leq 2$  km), and these effects will be

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects

intermittent and of comparatively short duration. If prey species are displaced due to construction activity then this is likely to result in a redistribution of the seabirds which prey on them, thereby reducing the degree of direct displacement. Therefore, if neither impact (direct and indirect) occurs, or both occur, they will cancel each other out, and the only circumstance in which there could be a negative interaction would be if prey species are unaffected, but seabirds are displaced. However, this is equivalent to impacts assessed in Chapter 12: Offshore Ornithology and no further interaction needs to be considered. Consequently, no effects of greater significance than the individual impacts in isolation (i.e. imperceptible or slight adverse) are predicted during the construction phase.

With regards to interaction (b), mortality arising from collisions and also from operational displacement are considered to be mutually exclusive as a species cannot simultaneously exhibit a high level of avoidance (displacement) and a high level of collision risk. Furthermore, there is a separation between those species considered susceptible to collisions and those which are considered susceptible to displacement. The former are typically species which forage on the wing and therefore spend a notable proportion of time at rotor height, such as gannet and gull species, while the latter, such as auks and divers, forage by diving from the sea surface and typically fly well below rotor height. The consequence of this is that in-flight foraging species, while at greater collision risk, tend to have greater habitat flexibility since they move rapidly between foraging opportunities and are therefore less affected by displacement. In contrast, deeper diving species are more likely to fly directly to and from a foraging location (typically flying close to the sea surface) where they will spend a period of time and are less likely to move between foraging locations. Although some species may be affected by both impacts, in such cases the individual components (collision and displacement) will be lower than those more affected by one or the other, with the result that the combination effect remains small, and this would not be in such a way as to increase the significance of any of the individual effect significances (i.e. imperceptible or slight adverse).

## Offshore Bats

23.4.2.20 The following potential impacts have been considered within the interactions assessment:

- Direct disturbance and displacement due to anthropogenic noise
- Direct disturbance and displacement due to increased vessel activity and infrastructure presence
- Disturbance and displacement due to artificial lighting at night (ALAN)
- Indirect disturbance and displacement resulting from changes to prey
- Collision and Barotrauma

23.4.2.21 Table 23.11 list the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development for offshore bat receptors.

**Table 23.11: Summary of potential interactive effects on offshore bats from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Direct disturbance and displacement due to anthropogenic noise	No significant effects	No significant effects	No significant effects	Anthropogenic noise in any one given year will be at its peak in the construction phase, reducing in the operational and maintenance phase as major installation vessels leave the site leaving smaller numbers of predominantly smaller crew and supply vessels operating each year, to then increase again (although at a lower level than construction as there will be no piling taking place) during decommissioning phase. Since bat species are less sensitive to temporary threshold shifts than other terrestrial mammals, effects are not predicted to be significant. Overall, across the project lifetime, the effects on bats 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 disturbance and displacement due to increased vessel activity and infrastructure presence	No significant effects	No significant effects	No significant effects	Vessel activity in any one given year will be at its peak in the construction phase, reducing in the operational and maintenance phase as major installation vessels leave the site leaving smaller numbers of predominantly smaller crew and supply vessels operating each year, to then increase again (although at a lower level than construction as there will be no piling taking place) during decommissioning phase. Since bats' echolocation abilities and agility make it unlikely that the stationary objects or moving vessels would pose a disturbance risk to individuals in flight, effects are not predicted to be significant. Overall,

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
				across the project lifetime, the effects on bats 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.
Disturbance and displacement due to ALAN	No significant effects	No significant effects	No significant effects	ALAN will be at its maximum during the operational and maintenance phase due to the lighting of all WTGs and OSPs on all nights. The vessels and infrastructure during construction and decommissioning will be more localised as the spill from the lighting will not be as prominent. Across the project lifetime, the effects on bats 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 disturbance and displacement resulting from changes to prey	No significant effects	No significant effects	No significant effects	Indirect disturbance and displacement resulting from changes to prey will be at its maximum during the operational and maintenance phase due to the lighting of all WTGs and OSPs on all nights creating a 'vacuum effect', denuding the surrounding area of invertebrate prey. The vessels and infrastructure during construction and decommissioning will be more localised as the spill from the lighting will not be as prominent. Across the project lifetime, the effects on bats 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 type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Collision and Barotrauma	N/A	Significant effects	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between impacts across the project phases.

