Oriel Wind Farm Project

Natura Impact Statement

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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Contents

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Natura Impact Statement
Stage 2 Appraisal to inform an Appropriate Assessment of Implications on European Sites

MDR1520B
Natura Impact Statement
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Glossary

Term	Meaning
The Applicant	Oriel Windfarm Limited
Birds Directive	European Parliament and Council Directive 2009/147/EC on the conservation of wild birds, a key legislative measure for the protection of birds in the European Union.
Catchment	An area of land contributing to a river, lake or other water body
Cumulative Impacts	Impacts that result from incremental changes caused by other reasonably foreseeable actions alongside the project in question. This includes the impact of all other developments that were not present at the time of data collection (surveys etc.) (derived from DMRB (Highways Agency *et al*., 2008)).
Displacement	In relation to offshore wind farm development, displacement refers to a reduced number of birds occurring within or immediately adjacent to an offshore wind farm.
Disturbance	Disturbance occurs when a bird's normal pattern of activity is interrupted by an anthropogenic activity. Individuals may choose to avoid sources of disturbance (e.g. swimming or flying away) and may not return until sometime later.
Environmental Impact Assessment	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 EIA Directive and EIA Regulations, including the publication of an Environmental Impact Assessment (EIA) Report.
Foreshore	The area of the land and seabed between the high-water mark of ordinary or medium tides and the 12 nautical mile limit.
Groundwater Body	Groundwater bodies are subdivisions of large geographical areas of aquifers so that they can be effectively managed in order to protect the groundwater and linked surface waters.
Habitat	The natural home or environment of an animal, plant, or other organism.
Joint Bay	These are concrete lined chambers, that provide a clean and dry environment for jointing the sections of cable together. Link boxes and communication chambers (C2) will also be required along the onshore cable route adjacent to each JB. These are small chambers which house connections between the joints for fibre optic cables, cable shielding and other auxiliary equipment.
Landfall	The area in which the offshore export cable make landfall and is the transitional area between the offshore cabling and the onshore cabling. The landfall is proposed at Dunany Point.
Magnitude	Size, extent and duration of an impact.
Measures included in the Project	The Project design includes a number of designed-in measures and management measures (or controls) which are committed to be delivered by the Applicant as part of the Project. These measures are standard measures applied to offshore wind development, including lighting and marking of the Project, use of 'soft-starts' for piling operations etc, to reduce the potential for impacts. These measures are integrated into the description of the development and have therefore been considered in the assessments in the NIS.
Migration	The regular seasonal movement, often north and south along a flyway, between breeding and wintering grounds.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact.
Offshore cable corridor	The offshore export cable will be installed along a route in this corridor.
Onshore Cable Route	The route of the proposed underground electrical cable between the proposed landfall site and the proposed onshore substation site.
Onshore Substation Site	The site location of the proposed onshore substation.
Ornithology	Ornithology is a branch of zoology that concerns the study of birds.
Oriel Wind Farm Project	The subject of this NIS.
Project Design Parameter	These are the design details and measurements of the Project infrastructure that are used to inform the assessment of the likely significant effects of the Project on the environment. These also include details on the Project construction, operation and maintenance and decommissioning phase activities. Where design flexibility applies under Section 287B of the Planning and Development Act 2000 as amended, the project design parameters include a

Term	Meaning
	description of the parameters or options e.g. the wind turbine hub height will vary within the range 145-152 metres above Lowest Astronomical Tide (maLAT).
Sensitive Receptor	Physical or natural resource, special interest or viewer group that will experience an impact.
Sensitivity	Vulnerability of a sensitive receptor to change.
Water Body	A surface water body as defined under the Water Framework Directive (WFD) (i.e. a river/ stream, lake, transitional, coastal or groundwater body).
Watercourse	Any water body (WFD designation) as well as any other stream or ditch identified during the course of this NIS.

Acronyms

Term	Meaning
AA	Appropriate Assessment
ABP	An Bord Pleanála
AC	Alternating Current
ADD	Acoustic Deterrent Device
AIS	Air Insulated Switchgear
BDMPS	Biologically Defined Minimum Population Scale
BMP	Best Management Practices
CAP	Climate Action Plan
CBRA	Cable Burial Risk assessment
CEMP	Construction Environmental Management Plan
CIL	Commissioner of Irish Lights
CMU	Catchment Management Unit
CO	Conservation Objective
CJEU	Court of Justice of the European Union
CRM	Collision Risk Modelling
cSAC	Candidate Special Area of Conservation
cSPA	Candidate Special Protection Area
CTV	Crew Transfer Vessel
DAHG	Department of Arts Heritage and the Gaeltacht
DaS	Dumping at Sea
dMPNI	draft Marine Plan for Northern Ireland
DoD	Department of Defence
DPV	Dynamic Positioning Vessel
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Fields
EMP	Ecological Management Plan
EPA	Environmental Protection Agency
FCS	Favourable Conservation Status
FWPM	Freshwater Pearl Mussel
GIS	Gas Insulated Switchgear
GNI	Gas Networks Ireland
GSRP	Grey Seal Reference Population
HDD	Horizontal Directional Drilling
HSRP	Harbour Seal Reference Population
HVAC	High Voltage Alternating Current
HWM	High Water Mark
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICA	In-Combination Assessment
IRCG	Irish Coast Guard
IMO	International Maritime Organisation
JB	Joint Bay
JUV	Jack-Up Vessel
LAT	Lowest Astronomical Tide

Term	Meaning
LCIM	Line Cable Interface Masts
LSE	Likely Significant Effect
LV	Low Voltage
MMMP	Marine Mammal Mitigation Plan
MPCP	Marine Pollution Contingency Plan
MSO	Marine Survey Office
MU	Management Unit
MV	Medium Voltage
NIS	Natura Impact Statement
NISA	North Irish Sea Array
NMFS	National Marine Fisheries Service
NMPF	National Marine Planning Framework
NPWS	National Parks and Wildlife Services
OHL	Overhead Line
ORE	Offshore Renewable Energy
OREDP	Offshore Renewable Energy Development Plan
OSS	Offshore Substation
OWF	Offshore Wind Farm
OWL	Oriel Windfarm Limited
PAM	Passive Acoustic Monitoring
PDP	Project Design Parameters
PLGR	Pre-lay Grapnel Run
PTS	Permanent Threshold Shift
pSPA	Proposed Special Protected Area
RBMP	River Basin Management Plan
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SAR	Search and Rescue
SCI	Special Conservation Interest
SCADA	Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment
SEL	Sound Exposure Level
SPL_{pk}	peak Sound Exposure Level
SEL_{cum}	cumulative Sound Exposure Level
SEL_{ss}	single-strike Sound Exposure Level
SHD	Strategic Housing Development
SID	Strategic Infrastructure Development
SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SOV	Service Operation Vessel
SPA	Special Protected Area
SPL	Sound Pressure Level
SPL_{pk}	peak Sound Pressure Level
SEL_{cum}	cumulative Sound Pressure Level

Term	Meaning
SEL_{ss}	single-strike Sound Pressure Level
SSC	Suspended Sediment Concentrations
TAO	Transmission Asset Owner
TJB	Transition Joint Bay
TSO	Transmission System Operator
TTS	Temporary Threshold Shift
UI	Uisce Éireann
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance
QI	Qualifying Interest
VP	Vantage Point
WTG	Wind Turbine Generator
ZoI	Zone of Influence

Units

Term	Meaning
dB	decibels
GW	giggawatts
ha	hectare
km	kilometre
km^2	kilometre squared
kHz	kilohertz
kJ	kilojoule
kV	kiloVolt
m	metre
m^2	metre squared
mAOD	Metres Above Ordnance Datum
mg/L	milligrams per litre
m/s	Metres/second
MW	megawatts
TWh	terawatt hours
µPa	micro pascal
uT	microteslas
µV/m	Microvolts per meter

1 INTRODUCTION

1.1 Scope of report

The Oriel Wind Farm Project (hereafter referred to as "the Project") is a proposed offshore wind farm in the Irish Sea, off the coast of County Louth (approximately 22 km east of Dundalk town centre and 18 km east of Blackrock). Oriel Windfarm Ltd (hereafter referred to as "the Applicant") is proposing to develop the Project.

RPS was commissioned by the Applicant to prepare a Natura Impact Statement (NIS) to inform a Stage 2 Appropriate Assessment (AA) for the Project. This NIS has been prepared to accompany an application for permission to construct, operate and maintain and decommission the Project under the Planning and Development Act 2000, as amended.

An assessment of whether the Project, alone or in combination with other plans and projects, is likely to have an adverse effect on the integrity of any European site(s) in view of best scientific knowledge and the Conservation Objectives (COs) of the site(s), has been completed within this NIS.

The purpose of this NIS is to inform the Stage 2 Appropriate Assessment (as set out in the procedure shown on Figure 1-1) to be undertaken by the relevant Competent Authority or Public Authority as the case may be.

1.2 Legislative context

With the introduction of the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) came the obligation to establish the Natura 2000 network, comprising a network of areas of highest biodiversity importance for rare and threatened habitats and species across the EU.

The Natura 2000 network of sites comprises Special Areas of Conservation (SACs) designated under legislation transposing the obligations under Directive 92/43/EEC; and Special Protection Areas (SPAs) classified under the Birds Directive (Directive 2009/147/EC on the conservation of wild birds). SACs and SPAs (including candidate and proposed sites) make up the pan-European network of Natura 2000 sites, and they are referred to collectively as "European sites".

In this report, candidate and proposed SACs and SPAs are referred to as "SACs" and "SPAs" throughout the appraisal, and there is no distinction made between candidate/proposed sites and European sites as they have the same level of protection as a matter of domestic law and, therefore, the AA procedure does not treat them differently. For the purposes of AA, they are one and the same.

SACs are designated for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are designated for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats. The annexed habitats and species for which each site is designated correspond to the Qualifying Interests (QIs) of the sites in the case of SACs, and Special Conservation Interests (SCIs) of the sites in the case of SPAs.

From these QIs and SCIs, the COs of the site are derived.

1.2.1 The Habitats Directive

Article 6(3) of the Habitats Directive requires that:

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and if appropriate, after having obtained the opinion of the general public*".

Thus, Article 6(3) provides a two-stage process:

- The first stage involves a screening for AA to determine whether the relevant plan or project is likely to have a significant effect on a European site or sites; and
- The second stage arises where, having screened the Project, the relevant public authority determines that an AA is required, in which case it must then carry out that AA.

1.2.2 Irish legislation

For the purposes of applications for planning permission, Part XAB of the Planning and Development Act 2000, as amended (the 2000 Act) implements the obligations under Article 6(3) into Irish law. In relation to other consent regimes (including the DaS framework under the Dumping at Sea Act 1996), the provisions of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended (the 2011 Regulations), transpose those obligations.

The Maritime Area Planning Act 2021 (MAPA) provides for new consenting processes for foreshore licences, foreshore leases and planning permissions for various marine projects, including offshore renewable energy infrastructure. It provides that two separate consents are required for the development of offshore renewable energy projects. Firstly, a Maritime Area Consent ("MAC") is required to occupy the maritime area; and, secondly, a development consent is required to allow for the development of that area. For the purposes of applications for planning permission, Part XAB of the Planning and Development Act 2000, as amended (the 2000 Act) also applies in the maritime area.

This report has been drafted in support of an application for planning permission, and as such the provisions of the Part XAB of the Planning and Development Act 2000, as amended, apply.

The planning authority shall determine that an AA of a project is required where the project is not directly connected with or necessary to the management of the site as a European site and if it cannot be excluded, on the basis of objective scientific information following screening that the project, individually or in combination with other plans or projects, will have a significant effect on a European site.

1.2.3 UK departure from the EU

It is recognised that following the United Kingdom's departure from the European Union, SACs and SPAs in the UK are no longer considered "Natura 2000 sites" for the purpose of an assessment pursuant to Article 6(3) of the Habitats Directive and are instead part of the UK national site network. However, pursuant to the UK's Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, those sites still retain the same protection under UK law as they did prior to the UK's exit from the EU.

In these circumstances, and consistent with Ireland's obligations as a signatory to the Bern Convention on the Conservation of European Wildlife and Natural Habitats, to which the Birds and Habitats Directives give effect, and in order to ensure the highest level of protection for the species and habitats protected by those Directives, the following assessment includes an assessment of the UK sites formerly forming part of the Natura 2000 network of sites protected under those Directives.

This will enable the competent authorities to ensure that there will be no adverse effect on the integrity of those former European sites (i.e. Natura 2000 sites) within the UK.

1.2.4 Step-wise procedure

According to European Commission guidance documents 'Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2021); 'Guidance document on wind energy developments and EU nature legislation' (EC, 2020); and 'Managing Natura 2000 sites: The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (EC, 2019), the obligations arising under Article 6 establish a step-wise procedure for the consideration of plans and projects affecting European sites as follows, and as illustrated in Figure 1-1.

The first part of this procedure consists of a pre-assessment (or screening) stage to determine whether, firstly, a project is directly connected with or necessary to the management of the site, and secondly,

whether it is likely to have a significant effect on the site. This part is governed by the first sentence of Article 6(3).

The second part of the procedure, governed by the second sentence of Article 6(3), relates to the AA and the decision of the competent national authority (or the 'Public Authority' under the 2011 Regulations) as to whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European site.

A third part of the procedure (governed by Article 6(4)) comes into play if, despite a negative assessment (i.e. is not able to conclude that there will be no adverse effects on the integrity of a European site), it is proposed not to reject a project but to give it further consideration. In this case Article 6(4) allows for derogations from Article 6(3) under certain conditions.

The extent to which the sequential steps of Article 6(3) apply to a project depends on several factors, and in the sequence of steps, each step is influenced by the previous step. The order in which the steps are followed is therefore essential for the correct application of Article 6(3).

Each step determines whether a further step in the process is required. If, for example, the conclusion at the end of a Stage 1 screening appraisal is that significant effects on European sites can be excluded in the absence of any best practice or targeted measures intended to avoid or reduce the harmful effects of the project on European sites (i.e. designed-in measures and further mitigation), there is no requirement to proceed to the next step.

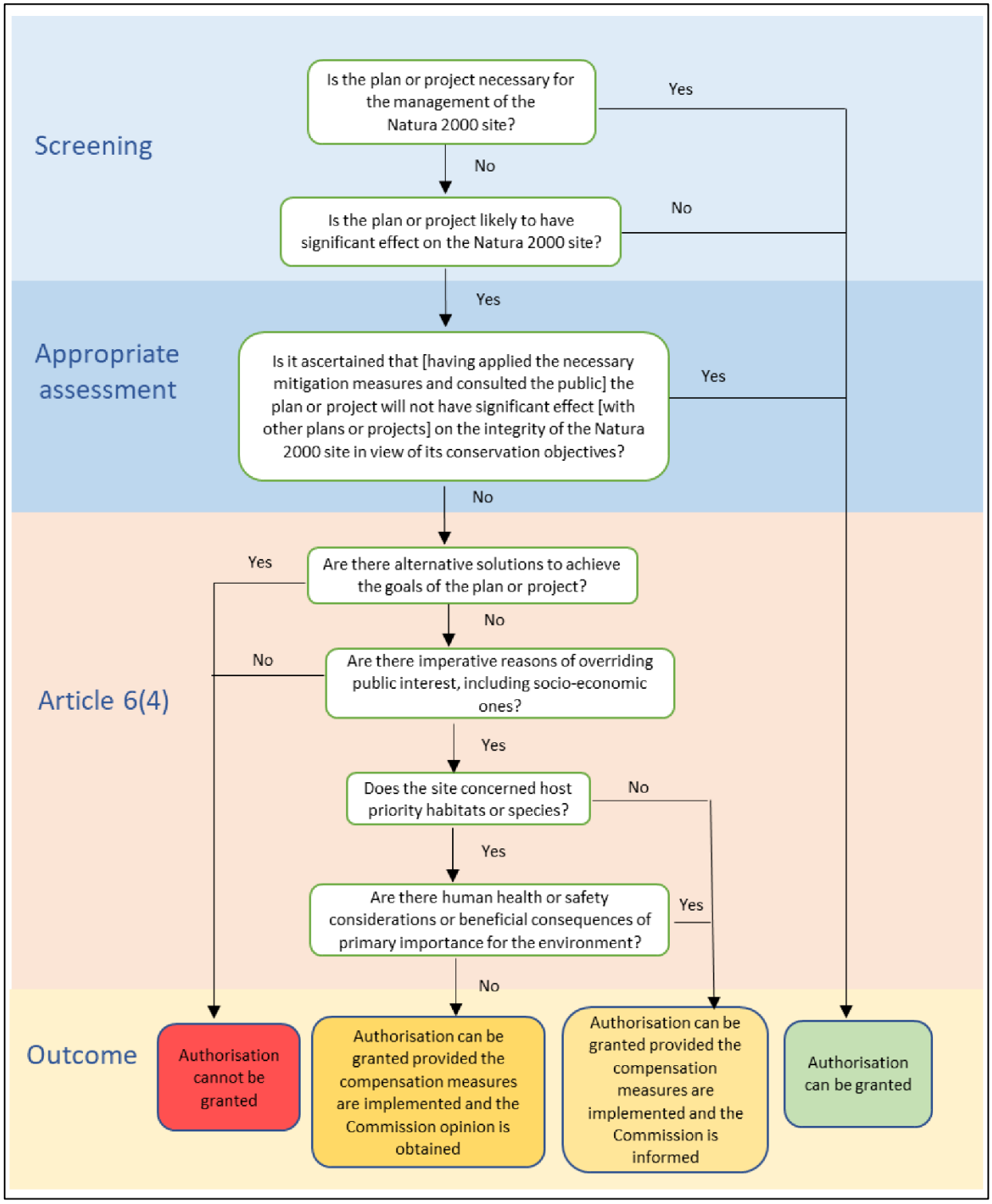


Figure 1-1: Step-wise procedure of Article 6 of the Habitats Directive (from EC, 2021).

1.3 Document structure

This report is structured as follows:

- **Section 1: Introduction** – This section defines the scope of the Project, setting out the legislative context which underpins the Stage 2 appraisal.

- **Section 2: Project Description** – This section describes the Project including the project design parameters and is the basis of the subsequent Stage 2 appraisal to inform appropriate assessment that follows.

- **Section 3: Methodology** – This section sets out the methodology followed and guidance documents used in conducting a Stage 2 appraisal to inform an appropriate assessment of the implications of the Project on European sites.

- **Section 4: Stage 1 Summary and Findings of the Report to Inform Screening for Appropriate Assessment** – This section summarises the results of the Stage 1 screening appraisal to inform screening for Appropriate Assessment and informs the subsequent Stage 2 appraisal to inform appropriate assessment that follows in section 5.

- **Section 5: Stage 2 Appraisal for Appropriate Assessment: Natura Impact Statement** –This section of the report contains a more detailed examination and analysis of the implications of the Project on the COs of those European sites where the possibility of likely significant effects (LSEs) could not be excluded at the Stage 1 Screening Appraisal in the absence of further evaluation and analysis, or the application of measures included in the project or further mitigation. The Stage 2 Appraisal has been undertaken in view of best scientific knowledge to assess the LSEs identified and the potential for adverse effects on the integrity of any European site(s) in light of the COs of the sites concerned and considers the Project individually and in combination with other plans and projects, to inform the Competent Authority responsible for undertaking AA.

  For the appraisal of habitats and species (see section 5.2 to section 5.7) a table setting out the project design parameters is presented. This sets out which phase of the Project (e.g. construction phase) the potential impact can occur and the design parameters (e.g. the laying of 41 km of inter-array cable or the installation of the monopile foundations) that have been used to inform the assessment. The appraisal also sets out the measures included in the project which are considered inherently part of the design of the Project and have therefore been considered in the assessment presented.

- **Section 6: Mitigation and Monitoring Measures** – This section summarises the mitigation and management measures (or controls) which have been committed to being delivered by the Developer as part of the Project, or have been applied to the Project to prevent adverse effects on the integrity of the sites concerned from occurring and which have been taken into account within section 6.

1.4 Supporting information

This NIS is informed by the Stage 1 Report to Inform Screening for Appropriate Assessment (appendix A), technical reports (appendix B, C and G) and appendices that provide supporting information (appendix D, E, F, H and I) on the potential impacts of the Project on relevant receptors which have been used to inform the assessment of adverse effects in section 5.

'Appendix K: Management Plans' includes a number of plans that outline how measures and controls will be implemented to prevent and minimise impacts from the Project. These plans support the assessments included in the Environmental Impact Assessment Report (EIAR) and the NIS.

The appendices are listed as follows:

- Appendix A: Report to Inform Screening for Appropriate Assessment;

- Appendix B: Marine Processes Technical Report;

- Appendix C: Subsea Noise Technical Report;
- Appendix D: Benthic Subtidal and Intertidal Ecology – Supporting Information;
- Appendix E: Fish and Shellfish Ecology – Supporting Information;
- Appendix F: Marine Mammal and Megafauna – Supporting Information;
- Appendix G: Marine Mammals and Megafauna Technical Report;
- Appendix H: Offshore Ornithology – Supporting Information; and
- Appendix I: Onshore Biodiversity – Supporting Information.

Additional appendices which also support this NIS include:

- Appendix J: Screening – In-combination Effects; and
- Appendix K: Management Plans[1].

[1] As the management plans support both the EIAR and NIS, there are cross references to the EIAR in the management plans. However, it is not necessary for the reader to cross reference to the EIAR to understand the measures and controls that are proposed in support of the NIS.

2 PROJECT DESCRIPTION

2.1 Introduction

This section of the NIS provides a description of the Project, which will have a maximum export capacity of 375 MW. It sets out the design, size and other features of the onshore and offshore infrastructure. It also describes the activities associated with the construction, operational and maintenance, and decommissioning phases of the Project.

Details on the design and construction of the offshore and onshore infrastructure of the Project are described in sections 2.5 and 2.6 respectively. The construction programme and information on employment is presented in section 2.6.5.

Details on the operational and maintenance phase activities are provided in section 2.8, while decommissioning activities are presented in section 2.9.

Information on the measures and controls that have been included in the Project are presented in section 2.10.

2.2 Project boundary

Figure 2-1 provides an overview of the Project, which is divided into the following main elements:

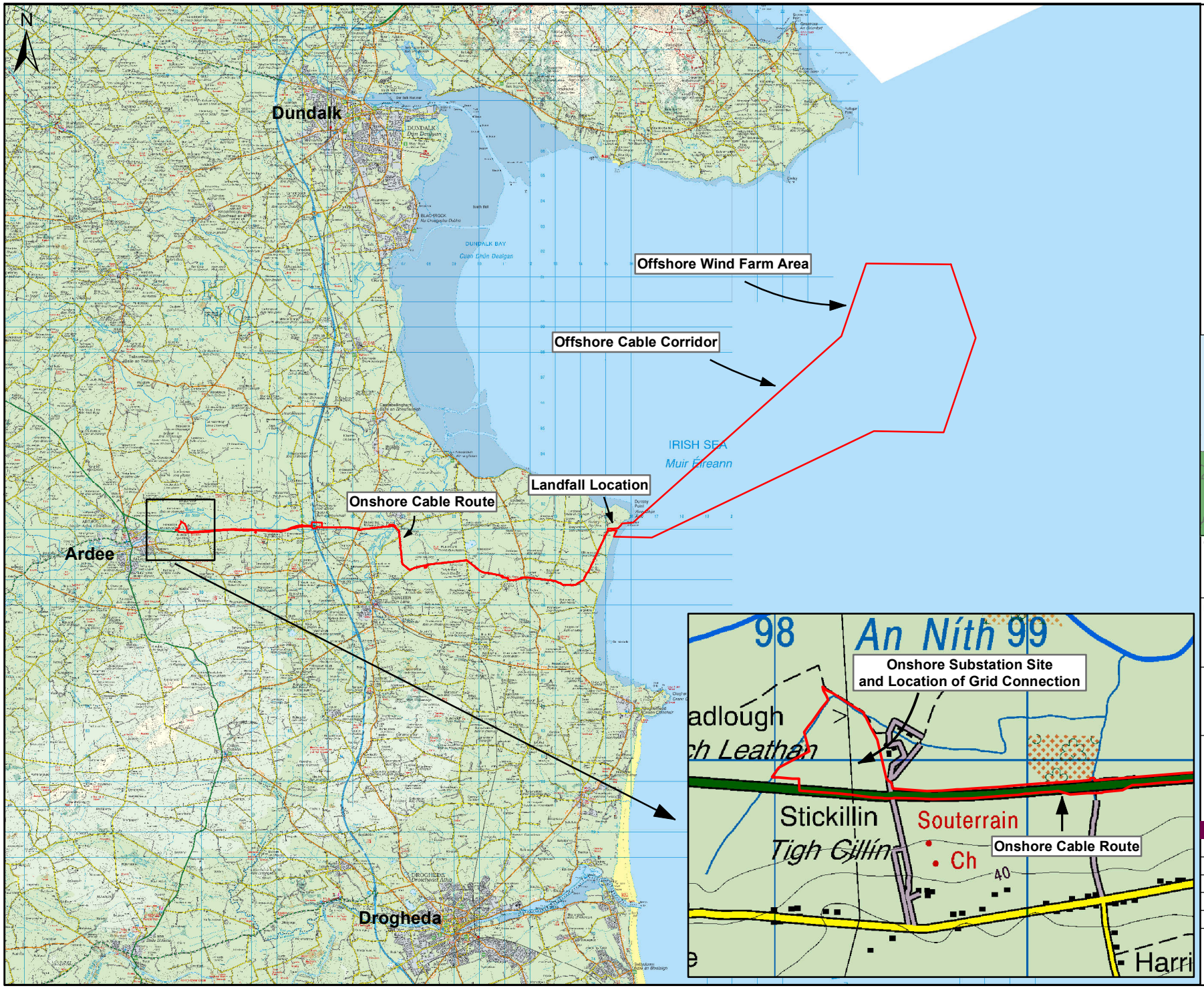
- The offshore wind farm area: This is where the offshore wind farm infrastructure will be located. This area will include the offshore wind turbines (also referred to as wind turbine generators (WTGs or turbines) including their foundations, the offshore substation (OSS) and its foundation, the inter array cables (between each of the WTGs and the OSS) and a short section of the offshore cable from the OSS;

- The offshore cable corridor: This is where the offshore cable will be largely located. The offshore cable extends from the offshore wind farm area to a landfall location south of Dunany Point;

- The onshore cable route: This is where the onshore underground cables and associated underground components (joint bays and link boxes) will be located; and

- The onshore substation site: This is where the onshore substation as well as the connections to the existing electricity transmission grid will be located.

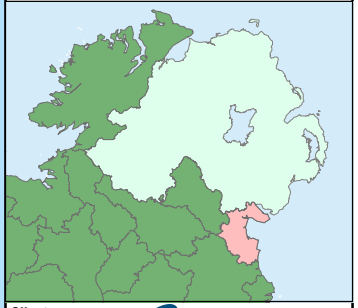
The extent and geographic location of each of these elements is explained in further detail below.



Legend

Planning Application Boundary

Data Sources: OWL, OSi.



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Figure 2.1:
Overview of Oriel Wind Farm Project

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: CC	**File Ref:** MDR1520bArc3072F03
Approved By: CC	
Scale: 1:200,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 12/03/2024	

2.2.1 Offshore wind farm area

The offshore wind farm area is located off the coast of County Louth to the east of Dundalk Bay, approximately 22 km east of Dundalk town centre, 18 km east of Blackrock, 5 km south of the Cooley Peninsula and 10 km north-east of Dunany Point. The closest wind turbine will be approximately 6 km from the closest shore on the Cooley Peninsula.

The offshore wind farm area covers approximately 27.7 km^2 and is broadly hexagonal in shape with a length of approximately 5.3 km west to east and 6.6 km north to south (see Figure 2-1).