### Receptor-led effects

Potential exists for spatial and temporal interactions between disturbance and displacement due to ALAN and indirect disturbance and displacement resulting from changes to prey and collision and barotrauma during the lifetime of the Proposed Development. Based on current understanding and expert knowledge, the greatest scope for potential interactions to occur is predicted to arise through the following:

The interaction of direct disturbance and displacement due to ALAN and indirect disturbance and displacement resulting from changes to prey during the lifetime of the Proposed Development; and

The interaction of direct disturbance and displacement due to ALAN and therefore, the indirect disturbance and displacement resulting from changes to prey with collision and barotrauma during the operational and maintenance phase.

With regards to (a), as noted above, the more lighting present within the Array Area during each phase of the Proposed Development and the greater the light spill, the greater the chances of creating a 'vacuum effect', denuding the surrounding area of invertebrate prey. This in turn would bring more individual bats out to investigate the Array Area, Cable Corridor and Working Area. However, this is equivalent to impacts assessed in this chapter and no further interaction needs to be considered. Consequently, no effects of greater significance than the individual impacts in isolation are predicted to occur.

With regards to (b), the more bats that investigate the Array Area due to attraction from ALAN and prey distribution, the more likely bats are to interact with the WTGs. Therefore, increasing the risk of mortality due to collision and barotrauma. However, this is equivalent to impacts assessed in this chapter and no further interaction needs to be considered. Consequently, no effects of greater significance than the individual impacts in isolation are predicted to occur.

### 23.4.3 Human environment

#### Commercial fisheries and aquaculture

23.4.3.1 For commercial fisheries, the following potential impacts have been considered within the interactions assessment:

- Loss of grounds or restricted access to fishing grounds;
- Displacement of fishing activity into other areas;
- Interference with fishing activities;
- Increased steaming times to fishing grounds;
- Impacts on commercially exploited species; and
- Gear snagging (loss/damage of fishing gear).

23.4.3.2 Table 23.12 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Proposed Development, and the receptor-led effects that are predicted to arise for loss of access and displacement.

23.4.3.3 Effects on fish and shellfish receptors also have the potential to have secondary effects on commercial fisheries, which is considered in chapter 10: Fish, Shellfish and Sea Turtle Ecology.

23.4.3.4 Effects on shipping and navigation receptors also have the potential to have secondary effects on commercial fisheries, which is considered in Chapter 15: Shipping and Navigation.

**Table 23.12 Summary of potential interactive effects on commercial fisheries from project lifetime effects and receptor-led effects.**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Loss of grounds or restricted access to fishing grounds within the Array Area	Slight adverse to not significant	Slight adverse to not significant	Slight adverse to not significant	During construction and decommissioning phases of project, advisory safety zones, and therefore the areas from which commercial fishing will be excluded, will be highly localised. While 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 elsewhere and within the Array Area during the operational and maintenance phase, 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.
Loss of grounds or restricted access to fishing grounds within the Cable Corridor and Working Area	Slight adverse to not significant	Slight adverse to not significant	Slight adverse to not significant	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 temporary 500 m roaming advisory safety zones around cable installation activities. During operation, there will be no formal exclusion of fishing activity except for within temporary 500 m roaming safety zones implemented during major maintenance activities. In addition, disruption to Irish potters along the Cable Corridor and Working Area during construction will reduce during the operational 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 of fishing activity into other areas	Slight adverse to not significant	Slight adverse to not significant	Slight adverse to not significant	Fishing may be disrupted, and partial exclusion may occur during the construction, operational and maintenance and decommissioning phases of the Proposed Development. However, it is anticipated that fishing will resume where productive grounds can be targeted, with the exception of advisory safety zones around infrastructure undergoing major maintenance and advisory safe distances around vessels undertaking major maintenance activities. Also, alternate fishing grounds will be available for the fleets that operate across the Array Area and Cable Corridor and Working Area. Therefore, effects on commercial fisheries are not anticipated to interact in

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
				such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Interference with fishing activities	Slight adverse	Slight adverse	Slight adverse	With the successful implementation of measures adopted for this development (i.e. issue of Notices to Mariners (NTMs), preparation of a FMMS (Fisheries Management and Mitigation Strategy), close liaison with the local vessels), no significant effects are predicted for the construction, operation and maintenance, and decommissioning phases of the project. The majority of vessel traffic (resulting in interference with fishing) is predicted to peak during construction and decommissioning with reduced potential for interference during the operation and maintenance phase. 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.
Increased steaming times to fishing grounds	Not significant	Not significant	Not significant	Impacts due to increased steaming times may occur on a very localised scale during construction, operation and decommissioning. These are expected to peak during construction and decommissioning with reduced potential for increased steaming times required during the operational and maintenance phase. 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.
Effects on commercially exploited species	Slight adverse	Slight adverse	Slight adverse	Project lifetime inter-related effects are unlikely as the majority of disturbance (resulting in highest SSC/deposition) will be during the construction and decommissioning phases with minimal disturbance likely during the operational and maintenance phase. Impacts to prey species (i.e. fish and shellfish) will be at their maximum during the construction phase as a result of effects associated with underwater noise from piling, increased suspended sediments and habitat loss. 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.