2.2.2 Offshore cable corridor

One offshore export cable will be installed within the offshore cable corridor that connects the offshore wind farm area to a landfall approximately 700 m south of Dunany Point. The offshore cable corridor is contiguous to the High Water Mark (HWM) at the landfall and to the south western boundary of the offshore wind farm area.

The offshore cable corridor is approximately 11 km in length and covers an area of approximately 25 km^2 and is shown in Figure 2-1.

The offshore cable corridor is approximately 4 km at its widest point, southwest of the offshore wind farm area, and narrows to approximately 640 m at its narrowest point, just before landfall south of Dunany Point. The offshore export cable will be installed in a trench approximately 3 m wide within this corridor (see section 2.2.2). The exact location of this trench within the corridor will be confirmed at construction phase. However, the installation of the offshore export cable at any location within the corridor has been assumed for the purposes of the assessments to inform this NIS.

2.2.3 Onshore cable route

The single offshore export cable is joined to three onshore cables within an underground transition joint bay (TJB) close to the landfall. The onshore cables will be installed within a single trench of approximately 1 m in width, along an onshore cable route that connects the TJB to the substation site at Stickillin, east of Ardee on the N33. The length of the onshore cable route is approximately 20.1 km, principally located along public roads.

2.2.4 Onshore substation site

The onshore substation will be located in an agricultural field in the townland of Stickillin. The field has an existing access from the N33 national road which provides access to the field and existing agricultural buildings. It is located approximately 3 km east of the town of Ardee, County Louth. The existing 220 kV overhead line from the Louth substation (east of Dundalk) to Woodland substation (south of Dunshaughlin, County Meath) passes from north to south over the field.

The agricultural field is approximately 9.7 hectares in area. The onshore substation site is approximately 3.1 hectares in area and is located to the east of the existing overhead line. The substation site will therefore occupy approximately one third of the existing agricultural field.

2.3 Project infrastructure overview

The Project will comprise of offshore and onshore infrastructure. An overview of the infrastructure is presented below and schematically in Figure 2-2.

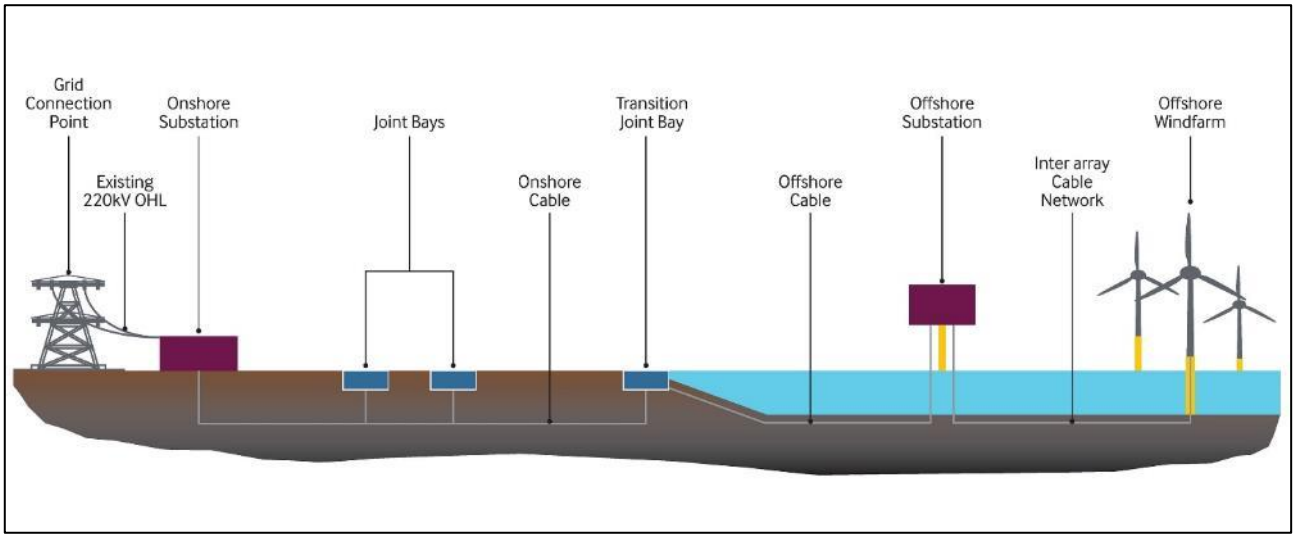


Figure 2-2: Key components of the Project.

2.3.1 Offshore infrastructure

Wind turbines

The Project will comprise of 25 wind turbines (also referred to as wind turbine generators (WTGs)) located within the offshore wind farm area. These wind turbines will be mounted on foundations which will be fixed to the seabed. The dimensions of the main components of the wind turbines (blade, tower, hub) are presented in section 2.5.3 and the layout of the wind turbines is described and shown in section 2.3.

Monopile foundations

A monopile foundation for each wind turbine and the OSS is proposed. This foundation type was selected based on the site geology. The dimensions and parameters of the foundation design and the proposed method of installation are presented within section 2.5.

Inter-array cables

The WTGs will be connected by a network of 41 km of 66 kV subsea inter-array cables to an offshore substation also located within the offshore wind farm area. The design, installation methodology, cable protection and approximate route of the inter-array cables within the offshore wind farm area are described in section 2.5.6.

Offshore substation

The OSS will be mounted on a fixed monopile foundation. The OSS will transform the generated electricity from 66 kV to 220 kV High Voltage Alternating Current (HVAC). The location, design and dimensions for the OSS are provided in section 2.5.7. The offshore substation equipment will be maintained by the Transmission Asset Owner (TAO) and operated by the Transmission System Operator (TSO).

Offshore cable

A single offshore export cable consisting of three internal cores will export the power from the OSS through to landfall approximately 700 m south of Dunany Point. The design of the offshore cable is presented in section 2.5.8 and a description of works at the landfall is described in section 2.5.9.

2.3.2 Onshore infrastructure

Landfall - Transition Joint Bay (TJB)

The offshore export cable will be connected to three separate land-based cables also operating at 220 kV HVAC in an underground TJB located close to the landfall and above the HWM. The design of the TJB is presented in section 2.5.9.

Onshore export cables

Three onshore export cables will be installed in a single trench which will be routed principally along public roads to a new 'loop-in' onshore substation located below the existing 220 kV overhead line (OHL) from Louth to Woodland. The onshore export cables will divert off the public road at five locations to enable the cables to pass below the Port Stream at Togher, the Port Stream at Clonmore, the River Dee at Drumcar, the M1 motorway and the Dublin to Belfast rail line and the River Dee at Richardstown on the N33. The onshore cables will pass below the Salterstown Stream, within the public road. The infrastructure to allow the cables to pass below five of these locations will be installed using horizontal directional drilling (HDD). The Port Stream at Clonmore will be crossed by trenching methods. These installation methods are presented in section 2.6.

Onshore substation

The onshore substation will consist of three compounds: Compound 1 will contain Gas Insulated Switchgear (GIS) located inside a building. Compound 2 will contain outdoor Air Insulated Switchgear (AIS) and will form part of the transmission system for the offshore grid. The entrance compound, which will include a telecommunications building, standby diesel generator and car parking. The onshore substation equipment will be maintained by the TAO and operated by the TSO.

Transmission cables from the GIS substation in Compound 1 will connect to the existing overhead power line through two new Line Cable Interface Masts (LCIM). An existing 220 kV ESB tower adjacent to the substation compounds will be replaced by the two LCIM towers to enable this connection.

2.4 Project design and flexibility

The design of the Project has established the project design parameters for the purposes of providing a comprehensive assessment of the potential adverse effects of the Project on European Sites.

The process to define the Project used extensive offshore and onshore surveys, design assessments and passed through several iterations. The design provides engineering parameters that allow meaningful analysis of the Project to be undertaken for the purpose of assessment.

The project design is assessed on a topic by topic and impact by impact basis in section 5 of the NIS. Where maximum design parameters have been used to inform the assessment, these have also been stated.

Where design parameters are unconfirmed due to design flexibility, the parameters and details are outlined in section 2.5 and section 5.

2.4.1 Surveys to inform the project design

A wide range of surveys have informed the design of the Project. Offshore surveys were undertaken under Foreshore Licence (FS006459, granted 10 May 2019). Relevant surveys included:

- Geophysical surveys of the offshore wind farm area and offshore cable corridor August - September 2019 and November – December 2022;
- Geotechnical boreholes in the offshore wind farm area and offshore cable corridor March - April 2020;
- Offshore wind and metocean measurement campaign October 2019-December 2020;
- Onshore wind measurement at landfall March 2020-present; and

- Site investigation surveys of the onshore substation, onshore cable route and landfall – May 2021 and October 2021.

The above surveys were robust and sufficient to inform the project design and the assessments.

A future offshore geotechnical survey (under Foreshore Licence FS007383 issued 17 May 2023) is planned. This will drill a minimum of one borehole at each proposed foundation location and along the inter-array cable routes and the offshore cable corridor to inform the final detailed design of each foundation and the cable installation. This survey has been consented under Foreshore Licence. A further site investigation campaign will be undertaken at the onshore substation and along the onshore cable route to inform the detailed design and procurement of the onshore substation and onshore cable.

2.4.2 Design flexibility

The design of the Project is well advanced, and the Applicant has made every effort to finalise details of the Project, insofar as possible. There are some details of the design requiring finalisation, which cannot be completed in advance of submission of the application. Therefore, the Applicant submitted an application for an opinion under Section 287B of the Planning & Development Act, 2000 as amended, for consideration of the design flexibility required for the Project.

A description of details or groups of details where design flexibility was sought are provided in sections 2.5 and 2.6 under the sub-heading ‘Design flexibility’ together with details on the opinion from An Bord Pleanála.

2.5 Description of offshore infrastructure

The following sections provide a description on the design and size of the offshore infrastructure of the Project (WTG, foundations, inter-array cables, offshore export cable etc.) including the TJB where the offshore export cable will connect to the onshore cables. Information on the construction methodology is also provided in the sections below.

2.5.1 Construction port

The main offshore structures (WTGs, OSS, foundations and offshore cables) will be fabricated at a number of manufacturing sites across Europe or elsewhere, to be determined as part of a competitive procurement process following award of consent.

A marshalling harbour will be required to stockpile and pre-assemble components for the foundations and wind turbines. The fabricated components will be delivered to the marshalling harbour by ship, before pre-assembly and then delivered by ship directly to the offshore wind farm area for installation/final assembly. Space in a construction port can only be contracted when the construction programme is finalised and timelines are known and therefore the final construction port will not be known at the time of application.

A port that has the required facilities and consents/permissions for the pre-assembly operations will be used. There are suitable ports that are being considered for the Project within the Irish Sea and Celtic Sea including those with existing consents such as Belfast Port or Mostyn Harbour (Wales) and ports with proposed development plans for offshore wind pre-assembly facilities such as Rosslare Europort and Port of Cork. The activity of delivery and installation of the pre-assembled components to the site has been considered within the environmental assessment and a sailing distance of 350 nm from the centre of the wind farm has been used. This distance includes all potential ports for the pre-assembly operations.

Components, such as the prefabricated OSS and the offshore cables, will be delivered directly from the manufacturing facility to the offshore wind farm area when required.

2.5.2 Site preparation activities

A number of site preparation activities may need to be undertaken within the offshore wind farm area and along the offshore cable corridor prior to the commencement of construction. An overview of these activities is provided in the subsections below.

Geophysical and geotechnical surveys have been conducted across the offshore wind farm area and offshore cable corridor to inform the project design to date as described in section 2.4.1. These surveys have indicated suitable seabed conditions and seabed preparation is expected to be confined to localised areas around wind turbine foundations, inter-array and offshore cable corridor and the offshore substation. In particular, the seabed studies to date have indicated the absence of existing pipelines, cables, significant sand waves or boulder fields within the offshore wind farm area.

Unexploded ordnance (UXO)

UXO can pose a health and safety risk where it coincides with the planned location of infrastructure and associated vessel activity, and therefore it is necessary to survey for and carefully manage UXO.

A desk study for potential UXO contamination has been carried out within the offshore wind farm area and offshore cable corridor. Based on the research and the risk assessment undertaken, it was concluded that there is low risk of encountering UXO during the development of the Project. Additionally, geophysical surveys have been undertaken across the site and high-resolution surveys at each foundation location; these geophysical surveys have not identified the potential for UXO.

As such, UXO clearance is not anticipated to be required, however Explosives Site Safety Guidelines which follow UK MGN 323 (M+F) and relevant training will be prepared and implemented during the construction phase. In addition, Remotely Operated Vehicle (ROV) inspection work will be undertaken, if required, on any potential items of UXO identified within the array area and offshore cable corridor. If UXOs are found, the location of infrastructure will be adjusted to avoid the obstacle.

Pre-lay grapnel run

While it is understood that there are no existing or out-of-service cables within the offshore wind farm area or along the offshore cable corridor a pre-lay grapnel run (PLGR) and an associated route clearance survey of the final cable route (inter array and offshore cable) will be undertaken following the pre-construction route survey. A multi-purpose vessel will be mobilised with a series of grapnels, chains, recovery winch and survey spread suitable for vessel positioning and data logging.

The PLGR work will take account of and adhere to any archaeological protocols developed for the Project or required by a planning authority.

Boulder clearance and sand wave removal

Boulder clearance or sand wave removal may be required if there are areas identified where positioning of cables around these features is not feasible and that there is a risk that cable installation tools could snag the feature. If required, a corridor of up to 15 m may be cleared through an area of boulders or sand waves for cable installation. A maximum of 10% of the inter-array cable route may be required for clearance. This would result in a total offshore wind farm area clearance of 61,500 m^2 of seabed material. A maximum of 10% of the offshore cable route may be required for clearance. This would result in the clearance of 16,500 m^2 of seabed material. To implement the boulder and sand wave clearance a displacement plough that scrapes along the surface of the seabed would be used. The plough would only be lightly ballasted to clear boulders whilst not leaving a deep depression in the seabed. This method may be combined with a subsea grab for the relocation of larger boulders outside the offshore cable corridor. The subsea grab would be aided by a Remotely Operated Vehicle (ROV) for positioning of the grab onto boulders and the recording of their new position.

The boulder clearance and sand wave removal work will take account of and adhere to any archaeological protocols developed for the Project or required by a planning authority.

2.5.3 Wind turbines

The Project will comprise of 25 wind turbines. The key wind turbine design parameters for the Project are presented in Table 2-1. These are the project design parameters that have informed the assessments. The

parameters are defined relative to Lowest Astronomical Tide[2] (LAT). All wind turbines will be marked for aviation and navigation purposes (refer to section 2.5.11).

Each wind turbine will be a three-bladed, horizontal rotor axis type, designed for offshore conditions. The blades will be connected to a central hub, forming a rotor which turns a shaft connected to a generator. The generator is part of the drive train, which will be located within a containing structure, known as the nacelle, situated adjacent to the rotor hub. Together it is referred to as the rotor nacelle assembly. A hoist platform is mounted on the roof of the nacelle to allow for emergency access and egress.

The nacelle will be mounted on top of a tubular steel tower structure affixed to the foundation which forms the connection to the subsea soil. Further information on foundation design and installation is detailed in section 2.5.5. The nacelle will be able to rotate or 'yaw' on the vertical axis in order to face the incoming wind direction. The colour of the components will be light grey (RAL 7035 or 9010) apart from the hoist platform, navigation markings and the foundation. An illustration of this design is presented in Figure 2-3.

Table 2-1: Project design parameters for the WTGs.

Wind Turbine Parameter	Value
Number of WTG	25
Minimum height of lowest blade tip above LAT (m)	27 m
Maximum blade tip height above LAT (m)	270 m
Hub height above LAT (m)[3]	145-152 m
Rotor diameter (m)	236 m
Rotor cut-in/cut-out wind speed (m/s)	Cut in: 2.6 m/s Cut out: 28-35 m/s
Nominal rotor speed (revolutions per minute (rpm))	7.8-8.4

Design flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final height of offshore infrastructure.

The final height of the wind turbines will be confirmed following detailed geotechnical investigations and analysis of ground conditions.

The wind turbine hub height will vary within the range 145-152 m above Lowest Astronomical Tide (maLAT) across the wind farm site due to the specific height of each foundation.

A preferred wind turbine model of 15 MW is selected and the wind turbine rotor diameter is fixed at 236 m (i.e. 118 m radius). A maximum tip height of 270 maLAT (152 maLAT + 118 m) and a minimum tip height of 27 maLAT (145 maLAT – 118 m) is presented.

A monopile foundation design has been selected. This has been determined from metocean, geophysical and geotechnical studies completed to date. The height of each foundation will be determined as part of a construction contract and will be specific to the water depths and soil conditions at each foundation location. The height of the foundation is the determining factor in the final hub height of each wind turbine.

[2] Lowest Astronomical Tide (LAT) is defined as the lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.

[3] Wind turbine hub height will vary within the range stated across the Project offshore wind farm area. The design and height of each wind turbine foundation is specific to the subsoil geology and geotechnical properties at each wind turbine location. The foundation height will affect the hub height of each wind turbine (see section 2.5.5 for further information).

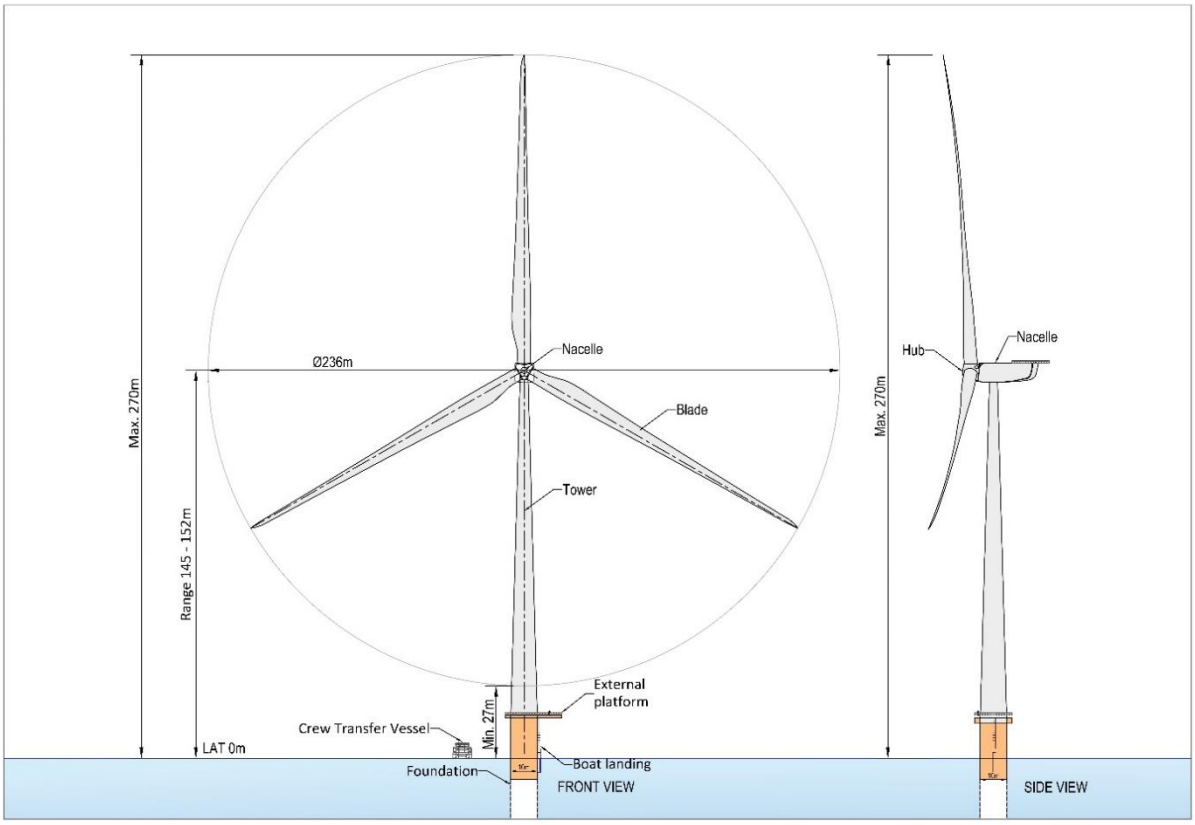


Figure 2-3: Illustration of the proposed wind turbine design.

Oils and fluids

Each wind turbine will contain components that require lubricating oils, hydraulic oils and coolants for operation. A diesel generator may be installed for restart in the case of power failure or the WTG may have built-in idle mode generation for unassisted restart. The diesel fuel and generator are included and assessed as a design parameter. Table 2-2 presents the maximum requirements for oils and fluids in a single wind turbine.

Table 2-2: Requirements for wind turbine oils and fluids for a single wind turbine.

Parameter	Maximum Requirement
Grease (l)	500
Hydraulic oil (l)	1000
Gear oil (l)	2,500
Total lubricants (l)	~12,000
Transformer Silicon/Ester oil (litres/kg)	8000
Diesel Fuel (l)	2000
SF6 (kg)	15
Nitrogen (litres at 1 bar abs pressure)	63,000
Glycol/Coolants	1800
Damping Liquid (Water/Glycol) (litres)	14000

All turbines have primary and secondary containment systems installed to ensure that all fluids can be captured within either the nacelle or the tower in the event of leakage, thereby minimising leaks to the environment.

Noise emissions

Due to the rotation of the rotor and other moving components (e.g. gearbox, yaw motors, etc.) the wind turbine will create noise. The noise level of the rotor depends on several parameters such as rotor blade shape, wind speed and rotational speed. However, the maximum sound power level of the WTG will not be greater than 118.0 dBA (airborne).

Installation and commissioning

The wind turbines will be installed and commissioned using the following process:

- Wind turbine components will be collected from the marshalling harbour by an installation vessel. This vessel will typically be a Jack-Up Vessel (JUV) to ensure a stable platform for the WTG installation task when on site. For this Project, JUVs with up to six legs with an area of up to 250 m^2 per foot are proposed. Separate components of blades, nacelles and towers for a number of wind turbines are normally loaded onto the installation vessel.

- The installation vessel will then transit to the offshore wind farm area and the components will be lifted onto the pre-constructed foundation structure by a crane on the installation vessel (illustrated in Figure 2-4). Each wind turbine will be assembled on site in this manner with technicians fastening components together as they are lifted into place. The exact methodology for the assembly is dependent on wind turbine model and installation contractor; and will be defined in the pre-construction phase following consent.

- Alternatively, the wind turbine components may be loaded onto barges or dedicated transport vessels at port and installed as above by an installation vessel that remains on site throughout the installation campaign.

- The commissioning of the wind turbines is done directly from the installation vessel or from another vessel such as a service operation vessel (SOV) or crew transfer vessel (CTV). The activities may require several visits to each WTG. Once the WTG is connected to the OSS via the inter-array cables (see section 2.5.6), energised and tested it is in normal operational mode.

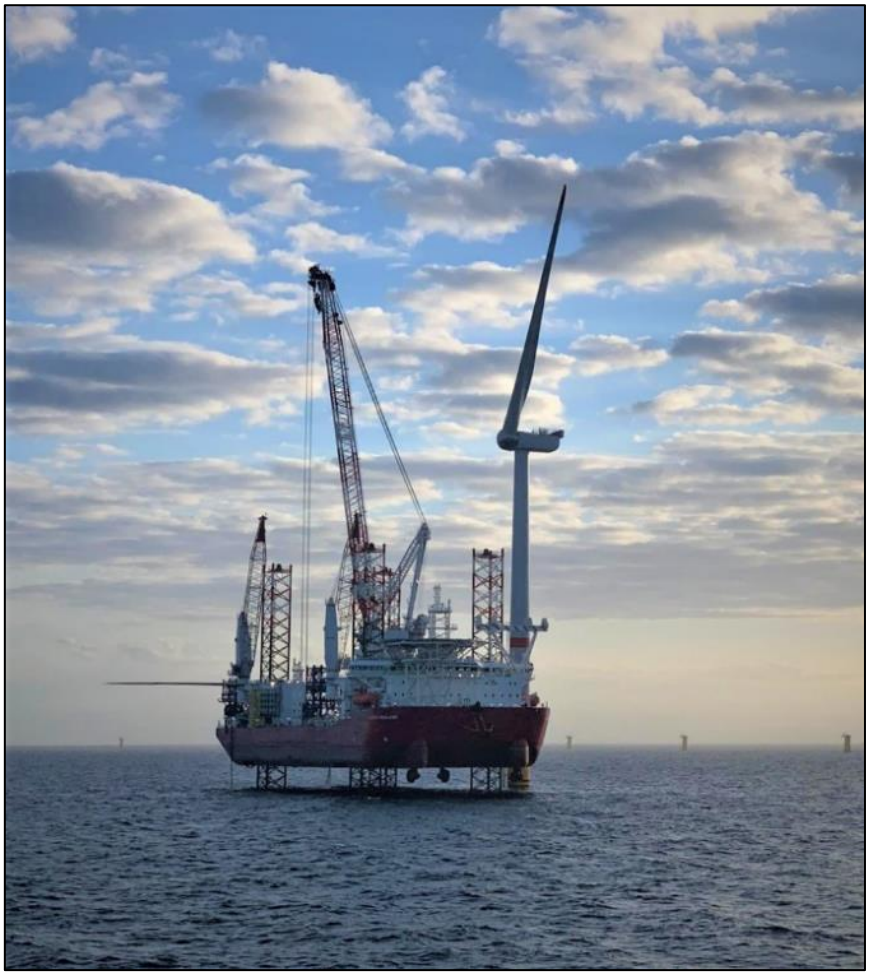


Figure 2-4: Installation vessel installing wind turbine blades.

Each installation vessel may be assisted by a range of support vessels. These are typically smaller vessels including service operating vessels for commissioning, crew transfer vessels and guard vessels. These vessels will primarily make the same movements to, from and around the wind farm as the installation vessels that they are supporting.

The construction programme is presented in section 2.7. The total duration of the WTG installation campaign for the wind turbines is expected to be six months.

Table 2-3 presents the maximum number of vessels and the number of return trips to the offshore wind farm area from port during the wind turbine installation campaign.

Table 2-3: Wind turbine installation vessel numbers.

Vessel Type	Maximum number of vessels	Maximum number of return trips per vessel type
Main Installation Vessels (Jack-up Barge/DP vessel)	1	13
Commissioning Vessel (SOV)	1	13
Guard Vessels	1	20
Crew Transfer Vessels	3	180

Operation and control

Wind turbines operate within a set wind speed range dependent on the specific turbine model. At approximately 2.6 m/s the WTG will start to rotate and generate electricity and at 13-16 m/s the WTG will reach nominal power output with approximately 8 rotor rotations per minute. In higher wind speed conditions, the wind turbine will pitch the blades (rotate blades on their own axis) to reduce the thrust to keep a constant power output. At 25 m/s the wind turbine output starts to decrease gradually towards zero. This enables the wind turbine to shut down in very high wind speeds to protect the wind turbine and foundation, whilst enabling a gradual ramp-down of the power output to support the operation of the electricity transmission grid. The cut-out wind speed depends on WTG type and is between 28 and 35 m/s.

Each wind turbine will have its own autonomous control system to carry out functions like yaw control and ramp down in high wind speeds. In case of severe alarms or faults the turbine can perform an automatic emergency stop which will stop the rotor within seconds. The same applies if the communication to shore is interrupted for a long period or the system detects an unsafe state (e.g. high wind speeds, grid outage etc.).

All wind turbines of a wind farm are connected to a central Supervisory Control and Data Acquisition (SCADA) system for control of the wind farm remotely at the operational and maintenance base. This allows functions such as remote wind turbine shutdown if faults occur or curtailment of the wind farm by the grid operator. The SCADA system will communicate with all components of the wind farm via ethernet through fibre optic cables which are embedded within the export and inter-array cables. Individual wind turbines can also be operated manually from within the wind turbine nacelle or tower base to control the wind turbine for commissioning or maintenance activities.