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Potential for snagging of gear	Slight adverse	Slight adverse	Slight adverse	Impacts due to gear snagging have the potential to occur during the construction, operational and maintenance phase due to the presence of cable protection on the seabed and the presence of the export cable and inter-array cables. During decommissioning this wind turbine infrastructure will be removed although cable and scour protection will be left in situ following decommissioning. However, 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.

### Receptor-led effects

Inter-related effect from the combination of the reduction in access to fishing grounds and the subsequent increased pressure on adjacent grounds: During the construction and decommissioning phases, both effects will be temporary and short lived, with access to fishing grounds being prevented where construction and decommissioning activity is taking place. During operation the effects will be different depending on the receptors affected. The Irish potting fleet may access specific grounds within the Array Area or move to other fishing areas in the inshore area, which could put them into conflict with other potting fleet operators. As a result, the static fleets will be subjected to potential increases in pressure on their grounds. While the two effects may act together, it is considered that appropriately mitigated loss of access (see Chapter 14: Commercial Fisheries and Aquaculture), will limit the impact of displacement and that therefore, overall, any inter-related effect will not be of any greater significance than those already assessed in isolation (i.e. slight adverse significance).

## Shipping and navigation

23.4.3.5 For shipping and navigation, the following potential impacts have been considered within the interactions assessment:

- Displacement of routing vessel traffic;
- Port access restrictions;
- Increased collision risk;
- Increased allision risk;
- Cable interaction risk;
- Diminished emergency response capability; and
- Interference with marine navigational equipment.

23.4.3.6 Table 23.13 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise for shipping and navigation receptors.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.3.7 No linked receptor effects have been identified for shipping and navigation and other technical assessments.

**Table 23.13: Summary of potential interactive effects on shipping and navigation receptors from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Displacement of routeing vessel traffic	Broadly acceptable	Broadly acceptable	Broadly acceptable	Due to the shallow nature of the Arklow Bank, all larger commercial vessels within the Shipping and Navigation Study Area already avoid the Array Area. Worst case routing assessments (as described in Volume III, Appendix 15.1: Navigational Risk Assessment) identified a maximum increase in journey distance of 0.83%, which after consultation with the most sensitive of receptors (commercial ferries), was deemed to be of minimal concern due to the large clearance from shallow waters already given. Due to the significant majority of vessels not being displaced by the Proposed Development, in addition to factored-in measures to provide early promulgation of construction and maintenance activities through NtMs, it is unlikely across the project lifetime that effects on shipping and navigation will act together. Any interactions between effects will not be of any greater significance than those already assessed in isolation (i.e. broadly acceptable significance).
Port access restrictions	Broadly acceptable	Broadly acceptable	Broadly acceptable	Given existing vessel access routes into Arklow Port already avoid the Array Area, the only potential consequence is minor and temporary restriction associated with the offshore export cable route works and associated vessel movements. This impact is likely to be at its greatest extent during the construction phase. As it is not expected that there is a situation where port access is prevented, 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 collision risk	Broadly acceptable	Broadly acceptable	Broadly acceptable	The scale of effects to shipping and navigation progressively increases during construction as the wind turbines and ancillary structures are installed, and a greater number of vessels are increasingly displaced. However, the factored-in measures, including a 'rolling' 500 m advisory safety passing distance surrounding all fixed structures where work is being undertaken by a construction or maintenance vessel, will reduce the likelihood of collision with vessels. Further factored-in measures including

				<p>50 m advisory safety passing distances (around all surface structures up until point of commissioning), appropriate vessel health and safety (including IMO conventions) and NtMs will ensure the safety of vessels operating in close proximity to the Proposed Development (see Table 15.10 of Chapter 15: Shipping and Navigation for full list of factored-in measures). Although the temporal effect is lengthened, with the implementation of the factored-in measures, 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.</p>
Increased allision risk	Broadly acceptable	Broadly acceptable	Broadly acceptable	<p>The scale of effects to shipping and navigation receptors progressively increases during construction as the wind turbines and ancillary structures are installed. The factored-in measures, including lighting and marking, depiction on charts, advisory safety zones and NtMs, will reduce the likelihood of allision from a powered vessel. In addition, the frequency of vessels not under command is extremely low. Although the temporal effect is lengthened, with the factored-in measures 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.</p>
Cable interaction risk	Broadly acceptable	Broadly acceptable	Broadly acceptable	<p>The scale of effects to shipping and navigation receptors progressively increases during construction as the inter-array, interconnector and offshore export cables are installed. The factored-in measures, including refinement of cable burial depths and cable protection requirements taking into account under keel clearance as part of the construction methods outlined in Volume II, Chapter 4: Description of Development, charting of all structures associated with the Proposed Development on relevant nautical and electronic charts and NtMs will reduce the likelihood of cable interactions (see Table 15.10 of Chapter 15: Shipping and Navigation for full list of factored-in measures). Although the temporal effect is lengthened, with the factored-in measures 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.</p>