Access and egress

The WTGs are normally accessed and egressed to/from a vessel via a boat landing or a stabilised gangway to an external platform which is part of the foundation structure. In the event of an emergency the wind turbine can be accessed directly by hoist from a helicopter to a platform on top of the nacelle. Emergency access by winch down from a helicopter will be designed in accordance with relevant Irish Aviation Authority (IAA) guidance and standards. Figure 2-5 illustrates the normal access to wind turbine foundation (transition piece) via a stabilised gangway.

2.5.4 Wind farm area layout

The Project layout has been designed such that it complies with the following principles:

- All surface offshore infrastructure is confined within the area designated by the Maritime Area Consent (MAC) for the Project;
- A minimum spacing of 4 x maximum rotor diameter (i.e. at least 944 m) is maintained between the centre points of all wind turbines;
- The wind turbine layout meets the requirements to facilitate Search and Rescue (SAR);
- The wind turbine layout seeks to avoid clustering of wind turbines from key viewpoints; and
- The wind turbine layout seeks to avoid visual overlap with background landscape from land-based viewpoints.

The layout as shown in Figure 2-6 was developed through an iterative process which considered the landscape and seascape visual impacts and to maximise use of the available wind resource and minimise turbulence and wake effects between turbines within the constraints of the principles presented above.

Figure 2-5: Access of external platform (yellow) via stabilized gangway from a CTV (shown in red).

The layout has rows of five turbines orientated in an approximate northwest to southeast direction with a minimum separation between turbines of 944 m (four times the rotor diameter). The offshore substation is located in the southwest area of the array. Four SAR corridors with a minimum spacing of 500 m are maintained between the turbines with a north-northeast heading.

Design flexibility

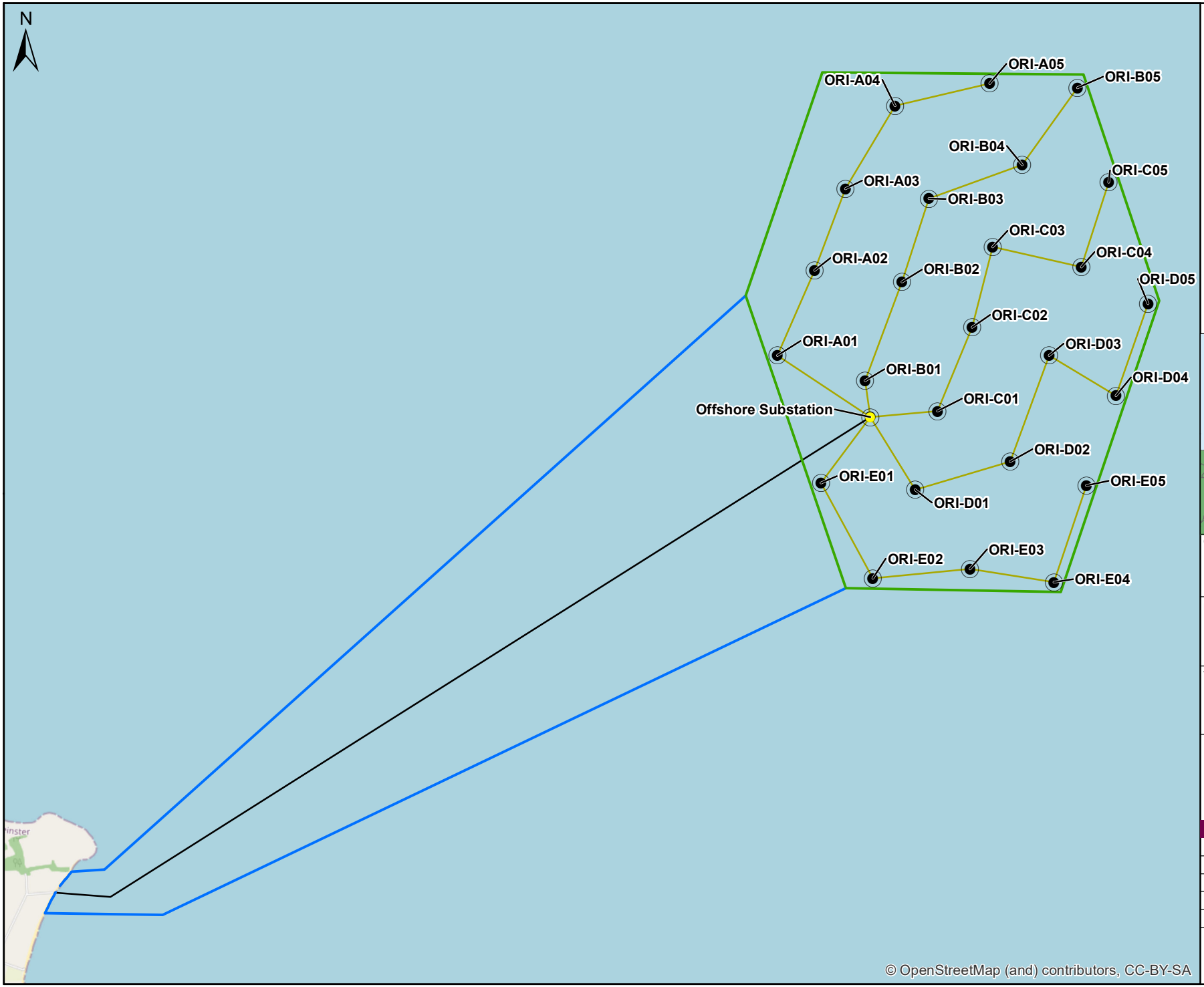
The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final exact location of each offshore wind turbine and the offshore substation.

The final exact location of each wind turbine will be confirmed following geotechnical investigations and analysis of ground conditions.

The locations of the WTG and OSS may require adjusting within a 50 m radius should an obstruction to the foundation be identified. Detailed geophysical studies have been completed for each proposed foundation location. Future geotechnical investigation and trial drilling of each location will be completed prior to construction as part of a foreshore licence (see section 2.4.1). Variable ground conditions across the offshore wind farm area have been identified and ground conditions such as boulders would result in the requirement to move the foundation.

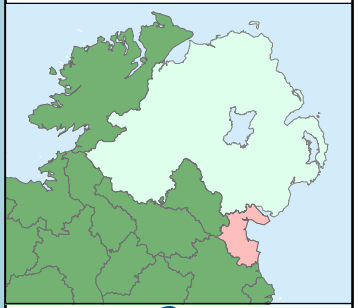
A 50 m radius of lateral deviation in the final location of each offshore wind turbine (and the offshore substation) is proposed and is sufficient to identify alternative, feasible locations.



Legend

- Offshore Wind Farm
- Offshore Cable Corridor
- Inter-array Cable
- Export Cable
- Offshore Subsation
- WTG

Data Sources: OWL, OSi



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 2-6: Wind farm layout

RPS
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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: CC	**File Ref:** MDR1520bArc3105F01
Approved By: CC	
Scale: 1:65,000 @A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 24/11/2023	

2.5.5 Foundations

The WTGs and OSS are attached to the seabed by foundation structures. A monopile foundation is proposed for the Project. Each monopile foundation will be specifically designed for the ground conditions and metocean conditions encountered at each WTG location and the OSS location and to the available and appropriate installation methodology. A graphic illustrating the foundation design is presented in

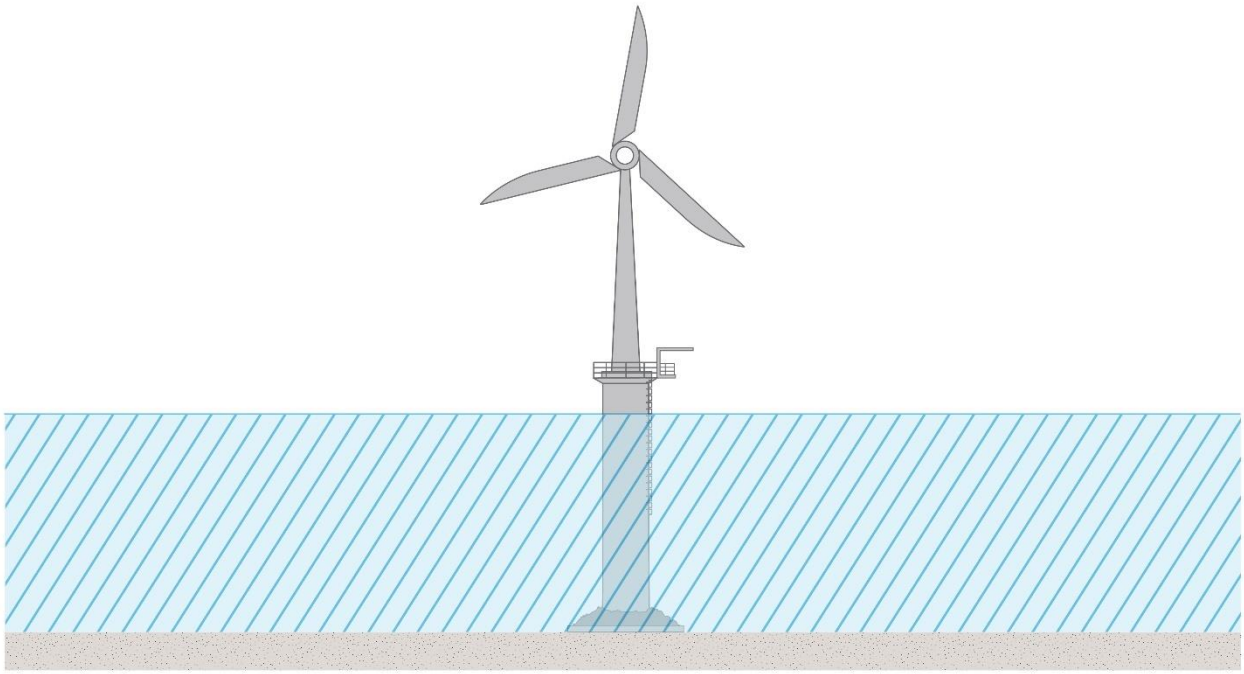


Figure 2-7 and a photograph of the monopile drilled installation is presented in Figure 2-8 for information.

The height and depth of each foundation is dependent on the loading requirements from each structure (WTG and OSS) and the specific geology encountered at each site. The final design of each foundation will be completed following the procurement and contracting process after consent. The final height of each foundation is the determining factor in the final hub height of each wind turbine. The wind turbine hub height will vary within the range 145-152 m above LAT across the wind farm site due to the final height of the top of each foundation above LAT.

The foundations will be fabricated offsite and stored at a suitable port facility or fabrication yard with the appropriate pre-existing consent/licence/permit and transported to site when required. Specialist vessels will transport and install the foundations. Scour protection (typically rock) may be required on the seabed and will be installed before and/or after foundation installation. The design has assumed that scour protection will be required.

Monopile foundations typically consist of a single steel tubular section, consisting of a number of sections of rolled steel plate (called cans) which are welded together. A transition piece is fitted over the monopile and secured via bolts or grout. The transition piece includes boat landing features, ladders, a crane, and other ancillary components as well as a flange for connection to the wind turbine tower. The transition piece is painted yellow and marked per relevant regulatory guidance from the Commissioner of Irish Lights (CIL), Marine Survey Office (MSO) and IAA and may be installed with the monopile or separately following the monopile installation.

The design parameters of the monopile foundations, including associated scour protection, are presented in Table 2-4 below.

Further details on the foundation design are described in the following sections.

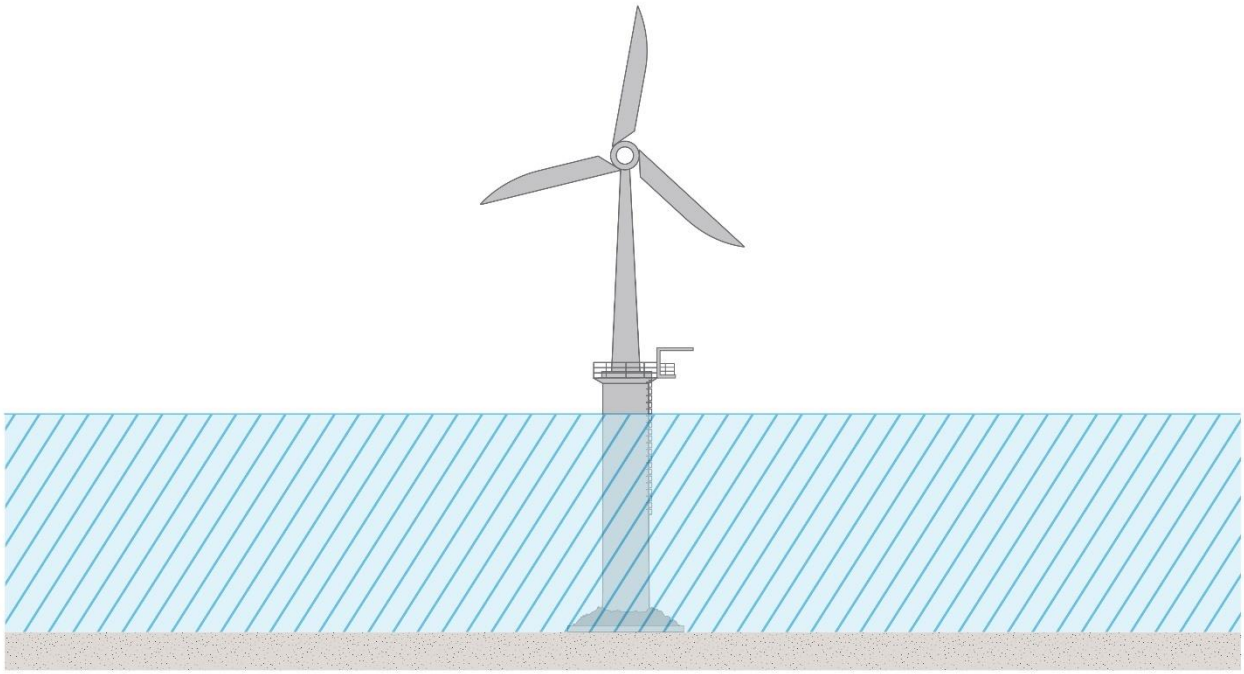


Figure 2-7: Illustration of Monopile foundation design.

Figure 2-8: Monopile foundation installation from a JUV.

Table 2-4: Project design parameters for monopile foundations.

Element	Design parameter (WTGs + OSS)
Monopile	
Total number of structures	26 (25 WTGs + 1 OSS)
Maximum diameter of monopile (m)	9.6
Pile penetration depth (below seabed) (m)	35.0
Seabed footprint per pile (m^2)	72.4
Scour protection	
Scour protection material type	Rock
Scour protection material height (m)	1.0
Scour protection footprint per pile (m^2)	1,810
Scour protection volume per pile (m^3)	1,810
Total Project scour protection volume (m^3)	47,060
Total seabed footprint	
Total Project seabed footprint including scour protection (m^2)	47,060
Grout	
Grout volume per pile (m^3)	320
Drill characteristics	
Maximum drilling duration (per pile)	6
Maximum drill depth	35.0
Volume of drill arisings per pile (m^3)	3,200
Total Project volume of drill arisings (m^3)	83,200

Installation

Monopiles (and transition pieces) will be transported to site either on the installation vessel (either JUV or Dynamic Positioning Vessel (DPV)), or on feeder barges.

Once on site, the monopiles will be lifted into position and installed by driving with assistance from a hydraulic hammer up to a maximum resistance and then by drilling to the required embedment depth. The methodology is described below.

One installation vessel will be used, with one piling or drilling event taking place at any one time. The details for the vessels and numbers of trips required are presented in Table 2-5. Monopile installation may take place over a total installation period of six months, dependent on weather and vessel down-time.

Seabed preparations for monopile installation are usually minimal as the area requiring preparation is limited to the foundation diameter (see section 2.5.2). If pre-construction surveys show the presence of boulders or other seabed obstructions at foundation locations, these may be removed if the foundation location cannot avoid the obstruction.

Table 2-5: Vessel requirements for monopile foundations.

Vessel type	Maximum number of vessels (WTGs and OSS)	Maximum number of return trips per vessel (WTGs + OSS)
Main Installation Vessels (Jack-up Barge/DP vessel)	1	26
Guard Vessels	1	20
Crew Transfer Vessels	1	38
Scour Protection Installation Vessels	1	4

All monopile foundation installations will require a combination of piling followed by drilling (drive, drill and grout method). The modelled (noise) piling scenario (see appendix C: Subsea Noise Technical Report) for monopiles assumes a maximum piling duration of 8 hours per pile (average duration 5 hours per pile). A single installation vessel is proposed and there will be no concurrent piling of foundations.

The maximum hammer energy proposed for the Project is 3,500 kJ for monopiles and this is considered the maximum design parameter. However, the actual energy used when piling will be significantly lower for the majority of the time and the driving energy will be raised to 3,500 kJ only when absolutely necessary.

Following a preliminary analysis of ground conditions at the site, the Project currently expect the average hammer energy during piling installation to be 2,500 kJ. The highest hammer energy (3,500 kJ) will be required when the pile reaches maximum resistance, which is expected to be at rockhead.

The proposed monopile piling durations for each energy level is provided in Table 2-6. This has formed the basis for the subsea noise modelling of monopile installation provided in appendix C: Subsea Noise Technical Report.

Table 2-6: Piling durations for monopile installation using a maximum hammer energy of 3,500 kJ.

Activity/stage	Hammer Energy	Piling Duration – Monopiles (minutes)
Initiation	525 kJ	1
Soft start	525 kJ	20
Ramp up	525 – 2,500 kJ	9
Piling	2,500 kJ	150
Full power piling	3,500 kJ	120
Total piling duration	-	300 (5 hours)

When percussive piling installation is not possible due to the presence of rock or hard soils a drill will be inserted into the monopile and material will be drilled out to the required depth. An inner pile will then be inserted into the outer pile and the annulus between the piles filled with grout.

In the event that the foundation installation encounters an unexpected obstacle such as a large buried boulder the foundation may be relocated in the adjacent area. A 50 m radius of lateral deviation is included with the assessment.

Soil and rock arising from the drilling (the “drill arisings”) will be returned to the area adjacent to the foundation location through a fall pipe below the sea surface to minimise dispersion of the drill arisings. This activity will be the subject of a separate Dumping at Sea Permit obtained from the EPA. The maximum volume of drill arisings for the wind farm foundation installation is presented in Table 2-4 above.

Scour protection

Scour protection will be installed around each foundation to prevent scour holes developing around the structures.

The preferred scour protection solution will comprise a rock armour layer resting on a filter layer of smaller graded rocks. The filter layer can either be installed before the foundation is installed (‘pre-installed’) or afterwards (‘post-installed’). Alternatively, by using heavier rock material with a wider gradation, it is possible to avoid using a filter layer and pre-install a single layer of scour protection.

The amount of scour protection required will vary dependent on the seabed material and metocean conditions present at each foundation location. The scour protection will be determined after detailed design of the foundation structure, considering a range of aspects including geotechnical data, marine processes, meteorological and oceanographic data, water depth, foundation type and maintenance strategy.

Scour protection will be brought directly by sea from a rock quarry by a dedicated vessel designed for the purpose. The selection of the rock quarry will be included as part of the foundation installation contract. Hard rock quarries in southern Norway have been used for other offshore wind farm projects.

The maximum diameter of the rocks used would be 1 m and the maximum thickness of scour protection layer would be 1.0 m. Scour protection parameters have been presented for the monopile foundation in Table 2-4 above.

2.5.6 Inter-array cables

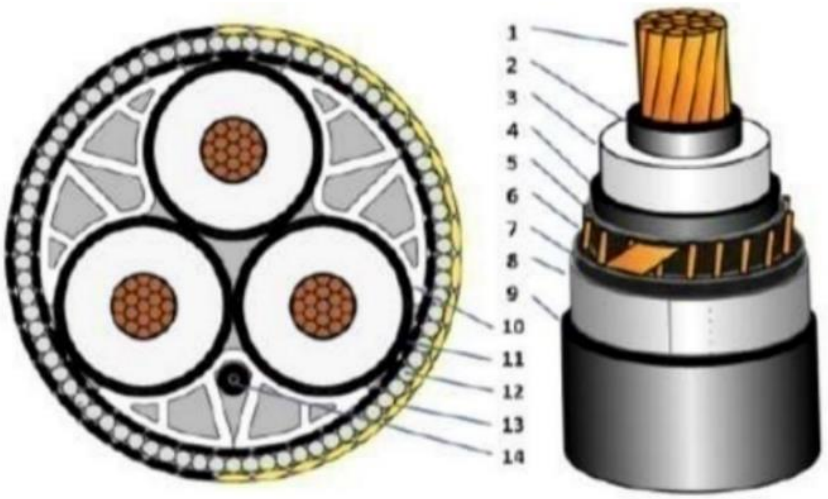
Inter-array cables will carry the electrical current produced by the WTGs to the OSS in a layout as shown on Figure 2-6. A small number of wind turbines (approximately five) will be joined together on the same cable 'string' connecting those wind turbines to the OSS. Five cable 'strings' will therefore connect back to the OSS. The inter-array cable system will use 66 kV AC technology.

Design

The inter-array cables will consist of a number of conductor cores, usually made from copper or aluminium surrounded by layers of solid insulating material, as well as material to armour the cable for protection from external damage. A diagrammatic representation of the cross-section of the cable is presented in Figure 2-9. No mineral oils or other fluids are contained within the cable. The design parameters for the inter-array cables are presented in Table 2-7.

Table 2-7: Project design parameters for inter-array cables.

Parameter	Design parameter
Cable diameter (mm)	250
Total length of cable (km)	41
Voltage (kV)	66



No.	Description	Details
1	Conductor	Longitudinally water blocked compact stranded copper, Class 2 to IEC 60228
2	Conductor screen	Extruded bonded semi-conductive compound
3	Insulation	XLPE (cross linked Polyethylene)
4	Insulation screen	Extruded bonded semi-conductive compound
5	Water blocking	Semi conductive water swelling tape
6	Metal sheath	Helically applied copper wires with equalising tape
7	Water blocking	Semi-conducting water - swelling tape
8	Radial water barrier	Longitudinal aluminium foil bonded to sheath
9	Inner sheath	Polypropylene sheath
10	Lay-up	Three power cores are laid up with fillers (polypropylene yarns or shaped extruded) and up to 3 fibre optic cables
11	Armour bending	Polypropylene Yarns
12	Armouring	Galvanised Steel Wires with Bitumen
13	Outer serving	Polypropylene Yarns
14	Fiber Optic Cable	1 x Optical Fibers Cable with 48 fibres (48 Single mode)

Figure 2-9: Cross section of inter-array cable design.

Installation

Inter-array cables will be installed from a dedicated cable-laying vessel. This vessel will be positioned through dynamic positioning and the vessel will therefore only need to anchor in the wind farm area in emergency situations (e.g. loss of power).

Inter-array cables will be installed into the seabed via jetting or ploughing methods where feasible or surface laid and protected with concrete/steel mattress and rock. Jetting modifies the seabed with high-speed water jets so that the pre-laid cables sink by their own weight to a pre-determined depth. In the case of ploughing, a subsea plough is towed by the cable installation vessel to bury the cables simultaneously with the laying process. The plough lifts a wedge of soil and places the cable at the base of the trench before the wedge of soil backfills over the cable due to gravity. The cables will be buried below the seabed wherever possible, to a minimum burial depth of 0.5 m and a maximum burial depth of 3 m. The final selected installation method and target burial depth will be defined prior to construction based on a detailed cable burial risk assessment (CBRA) (see section 2.10). This depth is likely to vary across the offshore wind farm area due to the differing soil substrates. The design parameters for inter-array cable installation are presented in Table 2-8.

Inter-array cable installation will take place over a total installation period of six months. The details for the vessels and numbers of trips required are presented in Table 2-8 below. The maximum amount of cable installation vessel trips assumes one cable per return trip. The CTV return trips assumes there is no service (hotel) vessel in the field during the cable termination works. In case a service vessel is employed, the number of CTV return trips will be reduced.

Table 2-8: Project design parameters for inter-array cable installation.

Element	Design parameter
Installation methodology	Ploughing or jetting
Maximum Burial depth (m)	3.0
Trench width (m)	1.0
Width of seabed disturbance from installation tool (m)	10.0
Total Project area of seabed disturbance (km^2)	0.41

Table 2-9: Inter-array cable installation vessel requirements.

Vessel type	Maximum number of vessels	Maximum number of return trips per vessel
Cable Installation Vessels	1	5
Guard Vessels	1	20
Crew Transfer Vessels	1	150
Cable Protection Installation Vessels	2	25

Cable protection

Where the cable cannot achieve target burial depth due to ground conditions, cable protection will be deployed. Cable protection will include either rock placement and/or concrete/steel mattresses. It is anticipated that up to 50% of the inter-array cable route may require cable protection. Potential cable protection options are described below. No cable crossings are required and therefore subsea cable bridging is not proposed.

Rock Placement

Rocks of different grade sizes are placed, from vessel through a fall pipe over the cable. Initially smaller stones are placed over the cable as a covering layer. This provides protection from any impact from larger grade size rocks, which are then placed on top.

This rock grading has mean rock size in the range of 90 to 125 mm (1-3 kg) and maximum rock size of 250 mm (25 kg). The rocks form a berm of trapezium shape, approximately 2.0 m in height above the seabed with a 3:1 gradient and 10 m in width. The cross-section may vary dependent on expected scour. The length of the berm is dependent on the length of cable which is either unburied or has not achieved target depth. The trapezium shape is designed to provide protection from both direct anchor strikes and anchor dragging.

Table 2-10 provides the design parameters for cable protection.

The maximum potential lengths of inter-array cable and the maximum portion of the cable requiring protection by rock or concrete mattress have been assessed.

Mattress Placement

Mattresses generally have dimensions of 6 m by 3 m by 0.3 m. They are formed by interweaving a number of concrete blocks with rope and wire and are lowered to the seabed on a frame. Once positioning over the

cable has been confirmed, the frame release mechanism is triggered, and the mattress is deployed. This mattress placement will be repeated over the length of cable which is either unburied or has not achieved target depth. Mattresses provide protection from direct anchor strikes but are less capable of dealing with anchor drag.

Table 2-10: Project design parameters for inter-array cable protection.

Parameter	Design parameter
Cable protection material (type)	Rock placement, concrete mattresses
Maximum Length of cables requiring cable protection (m)	20,500
Cable protection height (m)	2.0
Cable protection width (m)	10.0
Total Project cable protection footprint (m^2)	205,000
Total Project cable protection volume (m^3)	300,000
Proportion of inter-array cable route with cable protection (%)	50

Design flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final route and length, of the offshore cable and offshore inter-array cables.

Due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore inter array cables will be confirmed during construction.

A preferred route for each inter-array cable (5 no.) has been identified following detailed geophysical and geotechnical site investigations. A deviation to these routes within the offshore wind farm area could be required. For the purposes of assessment, 41 km of cable routes within the offshore wind farm area have been assessed.

Should obstacles be encountered during the installation of the inter-array cables, the obstacle will be relocated or the route adjusted to avoid the obstacle.

2.5.7 Offshore substation (OSS)

A OSS is a prefabricated structure housing electrical equipment to provide a range of functions such as regulating and increasing the voltage level to reduce electrical losses and monitoring, protection and control of the electrical infrastructure. The OSS location is presented on Figure 2-6. The location has been determined taking account of ground conditions, the SAR corridors and the most efficient cable routing amongst other considerations. The OSS will not be manned but once functional will be subject to periodic operational and maintenance visits. A description of the OSS is provided below.