Diminished emergency response capability	Broadly acceptable	Broadly acceptable	Broadly acceptable	Activities occurring across all phases of the Proposed Development could both increase the occurrence of incidents requiring emergency response in the area and diminish the capability of emergency response operations to respond to emergency situations by restricting access. However, the presence of construction, operational and maintenance and decommissioning vessels, as well as the provision of potential safe havens on OSPs, and the requirement for the agreed emergency response procedures in consultation with the Irish Coast Guard at each project phase, will 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.
Interference with marine navigational equipment	N/A	Broadly acceptable	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.

### Receptor-led effects

The potential exists for spatial and temporal interactions between deviations resulting in vessel collision risk, vessel to structure allision risk and diminished emergency response capability. The greatest scope for potential interactions between impacts could arise from the following:

- The interaction of collision risk and displacement of vessel traffic on shipping receptors; and
- The interaction of vessel allision risk and displacement vessel traffic on shipping receptors.

With regards to interaction (a), the displacement of routeing vessel traffic may lead to an increase in encounters and therefore vessel to vessel collisions, however this has been fully assessed in Volume III, Appendix 15.1: Navigational Risk Assessment. 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. broadly acceptable).

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

### Civil and military aviation and radar

23.4.3.8 For civil and military aviation, the following potential impacts have been considered within the interactions assessment:

- Creation of physical obstacles affecting air traffic; and
- Interference with civil and military Primary Surveillance Radar (PSR) systems.

23.4.3.9 Impacts scoped out of the assessment of civil and military aviation, have not been considered within the interactions assessment.

23.4.3.10 Table 23.14 lists the interactive effects (project lifetime effects) that are predicted to arise during the construction, operational and maintenance, and decommissioning of the Proposed Development and also the interactive effects (receptor-led effects) that are predicted to arise for civil and military aviation receptors.

23.4.3.11 Civil and military aviation is not considered to be linked with any other receptor group considered within the interactions assessment; see Table 23.14.

**Table 23.14: Summary of potential interactive effects on civil and military aviation from project lifetime effects and receptor-led effects.**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Creation of physical obstacles affecting air traffic	Not Significant	Not Significant	Not Significant	The scale of effects to civil and military aviation receptors progressively increases during construction as the wind turbines and ancillary structures are installed. Once installed, the infrastructure causing physical obstacles to air traffic will remain constant until the decommissioning phase. The effects on civil and military aviation 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.
Interference with civil and military PSR systems	N/A	Not Significant	N/A	This effect will only arise during the operational and maintenance phase and as such there will be no interactions between effects across the project phases.

#### Receptor-led effects

Potential exists for spatial and temporal interactions between direct impacts to civil and military aviation. Based on current understanding of stakeholders' views and expert knowledge, the greatest scope for potential interactions between impacts is predicted to arise from creation of physical obstacles affecting air traffic and interference with civil and military PSR systems during the operational and maintenance phase. It is unlikely that effects will act together and that any interactions between effects will not be of any greater significance than those already assessed in isolation (i.e. imperceptible to moderate significance).

## Seascape, landscape and visual amenity

23.4.3.12 For seascape, landscape and visual receptors, the following potential impacts have been considered within the interactions assessment:

- Changes to views experienced by people from specific and representative viewpoints and from visual receptors;
- Changes to the perceived seascape (coastal) character of coastal character areas;
- Changes to the perceived landscape character and qualities of designated landscapes; and
- Changes to night-time views and perceived character of coastal character as a result

23.4.3.13 Table 23.15 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operational and maintenance phase, and decommissioning of the Proposed Development and also the inter-related effects (receptor-led effects) that are predicted to arise for seascape, landscape and visual receptors.

### SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

23.4.3.14 Effects on seascape, landscape and visual receptors 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:

- Chapter 18: Marine Archaeology and Cultural Heritage

23.4.3.15 Temporary (during construction, operation and maintenance and decommissioning phases), long-term (during operation and maintenance phase only) and reversible (post-decommissioning) addition of Proposed Development resulting in direct effect to views from and indirect effect to perceived character of Gardens and Designed Landscapes (GDLs) and Registered Parks and Gardens (RPGs), including Lindisfarne Castle, and the North Northumberland Heritage Coast;

- Chapter 21: Population and Human Health

23.4.3.16 Temporary (during construction, operation and maintenance and decommissioning phases), long-term (during operation and maintenance phase only) and reversible (post-decommissioning) addition of Proposed Development resulting in indirect effect to visitor and tourist use of the coast including receptors such as beaches, recreational routes, golf courses and visitor attractions.

23.4.3.17 The summary of potential interactive effects for seascape, landscape and visual are shown in Table 23.15.

**Table 23.15: Summary of potential interactive effects for seascape, landscape and visual receptors**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
<b>Proposed Development lifetime effects</b>				
Changes to views experienced by people from specific and representative viewpoints and from visual receptors	✓	✓	✓	No greater than individually assessed impacts. Although impacts are broken down into different receptors (viewpoints and visual receptors) the actual receptor is the same in each case i.e., the people perceiving the effect. On balance, these people will only perceive the effect one way (visually) at one point in time, and will not experience the construction, operation and decommissioning phases simultaneously, or across multiple pathways.
Changes to the perceived seascape (coastal) character of coastal character areas	✓	✓	✓	No greater than individually assessed impacts. Although impacts are broken down into different receptors based upon physical and perceived characteristics (coastal character areas) the actual receptor is the same in each case i.e., the people perceiving the effect on coastal character. On balance, these people will only perceive the effect one way (visually) at one point in time, and will not experience the construction, operation and decommissioning phases simultaneously, or across multiple pathways.
Changes to the perceived landscape character and qualities of designated landscapes	✓	✓	✓	No greater than individually assessed impacts. Although impacts are broken down into different receptors based upon physical and perceived characteristics (landscape character types) and planning policies (landscape designations) the actual receptor is the same in each case i.e., the people perceiving the effect on coastal character. On balance, these people will only perceive the effect one way (visually) at one point in time, and will not experience the construction, operation and decommissioning phases simultaneously, or across multiple pathways.
Changes to night-time views and perceived character of coastal	✗	✓	✗	No greater than individually assessed impacts. Although impacts are broken down into different receptors (viewpoints and visual receptors) the actual

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
character as a result proposed development lighting				receptor is the same in each case i.e., the people perceiving the effect. On balance, these people will only perceive the effect one way (visually) at one point in time, and will not experience the construction, operation and decommissioning phases simultaneously, or across multiple pathways.

### Receptor-led effects

Receptor led effects (i.e. those that interact, spatially and temporally, to create inter-related effects on a receptor) will not occur on seascape, landscape and visual receptors, since changes are experienced by the same receptor in each case (people) and in one way (visually) at one point in time, therefore effects on views and on perceived character are inter-linked, and do not interact to produce a different, or greater effect, on a receptor than when effects are considered in isolation.

## Marine archaeology and cultural heritage

23.4.3.18 For marine archaeology and cultural heritage, the following potential impacts have been considered within the interactions assessment:

- Sediment disturbance and deposition leading to effects on known heritage assets;
- Direct impact on historic shipwreck sites; and
- Direct impact on buried palaeo-landscapes;

23.4.3.19 Table 23.16 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise upon marine archaeology and cultural heritage receptors.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

### COASTAL PROCESSES

23.4.3.20 As described in Chapter 6: Coastal Processes, for the most part, coastal processes associated with the physical environment (i.e. currents, waves and sediment transport) are not receptors in themselves, but they are the pathway for impacts on other receptors.

23.4.3.21 The surface deposits on Arklow Bank are principally sand, while the seabed surface within the Cable Corridor and Working Area is principally gravelly mud. The sand is mobile and its movement can both expose marine archaeological receptors and bury such receptors. This is indicated in the pattern of wreck site identification recorded in the course of marine geophysical surveys, as described in Volume III, Appendix 18.1: Marine Archaeology and Cultural Heritage Technical Report.

23.4.3.22 The Coastal Processes chapter records the pattern of suspended sediment that moves across the Array Area and the Cable Corridor Working Area, extending within one tidal extent of the Proposed Development. The distribution of suspended sediment is greatest in the winter months (December to March) and at a minimum in July. The high level indicative construction programme presented in Chapter 4: Description of Development indicates that construction will take place throughout the year. The likely impacts on marine archaeology receptors from suspended sediment is likely to be greatest in the winter months.