Design

The OSS will comprise a platform with decks, attached to the seabed by means of a monopile foundation, containing equipment required to switch and transform electricity generated by the wind turbines to a higher voltage and provide reactive power compensation. It will house auxiliary equipment and facilities for operating, maintaining, and controlling the substation. There will be a telecommunication mast on one corner of the platform and a crane.

Access and egress to the OSS will be by SOVs and CTVs in a similar arrangement to the WTGs (see section 2.5.3). The OSS will not be equipped with a helideck but will include a hoisting area on the roof deck for emergency access by helicopter.

The OSS will collect the electricity generated by the operational WTGs via the inter-array cables. The voltage will be "stepped up" by one or two transformers on the OSS before transmission to the onshore electrical infrastructure by the offshore cable. The design parameters for the offshore substation topside are presented in Table 2-11. The design parameters for the offshore substation foundation was described in section 2.5.5.

The OSS will be coated in a marine grade coating system. Corrosion protection measures will be applied to all equipment installed in non-climatised conditions. To limit the visibility against the sky, the OSS topside structure will be coated in a light grey colour.

Table 2-11: Project design parameters for the offshore substation (OSS).

Element	Design parameter
Topside structure	
Height of main structure (above LAT) (m)	40
Height of lightning protection (above LAT) (m)	48
Height of crane (above LAT) (m)	48
Height of telecommunication mast (above LAT) (m)	56
Topside length (m)	40
Topside width (m)	30
Topside weight (t)	3,000
Consumables (maximum volumes)	
Diesel fuel (litres)	10,000
Grey Water (litres)	3,000
Black Water (litres)	1,000
Transformer coolant oil (m^3)	230
UPS Batteries (kg)	3,000
Fire Suppression Systems	5,000 litres foam + 5,000 kg Argonite
HVAC coolant (litres)	1,000
SF6 (kg)	1,750

The OSS will be equipped with a drain system to collect and contain any leakages from equipment containing environmentally damaging fluids. This sealed system will ensure no discharge of fluids to the marine environment. The HV transformer(s) will have a sump area in the deck structure, covered with flame retardant grating. A double walled sump tank on the cable deck will be connected to the sump area via an overflow pipe in the transformer room(s) to ensure the total volume of the transformer oil and additional water/foam mixture during fire extinguishing can be contained. An oil/water separator will prevent rainwater collecting in the sump area. The main diesel oil tank is double walled and bunded.

The external and internal lighting system on the OSS will be designed according to relevant standards such as:

- IEC 61892 (Part 1 to 7): Mobile and Fixed Offshore Units - Electrical Installation;
- GL: GL Rules IV Industrial Services Chapter 6 Offshore Installation;
- EN 12464: Lighting of Workplaces;
- EN 1838: Lighting application – Emergency lighting;
- DNV-OS-D201: Electrical installations;
- DNV-ST-0145: Offshore substations for wind farms;

- 2004/108/EC: EMC Directive;
- DS/EN 61000-6: Electromagnetic compatibility; and
- 2006/95/EC: Low Voltage Directive.

When the OSS is manned, all lighting on the topside will be switched on. In unmanned mode, the lighting around the boat landing, helicopter hoist area and outside platform marking will always remain on.

Installation

The OSS is generally installed in two phases, the first phase will be to install the foundation for the structure which will be as for the wind turbine foundation structures (see section 2.5.5). Secondly, a Heavy Lift Vessel will lift the topside from a transport vessel/barge, onto the pre-installed foundation structure. The Heavy Lift Vessel may also be used to transport the offshore substation topside to the site. A photograph of an OSS installation is presented in Figure 2-10.

Figure 2-10: Heavy Lift Vessel installing an OSS Topside.

OSS installation and commissioning may take place over a total period of three months. The vessel requirements for this process are presented in Table 2-12.

Table 2-12: OSS installation vessel numbers and movements.

Vessel	Numbers	Number of return trips
Main Installation Vessels (Jack-up Barge/DP vessel)	1	1
Tug/Anchor Handlers	2	2
Guard Vessels	1	20
Crew Transfer Vessels	2	35

Design flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final height of offshore infrastructure.

The final exact location of each offshore wind turbine and the offshore substation.

The final exact location of the OSS will be confirmed following geotechnical investigations and analysis of ground conditions.

The location of the OSS may require adjusting within a 50 m radius should an obstruction occur during installation. Detailed geophysical studies have been completed for the proposed foundation location. Future geotechnical investigation and trial drilling of each location will be completed prior to construction as part of a foreshore licence (see section 2.4.1). Variable ground conditions across the offshore wind farm area have been identified and ground conditions such as boulders would result in the requirement to move the foundation.

A 50 m radius of lateral deviation in the final location of the offshore substation is proposed and is sufficient to identify alternative, feasible locations.

The final height of the OSS will be confirmed following detailed geotechnical investigations and analysis of ground conditions.

A monopile foundation design has been selected. This has been determined from metocean, geophysical and geotechnical studies completed to date. The height of each foundation will be determined as part of a construction contract and will be specific to the water depths and soil conditions at each foundation location. The height of the foundation is the determining factor in the final height of the OSS. The proposed maximum height of the OSS structure including the crane is 48 maLAT.

2.5.8 Offshore export cable

A single HVAC offshore export cable rated at 220 kV will be used for the transfer of power from the offshore substation to the landfall. The cable will be located within the offshore cable corridor identified in Figure 2-1. The cable will be buried below seabed level where possible and additional protection measures as outlined below will be used where burial is not possible due to any physical constraints posed by seabed sediment conditions.

Design

The export cable will consist of three conductor cores, usually made from copper or aluminium. These will be surrounded by layers of solid insulating material as well as material to armour the cable for protection from damage and material to keep the cable watertight. No mineral oils or other fluids are contained within the cable. Export cables are typically larger in diameter than inter-array cables (350 mm for the offshore cable compared with 250 mm for the inter-array cables). The design parameters for the offshore cable are presented in Table 2-13. A cross-sectional illustration of a typical export cable is presented in Figure 2-11.

Table 2-13: Project design parameters for offshore cable.

Parameter	Design parameter
Number of offshore cables within offshore cable corridor	1
Export cable voltage (kV)	220
Offshore Cable Type	HVAC
Maximum external cable diameter (mm)	350
Maximum length of offshore cable (km)	16

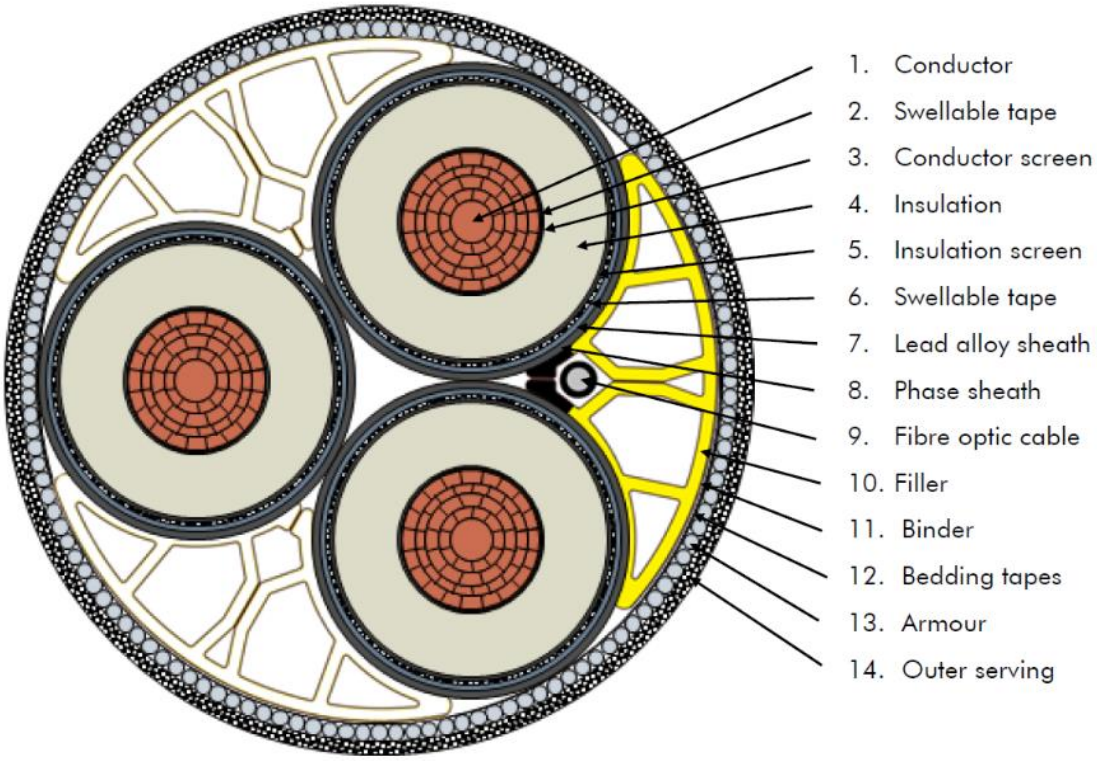


Figure 2-11: Cross-section of offshore cable.

Installation

The offshore cable installation methodology, as well as the burial depth and any requirement for protection measures, will be defined by a detailed CBRA (see section 2.10) to be prepared, by the chosen cable installation contractor. Typically, the cable will be buried between 0.5 m to 3 m. The CBRA will inform cable burial depth which will be dependent on ground conditions as well as external risks. This assessment will be undertaken prior to construction. The installation techniques will consist of a combination of ploughing and jetting. Jetting modifies the seabed with high-speed water jets so that the pre-laid cables sink by their own weight to a pre-determined depth. In case of ploughing, cable ploughs are towed by the cable installation vessel to bury the cables simultaneously with the laying process. The plough lifts a wedge of soil and places the cable at the base of the trench before the wedge of soil backfills over the cable due to gravity. The design parameters for installation of the offshore cable are presented in Table 2-14.

Table 2-14: Project design parameters for the offshore cable installation.

Element	Design parameter
Installation methodology	Ploughing or jetting
Maximum Burial depth (m)	3
Trench width (m)	3
Width of seabed disturbance from installation tool (m)	10
Total Project area of seabed disturbance (km^2)	0.16

Cable Protection

Where the cable cannot achieve target burial depth due to ground conditions, cable protection will be deployed. Cable protection may include rock placement and/or concrete/steel mattresses, as described in section 2.5.6. It is anticipated that 50% of the offshore cable may require cable protection. Table 2-15 provides the design parameters for cable protection.

Table 2-15: Project design parameters for offshore cable protection.

Element	Design parameter
Cable protection material (type)	Rock placement and/or concrete/steel mattresses
Length of cables requiring cable protection (m)	8,000
Cable protection height (m)	2.0
Cable protection width (m)	10.0
Total cable protection footprint for offshore cable (m^2)	80,000
Total cable protection volume for offshore cable (m^3)	160,000
Proportion of offshore cable with cable protection (%)	50

Export cable installation may take place over a total installation period of three months. Cable installation and route preparation will be undertaken by specialist vessels, the vessel requirements for offshore cable installation are presented in Table 2-16. Based on previous experience within the Applicant's Project Team at other offshore wind farms, it is possible that a small JUV or a flat top barge may also be used for offshore cable installation in shallow water.

Table 2-16: Installation vessel numbers and movements for installation of the offshore cable.

Vessel	Number	Number of return trips
Cable Installation Vessels	1	1
Guard Vessels	1	20
Crew Transfer Vessels	1	20
Cable Protection Installation Vessels	2	5

Design flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final route and length, of the offshore cable and offshore inter-array cables.

Due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore cable will be confirmed during construction.

An offshore cable corridor has been identified following detailed geophysical and geotechnical site investigations. For the purposes of assessment, a 16 km of offshore cable route within the offshore wind farm area have been assessed.

Should obstacles be encountered during the installation of the inter-array cables, the obstacle will be relocated or the route adjusted to avoid the obstacle.

2.5.9 Landfall and Transition Joint Bay (TJB)

The offshore export cable will make landfall approximately 700 m south of Dunany Point, Co. Louth.

The offshore export cable will be installed in a buried trench in the intertidal area and will connect to the TJB located above the high water mark.

A geotechnical investigation of the landfall above the high water mark was conducted in 2021. This included the drilling of four cable percussion boreholes, a rotary borehole and a geophysical survey of seismic

refraction and electrical tomography. The investigation determined that the subsoil deposits were suitable for installation of the cable at the landfall within a dug trench. The technique for installation is described in the following sections.

Intertidal area - export cable installation

Figure 2-12 below details the typical phases which would apply when floating in a cable at the proposed landfall. The offshore export cable will be pulled ashore at high tide or alternatively rolled in on rollers and lowered into an open trench within the beach. The trench will then be backfilled as the tide recedes.

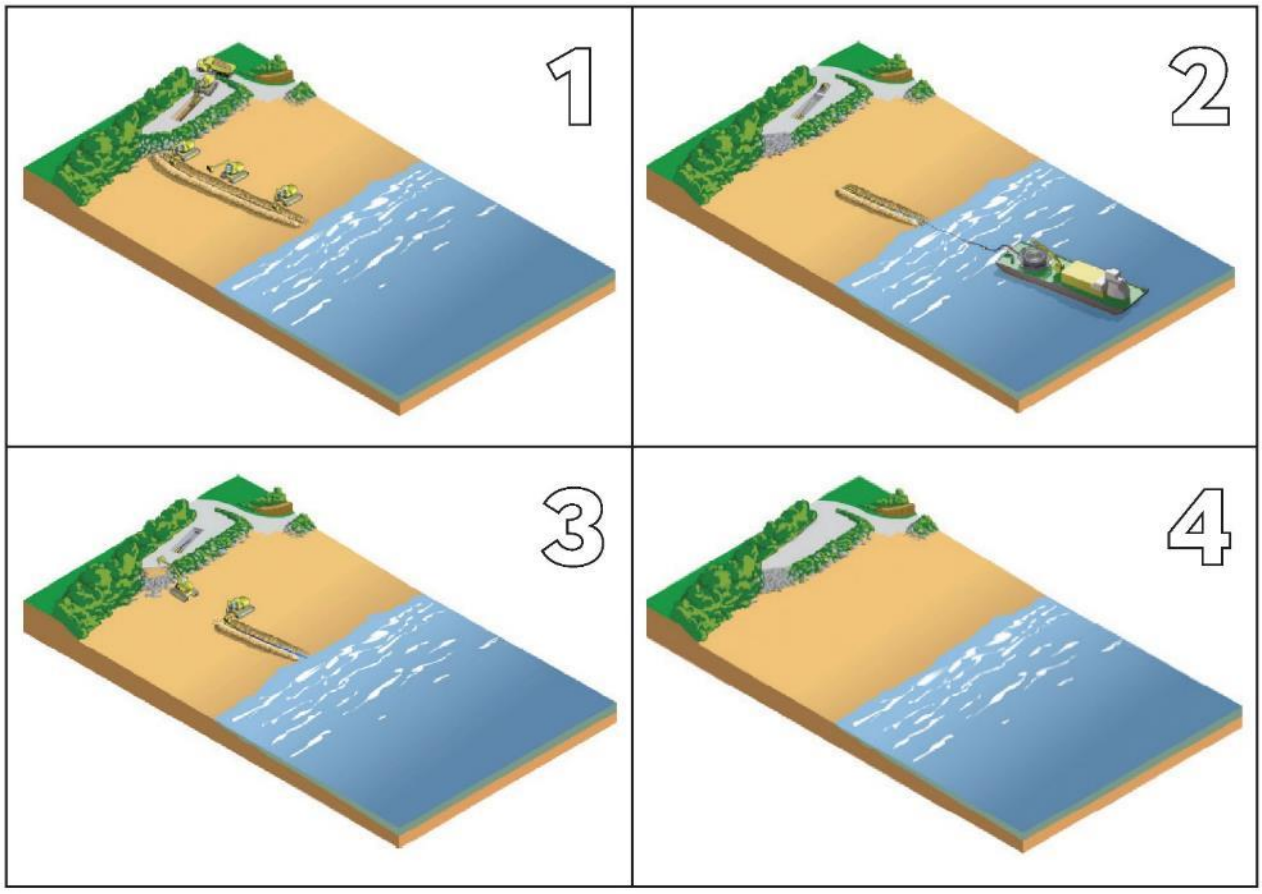


Figure 2-12: Schematic showing phases of installing a cable trench at a landfall.

A 30 m wide working area will be defined between the high water mark and the low water mark along the route of the offshore cable. Prior to the cable laying vessel arriving on site, a trench will be excavated on the beach to provide a cable route between the low water mark and the high water mark.

The trench will be backfilled immediately after installation of the cable and the beach returned to its prior condition. The exact location of the cable will be recorded using precise survey grade equipment. A winch wire will be pulled offshore where it will connect to the cable which is floated towards the shoreline using work boats. For long float in operations, a jack up barge (backhoe excavator) may be required for the excavation and reinstatement through the intertidal zone and also during the floating to control the cable location between the TJB and cable laying vessel.

The barge will be positioned ideally no more than 1 km from the shoreline. Divers will typically be used to remove the floats at the low water mark and rollers will be positioned along the beach to guide the cable along the trench. The cable can be floated ashore during high tide or alternatively pulled along the beach

through rollers during low tide. Once the cable is anchored at the TJB, the cable laying vessel can continue out to sea laying the cable along the seabed as it transits to the OSS location. The excavated trench out to the low water mark will then be backfilled and the ground reinstated.

The final method for installation will be dependent on the results from the detailed site investigation for the intertidal area (which will be undertaken as part of an existing Foreshore Licence) and the contractor selected for the work. A photograph illustrating the cable installation techniques is presented in Figure 2-13 for information.

Figure 2-13: Photo showing installation of a cable in a trench at a landfall.

Alternatively, self-powered bespoke installation tools may be used. These are usually tracked vehicles, that excavate a trench, lay the cable, and then bury the cable simultaneously. These are ROV type systems, controlled from and connected to the offshore installation vessel.

A photograph of a cable laying vessel and equipment is presented in Figure 2-14 for information.

A graphic of a typical arrangement for the TJB based winch is presented in Figure 2-15.

Figure 2-14: Photo showing example of an intertidal cable burial using a plough.

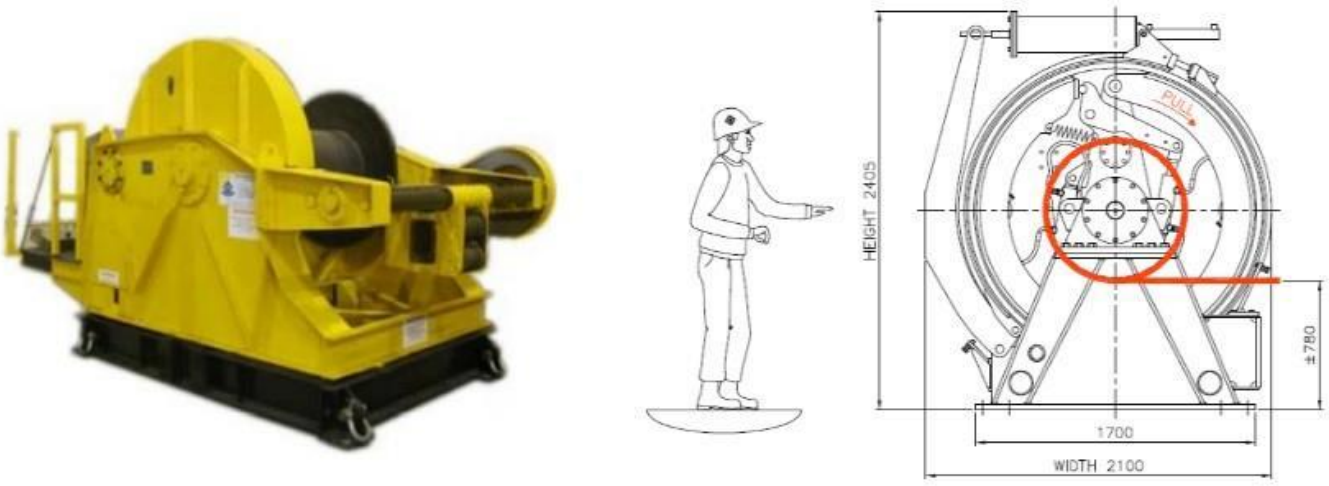


Figure 2-15: Typical shore based winch arrangement.

The project design parameters for open trench installation at the intertidal area are presented in Table 2-17 and for installation equipment to the site are presented Table 2-18. Following completion of the cable installation, the working corridor will be reinstated to its previous condition. Any surplus soil will be taken off site by a waste licenced contractor to an appropriate licenced waste facility for reuse where possible.

Table 2-17: Project design parameters for landfall open trench installation.

Element	Design Parameter
Number of trenches	1
Landward of HWM	
Width of trench (m)	5 m at top and 1.5 m at base
Length of trench (m)	10 m – 200 m (between HWM and TJB)
Depth of trench (m)	3
Working areas either side of trench (m)	15
Intertidal (HWM to LWM)	
Width of trench (m)	5 m at top and 1.5 m at base
Length of trench (m)	800
Depth of trench (m)	3
Area of trenches (m^2)	4,000
Volume of material excavated from trenches (m^3)	12,000
Working areas either side of trench (m)	15
Installation duration	
Installation duration	3 months

Table 2-18: Open trench installation vessels/equipment.

Vessel/Equipment	Numbers	Number of return trips
HGV return trips - mobilisation	2	10
HGV return trips - trenching operations	3	30
HGV return trips - demobilisation	2	10
Tug/Anchor Handlers	1	1
Cable Installation Vessels	1	1
Guard Vessels	1	1
Survey Vessels	1	1
Crew Transfer Vessels	1	1

Transition Joint Bay (TJB)

The offshore cable is connected to the onshore cables at the TJB. The TJB is a fully buried concrete chamber which is located close to the high water mark to minimise the length of the offshore export cable on land. This is due to the technical properties of the tricore marine cable which has limits on its thermal properties along its length.

The design parameters for the TJB are presented in Table 2-19 and the maximum number of return trips for installation equipment to the site are presented in Table 2-20.

The purpose of the TJB is to ensure that the jointing of the export cables can take place in a clean, dry environment and also to protect the joints once completed. Once the joints are completed the TJB is covered and the land above reinstated. It is not expected that access to the TJB will be required during the operation of the wind farm, however, the link box and communication chamber will be located adjacent to the TJB with access for monitoring of the cable joints during the operational phase. These will also be reinstated but will

have maintenance covers for access. A hard stand area for crane operations will be constructed adjacent to the TJB. This will be covered and the land above reinstated once the TJB is completed. However, it will be available should a future maintenance operation require opening of the TJB.

Two options for the location of the TJB have been identified and are presented on Table 2-16 (map 12 of 12). The options are described below.

- **Option 1** is located close to the beach end of the laneway along the southern boundary of Dunany Demesne. The offshore cable would transition across the intertidal area and be pulled into the TJB by a winch system either within the laneway or in the adjacent field through a pulley system (see Figure 2-15). The TJB has been located to avoid impact on the cliff and its top will be buried at depth of approximately 1.1 to 1.5 m below existing ground level. During excavation for the TJB the adjacent cliff will be stabilised through the installation of temporary sheet piling which will be removed following reinstatement.

- **Option 2** is located in the field at the southern boundary of Dunany Demesne. An open trench would be dug through the glacial till of the cliff and the export cable would be pulled into the TJB by a winch located in the field (see Figure 2-15). The open trench would be stabilised through the installation of temporary sheet piling. The trench would then be backfilled on completion, the sheet piling removed, and the cliff stabilised through replanting with existing vegetation species.

The geotechnical site investigations to date have demonstrated that the installation of temporary sheet piles by driving or vibro-action is possible; installation by driving becoming more probable should stiff or dense ground conditions be encountered. Should bracing of the installed piles be practicable, it may be possible to reduce pile embedment depth. Alternatively, pre-boring may be deemed appropriate, where driving conditions are difficult. Following installation of the cable or construction of the transition joint bay, these piles will be removed by excavator. The duration of installation will be dependent on construction programming and staging; but is not expected to exceed two weeks.

The location for the TJB is dependent on cable and soil properties which cannot be determined until the cable contracts have been concluded and the final cable is selected (see further details in subsection titled ‘design flexibility’ below).

Transition Joint Bay (TJB) access track

The EirGrid functional specifications require permanent vehicular access to the TJB. For this a single vehicle width access track along the southern boundary of the field will be constructed (if option 2 is used). The access track will be gated at the entrance to the field to prevent unauthorised access. The existing access to the beach at Dunany will be used for access to option 1.

Engineering stone fill will be laid and compacted and maintained as required for the duration of the construction works. Once the construction works are completed, the engineered stone fill will remain in situ to allow maintenance access. It may be necessary to carry out repairs to this access track over the lifetime of the cable circuit due to general wear and tear from maintenance traffic. In the case of a fault during the operational phase of the cable circuit the access track will facilitate a repair of the cable circuit.

A temporary construction compound will be required for the works. The location of the compound is shown on Figure 2-16 (map 12 of 12).

Table 2-19: Design parameters for TJB.

Parameter	Dimensions
Number of TJBs	1
TJB area of temporary excavation required (m^2)	100 (option 1) 300 (option 2)
Depth of excavation (m)	2.0
Area of TJB (m^2)	32.5
Volume of material excavated from TJB (approximate) (m^3)	110 (option 1) 200 (option 2)
Landfall construction compound (m^2)	4,120

Table 2-20: TJB installation equipment.

Equipment	Numbers	Number of return trips
HGV return trips - mobilisation		20
HGV return trips - TJB		100
HGV return trips - demobilisation		20

Design flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The location and layout of the landfall transition joint bay.

The final location of the TJB will be confirmed on examination of the electrical and thermal properties of the selected offshore cable and the ground conditions at the landfall.

As outlined above, two options for the location of the TJB are presented. The two options are in close proximity and approximately 40 m from each other. Option 1 is close to the beach at Dunany above the high water mark. Option 2 is in an agricultural field adjacent to the beach (see Figure 2-16 (map 12 of 12). Both options will be examined to determine which is most suitable for the properties of the selected offshore export cable.

2.5.10 Construction vessel activities

During the construction of the Project, a number and variety of vessels will be utilised for installation, support and transport of personnel, equipment and infrastructure to the offshore wind farm area and the offshore cable corridor. These have been provided in the above sections relevant to the installation of each component of the Project.

The total vessel numbers and vessel movements (return trips from a marshalling harbour to site and back again) are collated in Table 2-21 below. Each vessel movement represents a return trip to and from the offshore wind farm area or offshore cable corridor (as appropriate).

Table 2-21: Total installation vessel numbers and movements.

Vessel	Numbers	Number of return trips
Main Installation Vessels (Jack-up Barge/DP vessel)	1	40
Commissioning Vessel	1	28
Tug/Anchor Handlers	2	12
Cable Installation Vessels	1	6
Guard Vessels	1	20

Vessel	Numbers	Number of return trips
Survey Vessels	1	8
Crew Transfer Vessels	1	325
Scour/Cable Protection Installation Vessels	1	36

2.5.11 Aids to navigation, colour, marking and lighting

The lighting and marking of the infrastructure has been designed based on the recommendations of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA, 2013) and will be agreed with the CIL, Irish Coast Guard (IRCG), the MSO, the IAA and the Department of Defence (DoD).

The positions of all infrastructure (including wind turbines, the OSS and subsea cables) will be conveyed to the CIL and the UK Hydrographic Office (UKHO) so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures.

2.5.12 Safety zones and advisory clearance distances

During construction and decommissioning the Applicant will implement advisory safety zones of 500 m in radius around individual structures undergoing installation. Safety zones of 50 m will be advised for incomplete structures at which construction activity may be temporarily paused (and therefore the 500 m safety zone has lapsed) such as installed foundations or where construction works are completed but the wind farm has not yet been commissioned.