**Table 23.16: Summary of potential interactive effects on interactive effects on marine archaeology and cultural heritage from project lifetime effects and receptor-led effects.**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Sediment disturbance and deposition leading to effects on known and unknown heritage assets	None	None	None	The majority of sediment disturbance and deposition (resulting in greatest potential for effects on heritage assets) will be during the construction phase, with a lower magnitude of disturbance likely from maintenance activities. 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 impact on historic shipwreck sites	None	None	None	The greatest extent of activities resulting in direct impact to the seabed will occur during the construction 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 impact on buried palaeo-landscapes	None	None	None	The greatest extent of activities resulting in direct impact to the seabed will occur during the construction 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.

### Receptor-led effects

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 interactions is predicted to arise through the following:

- Combined effects on different elements of the historic environment (e.g. shipwrecks and buried palaeo-landscapes); and
- 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.

With regards to interaction (a), the factored-in measures proposed for the Proposed Development, which include implementation of Archaeological Exclusion Zones (AEZs) to avoid sites of identified archaeological significance as well as avoidance of archaeological constraints through layout refinement, will minimise combined effects on



Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects

different elements of the historic environment. It is therefore predicted that any interactions between effects will not be of any greater significance than those already assessed in isolation (i.e. slight adverse).

With regards to interaction (b), the implementation of AEZs will minimise the combined interactions of effects so that it will not be of any greater significance than those already assessed in isolation (i.e. slight adverse).

### Infrastructure and other users

23.4.3.23 For Infrastructure and Other Users, the following potential impacts have been considered within the interactions assessment:

- Potential for damage to ABWP1 export cable;
- Restriction of access to ABWP1 for maintenance activities;
- Impact on the ABWP1 existing cables from scour and sediment mobilisation;
- Displacement of other users due to the physical presence of infrastructure;
- Displacement of other users due to increased vessel movements and
- Increased suspended sediment concentrations and associated deposition affecting recreational diving sites.

23.4.3.24 Table 23.17 lists the Proposed Development lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise upon Infrastructure and Other Users' receptors.

## SUMMARY OF LINKED RECEPTOR GROUP ASSESSMENTS

### COASTAL PROCESSES

23.4.3.25 Effects on the sediment regime (i.e. from increases in SSC and sediment deposition above background levels or changes to sediment transport pathways) also have the potential to have secondary effects on Infrastructure and Other Users receptors. These receptors and effects are:

- Increased SSCs and associated deposition affecting recreational diving sites during the construction and decommissioning phases of the Proposed Development of **Slight adverse** significance; and during the operational and maintenance phase of **imperceptible adverse** significance.

### MARINE WATER AND SEDIMENT QUALITY

23.4.3.26 Increased SSC caused by Proposed Development activities have the potential to alter water clarity (i.e. leading to reduced dissolved oxygen and increased bacterial counts). This reduction in water clarity can lead to secondary effects on recreational diving sites and recreational fishing activities during construction and decommissioning phases of the Proposed Development of **slight adverse** significance; and during the operational and maintenance phase of **imperceptible adverse** significance (Chapter 7: Marine Water and Sediment Quality).

**Table 23.17: Summary of potential interactive effects on Infrastructure and Other Users from project lifetime effects and receptor-led effects**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Potential for damage to ABWP1 export cable	Slight adverse	Slight adverse	N/A	The ABWP1 export cable will be crossed by the Proposed Development cables. In addition, the installation and presence of infrastructure, advisory safety zones and advisory clearance distances may restrict access to the ABWP1 export cable during the construction and operational and maintenance phases. Cable crossing and proximity agreements will be developed and implemented with Arklow Energy Limited to minimise the potential for any impact. Therefore, across the Project lifetime, the effects 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.
Restriction of access to ABWP1 for maintenance activities	Slight adverse	Slight adverse	N/A	The installation and presence of infrastructure, advisory safety zones and advisory clearance distances during the construction and operational and maintenance phases may result in restricted access to ABWP1 for maintenance activities. As described above, detailed design and implementation of ABWP1 cable crossings will be coordinated with Arklow Energy Limited, to minimise the potential for any impact on access to ABWP1 for maintenance, in accordance with recognised industry good practice. Therefore, across the Project lifetime, the effects 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 the ABWP1 existing cables from scour and sediment mobilisation	N/A	Slight adverse	N/A	The presence of infrastructure associated with the Proposed Development in proximity to the ABWP1 export cable may lead to impacts on marine processes (e.g. changes to tidal currents, wave climate, sediment transport and seabed morphology), resulting in the potential for scour and associated sediment disturbance in the vicinity of the ABWP1 export cable. This impact is applicable to the operational and maintenance phase of the Proposed Development only, therefore, across the Project lifetime, there is no potential for interactions across project phases.
Displacement of other users	Slight adverse	Slight adverse	Slight adverse	The installation and presence of infrastructure, during the construction, operational and maintenance and decommissioning phases may result in the

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
due to the physical presence of infrastructure				displacement of recreational craft and recreational fishing vessels from the Array Area and along the offshore Cable Corridor and Working Area. Across the Project lifetime, the effects on recreational activities 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 of other users due to increased vessel movements	Slight adverse	Slight adverse	Slight adverse	The installation infrastructure, advisory safety zones and advisory clearance distances during the construction, operational and maintenance and decommissioning phases may result in the displacement of recreational craft and recreational fishing vessels from the Array Area and along the offshore Cable Corridor and Working Area. Across the Project lifetime, the effects on recreational activities 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 suspended sediment concentrations and associated deposition affecting recreational diving sites	Slight adverse	Imperceptible adverse	Slight adverse	The installation, maintenance and decommissioning of the Proposed Development may result in increased suspended sediment concentrations and associated deposition affecting recreational diving sites. Across the Project lifetime, the effects on recreational diving activities 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

Potential exists for spatial and temporal interactions between impacts to Infrastructure and Other Users receptors. The greatest scope for potential interactions between impacts is predicted to arise from the interaction of the displacement of recreational activities and the potential for damage to ABWP1 export cable. In the unlikely event that damage to the ABWP1 export cable occurs, the resulting maintenance/repair required may result in a further displacement of recreational activities due to advisory clearance distances around vessels. Through early promulgation of maintenance/repair works through Notices to Mariners, which is likely to apply to any works required at ABWP1, recreational activity would be able to be planned to avoid interactions with the works, and due to the proportionately small amount of sea area restricted in comparison to area available, it is unlikely that any interactions between these impacts will be of any greater significance than already assessed in isolation (i.e. slight adverse).

## Population and human health

23.4.3.27 The inter-related effects assessment considers likely significant effects from multiple impacts and activities from the construction, operational and maintenance, and decommissioning of the Proposed Development on the same receptor, or group of receptors.

23.4.3.28 The Population and Human Health assessment has considered potential effects arising from impacts identified in other chapters, including:

- Volume II, Chapter 8: Airborne Noise;
- Volume II, Chapter 14: Commercial Fisheries and Aquaculture;
- Volume II, Chapter 15: Shipping and Navigation;
- Volume II, Chapter 17: Seascape, Landscape and Visual Impact Assessment;
- Volume II, Chapter 19: Infrastructure and Other users;
- Volume II, Chapter 22: Major Accidents and Natural Disasters; and
- Volume III, Appendix 18.2: Cultural Heritage Visual Impact Assessment Report.

23.4.3.29 For Population and Human Health, the following potential impacts have been considered within the interactions assessment:

- Economic Activity in the Local Area Gross Value Added (GVA);
- Economic Activity in the Local Area (Employment);
- Economic Activity in Ireland (GVA);
- Economic Activity in Ireland (Employment);
- Tourism Economy Impact in the Local Area;
- Tourism Asset Impacts in the Local Area; and
- Residential Amenities and Community Facilities.

23.4.3.30 The effects on Population and Human Health are not anticipated to interact in such a way as to result in combined effects of greater significance on any other impact identified elsewhere in the EIAR.

23.4.3.31 Table 23.18 lists the project lifetime effects that are predicted to arise during the construction, operational and maintenance, and decommissioning phases of the Proposed Development and also the receptor-led effects that are predicted to arise upon population and human health receptors.

**Table 23.18: Summary of potential interactive effects on the economies of the Local Area and Ireland, the tourism economy of the Local Area, tourism assets in the Local Area, and residential amenities and community facilities in the Local Area**

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Economic Activity in the Local Area Gross Value Added (GVA)	Not Significant	Not Significant	Not Significant	The significance of effect from GVA impacts on the economy of the Local Area was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.
Economic Activity in the Local Area (Employment)	Not Significant	Not Significant	Not Significant	The significance of effect from GVA impacts on the economy of Ireland was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.
Economic Activity in Ireland (GVA)	Not Significant	Not Significant	Not Significant	The significance of effect from employment impacts on the economy of the Local Area was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.
Economic Activity in Ireland (Employment)	Not Significant	Not Significant	Not Significant	The significance of effect from employment impacts on the economy of Ireland was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.
Tourism Economy Impact in the Local Area	Not Significant	Not Significant	Not Significant	The significance of effect from impacts on the tourism economy of the Local Area was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.