During the operational and maintenance phase, the Project may also implement advisory safety zones of 500 m radius around infrastructure undergoing major maintenance (for example a blade replacement).

The Applicant will also recommend that advisory clearance distances of 500 m radius are observed around cable installation vessels and cable repair vessels.

All safety notices will be advised through Marine Notices published by the Marine Survey Office of the Department of Transport.

2.6 Description of onshore infrastructure

The following sections provide a description on the design and size of the onshore infrastructure of the Project, together with relevant information on construction methods and techniques for the installation of the onshore cable and associated infrastructure (sections 2.6.1 and 2.6.2) and the onshore substation (section 2.6.3 and 2.6.4).

2.6.1 Onshore cable

The single offshore export cable will connect to three onshore cables at the TJB to transfer the power onwards to the onshore substation. The three onshore cables will be installed in the same trench and buried for the entirety of the length from the TJB to the onshore substation.

This 220 kV circuit has been designed and will be installed in compliance with the EirGrid's functional specification for underground cables. It is the policy of EirGrid that, in so far as possible, high voltage underground cables shall only be installed under public roads to allow for standard construction methods and operational access. Furthermore, the cable route has been designed in accordance with a wide range of technical, environmental and socio-economic considerations.

Onshore cable route

The route of the onshore cable is shown on Figure 2-16 (maps 1 - 12). It is located within the following townlands in Co. Louth: Dunany, Mitchelstown, Port, Nicholastown (Barony of Ferrard), Boycetown, Togher, Clonmore, Tullydonnell, Corstown (Electoral Division of Drumcar in the Barony of Ardee), Corstown

(Electoral Division of Dunleer in the Barony of Ferrard), Drumcar, Mullincross, Charleville, Dromgoolestown, Richardstown (Electoral Division of Stabannan in the Barony of Ardee), Harristown, and Stickillin.

The onshore cable route commences at the laneway that runs along the southern boundary of Dunany Demesne (see Figure 2-16 map 12) and follows local roads heading south through the townlands of Roadstown, Mitchelstown and Port before heading westwards on local roads through Boycetown, Togher and Clonmore (see map 9). At Keenan's Cross, it continues westwards through Tullydonnell before heading northwards through Corstown.

The route then crosses under the River Dee at Drumcar Bridge (see Figure 2-16 map 5) and continues along local roads, heading in a westerly direction. At Mullincross, the route crosses the R132, and then at Charleville the route passes under the M1 motorway and Dublin to Belfast Rail Line (see Figure 2-16 map 3). It then follows the N33 and crosses under the River Dee (see Figure 2-16 map 3) for a second time before continuing westwards to tie-in to the existing overhead line at the onshore substation site, in the townland of Stickillin (see Figure 2-16 map 1).

Where the onshore cables are required to pass under obstructions such as the River Dee or M1 motorway the onshore cable route diverts to agricultural fields adjacent to the road from where ducts are drilled under the obstruction and the onshore cable installation undertaken (see section 2.6.2 Crossings).

Cable route wayleave

Once installed a permanent wayleave of 5 m in width will be maintained at all locations where the onshore cable route is installed away from the public road. This is in accordance with the functional specification of EirGrid.

A new permanent access track will be constructed to the TJB (option 2 only) to allow for maintenance. The access track will be approximately 4 m wide and is shown on map 12 (see Figure 2-16). The existing public access lane will be used if option 1 is constructed.

Cable design

The onshore cable will be a single circuit connection consisting of three conductor cables, each in a separate duct. These ducts along with two fibre-optic communication cables are arranged within a single trench as illustrated in Figure 2-17. The cable will consist of copper or aluminium conductors wrapped with various materials for insulation, protection, and sealing. The cables are supplied in section lengths of approximately 700 m. Each section of cable is joined in the joint bays (JBs). Cable installation is described in section 2.6.2 'Cable Pulling and Jointing'.

Table 2-22 presents the design parameters for the onshore cable. Fibre-optic cables will also be integrated in the cables to allow for communication with the control systems on the wind turbines and OSS. A telecommunication mast at the proposed onshore substation will provide the primary communication from the substation to the EirGrid control centre.

The EirGrid functional specification requires a secondary communication from the proposed onshore substation at Stickillin. Therefore, two additional fibre optic cable ducts will be installed within the underground cable trench from the proposed onshore substation for approximately 3 km to a connection into a 110 kV double wooden poleset on the existing Drybridge-Louth 110 kV overhead line in the townland of Richardstown. The ducts will allow a fibre connection into the existing electricity network to provide communications to the proposed 220 kV substation.

The potential generation of electromagnetic fields (EMF) is a factor of cable current.

Joint bays, link boxes and communication chambers

JBs will be required along the onshore cable route to connect the sections of cable. JBs are concrete lined chambers, that provide a clean and dry environment for jointing the sections of cable together. JB dimensions are presented in Table 2-22. JBs are designed to be covered over following reinstatement. A total of 29 joint bays are required along the onshore cable route (see locations shown in Figure 2-16). 26 JBs are proposed to be located below the public road. Three JBs will be located in agricultural land, these are proposed to be located on the edge of fields and will be covered over to allow the land to be used for

agriculture practices. JBs will only require access in the event of a cable failure requiring replacement or maintenance.

Link boxes and communication chambers (C2) will also be required along the onshore cable route adjacent to each JB. These are smaller chambers, compared to JBs, which house connections between the cable shielding, joints for fibre optic cables and other auxiliary equipment. The land above the link boxes and C2s will also be reinstated, however, they will be finished with manhole covers for access during the operational and maintenance phase.

The design parameters for the JBs, link boxes and communication chambers are presented in Table 2-22.

Table 2-22: Project design parameters for the onshore cable, joint bays, link boxes and communication chambers.

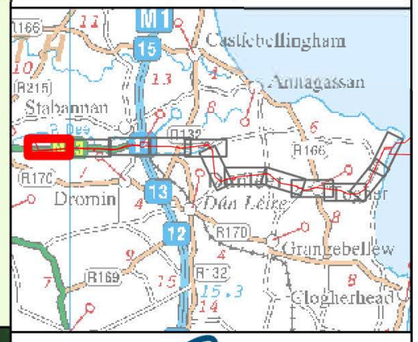
Element	Design parameters
Number of trenches to install onshore cable	1
Details of cable pipes (if any)	3 x 200 mm SDR21 HDPE & 2 x 125 mm SDR17.6 HDPE
Details of concrete (if any)	Ducts Laid in CBGM (CL 822) Compacted to CL.813.1 of TII.
Standard trench width	700 mm
Trench length	20.1 km
Trench depth	1,425 mm
Surface area of trenches (700 mm* wide trench) (m^2)	c. 14,070m^2 based on 700 mm x 20.1 km
Volume of material excavated (per metre of trench)	circa 1 m^3
Working Areas (width either side of trench) (m)	Varies depending on site restrictions circa 5 m
Number of joint bays and link boxes	29 each
Area of joint bays (m^2)	20
Area of Communications (C2) Chamber (m^2)	2.5
Area of Link Box (m^2)	2.5
Volume of material excavated (per joint bays) (approximate) (m^3)	40 m^3
Area for each Passing Bay (approximately 60 m x 10 m) including storage areas (topsoil, materials and equipment) and temporary works at each joint bay	c. 600 m^2

* This does not include for non-standard trench design, e.g. when obstacles are encountered.

Legend

- Planning Application Boundary
- Line Cable Interface Mast (LCIM)
- Proposed Joint Bay Locations
- Proposed Onshore Cable Route
- Proposed fibreoptic cable route
- Compound 1 - GIS
- Compound 2 - AIS
- Cable Pulling Temporary Hardstand
- Temporary Construction Compound (substation)
- Temporary Construction Compound (underground cable installation)
- Temporary Storage Area
- Temporary Construction Area
- Proposed Access Tracks

Data Sources: OWL; OSi.



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ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 2-16: Onshore Cable Route

Map 1 of 12

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Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Onshore Cable Route
- Proposed fibreoptic cable route

Data Sources: OWL; OSi.

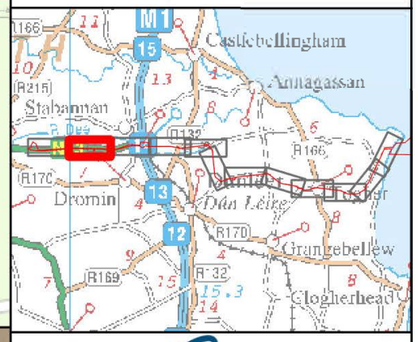

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Figure 2-16: Onshore Cable Route

Map 2 of 12

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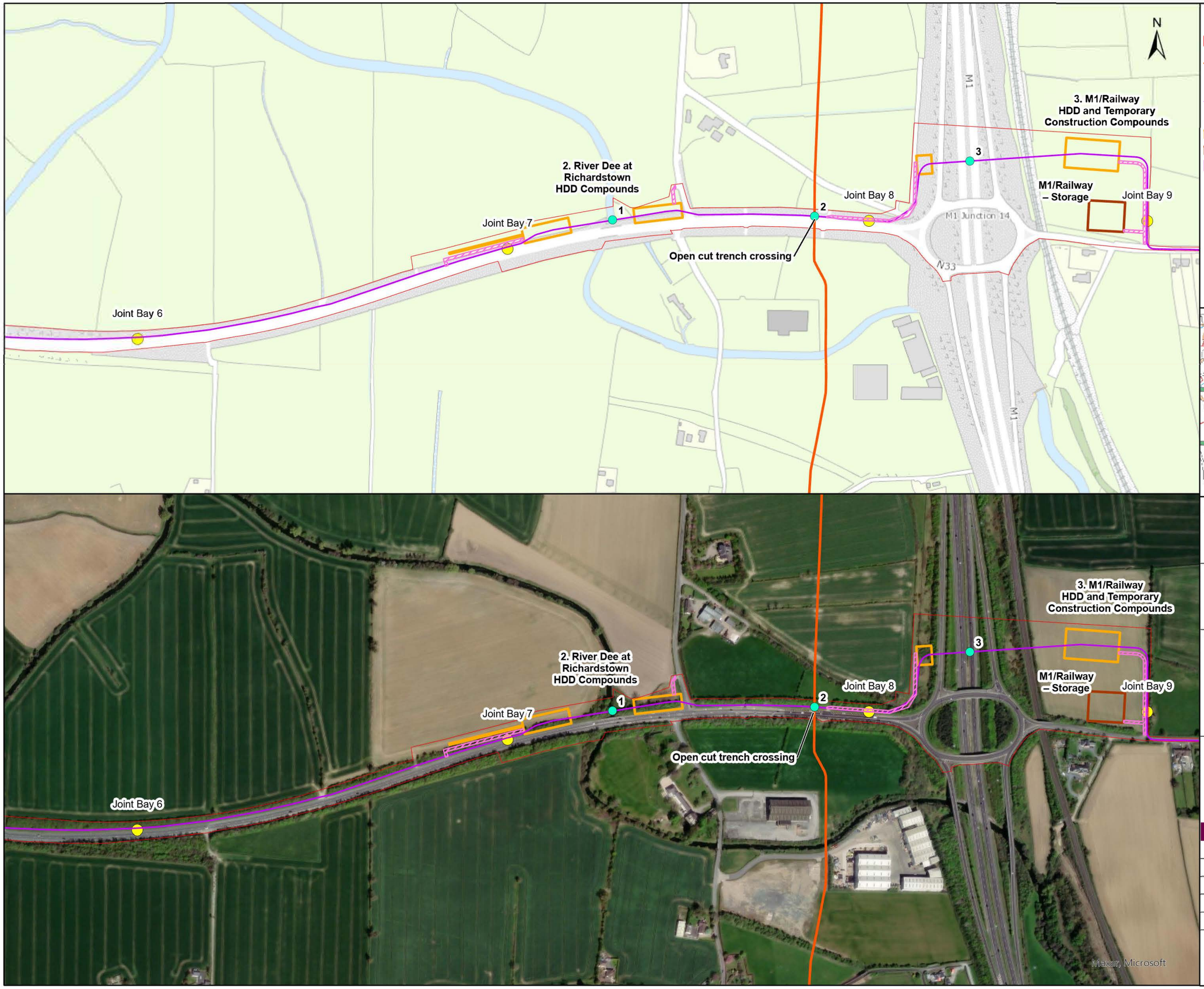

Legend

- Planning Application Boundary
- High Pressure Transmission Gas Main
- Proposed Joint Bay Locations
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8
- Proposed HDD Compounds
- Temporary Construction Compounds
- Proposed Access Tracks

Data Sources: OWL; OSi.

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Figure 2-16: Onshore Cable Route

Map 3 of 12

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Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route

Data Sources: OWL; OSi.

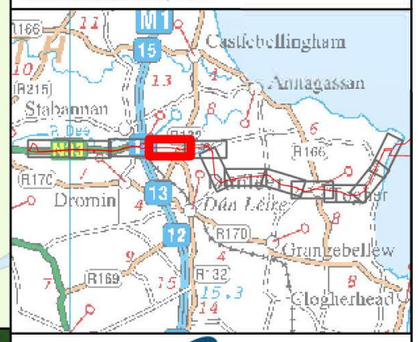

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Figure 2-16: Onshore Cable Route

Map 4 of 12

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Legend

- Planning Application Boundary
- High Pressure Transmission Gas Main
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8
- Proposed HDD Compounds
- Proposed Access Tracks
- Drill Staging Area

Data Sources: OWL; OSi.

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Figure 2-16: Onshore Cable Route

Map 5 of 12

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Legend

- Planning Application Boundary
- High Pressure Transmission Gas Main
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8

Data Sources: OWL; OSi.

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Figure 2-16: Onshore Cable Route

Map 6 of 12

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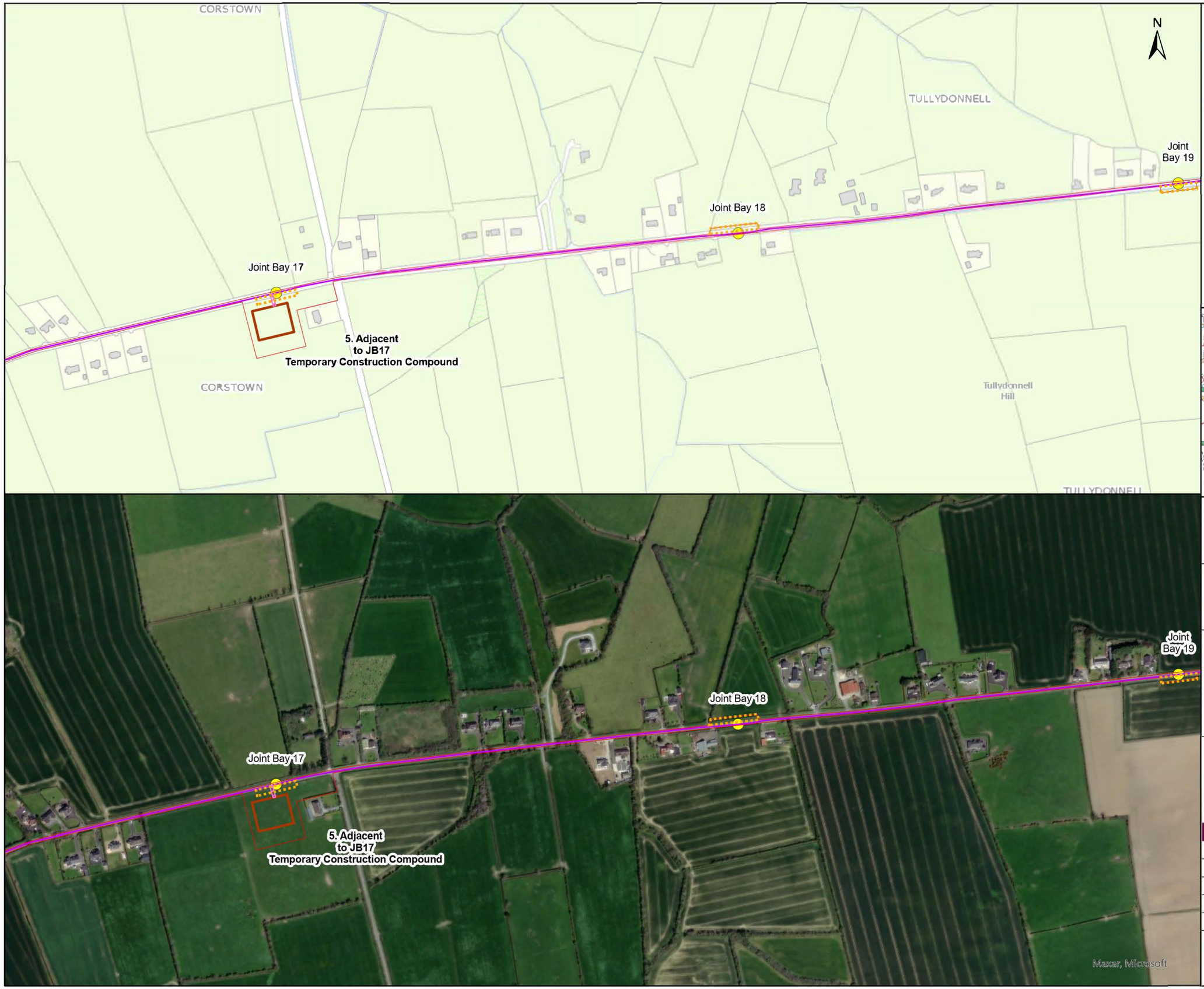

Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Temporary Construction Compounds
- Proposed Access Tracks

Data Sources: OWL; OSi.

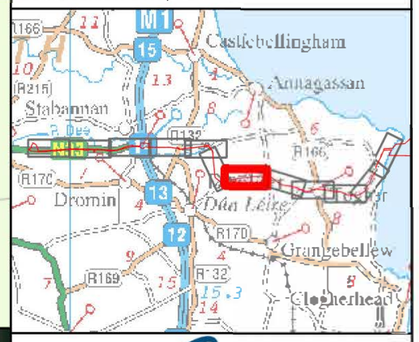

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Figure 2-16: Onshore Cable Route

Map 7 of 12

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Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8
- Proposed Access Tracks

Data Sources: OWL; OSi.

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title: **Figure 2-16: Onshore Cable Route**

Map 8 of 12

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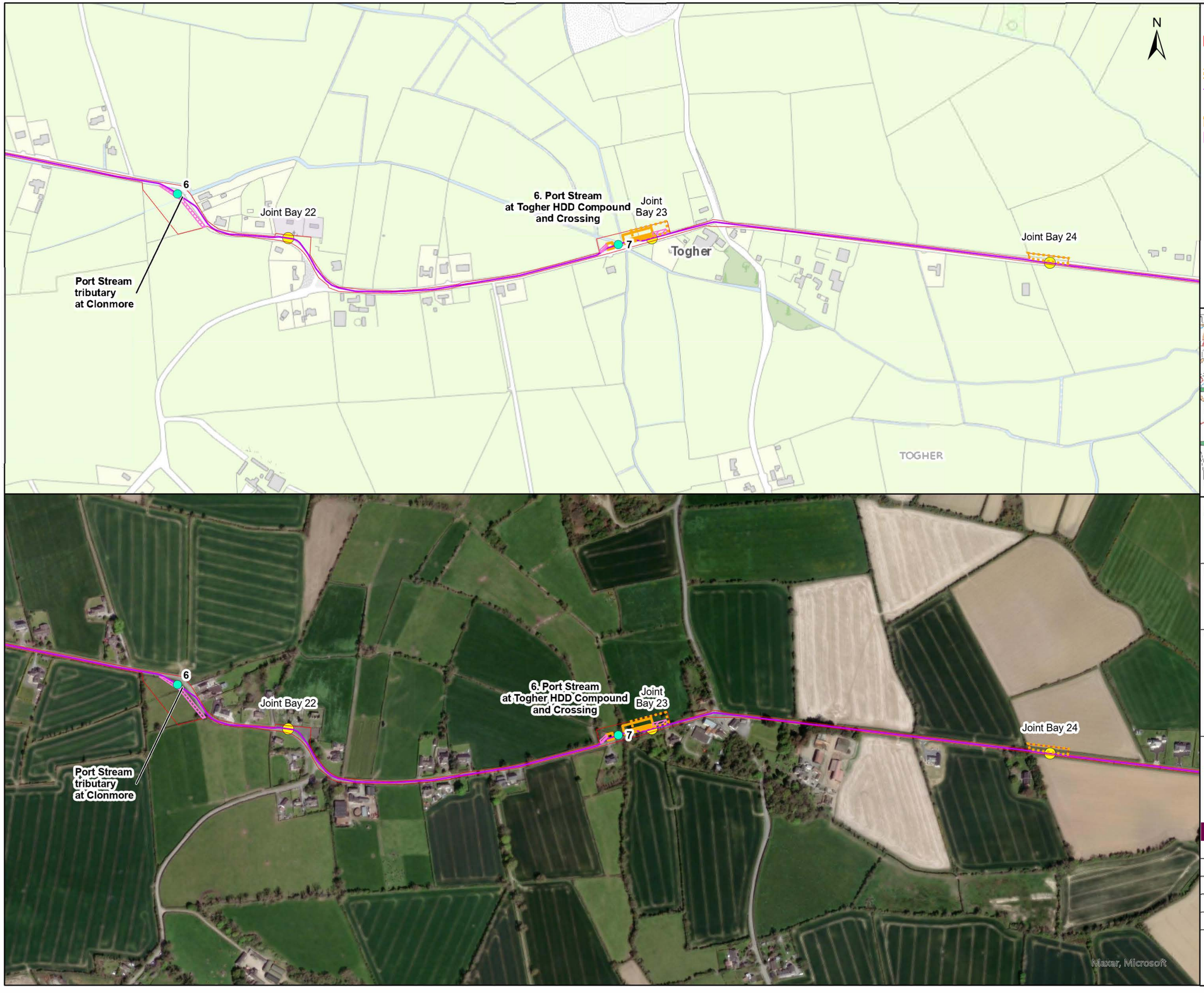

Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8
- Proposed HDD Compounds
- Proposed Access Tracks

Data Sources: OWL; OSi.

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Figure 2-16: Onshore Cable Route

Map 9 of 12

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Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route

Data Sources: OWL; OSi.

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Figure 2-16: Onshore Cable Route

Map 10 of 12

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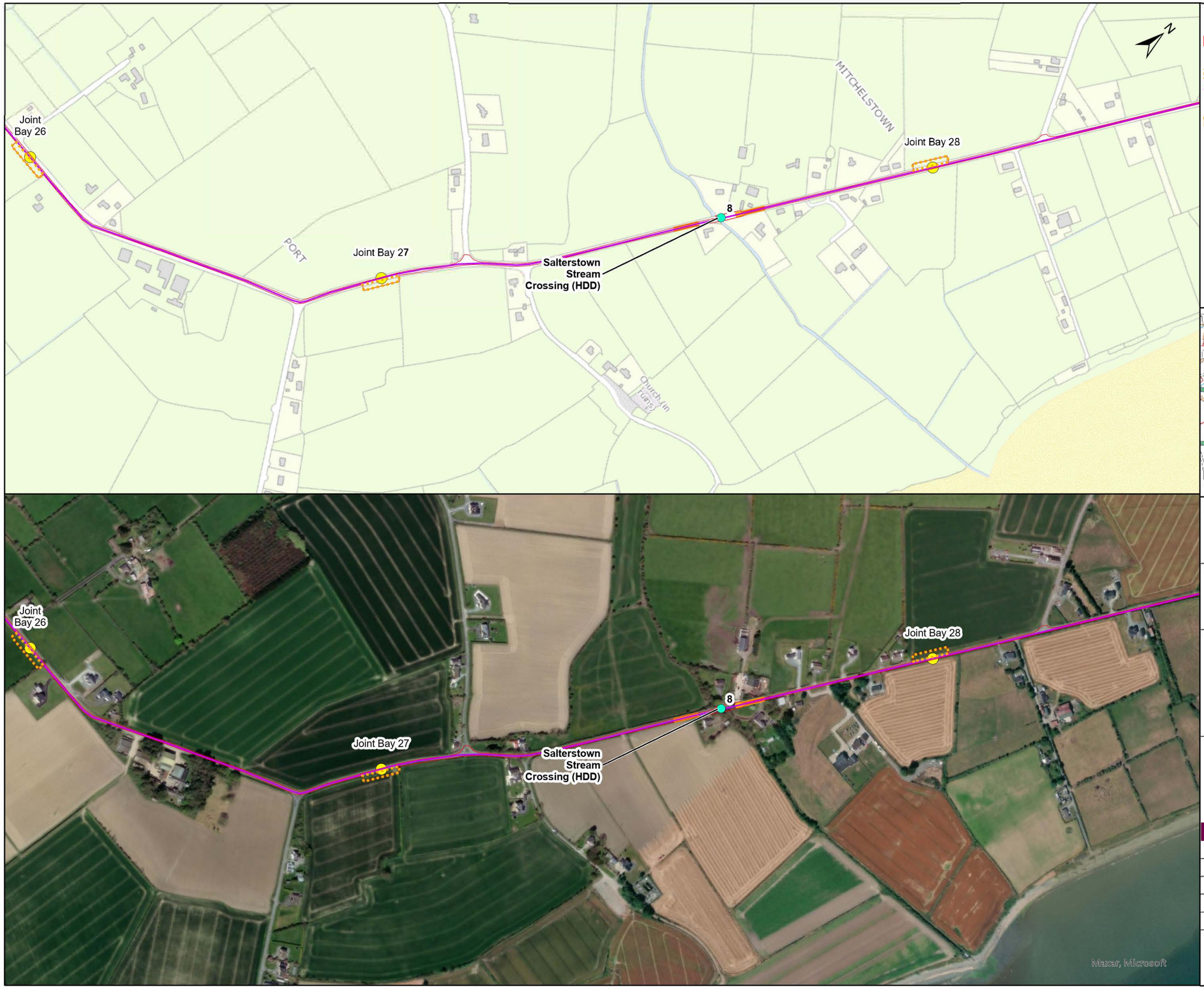

Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Proposed Onshore Cable Route
- Onshore Cable Crossing 1-8
- Proposed HDD Compounds

Data Sources: OWL; OSi.

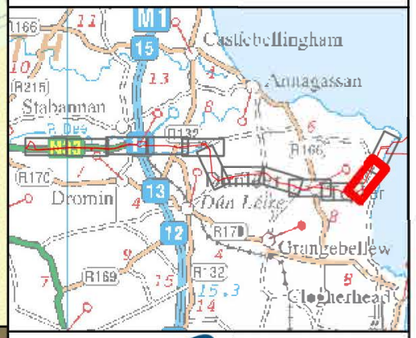

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Figure 2-16: Onshore Cable Route

Map 11 of 12

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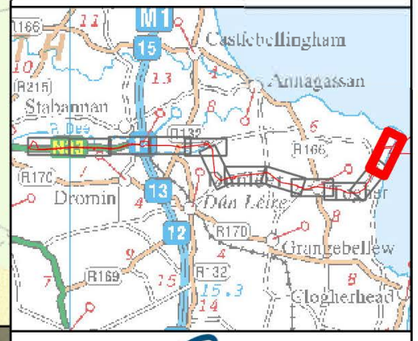
Legend

- Planning Application Boundary
- Proposed Joint Bay Locations
- Proposed Passing Bay
- Temporary Construction Compounds
- Proposed Access Tracks
- Proposed Onshore Cable Route
- Proposed Transition Joint Bay Option One
- Proposed Transition Joint Bay Option Two

Data Sources: OWL; OSi.