Impact type	Residual effects			Interactions assessment
	C	O	D	Project lifetime effects
Tourism Asset Impacts in the Local Area	Not Significant/ Imperceptible	Not Significant/ Imperceptible	Not Significant/ Imperceptible	The significance of effect from impacts on the tourism assets of the Local Area was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.
Residential Amenities and Community Facilities	Not Significant	Not Significant	Not Significant	The significance of effect from impacts on the residential amenities and community facilities of the Local Area was assessed as <b>Not Significant</b> in EIA terms. Therefore, no additional mitigation was considered necessary. Therefore, no significant adverse residual effects have been predicted in respect of an increase in employment.

## 23.5 Summary

- 23.5.1.1 The matrices presented within this chapter assess potential interactive effects arising from the Proposed Development 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 EIAR chapters. The identification of potential interactions has been based on a largely qualitative assessment using expert judgement and noting that interactive effects have already been accounted for, in several instances, within the assessments in the topic specific chapters.
- 23.5.1.2 Project lifetime and receptor-led effects have been defined in order to differentiate the two types of interactive effects that may arise as a result of the Proposed Development.
- 23.5.1.3 Based on the detailed assessments presented in the preceding chapters of this EIAR (chapters 6 to 21), both project lifetime and receptor-led interactive effects have been identified and these interactions have been summarised in an Environmental Interactions Matrix (Table 23.19) to show where interactions between effects on different factors have been addressed (yellow ticked cells). However, based on one or a combination of the following factors: the low sensitivity of receptors; temporary and small-scale nature of effects; availability of alternative habitats; and also considering the factored-in measures, the overall significance of any interactive effects was not judged to increase above the significance value assessed for individual effects in the topic-specific chapters.



**Table 23.19: Environmental Interactions Matrix**

Interaction	Coastal Processes			MWSQ			Airborne Noise			Benthic Subtidal & Intertidal Ecology			Fish, Shellfish & Sea Turtle Ecology			Marine Mammals			Offshore Ornithology			Offshore Bats			Commercial Fisheries			Shipping & Navigation			Civil, Military & Aviation			Seascape, Landscape & Visual Amenity			Marine Archaeology and Cultural Heritage			Infrastructure & Other Users			Air Quality & Climate			Population & Human Health		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D			
Coastal Processes				✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓	✓	✓									
MWSQ										✓	✓	✓	✓	✓	✓																						✓	✓	✓									
Airborne Noise																																											✓	✓	✓			
Benthic Subtidal & Intertidal Ecology													✓	✓	✓				✓	✓	✓																											
Fish, Shellfish & Sea Turtle Ecology																✓	✓	✓	✓	✓	✓				✓	✓	✓																					
Marine Mammals													✓	✓	✓																																	
Offshore Ornithology										✓	✓	✓	✓	✓	✓										✓	✓	✓																					
Offshore Bats																																																
Commercial Fisheries												✓	✓	✓																																		
Shipping & Navigation																																																
Civil, Military & Aviation																																																
Seascape, Landscape & Visual Amenity																																																

Interaction	Coastal Processes			MWSQ			Airborne Noise			Benthic Subtidal & Intertidal Ecology			Fish, Shellfish & Sea Turtle Ecology			Marine Mammals			Offshore Ornithology			Offshore Bats			Commercial Fisheries			Shipping & Navigation			Civil, Military & Aviation			Seascape, Landscape & Visual Amenity			Marine Archaeology and Cultural Heritage			Infrastructure & Other Users			Air Quality & Climate			Population & Human Health		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D			
Marine Archaeology	✓	✓	✓																																													
Infrastructure & Other Users	✓	✓	✓	✓	✓	✓																																										
Air Quality & Climate																																																
Population & Human Health																																																

## 23.6 References

DCCAE (2014) Offshore Renewable Energy Development Plan, A Framework for the Sustainable Development of Ireland's Offshore Renewable Energy Resource. Department of Communications, Energy and Natural Resources. February 2014.

DHLGH (2019) National Marine Planning Framework, Consultation Draft Available at: <https://www.housing.gov.ie/planning/marine-planning/public-consultation-draft-national-marine-planning-framework> [Accessed 03/06/2020].

European Commission (EC) (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 1999.

Environmental Protection Agency (EPA) (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

Lambkin, D., Harris, J., Cooper, W., Coates, T. (2009), 'Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment: Best Practice Guide'. Technical Report, COWRIE.