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Project

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Figure 2-16: Onshore Cable Route

Map 12 of 12

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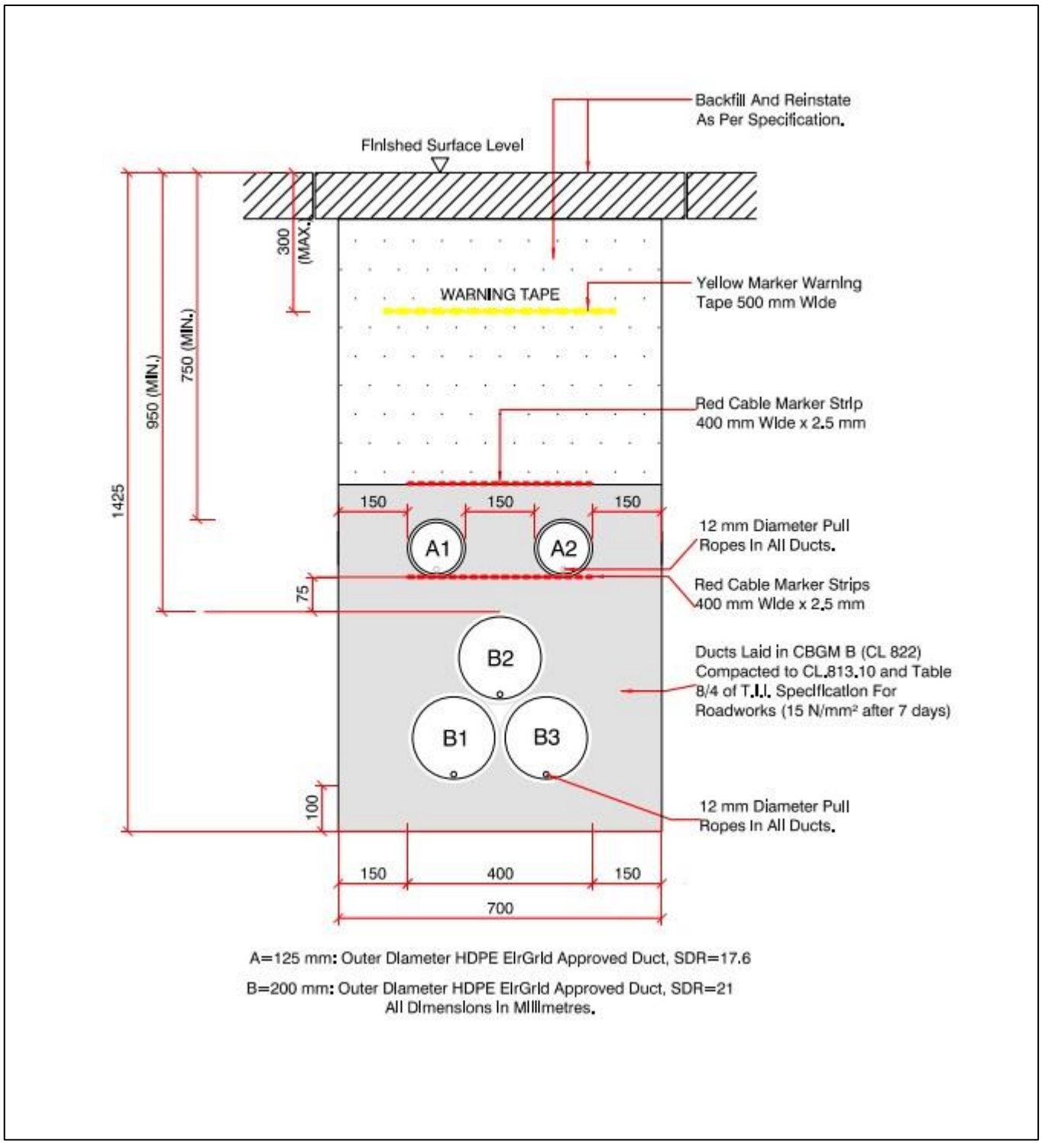


Figure 2-17: Cross-section of a 220 kV onshore cable arrangement.

2.6.2 Onshore cable installation

Site investigations

Site investigations along the proposed cable route will be carried out in advance of construction. These site investigations will include trial holes along the roadway to confirm the final depths and to gather information on the road cover available over existing bridges and culverts.

Site investigations including trial holes and / or boreholes will also be required at locations where trenchless methods (see section 2.6.2 crossings) are proposed to determine the geotechnical properties of the soil. This information will be required to finalise the HDD design.

Preconstruction surveys

Prior to any construction taking place a number of pre-construction biodiversity surveys will be required as outlined in appendix I: Onshore Biodiversity – Supporting Information.

Construction corridor

To construct the onshore cable, part of the public road will be utilised to allow for trenching and installation of the onshore cables and ducting and to maintain traffic access. Wider working areas will be required to provide access for the construction of the onshore cable at the following locations where the onshore cable route deviates off the public road (see Figure 2-16 maps 1-12):

- Onshore substation (see map 1 of 12);
- River Dee at Richardstown (on the N33) (see map 3 of 12);
- M1 and Dublin-Belfast Rail Line (at Charleville) (see map 3 of 12);
- River Dee at Drumcar Bridge (see map 5 of 12);
- Port Stream at Togher (see map 1 of 12); and
- Landfall (see map 9 of 12).

The full road width will be required for the cable crossing at Salterstown Stream (map 11) because HDD will be required for this crossing.

Site preparation / enabling activities

Prior to works commencing, temporary construction compounds and site access roads will be set up at seven locations along the onshore cable route as shown on Figure 2-16 and detailed in Table 5-24.

Onshore cable trenching and ducting

For the majority of the length of the cable route, an open cut trench and ducting method will be used to install the onshore cable. A summary of the sequence of the trenching and ducting works along the public network is provided below. Details on the installation of the onshore cable, off the public road are outlined under the section titled ‘crossings’ below:

- A road planer or other approved method will be used to remove the trench section of the road surface.
- Excavate approximately 12 m lengths of the trench with due attention to the presence of other services and to the grade of the trench. Hand dig when within 500 mm of services and around trees as required.
- Simultaneously load and remove soil offsite for reuse, recovery or disposal at a licensed facility and in accordance with the waste hierarchy. In grassed areas the excavated soil will be stored within the temporary construction corridor for future reinstatement.

- Grade, smooth and trim trench floor when the required depth and width have been obtained.
- Place ducts, bedding layer of Cement Bound Granular Mixture B (CBGM B), cable protection strips and backfill as shown in Figure 2-15.
- Permanent reinstatement of roads and grassland sections in compliance with the 'Purple Book'4, to the standard required and in accordance with the pre-application consultation with Louth County Council, subject to change during the road opening licencing process. For unsurfaced/grass sections, the trench will be reinstated with the excavated material to allow soil to be seeded).
- Clean and test the ducts in accordance with the specification and install draw rope in each duct and seal all ducts.

All surface water and groundwater that requires pumping during trenching will be treated prior to discharge.

Construction of joint bays and cable pulling

The construction of the JBs (at locations shown on Figure 2-16) will follow the sequence below. Excavate area for installation of joint bay and prepare bottom of excavation with blinding layer. Removal of excavated material offsite for reuse, recovery or disposal at a licensed facility.

- Joint bays will either be constructed:
  - In-situ construction with 200 m thick reinforced concrete side walls (Figure 2-18); or
  - Installation of pre-cast concrete construction (Figure 2-19).
- Temporary reinstatement of surface and placement of joint bay covers.

All surface water and groundwater that requires pumping during construction of the JBs will be treated prior to discharge.

[4] guidelines_for_managing_openings_in_public_roads_apr._2017.pdf (rmo.ie)

Figure 2-18: Photo showing joint bay under construction (in-situ).

Figure 2-19: Photo showing joint bay under construction (pre-cast)

Cable pulling and jointing

The cable is supplied in pre-ordered lengths on large cable drums. The cable length on each drum is specific to the distance between joint bays with approximately 700 m lengths on each cable drum. The cable is installed in the following sequence:

- Set up cable pulling winch next to joint bay and connect cables to the winch rope (see Figure 2-20);
- Pull each cable from previous joint bay through ducts to the cable winch;
- Once the cables are pulled into the joint bay a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment (See Figure 2-21);
- Following the completion of jointing and duct sealing works in the joint bay, cement-bound sand in approximately 200 mm layers is placed and compacted to the level of the cable joint base to provide vertical support;
- Cable protection strip is then placed prior to backfill with cement-bound sand to a depth of 250 mm below surface; and
- Permanent reinstatement (see Figure 2-22) is undertaken including placement of warning tape at 400 mm depth below finished surface.

Figure 2-20: Photo of cable pulling procedure.

Figure 2-21: Photo of jointing container.

Figure 2-22: Permanent reinstatement of road surface over trench.

Figure 2-23: Photo of passing bay.

Passing bays

At 16 locations along the onshore cable route, temporary traffic passing bays will be installed adjacent to JBs to enable through traffic during the construction and cable installation at the JBs (locations are presented on Figure 2-16). The passing bay arrangement is presented in Figure 2-24. The remaining 13 JBs are located either off-road or located on the wider primary road, avoiding the requirement for temporary passing bays to maintain through traffic (Figure 2-23).

As with all road works, traffic management procedures will be required when installing the cable within the public road. Access for through traffic will be maintained along all roads through the installation of the passing bays. Advisory diversion routes avoiding the active works will be signed. Local access to properties will be maintained by the contractor at all times. This will be completed with the use of temporary metal cover plates for sections of open trench. For the regional roads to the east of the M1, one carriageway will be closed with use of the other carriageway restricted and controlled by temporary traffic lights or a “stop and go” traffic management system for the duration of the works. Traffic management and corresponding works will be carried out with the agreement of Louth County Council.

The following sequence is proposed to construct and reinstate the passing bays once joint bays are constructed.

1. Removal of vegetation to a licensed facility. Measures to protect biodiversity will be implemented as outlined in appendix I: Onshore Biodiversity – Supporting Information;

2. Erect temporary stockproof fencing;

3. Excavate topsoil and store for reinstatement;

4. Place suitable sub-base on geotextile member and compact using road roller to allow passing bay to be used by traffic during the cable laying and jointing operations;

5. Following completion of cable pulling and jointing, the passing bay will be reinstated with the excavated soil, and the temporary stockproof fencing removed; and

6. The hedgerow will be replanted as outlined in appendix I: Onshore Biodiversity - Supporting Information.

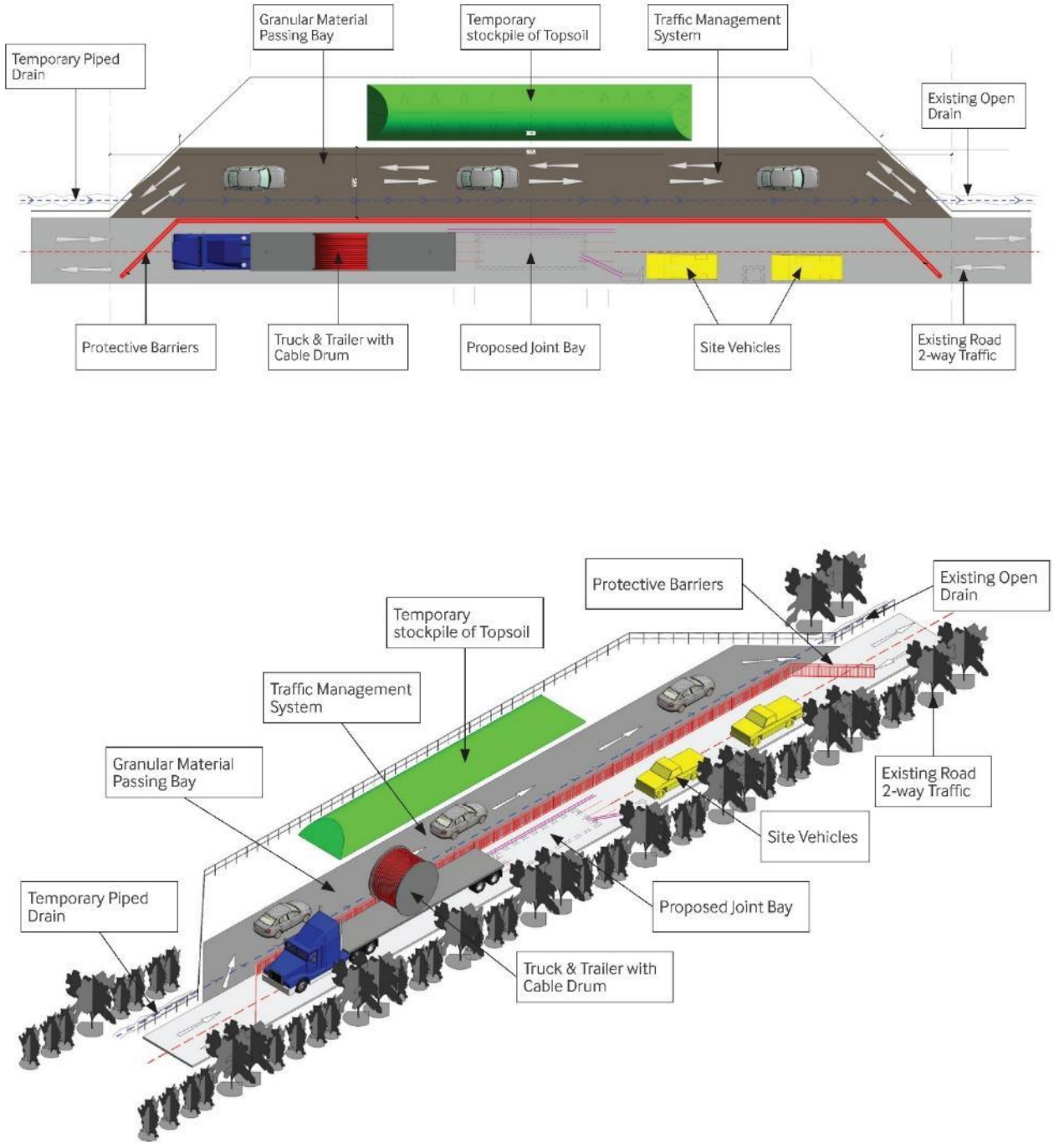


Figure 2-24: Typical passing bay arrangement (plan view (top) and isometric view).

Crossings

The onshore cable will cross a number of obstacles along its route. The methodology for each of these crossings is detailed below and summarised in Table 2-23.

Table 2-23: Proposed crossing methods.

No.	Cable Crossing	Proposed Method	Map ref. on Figure 5-16
1	River Dee at Richardstown, N33	HDD	Field (see map 3 of 12)
2	High Pressure Gas Main at Richardstown N33	Open Trench	Road (see map 3 of 12)
3	M1 Motorway and Dublin Belfast Rail Line at Charleville	HDD	Field (see map 3 of 12)
4	River Dee at Drumcar	HDD	Field (see map 5 of 12)
5	High Pressure Gas Main at Drumcar	Open Trench	Road (see map 5 of 12)
6	Port Stream tributary at Clonmore	Open trench	Field (see map 9 of 12).
7	Port Stream at Togher	HDD	Field (see map 9 of 12).
8	Salterstown Stream	HDD	Road (see map 11 of 12).

Note: The crossing of the Port Stream at Clonmore also includes a smaller crossing of the Ardballan Stream.

The cable route may also cross small streams and agricultural ditches. It is possible that the onshore cable can be installed within the existing roadway for these crossing, however if sufficient depth is not available then the alternative will be to install cables with the open trench method. Any agricultural land drains along the onshore cable route will also be traversed using open trench methods as outlined below.

There will also be a number of crossings of existing utilities/services along the cable route. These crossings will also be carried out using open cut trenching.

Horizontal Directional Drilling (HDD)

The use of HDD methods is proposed for crossings of watercourse and other obstacles as it allows installation of the onshore cable underneath the watercourse / obstacle thereby avoiding direct impact. Although there is potential for runoff from the HDD works on either side of the crossings, measures will be put in place to minimise such impacts as outlined in appendix I: Onshore Biodiversity – Supporting Information.

Horizontal Directional Drilling (HDD) involves drilling a long borehole approximately 600-900 mm in diameter underneath the obstacle (e.g., river, motorway, rail line) using a drilling rig located in the onshore cable construction corridor. The generally arrangement for HDD is provided in Figure 2-25 and shown in the photo in Figure 2-26.

Drill entry and exit pits are excavated at both ends of the planned drill to below the level required for the cable. The drilling into the ground is at a shallow angle. The process uses a drilling head controlled from the rig to drill a pilot hole along a predetermined profile based on an analysis of the ground conditions and cable installation requirements. This pilot hole is then widened using larger drilling heads until the hole is wide enough to fit the cable ducts. Bentonite is pumped to the drilling head during the drilling process to stabilise the hole and ensure that it does not collapse. Prior to the drilling taking place, an exit pit may be excavated passed the obstacle within the onshore cable construction corridor in order for the HDD profile and ducts to stop at the required installation depth for the cable.

A transition chamber is required at HDD locations to ensure that the cables are not damaged when transitioning between the different inner duct diameters of the HDD and standard cable trench. A transition chamber is approximately 1.7 m by 1.2 m concrete chamber. The transition chamber will be opened during cable installation to allow the smooth transition of the cable between the two different duct sizes and to ensure the cable is not damaged during this transition. The transition chamber will then be sealed, and the ground fully reinstated once the cable is installed.

Once the HDD drilling has taken place the ducts (within which the cable will be installed) are pulled through the drilled hole from the drill staging area. The length of the drill staging area will match that of the length of the bored hole.

The size of the HDD compounds is dependent on the amount of equipment that is required to construct the crossing, which in turn is primarily governed by the length of the HDD or its complexity. The required area has been included within the planning application boundary for the Project. The temporary construction compounds, which will be used during the HDD construction are shown in Figure 2-16 and are described further below.

The crossing of the M1 and Dublin Belfast Rail Line will be undertaken using HDD methods. These proposals have been discussed with Irish Rail and the works will be completed to Irish Rail specifications and required standards.

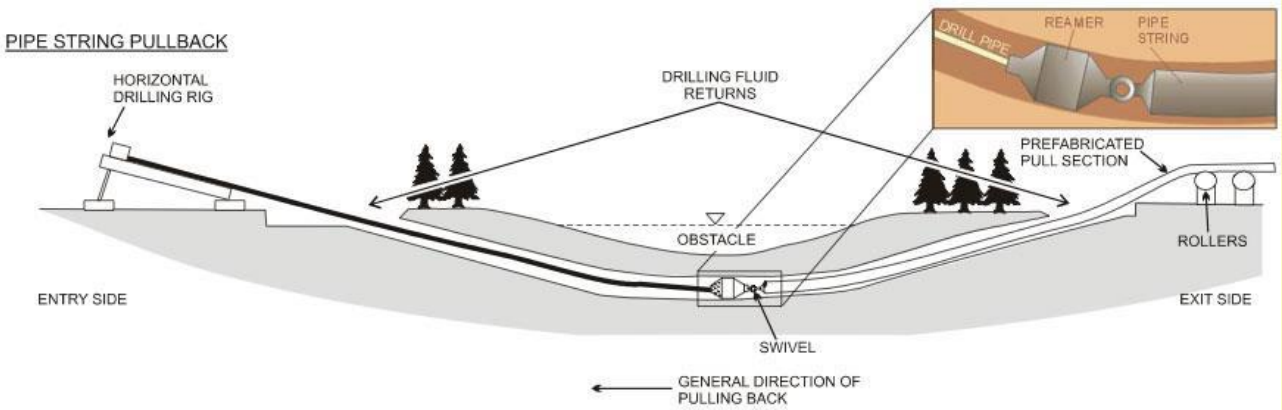


Figure 2-25: General arrangement for HDD.

Figure 2-26: Standard HDD site on local road where HDD was used to go underneath a bridge (bridge parapet walls visible).

Open trench crossings (ditches, drains)

The onshore cable will traverse a number of drains and ditches. The proposed methodology for these crossings is by open trench method which will be carried out as follows:

1. The flume pipe(s) will be set out on the bed of the existing ditch or drain. Alternatively, a pump may be used to transfer the stream water to the other side of the dam;

2. A dam will be constructed using sandbags and suitable clay material around the flume pipe(s) and across the drain so that all the flows are diverted through the pipe(s);

3. Silt traps comprising of a geotextile membrane will be placed downstream of the trenching location prior to construction, to minimise silt loss;

4. The proposed cable trench will be excavated in the dry ditch and under the flume pipe(s). If required, a temporary pump sump will be created, and a pump used to remove any additional water to tanker for offsite disposal with a licensed waste contractor;

5. Cable ducts will be installed and encased in concrete within the stream bed or a precast concrete slab will be installed which incorporates the ducts; and

6. Following the installation of the cable ducts, the stream bed will be re-instated with original or similar material and any spawning gravels (if present) replaced under the supervision of the aquatic ecologist.

Measures are outlined in appendix I: Onshore Biodiversity - Supporting Information regarding the protection of watercourses including seeking prior approval of all construction methodologies from the Inland Fisheries Ireland (IFI).

Appropriate measures will be put in place by the contractor to prevent ground damage on the access routes to watercourse crossings on both banks, particularly where the ground is soft or slopes steeply toward a crossing. This will manage and control potential sedimentation of the watercourse from damaged access tracks. Works in proximity to watercourses will be carefully managed and measures will be put in place to protect the watercourse as outlined in appendix I: Onshore Biodiversity – Supporting Information.

Utility crossings

The location of existing utilities/services has been identified by requesting utility/service records from service providers along the onshore cable route. There will be a number of crossings of existing utilities/services along the cable route. It is proposed that the crossings will be carried out by using open cut trenching, however, should circumstances arise during construction regarding the depth of the utility, there may be a requirement to use HDD. Should HDD be necessary, such works will take place within the planning application boundary.

The preference is to cross beneath an existing utility/service where possible as this reduces the possibility of cable faults from third party excavations. The actual separation between the cable ducts and the existing utility service will be decided in conjunction with the utility service provider adhering to their guidelines/codes of practices. Where possible, crossing of existing services will be carried out at right angles. The duct installation contractor will provide a standard minimum 300 mm vertical clearance between the proposed ducts and the existing services to be crossed. The installation contractor will ensure a minimum distance of 500 mm horizontal separation is maintained between the edge of the power ducts and existing services. The duct installation contractor will protect all services against damage due to trenching, ducting, backfilling and compaction.

It may not always be possible to locate under an existing service and therefore an above service crossing may be required. The minimum depth to the top of the cable ducts is 450 mm below ground level in this case as per the Health and Safety Authority's Code of Practice for Avoiding Danger from Underground services. The cable duct if being installed at 450 mm cover depth will have additional mechanical protection by using steel plates and A393 steel mesh above the concrete the cable ducts are encased in. There may be also a

requirement to realign an existing utility/service due to a conflict and this will be arranged through consultation with the third-party service provider.

Gas Pipeline and Water Crossings

Crossing of a high-pressure gas pipeline is required at Drumcar and on the N33 at Richardstown. There are also a number of crossings of the Uisce Éireann network. The gas crossings will be undertaken under the guidance and control of the asset owner, Gas Networks Ireland (GNI). The water crossings will be undertaken under the guidance and control of the asset owner, Uisce Éireann (UI). Typically, the area around the existing utility will be carefully excavated by hand within 500 mm of an asset and the asset supported before installation of the cables below the pipelines can take place. This is generally the preferred method of the asset owner as visual confirmation of the integrity of the asset can be maintained throughout the works. A length of 12 m of excavation will be exposed on each side of the pipeline to allow for bending of ducts and to avoid obstacles.

Temporary construction compounds

The HDD construction compounds will be provided with suitable surfacing, typically this will be constructed from stone. The compound will be secured by fencing and provided with lockable gates to control access. Appropriate drainage measures including treatment prior to pumping to tanker for disposal offsite at a waste licensed facility will be implemented to control surface run-off from the compound.

Seven temporary construction compounds are proposed to support the installation of the onshore cable. Details of these compounds are provided in Table 2-24 and locations are shown on Figure 2-16.

The construction compounds will require hard standing suitable for the temporary placement of site facilities (such as offices, briefing rooms, catering facilities, storage etc. typically housed in port-a-cabins) and to allow plant and materials to be stored safely and securely. Temporary access tracks for construction traffic will be required to provide access to the landfall, onshore substation site and to the HDD locations.

All construction compounds will be removed, and sites restored to their original condition when construction and commissioning of the Project has been completed.

Table 2-24: Location of temporary construction compounds and proposed activities.

Temporary construction compound location	Proposed compound activities	New temporary access required	Map ref. on Figure 5-13	Details	Duration compound will be in place
Site of onshore substation at Stickillin	Storage	No, the site will be accessed along a temporary access track from existing entrance to the onshore substation on the N33.	Map 1	This compound will operate as a base for the onshore construction works (including onshore cable and onshore substation) and will house the offices, and stores, as well as acting as a staging post and secure storage for onshore equipment and component deliveries. Footprint will be approximately 12,860 m^2.	27 months
River Dee at Richardstown	HDD Compounds (east and west of River Dee)	Yes, new access from N33 for the west side of the compound. For the east side, an existing access will be used.	Map 3	The River Dee passes below the N33 road at Richardstown, approximately 500 m west of the M1. It is proposed to cross below the river in the fields immediately north of the N33. This crossing is approximately 180 m in length, to a minimum depth of 5 m below the river, with the drive pit located in a field to the east of the river and the reception pit located in a field to the west of the river. These compounds will be in place for the duration of the HDD crossing. Equipment for the HDD includes bentonite batching, pumping and recycling equipment, the drill unit and areas for pipe stringing and storage. Footprint will be approximately 4,000 m^2.	3 months
M1/Railway	Storage and HDD Compounds (east and west of M1/Railway)	Yes, new access from N33 for the west side of the compound. For the east side, an existing farm gate access will be used.	Map 3	The crossing under the M1 motorway and Dublin-Belfast rail line is approximately 250 m long, to a minimum depth of 7 m below the rail and motorway	HDD compounds - 3 months Storage compound – 18 months.

Temporary construction compound location	Proposed compound activities	New temporary access required	Map ref. on Figure 5-13	Details	Duration compound will be in place
				infrastructure, with the drive pit located in a field to the east of the railway line and to the north of the N33 and the reception pit located in a field to the west of the M1 and also to the north of the N33. Three temporary compounds are proposed at this crossing. A compound either side for the HDD and a separate compound for storage of plant and equipment for the onshore cable construction. Footprint will be approximately 7,500 m^2.	
River Dee at Drumcar	HDD Compounds	Yes, new access from local road for the east side of the compound. For the west side, an existing farm gate access will be used.	Map 5	The River Dee crossing at Drumcar Bridge is approximately 90 m in length, to a minimum depth of 5 m below the river, with the drive pit located in a field to the east of the Drumcar Bridge and the reception pit located in a field to the west of Drumcar Bridge. Footprint will be approximately 2,300 m^2.	3 months
Adjacent to JB17	Storage	Yes, new access from local road.	Map 7	A site adjacent to JB17 will provide storage for plant and equipment for the onshore cable installation. Footprint will be approximately 3,000 m^2.	18 months
Port Stream at Togher	HDD Compounds	Yes, new access from local road to access both compounds.	Map 9	The stream crossings at Port approximately 50 m in length, to a minimum depth of 5 m below the stream, with the drive pit and reception pit located in the fields to the north of the local Dunleer to Togher Road. Footprint will be approximately 750 m^2.	1 month

Temporary construction compound location	Proposed compound activities	New temporary access required	Map ref. on Figure 5-13	Details	Duration compound will be in place
Dunany; Landfall	Storage	Yes, new access off private road.	Map 12	A site at the proposed landfall will be the base for the construction of the TJB and the export cable pull. The compound will provide storage for plant and equipment. Footprint will be approximately 4,120 m^2.	18 months

2.6.3 Onshore substation

The proposed onshore substation will contain equipment required to filter, monitor and control electricity received from the offshore wind farm. The onshore substation equipment will be maintained by the Transmission Asset Owner (TAO) and operated by the Transmission System Operator (TSO).

Location

The proposed onshore substation will be located in the townland of Stickillin, east of Ardee (see Figure 2-16) (map 1 of 12). The substation will connect to the existing Woodland to Louth 220 kV overhead line which traverses the substation site. The extent and layout of the proposed onshore substation is presented in Figure 2-27.

Design

The substation will comprise of the following main elements:

Compound 1 Gas (GIS) (Onshore Transmission Connection): This compound will contain the 220 kV Gas Insulated Switchgear (GIS) infrastructure within a building with a gross floor area of approximately 2,155 m^2 (two storeys) and a height of approximately 17 m. The entire compound has an area of approximately 4,600 m^2. Associated development within the compound will include a lattice steel telecommunication mast of approximately 36 m in height and six lightning finials of approximately 3 m in height located on the parapet of the GIS building. There will be 5 No. car parking spaces located within this compound. An access road 5 m in width will loop around the building and connect with the entrance compound. An MV/LV house transformer will be located near the main entrance to the compound. The compound will be bounded by a secure palisade fence 2.6 m in height.

Compound 2 (AIS) (Offshore Transmission System): The compound will contain a control building with six lightning finials of approximately 3 m in height located on the parapet of the building. The compound will also contain 220 kV Air Insulated Switchgear (AIS) for the TSO's control in accordance with the grid connection offer and will include equipment for dynamic and/or static reactive power compensation, harmonic filtering and switching. In summary, the AIS compound will contain the following type of equipment:

- 1 x 220 kV AIS busbar;
- 1 x 220 kV statcom bay including statcom building;
- 1 x 220 kV transformer bay;
- 2 x 220 kV harmonic filter bays;
- 1 x 220 kV shunt reactor bay;
- 2 x 220 kV cable bays;
- 1 x control building; and
- 1 x MV/LV house transformer.

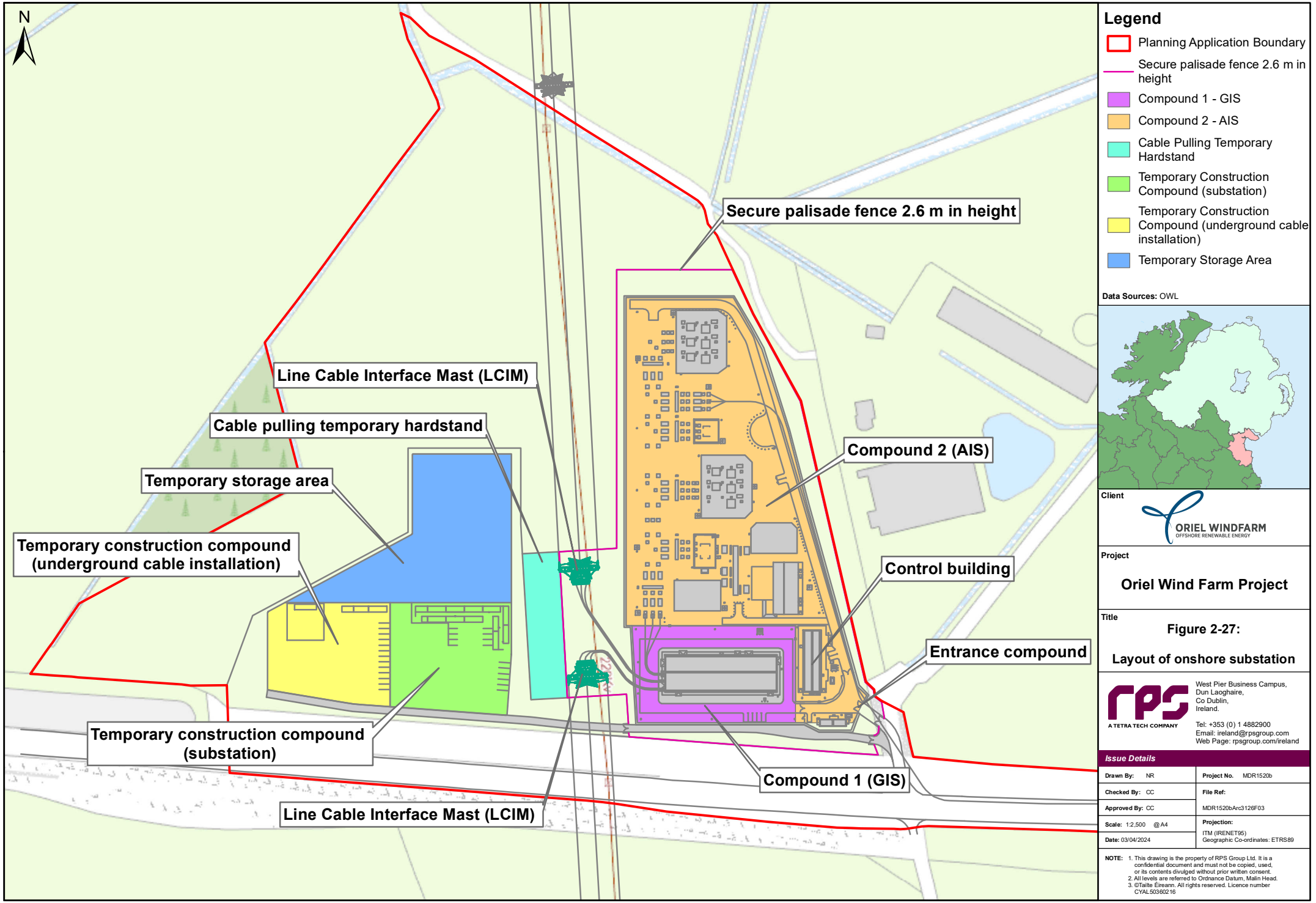
The compound has an area of approximately 17,200 m^2. 12 No. lightning monopoles of approximately 20 m in height will be placed within the compound for lightning protection and will include a lattice steel telecommunication mast of approximately 36 m in height. There will be 4 No. car parking spaces located within this compound. The compound will be bounded by a green palisade fence 2.6 m in height. An access road of 5 m in width will run alongside the eastern and northern palisade fences and connect with the entrance compound.

Entrance Compound: The entrance is shared by compound 1 and compound 2 with an area of approximately 600 m^2. The compound will contain a telecommunications building, which will be 15 m x 4 m and a height of 4 m. It will also contain a backup bunded diesel generator. There will be 1 No. car parking space located within this compound. The area will be bounded by a secure palisade fence 2.6 m in height.

Works below ground level: There will be 2 No 220 kV underground network circuits from the GIS building to the new line cable interface mast (LCIMs). There will also be 1 No. 220 kV underground circuit to the Compound 2 (AIS). The depths of excavations for construction of the onshore substation infrastructure will not exceed 2 m below ground level (bgl). A new underground drainage network will be installed as part of works. The depths of excavation for construction of pipework, inspection chambers and other related underground elements will not exceed 3 m below the proposed finished floor level or 2 m below the existing ground level.

Line Cable Interface Masts (LCIM): Two LCIMs will be constructed in the agricultural field adjacent to the onshore substation. An existing 220 kV tower (approximately 31 m in height) will be decommissioned to allow for the construction of the two new LCIMs. The LCIMs will be approximately 27 m in height to facilitate the connection of the overhead lines to the underground cables, which will run from the towers into a termination point in the GIS building in Compound 1. This will result in the removal of a section of existing OHL (approximately 50 m).

Ancillary Elements and Landscaping: The substation (containing the Compound 1, Compound 2 and an entrance compound) and palisade fence are bounded within a post and rail property fence 1.4 m in height. There is planting of native trees proposed along the northern boundary of Compound 2. A single main entrance to these areas will utilise the existing access route off the N33 national road. Existing vegetation on either side of the entrance will be trimmed back to achieve the required sightlines.



Legend

- Planning Application Boundary
- Secure palisade fence 2.6 m in height
- Compound 1 - GIS
- Compound 2 - AIS
- Cable Pulling Temporary Hardstand
- Temporary Construction Compound (substation)
- Temporary Construction Compound (underground cable installation)
- Temporary Storage Area

Data Sources: OWL

Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 2-27:

Layout of onshore substation

RPS
A TETRA TECH COMPANY

West Pier Business Campus,
Dun Laoghaire,
Co Dublin,
Ireland.

Tel: +353 (0) 1 4882900
Email: ireland@rpsgroup.com
Web Page: rpsgroup.com/ireland

Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: CC	**File Ref:** MDR1520bArc3126F03
Approved By: CC	
Scale: 1:2,500 @A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 03/04/2024	

Design parameters

The design parameters and major components for the onshore substation are presented in Table 2-25.

Table 2-25: Design parameters and major components for the onshore substation.

Dimensions	Parameter (approximately)
Area of footprint of substation (Compounds 1 and 2)	230 m x 130 m
Height of buildings	17 m GIS Building (Compound 1) 11 m Control Building (Compound 2) 10 m Statcom Building (Compound 2) 4 m Telecommunications Building (Entrance Compound)
Building(s) Area	20 m x 60 m GIS Building (Compound 1) 10 m x 34 m Control Building (Compound 2) 14 m x 28 m Statcom Building (Compound 2) 15 x 4 m Telecommunications Building (Entrance Compound)
Telecommunication Mast	36 m height
Terminal towers/line-cable interface mast	2 No. 27 m High Lattice Steel Structure for 220 kV OHL Termination

The following sections describe the Project:

Compound 1 (GIS) Main Structures

The 220 kV GIS building will comprise of a two-storey structure. It will house the new gas insulated switchgear (containing Sulphur Hexafluoride (SF_6) or similar insulating gas), insulated circuit breakers, busbars, disconnectors and other high voltage equipment. Auxiliary services equipment, such as control and telecoms equipment and low voltage switchgear will be located in the relay room, an emergency diesel generator which will be located in the generator room, batteries in the battery room and welfare facilities (i.e. toilets, messroom) will also be located within the building. The underground cables will connect into the substation via below ground cable entries which will not exceed 2 m below ground level and will be designed to prevent any water ingress.

The GIS building will comprise a structural steel frame clad with profiled metallic sheet wall and roof cladding. Internal walling of masonry will be adopted, except where specific load carrying requirements necessitate the use of reinforced concrete walls.

The GIS building cladding will be factory finished according to EirGrid specification. The roof will be shallow pitched and constructed of profiled metal decking on purlins spanning between rafters. Internally the building will have access gantries and walkways for access to equipment. These will be constructed of stainless/galvanized steel open grating type flooring supported on steel beams and columns.

External doors and escape doors will generally comprise metal flush doors with galvanised steel frames. Fire doors will comply with BS 476-22:1987 - Fire tests on building materials and structures.

The colour proposed for the building is a dark green. The final colours and finishing will be agreed with the planning authority prior to construction.

An image of an existing ESB 220 kV GIS Substation building with house transformer in the foreground is presented in Figure 2-28.

Figure 2-28: Photo of 220 kV GIS Substation Building.

Six lightning protection finials, approximately 3 m in height, are required to be installed on the roof of the GIS building. One at each corner of the building and 2 in the centres of the longest façade.

A steel telecommunication mast, approximately 36 m in height, is proposed to be installed adjacent to the proposed substation site to facilitate communications between the substation and the existing substations in Maynooth and Woodland. Antennas will be located at the top of the mast, and these will be connected by cables to telecommunications equipment housed in the substation control building. An external ladder will be permanently fixed to the mast to allow for maintenance access.

An earth grid will be installed below the ground in a grid arrangement approximately 600 mm below the finished surface. The earth grid will consist of bare stranded copper conductor. The purpose of the earth grid is to ensure personnel and public safety during electrical faults that may occur on the transmission grid.

Compound 2 (AIS) Main Structures

Control Building

The Control Building in Compound 2 will house auxiliary service equipment, such as control and telecoms equipment and low voltage switchgear located in the control room, an emergency diesel generator located in the generator room, batteries located in the battery room, stores room and welfare facilities (i.e. toilets, changing room, etc.} will also be located within the building.

The building size is approximately 34 m by 10 m and comprises of two storeys. The building will comprise a structural steel frame clad with profiled metallic sheet wall and roof cladding. Internal walling of masonry will be adopted, except where specific load carrying requirements necessitate the use of reinforced concrete walls.

The building cladding will be factory finished according to EirGrid specification. The roof will be shallow pitched and constructed of profiled metal decking on purlins spanning between rafters.

External doors and escape doors will generally comprise metal flush doors with galvanised steel frames. Fire doors will comply with BS 476-22:1987 - Fire tests on building materials and structures. The colour proposed for the external galvanized steel doors is a dark green.

The colour proposed for the building is a dark green. The final colours and finishing will be agreed with the planning authority prior to construction.

Statcom Building

The Statcom Building in Compound 2 will house auxiliary service equipment, such as control and telecoms equipment and low voltage switchgear located in the control room, batteries located in the battery room, cooling equipment in the cooling room, and power and electronic equipment located in the valve room will also be located within the building.

The building size is approximately 14 m by 28 m and comprises a story and a half. The building will comprise a structural steel frame clad with profiled metallic sheet wall and roof cladding. Internal walling of masonry will be adopted, except where specific load carrying requirements necessitate the use of reinforced concrete walls.

The building cladding will be factory finished according to EirGrid specification. The roof will be shallow pitched and constructed of profiled metal decking on purlins spanning between rafters.

External doors and escape doors will generally comprise metal flush doors with galvanised steel frames. Fire doors will comply with BS 476-22:1987 - Fire tests on building materials and structures. The colour proposed for the external galvanized steel doors is a dark green.

The colour proposed for the building is a dark green. The final colours and finishing will be agreed with the planning authority prior to construction.

Other Equipment

Equipment to be included within Compound 2 is summarised in Table 2-26 below. All AIS equipment is individually supported by galvanized steelwork and reinforced concrete bases. The surrounding area is filled with aggregate 804 stone to the finished ground level. Individual equipment is connected together with aluminium conductor tubes and connectors.

A lighting plan has been designed in line with those used on similar sized substations. Directional light fittings have been incorporated within the plan in order to minimise light pollution in the surrounding area. Lighting is only used as required, for access and security.

Table 2-26: Equipment Components within Compound 2 (AIS).

Equipment	Example Photograph
220 kV AIS busbar A 220 kV air insulated busbar spans the length of Compound 2 (approximately 100 m in length). The busbar connects to each of the individual 220 kV AIS bays including the onshore cable, harmonic filter, reactor, statcom, bays. It is 10 m height and supported at 16 m intervals. Post insulators can be grey or brown in colour. Galvanized steelwork is supported by reinforced concrete bases and the finished ground level the compound completed in aggregate 804 stone.	
220 kV Cable Bays The onshore cable bays consist of outdoor air insulated switchgear which include disconnector (busbar, line and earth), current transformers, voltage transformers, circuit breaker, lightning/surge arresters, post insulators and cable sealing ends.	
220 kV Statcom Bay A statcom is a 'static synchronous compensator' which is installed to support voltage and power factor regulation. The statcom bay consists of a 220 kV / MV power transformer, an MV busbar and MV statcom equipment. Equipment includes a busbar disconnector, instrument transformers, circuit breaker, lightning/surge arresters and post insulators. A 220 kV / MV power transformer and bushing will have a combined height of approximately 9 m. The transformer will be located within an oil retention bund of approximately 12 m by 18 m and surrounded by 8.5 m high reinforced concrete blast walls to the north and south the transformer. The transformer contains approximately 78,400 kg of mineral oil insulation use to insulate and cool the transformer cores.	

Equipment	Example Photograph
220 kV Shunt Reactor Bay The 220 kV reactor will use AIS bushing to connect to the 220 kV bays. 220 kV bushing which are approximately 4 m tall bring the combined height of the reactor to 7.5 m. The reactor will be located within an oil retention bund of approximately 13.5 m by 13 m and enclosed by 8 m high reinforced concrete blast walls to the north and south the rector. The reactor contains approximately 27,250 kg of mineral oil insulation use to insulate and cool the transformer cores.	
220 kV Harmonic Filter Bay Compound 2 will house two 220 kV harmonic filters bays. The harmonics filter bay consists of a 220 kV bay and a 220 kV filter bay that includes capacitor banks, reactors and resistors to provide filtering capacity to the 220 kV busbar. Each harmonic filter bank is enclosed within a compound of 34 m by 28 m and contains 3 capacitor banks, 3 reactors, 3 resistors, surge arresters and unbalance current transformers.	

Twelve lightning protection monopoles of approximately 20 m in height will be placed within the compound for lightning protection.

A second steel telecommunication mast, approximately 36 m in height, is proposed to be installed adjacent to the proposed substation site to facilitate communications between the substation and the existing substations in Maynooth and Woodland. Antennas will be located at the top of the mast, and these will be connected by cables to telecommunications equipment housed in the substation control building. An external ladder will be permanently fixed to the mast to allow for maintenance access.

An earth grid will be installed below the ground in a grid arrangement approximately 600 mm below the finished surface. The earth grid will consist of bare stranded copper conductor. The purpose of the earth grid is to ensure personnel and public safety during electrical faults that may occur on the transmission grid.

Entrance Compound

The entrance compound is shared by Compound 1 and Compound 2 with an area of approximately 600 m^2.

It will contain a telecommunications building with a size of approximately 15 m by 4 m and a height of 4 m. This building will be of steel construction and will have false flooring for inner cabinet cabling. External doors and escape doors will generally comprise metal flush doors with galvanised steel frames. Fire doors will comply with BS 476-22:1987 - Fire tests on building materials and structures. The colour proposed for the building is a dark green. The final colours and finishing will be agreed with the planning authority prior to construction.

The back up bunded diesel generator will also be located in this area for emergency power, if required.

An earth grid will be installed below the ground in a grid arrangement approximately 600 mm below the finished surface. The earth grid will consist of bare stranded copper conductor. The purpose of the earth grid is to ensure personnel and public safety during electrical faults that may occur on the transmission grid.

Line Cable Interface Masts (LCIM)

The two new LCIMs will be steel lattice towers with a height of approximately 27 m and will comprise conductors, associated hardware (including insulators, spacers and fittings and the facility to connect shield wires). A shield wire protects the towers against lightning. Each of the four tower legs will be separately anchored below ground in a block of reinforced concrete.

The typical tower foundations for each leg of an LCIM is approximately 4.5 m^2 squared, with a depth of approximately 4.5 m. A photo showing an example of the proposed LCIM design is presented on Figure 2-29.

Figure 2-29: Photo of 220 kV Line Cable Interface Mast with shield-wire facility.

Demolition

An existing ESB 220 kV tower adjacent to the proposed substation compounds will be replaced by the two ‘loop-in’ towers to enable this connection. The existing tower and foundations will require demolition prior to the installation of the two new LCIM.

Services and utilities

During the operational phase, the substation will generally be unmanned and remotely monitored/operated by EirGrid. Operations at the substation will involve six to eight visits per month and quarterly inspection visits and maintenance visits when required.

The provision of electrical supply, water supply and control of foul and stormwater are described in the sections below.

Electricity Supply

The electricity supply for each compound will be provided by a connection to separate house transformers from the Medium Voltage (MV) supply. These MV/LV house transformers will be bunded and located on concrete plinths close to each building.

Emergency backup diesel generators (less than 500 KVA each) will also provide independent power for the ancillary electrical services in Compound 1 and Compound 2, and will be used in rare cases, such as the loss of main power. In Compound 1 the generator will be located in a dedicated room within the GIS building with appropriate fire rating and ventilation. The generator fuel tank, to be located in the room with the generator, will be bunded. In Compound 2 the generator will be located in a dedicated room within the control building with appropriate fire rating and ventilation. The generator fuel tank, to be located in the room with the generator, will be bunded.

Water Supply

Water supply for welfare facilities will be provided by way of a rainwater harvesting unit from the roofs on-site. A supply of bottled water will also be stocked on site as required for potable use, which is appropriate give that the substation will generally be unmanned.

Foul Water

During construction, portable chemical toilets will be provided for the duration of the works and all waste material will be removed from site and disposed of to an appropriately licensed facility.

During the operational and maintenance phase, foul water will be discharged to a proprietary wastewater holding tank and collected periodically for off-site treatment by a licensed waste disposal contractor.

The holding tank has been sized conservatively on the basis of maintenance personnel being on site for 2-3 days each week (although this is not anticipated to occur in reality) and an emptying frequency of twice per year. No storm water collection elements (gullies, downpipes, etc.) will be connected to the foul water system.

Surface Water drainage

Surface water drainage for the Project have been designed to mimic the natural drainage patterns of the site in accordance with the Best Management Practices (BMPs) of SuDS (The SuDS Manual CIRIA, 2015). The surface water drainage design will replicate greenfield drainage conditions for the site. Should surface water be discharged from site, the design will ensure only high quality, treated runoff leaves the site at a controlled rate.

Most of the proposed compound will be surfaced with permeable stone and surface water generated on this area will largely infiltrate to ground as per the greenfield conditions. Surface water that does not infiltrate will be collected by a system of land drains around the perimeter of the compound. The surface water drainage is split between the GIS Building and Control Building, Statcom Building and the transformer bunds. The surface water generated from these elements will be collected in an underground drainage network and conveyed to separate attenuation and infiltration systems. Discharges from both networks will be at a controlled rate via a grassed surface water swale (incorporating check dams to capture sediment) to the surface watercourse which runs adjacent to the north of the site.

Surface water generated on the impermeable elements of the Project will be collected in an underground drainage network and conveyed to an attenuation and infiltration system. Discharge from the site shall be limited through the use of a vortex flow control unit directly downstream of this point. This system will be designed to ensure sufficient capacity for the 1:100-year storm event (as defined by Met Éireann) including an additional allowance for climate change to ensure no overflow from the infiltration system shall be required. The infiltration rates will be determined by soakaway tests carried out in accordance with BRE

Digest 365. The soakaway tests will be carried out as part of site investigations following planning submission.

Piped underground drainage incorporating downpipes, gullies, access junctions (AJs) (i.e. small, prefabricated inspection chambers) and manholes will collect stormwater from building roof areas. A land drain network will include catchpits. Catch-pit chambers will have a 300 mm sump provided which will allow for the capture of silt and sediment.

Collected stormwater runoff from bunded areas will pass through a Class 1 full retention oil separator prior to discharging through a proposed BMS Stormbreaker (or equivalent approved) stormwater attenuation / infiltration system. The infiltration rates will be determined by soakaway tests carried out in accordance with BRE Digest 365. This system will be designed to ensure sufficient capacity for the 1:100-year storm event (as defined by Met Éireann) including an additional 20% allowance for climate change to ensure no overflow from the infiltration system shall be required, provided ground conditions allow for it.

Drains will incorporate catchpit manholes to remove any grit or silt which may be washed into runoff during the operational and maintenance phase of the onshore substation.

The proposed electrical transformer and the diesel generator in the facility are oil filled equipment and as such are placed within impermeable bunds. In order to provide for treatment of surface water generated in the bunds, it is proposed to install an ‘Entexol SCS001’ or equivalent approved oil sensitive bund dewatering system with a 1 litre per second low shear vortex pump and oil separation detection within each bund. The bunds will also include an ‘Entexol SCS002’ Integrated Class 1 Full Retention Oil Separator. This system will ensure only non-contaminated water enters the site surface water drainage network. The bund dewatering system will be fitted with a high oil level alarm and will be connected back to the station control panel which is connected to a manned control centre via the station’s Supervisory Control and Data Acquisition (SCADA) telecom relay system.

The proposed Klargester (or equivalent approved) Class 1 Bypass Fuel Separator will provide treatment in accordance with BS EN 858 to treat any contaminated runoff from compound roads and car park spaces.

Access and Parking

An existing access track with entrance from the N33 will be upgraded in accordance with the TII Publication DN-GEO-03060 (2023). The access track will be upgraded to 6 m in width for approximately 38 m in length. The access track will comprise a tarmac finish road sloped to facilitate "over the edge" drainage to precast road gullies. Access is shared with neighbouring farmers who have a right-of-way to the common entrance.

In accordance with TII Publication DN-GEO-03060 (June 2023), permanent visibility splays will be required which have an ’x’ value of 3 m and a ‘y’ value of 215 m. A minimal amount of hedge trimming along the N33 will be required to achieve this visibility envelope (see appendix 5.9: Construction Traffic Management Plan). Alternatively, adopting the relaxed standard value for ‘x’ which is a distance of 2.4 m may achieve the visibility envelope with no hedge trimming. These design measures will ensure that the substation compound access has adequate sight lines and will allow access for all type of vehicles which are required during the operational phase of the substation.

Ancillary car parking will be provided within the Compound 1 area, Compound 2 area and the entrance compound.

Landscaping

New areas of planting are proposed at the onshore substation site to enhance the landscape character and visual resources.

Design Flexibility

The design flexibility opinion by An Bord Pleanála under section 278B of the Planning and Development Act 2000, as amended and the Planning and Development Regulations 2001, as amended, states that the following details of the Project may be confirmed after the proposed application has been decided:

- The final design for the type and siting of outdoor equipment within the proposed onshore substation compound.

The final design for the type and siting of outdoor equipment within the onshore substation will be confirmed on procurement of the equipment prior to construction.

The onshore substation design adheres to the requirements of the current EirGrid functional specification and utilises current best available technology. Detailed parameters for the buildings, two new line cable interface masts (towers to support the existing overhead line) and outdoor equipment are presented in the sections above. Contracts for the construction of the substation cannot be finalised in advance of consent.

Equipment suppliers and installation contractors will have variations in the dimensions and layout of specific outdoor equipment. Advances in technology may amend the size, location and type of equipment within the substation compound.

All final installed equipment will be of a similar type and perform a similar function to the equipment presented and assessed in the application.

2.6.4 Onshore substation construction

Site investigations

Site investigations at the substation site will be carried out in advance of construction. These site investigations will include for example trial holes and slit trenching to confirm the final depths for foundations.

Site preparation and enabling activities

Prior to works commencing a temporary construction compound will be set up in the area shown on Figure 2-16 (see map 1 of 12). This compound will include site offices, stores, delivery, offloading areas, welfare facilities, parking areas and security accommodation. A temporary construction access track will be installed from the proposed temporary construction compound to the main substation entrance that accesses onto the N33 national road. The temporary construction compound and access track will be reinstated on completion of construction.

The substation site and its access road will be prepared by removing vegetation and stripping topsoil and sub soils (i.e. down to the clay or sand layer below topsoil) before placing a capping layer of crushed stone to formation level.

The onshore substation site will require approximately 20,650m^3 of material to be excavated. The works include site levelling and roadways, building excavations, High-Voltage (HV) equipment foundations, and ancillary works. Any material that cannot be reused on site, will be removed from site by a licenced waste contractor for reuse, recovery or disposal in line with the waste hierarchy.

A security fence will be erected around the substation site and the contractor's areas. Site lighting for security will operate within the hours of darkness and will be directional to avoid unnecessary illumination. Site lighting for the illumination of construction operations will operate within the hours of construction.

Construction activities

The following lists the general sequence of construction phase activities and a short summary for each.

Site mobilisation:

- Set up temporary construction compound and access;
- Demarcation of construction work areas, clearance, and site levelling to prepare the works area;
- Install security measures, erect temporary heras fencing and signage;
- A wheel wash will be put in place at the substation entrance for the duration of construction works; and

- Topsoil will be stripped using excavators.

Construction of drainage system: The operational stage drainage network described in section 2.6.3 will not be installed at the outset of construction works. Given this is a greenfield site, drainage of the site will need to be managed carefully. Sediment control in the construction stage is an important consideration to ensure that only high quality, treated runoff leaves the site. Erosion control measures to prevent runoff flowing across exposed or excavated ground and becoming polluted with sediments will be provided for on-site as required during the construction stage. Erosion control measures include:

- Minimising the area of exposed ground and ensuring excavation will not proceed faster than the rate of construction;
- Monitoring of the weather forecast prior to planning excavation works; and
- Providing impermeable mats (plastic sheeting) as covers to mounded excavated material and open excavations during periods of heavy rainfall.

Other drainage runoff controls such as settlement tanks, catchpit, silt fences and silt traps will be temporarily provided adjacent to excavations and installed before starting site clearance and earthworks if deemed necessary by the supervising Engineer.

- **Entrance reconfiguration:** This will involve the widening of the existing entrance off the N33 and re-grading of existing track to accommodate deliveries. Hedge trimming may need to be carried out to accommodate required visibility splays. This will be undertaken outside the bird breeding season (see appendix I Onshore Biodiversity – Supporting Information). Temporary fence and gates will be installed.
- **Temporary construction compound and access road:** The temporary construction compound and access road will be excavated to suitable formation level. Imported stone will then be placed, compacted and graded to form access road and compound area.
- **Cable pulling temporary hardstand:** This will be very similar to the temporary construction compound. Engineering stone fill will be laid and compacted and maintained as required for the duration of the works. The cable drums/cable winch need a stable area due to their weight and ensure the cable is installed safely. This hardstand area may also be used for pulling of permanent cable solution to LCIM's. Once the works are completed, the engineered stone fill will be removed, and the land will be reinstated to its original condition.
- **Demolition of existing ESB 220 kV Tower:** This will involve the erection of temporary structures, which the existing OHL will be transferred to, in order to facilitate the decommissioning of the existing tower. It will also include the erection of 2 No. permanent LCIM's and reconnecting of OHL to new LCIM's.
- **Substation Compounds 1 and 2**: The areas of the substation compound will be marked. The topsoil will be stripped and stockpiled for later use in landscaping/construction activities. All remaining material excavated to achieve desired formation levels will be reused on site where possible or otherwise removed from site by a licenced waste contractor for reuse, recovery or disposal in line with the waste hierarchy. Imported stone will then be placed and compacted in layers to required level of 62 mAOD.

GIS Substation Building, Statcom Building, Control Building and Telecommunications Building

- **Foundation Works**: Foundation works will commence once the groundworks have been completed to the required level. The foundation installation will involve excavation, form work, steel reinforcement, and concrete placement. Foundations will be designed in accordance with the relevant EirGrid functional specifications. Excavated material will either be reused on-site for landscaping or disposed of off-site in accordance with applicable requirements.
- **Transformer (associated with Statcom building) bunding**: bunds for oil containment will be constructed in accordance with guidelines and EirGrid functional specifications.

- **Earth Grid**: the purpose of the earth grid is to dissipate fault currents, which is required for health and safety measure. When the foundations have been set, the copper earth grid will be installed into the soil in and around the foundation and will cover the entire substation compounds. The earth grid installation and permitted operating limits will be in accordance with the relevant EirGrid functional specifications.

- **Structural steel**: Following the installation of the foundation and earth grid, construction activities will shift to the erection of structural steelwork.

    - The GIS building in Compound 1 will be comprise of a two-story steel building over partial basement constructed in accordance with the required functional specification.
    - The control building in Compound 2 will comprise of a two-story steel building constructed in accordance with the required functional specification.
    - The statcom building will comprise a story and a half, steel building constructed in accordance with the required functional specification.
    - The telecommunications building will comprise a single-story steel building constructed in accordance with the required functional specification.

- **Cladding and building finishing works**: These will be undertaken once the structural frame and steel support structures are completed.

- **Complete electrical installation:** The electrical equipment will then be installed and tested in readiness for the connection of the offshore wind farm to the transmission grid.

- **Commission and test plant:** This will entail testing all substation equipment and documenting results to allow for back feed energisation. This is described in section 2.6.5.

- **Demobilise temporary construction compound and access road:** All equipment and temporary buildings will be removed from site, and the temporary access road reinstated as per landowner agreements.

- **Erect gates signs etc**: Once the construction of the onshore substation is complete, the site will be secured, and the supporting infrastructure finalised in readiness for the operational phase.

- **Temporary works reinstatement**: The temporary access route, and the temporary construction areas around the LCIM's including the cable pulling temporary hardstand, will be reinstated as close as possible to their original condition in accordance with the relevant ESB/ IFA Code of Practice for Survey and in consultation with the landowner.

2.6.5 Commissioning of onshore infrastructure

The commissioning activities ensures that equipment is installed properly and has the performance and interrelated functioning and communications needed for safe and reliable operation. Commissioning validates performance parameters before energizations and grid connection. The onshore commissioning phase will be completed by the principal Contractor and can take approximately six months to complete.

2.7 Construction programme

A high-level indicative construction programme is presented in Figure 2-30.

A 33 month programme is proposed. This includes 27 months for construction of the onshore infrastructure and 15 months for construction of the offshore infrastructure. The programme illustrates the likely duration of the installation activities associated with each of the major components, and how they may progress in relation to each other. The duration and the overlap between activities has been presented to inform the assessments in the NIS.

The installation of the onshore cable is expected to take 27 months including site preparation activities (see section 2.6) and reinstatement. However, work is expected to progress along the onshore cable with a

typical active works duration of six weeks at any particular location. Construction is expected to be carried out by two teams, working on different sections of the route.

A contractor carrying out standard 220 kV trenching and ducting specification will complete between 30 to 50 m linear metres of trench in a roadway per day depending on the ground conditions. The onshore cable will be installed in sections of 600 to 800 m in length, with each section of cable delivered on a cable drum from which it is spooled out as it is installed.

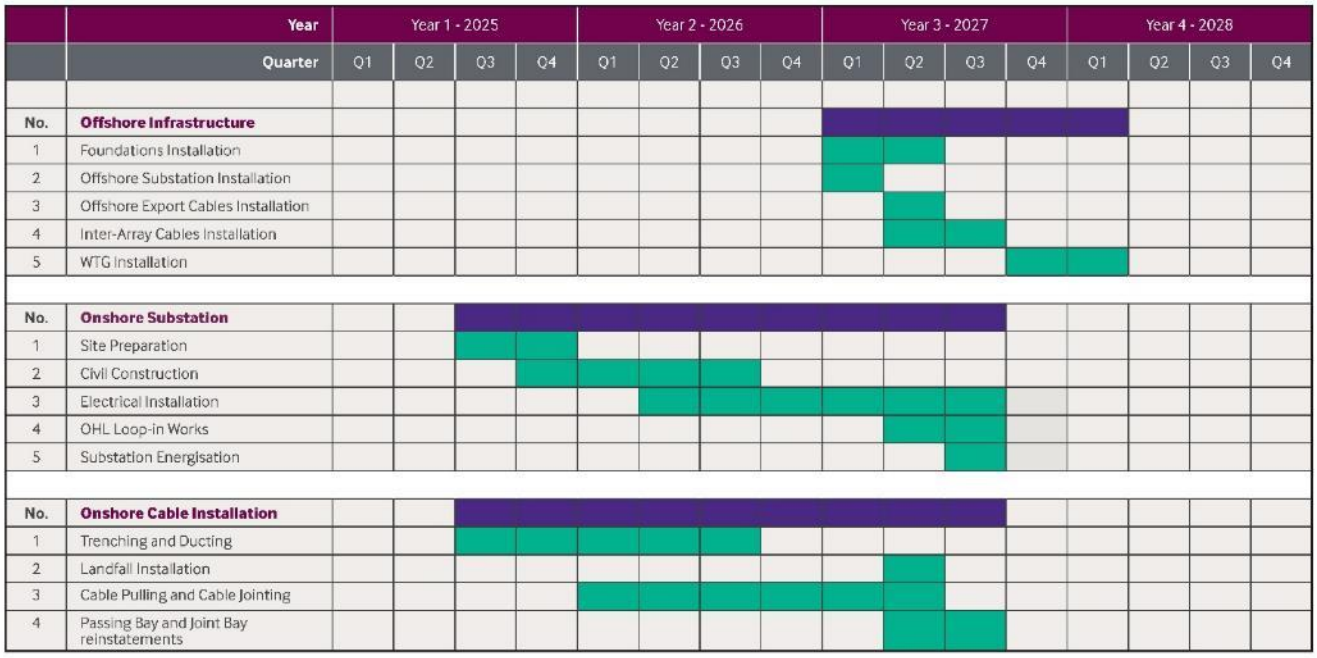


Figure 2-30: Proposed construction programme for the Project.

2.7.1 Construction working hours

Hours of construction (associated lighting) will be as follows:

- Monday to Saturday (inclusive) - 8:00am to 6:00pm; and
- Sunday and Bank Holidays - no operations and no associated lighting other than that required for security or safety.

Specific activities such as large concrete pours or delivery of large equipment (e.g. transformers) which require specific road control may occur outside these hours. The local authority and affected local stakeholders will be informed prior to these activities.

2.7.2 Construction employment

The construction (and decommissioning) of the Project will require approximately 140 Full Time Equivalent (FTE) jobs to construct the onshore infrastructure and approximately 100 FTE jobs for the offshore infrastructure. The majority of these jobs will require a particular level of specialist expertise.

2.8 Operational and maintenance phase

This section provides a description of the reasonably foreseeable planned and unplanned operational and maintenance activities for the Project. The design life of the Project is 40 years.

Operational and maintenance activities will be planned, controlled and monitored from an onshore operations and maintenance (O&M) base located at an existing harbour in County Louth or County Down. Three harbours (Kilkeel, Warrenpoint and Greenore) have suitable facilities and are approximately one hour sailing time from the offshore wind farm area.

A CTV will be located at the port to transfer crews to the offshore wind farm area for operations and maintenance. The port will provide access for personnel onto the CTV and a harbour side crane for lifting tools and general spares onto the CTV.

Operational and maintenance staff of both the Applicant and the WTG manufacturer will be co-located at the operations and maintenance base. Support facilities (office and warehouse space) will be leased for the Project within the local environs. Facilities will be leased by the Applicant and/or by the WTG manufacturer depending on the final procurement contract terms. These commercial contracts will not be concluded until operational timelines are known.

The support facilities required for operations and maintenance include:

1. Office space for operations and asset management (approximately 500 m^2) with welfare facilities and an attached controlled warehouse (approximately 1,000 m^2).
2. Office space for maintenance planning and preparation (approximately 500 m^2) with changing room facilities (10-30 persons) and a nearby controlled warehouse (approximately 5,000 m^2).
3. Secure outside storage.

The operational and maintenance phase will create approximately 30 full time equivalent jobs. The number of persons based at the facility will fluctuate depending on the maintenance schedule but is expected to be between 10 and 30 persons.

2.8.1 Offshore activities

Routine operational activities

Up to 30 operations and maintenance personnel will be based at the O&M base during routine periods of operations for the site. This number will increase during periods of maintenance as outlined in the sections below. The site office and facilities for these activities are set out in in the section above.

For normal operations, CTVs will be used for routine transfer of personnel, tools and equipment to and from the port to the wind farm site. CTV vessels are typically 26 m long with a deadweight of 30 tonnes A CTV accommodates 24 operations personnel in addition to the vessel crew (three personnel).

The CTV will in general operate during daylight hours with operations from 08:00 to 18:00. During winter, the vessels may leave and enter port during darkness. For a typical day offshore, a single CTV will be loaded with all personnel and required tools and equipment for the day. The CTV will then transit from the O&M base to the offshore wind farm area and deploy the operations personnel at the wind turbine requiring work or the OSS. The transit time from the O&M base is expected to be between 40 and 60 minutes. The CTV will normally remain onsite at the offshore wind farm area until the completion of the required work and then return to the O&M base. It may be necessary to occasionally operate the CTV outside normal hours for longer tasks or urgent action. The CTV may also sometimes transit to and from the O&M base more than once each day. The CTV will be obliged to abide by all rules for navigation and speed when entering and existing the port.

Routine inspections and seabed surveys

Routine inspections and seabed surveys will take place over the lifetime of the Project to ensure integrity of the Project infrastructure. The expected frequency and type of inspections and seabed surveys are presented in Table 2-27.

Table 2-27: Frequency of activities required for inspections and seabed surveys required during O&M.

Activity	Vessel Type	Frequency
Inspections		
Foundations: Inspections of foundations, including transition piece and ancillary structures (e.g. J-tubes), above and below sea level. Includes removal of any marine growth from foundations, transition pieces or access ladders	Crew transfer vessel	1 campaign per year per WTG
WTGs: Scheduled and unscheduled maintenance inside/outside the WTG. Includes replacement of consumables (e.g. filters, oils, lubricants) and minor repairs and replacements within the WTG (e.g. motors, pumps, fuses) as well as troubleshooting	Crew transfer vessel or service operation vessel (weather and setup dependant)	5-9 days per location per year (preferably in low wind season; multiple locations can be visited per day)
OSS: Inspections inside/outside the OSS. Includes replacement of consumables (e.g. oils, lubricants) and minor repairs and replacements within the OSS	Crew transfer vessel	24 inspections per year
Inter-array cables: Inspection of the cable and any cable protection, including at their entry into J-tubes on the WTG/OSS	Remote Operating Vessel (ROV) and Crew transfer vessel	1 survey campaign every 5 years.
Export cable: Inspection of the cable and any cable protection, including at its entry into J-tubes on the OSS	Survey vessel with geophysical survey equipment	1 survey per year
Geophysical surveys		
Foundations: survey of seabed and assets	Survey vessel with geophysical survey equipment	1 survey campaign every 5 years.
Inter-array and offshore cables: survey of seabed and any cable protection	Survey vessel with geophysical survey equipment	1 survey campaign every 5 years.

Repairs and replacements of navigational equipment

Any faulty navigation aids will be repaired or replaced to maintain availability of all lights, marks and sound signals. The expected frequency and type of repairs and replacements of navigation equipment is presented in Table 2-28.

Table 2-28: Frequency of activities required for repairs and replacements of navigational equipment.

Activity	Methodology	Frequency
Repairs and replacements of electrical equipment such as lighting, navigation lights and transponders.	Crew transfer vessel	1 per WTG over Project lifetime

Painting

The foundation structures (above seawater level), wind turbines and offshore substation may require painting over the lifetime of the project to protect the structures from corrosion. The design parameters for painting are presented in Table 2-29.

Table 2-29: Design parameters for painting.

Activity	Methodology	Frequency
Foundations: Application of paint or other coatings to protect the foundations from corrosion (internal/external), including surface preparation	Crew transfer vessel	30 days per year
WTG: Paint or other coatings applied (internal/external). Coatings on the blades and minor paint repairs to tower and nacelle	Crew transfer vessel or service operation vessel (weather and setup dependant)	10 days per year
OSS: Paint or other coatings applied (internal/external).	Crew transfer vessel	10 days per year

Major component replacement

This activity allows for the replacement of major foundation, offshore substation or wind turbine components, for example davit cranes, transformers, wind turbine blades, blade bearings, hub generators, yaw rings or nacelles. Works conducted under this activity would likely require a jack-up vessel (JUV) supported by at least one CTV. The design parameters for this activity are presented in Table 2-30.

Table 2-30: Design parameters for major component replacement.

Activity	Methodology	Frequency
Replacement of major components such as blades, gearboxes, transformers or generators.	JUV	1 campaign per year for average of 2 major component replacements. Average of 7 days per year.

Cable repair or reburial activities

Cable repair activities will take place in the event a fault is detected in the inter-array or offshore cables. Failure of a cable system would be detected by the wind farm protection system. Cable repair activities would involve excavation of the faulty cable section, jointing of the new cable section to the existing cable, cable lay and cable reburial using similar techniques to those described for cable installation, and post-works survey.

Cable reburial activities will take place in the event a cable becomes exposed over time. A cable exposure event would be detected during the regular seabed survey activities described above. Cable reburial

activities would involve cable reburial using similar techniques to those described for cable installation (see section 2.5.6).

The project design parameters for cable repair or reburial activities are presented in Table 2-31. The project design parameters in terms of width of seabed disturbance during these activities is anticipated to be similar to that described for the cable installation activities during the construction phase.

Table 2-31: Design parameters for cable repair or reburial.

Activity	Methodology	Frequency
Cable repair		
Inter-array cable repair: Repair and replacement of array cable section/whole inter-array cable.	Cable repair vessel	1 per 5 years
Export cable repair (subtidal): Repair and replacement of offshore cable section.	Cable repair vessel	1 per 10 years
Cable reburial		
Inter-array cable reburial: Reburial of exposed inter-array cable section.	Cable reburial jetting trencher	1 per 5 years
Export cable reburial (subtidal): Reburial of exposed offshore cable section	Cable reburial jetting trencher	1 per 10 years

Vessel activities

During the operational and maintenance phase of the Project, vessels will be required to support the activities described above. Generally, vessels will be limited to a CTV operating day to day from the O&M base and involved in the routine maintenance of the Project. Larger vessels will be required to support any major component replacement activities or cable repair/reburial activities.

The vessel numbers anticipated for the operational and maintenance phase are presented in Table 2-32 below. Helicopter access would be used in the event of an emergency only.

Table 2-32: Operational and maintenance phase vessel return trips.

Vessel	Number of return trips
Crew Transfer Vessels (CTV)	Up to 300 per year
Service Operation Vessel	Up to 50 per year
Jack-up Vessels (JUV)	1 campaign per year
Cable repair vessels	1 cable repair or reburial per 5 years
Maximum Return Trips to Offshore Wind Farm Area or Offshore Cable Corridor	**352 per year**

2.8.2 Onshore activities

Onshore maintenance activities

The onshore operation and maintenance requirements for the onshore cable will be largely corrective (because there is limited requirement for preventative maintenance on the onshore cable), accompanied by infrequent on-site inspections of the onshore cable (approximately every 3 years). The onshore cable will be consistently monitored remotely by EirGrid. Link boxes and C2 chambers will require inspection during the operational and maintenance phase.

Operation and maintenance requirements for the onshore substation will be both preventative and corrective. The onshore infrastructure will be consistently monitored remotely by EirGrid from their control centre. In

addition, there will be operation and maintenance staff visiting the onshore substation to undertake works on a regular basis. Operations at the substation will involve six to eight visits per month, quarterly inspection visits and maintenance visits when required. These visits will result in one vehicle (van) requiring access to the onshore substation.

The switchgear in the onshore substation will contain sulphur hexafluoride (SF_6) or an alternative approved insulating gas if this becomes available. SF_6 is a non-toxic gas but has a high CO_2 equivalence if released to the atmosphere. Gas handling on-site is primarily limited to the construction and decommissioning phases of a substation development. Specialised gas handling and maintenance procedures and training are incorporated into the management systems. Maintenance of SF_6 gas containing equipment will be undertaken in accordance with specified operating procedures. Alternatively, a specialist switchgear provider (such as the original equipment provider) may be employed, to undertake maintenance of SF_6 gas containing equipment. The electrical switchgear equipment will also be equipped with a pressure or density monitoring device which will detect any loss of SF6 gas containing equipment.

It is not expected that the TJB will need to be accessed during the operation of Project, however link boxes and C2 chambers will require inspection during the operational and maintenance phase. The link boxes and C2 chambers have manhole covers to allow for inspection. These visits will be undertaken by a technician and use of one vehicle (van).

Routine inspections and any maintenance requirement such as replacement of components for the LCIMs will be undertaken by ESBN and incorporated into the standard processes and protocols for the existing 220 kV OHL.

Security

The Project and its components will be suitably secured throughout all phases of the Project to ensure those working on the Project can work in safety and the supply of electricity to the Irish National Grid remains secure. Any above ground onshore infrastructure such as the onshore substation will be housed in secure gated compounds, as will any ongoing construction work. The onshore cable is buried and will not be accessible from the surface. Any accessible parts such as the link boxes C2 chambers will be accessible only through secure manhole covers.

Surface water drainage

Surface water drainage at the onshore substation and any drainage associated with the joint bays would be inspected on an annual basis. Maintenance of the drainage including any repair requirements will be carried out. This maintenance will include emptying and cleaning of the attenuation/infiltration systems and oil water separator systems in the onshore substation, in compliance with the manufacturers specification.

2.9 Decommissioning phase

At the end of the operational lifetime of the Project, it is anticipated that all structures above the seabed or ground level will be completely removed.

The offshore decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. Decommissioning will be carried out in accordance with a Rehabilitation Schedule supported by a decommissioning bond which will be agreed with the Maritime Area Regulatory Authority (MARA) prior to construction commencing.

It is also proposed that a decommissioning programme of works be developed in advance of decommissioning. This programme will include information such as:

- Project background information;
- Description of items to be decommissioned;
- Proposed decommissioning approach and updated assessment taking into consideration the following:
  - changes in the baseline environment and sensitivities at the time of decommissioning;

  - changes in technology to undertaking the proposed works;
  - changes in legislation and guidance.
- Proposed stakeholder engagement; and
- Post decommissioning management and monitoring strategy.

It is proposed that preparation of this programme would commence on completion of construction of the Project and be reviewed on an annual basis (to include any updates). Engagement with stakeholders on the programme should commence five years in advance of decommissioning.

2.9.1 Offshore infrastructure decommissioning

Wind Turbines and OSS Topside

Wind turbines and OSS topside will be removed by reversing the methods used to install them for disassembly and reuse, recycling or disposal onshore.

Foundations

Monopile foundations would be cut approximately 2 m below the seabed and removed, with due consideration made of likely changes in seabed level. This could be achieved by inserting pile cutting devices. Once the piles are cut, the foundations could be lifted and removed from the site. At this time, it is not thought to be reasonably practicable to remove entire piles from the seabed, but that the sections of pile that remain in the seabed are fully buried. Any scour protection will be left in situ.

Offshore cables

Currently there is no statutory requirement for removal of decommissioned cables and removing buried cables is difficult. It may be agreed with the relevant authorities that the best environmental option is to leave buried cables in-situ, recording their location and terminating, sealing and burying their ends.

For the purposes of ensuring that this application assesses the maximum range of activities it has been assumed that all buried cables will be removed during decommissioning, though any cable protection installed will be left in situ.

Any surface laid cables would be removed to ensure that they don't become hazards to other users of the seabed.

Equipment similar to that used for cable installation would be used to remove burial material and expose the cables. As a result, the area of seabed impacted during the removal of the cables would be the same as the area impacted during the installation of the cables. Divers and/or ROVs may be used to support the cable removal vessels.

Once the cables are exposed, grapples would be used to pull the cables onto the decks of cable removal vessels. The cables would be cut into manageable lengths and returned to shore. Once onshore, it is expected that the cables would be deconstructed to recover and recycle the copper and/or aluminium and steel within them.

2.9.2 Onshore decommissioning

Onshore cable

It is expected that onshore cables would be removed by disconnecting each section at the joint bay and pulling them through the cable ducts. This operation would be a reverse of the installation operation and result in the same impacts.

The structures associated with the joint bays will be removed only if it is feasible with minimal environmental disturbance or if their removal is required to return the land to its former use.

Onshore substation

The components of the onshore substation have varying life expectancies. Transformers typically remain operational for up to 50 years, and some components can be extended beyond this period. The case for decommissioning the onshore substation will be reviewed in discussion with the TSO and the regulator in light of any other existing or proposed future use of the onshore substation. If complete decommissioning is required, then all of the electrical infrastructure will be removed, and any waste will be taken off site by a licenced waste contractor and managed in accordance with the waste hierarchy and where required to be disposed, this will be done under licence from the appropriate authority.

Foundations will be broken up and the site reinstated to its original condition.

2.10 Environmental management

2.10.1 Measures included in the Project

As part of the project design process, a number of measures have been proposed to reduce the potential for adverse effects on site integrity of European sites. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project. These measures are considered standard industry practice for this type of development. These measures are presented in section 5.2.4, 5.3.4, 5.4.4, 5.5.4 , 5.6.4 and 5.7.4 are integrated into the description of the Project and have therefore been considered in the assessments presented in the NIS.

2.10.2 Management plans

The measures included in the Project include a number of management plans, which the Applicant is committed to implementing. These management plans are considered standard industry practice for offshore wind development.

These management plans have been prepared to support the NIS and are provided in appendix K. These management plans will be further developed prior to construction. These are summarised in Table 2-33. Final management plans will be submitted for approval to the consent authority or other relevant stakeholders prior to construction, as indicated in Table 2-33.

Table 2-33: Management plans.

Management Plan	Submission stage	Purpose
Construction Environmental Management Plan (CEMP)	At least six months prior to construction.	The CEMP provides information relating to the environmental management during the construction of the onshore infrastructure of the Project.
Environmental Management Plan (EMP) (including Marine Pollution Contingency Plan)	At least six months prior to construction.	The EMP provides the overarching framework for environmental management during the construction and operational phases of the Project.
Marine Invasive Non-Native Species Management Plan (MINNSMP)	At least six months prior to construction.	The MINNSMP sets out the approach to invasive species management and mitigation in respect of the Project, providing an outline of the measures proposed to be implemented to facilitate biosecurity control and to minimise potential impacts on the local and wider environment.
Marine Mammal Mitigation Plan (MMMP)	At least six months prior to construction.	The MMMP includes details of the refined piling methodology and anticipated duration of pile-driving, details of soft-start piling procedures and anticipated maximum piling energy required, and details of any mitigation and monitoring to be employed during pile-driving.

Management Plan	Submission stage	Purpose
Marine Megafauna: Vessel Code of Conduct	At least six months prior to construction.	The Vessel Code of Conduct provides best practice guidelines to be followed in cases of any interaction between vessels and marine megafauna within Irish waters.

3 METHODOLOGY

3.1 Appropriate Assessment guidance

Appropriate assessment guidelines for Planning Authorities have been published by the Department of the Environment, Heritage and Local Government (DoEHLG, 2010a) and more recently by the Office of the Planning Regulator Practice Note (PN01) (OPR, 2021). In addition to the advice available from the Department, the European Commission has published a number of documents which provide a significant body of guidance on the requirements of AA, most notably including 'Assessment of Plans and Projects in relation to Natura 2000 sites – Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2021), which sets out the principles of how to approach decision making during the process of AA.

The principal national and European guidelines have been followed in the preparation of this report. The following list identifies these and other pertinent guidance documents:

- Communication from the Commission on the Precautionary Principle., Office for Official Publications of the European Communities, Luxembourg (EC, 2000);
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Brussels (EC, 2001);
- Estuaries and Coastal Zones within the Context of the Birds and Habitats Directives – Technical Supporting Document on their Dual Roles as Natura 2000 Sites and as Waterways and Locations for Ports. European Commission (EC, 2009);
- Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government, Dublin (DoEHLG, 2010a);
- Department of Environment Heritage and Local Government Circular NPW 1/10 and PSSP 2/10 on Appropriate Assessment under Article 6 of the Habitats Directive – Guidance for Planning Authorities (DoEHLG, 2010b);
- Guidance document on the implementation of the birds and habitats directive in estuaries and coastal zones with particular attention to port development and dredging. European Commission (EC, 2011);
- Marine Natura Impact Statements in Irish Special Areas of Conservation: A working document, National Parks and Wildlife Service, Dublin (NPWS, 2012a);
- Interpretation Manual of European Union Habitats. Version EUR 28. European Commission (EC, 2013a);
- Guidelines on Climate Change and Natura 2000. European Commission (EC, 2013b);
- Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects. Department of Communications, Climate Action and Environment and Sustainable Energy Authority of Ireland (DoCCAE & SEAI, 2017);
- European Commission Notice C (2018) 7621 'Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg (EC, 2019);
- Institute of Air Quality Management 'A guide to the assessment of air quality impacts on designated nature conservation sites (Version 1.1)' (IAQM, 2020);

- European Commission Notice C(2020) 7730 'Guidance document on wind energy developments and EU nature legislation', Office for Official Publications of the European Communities, Luxembourg (EC, 2020);
- Office of the Planning Regulator Practice Note (PN01) 'Appropriate Assessment Screening for Development Management' (OPR, 2021);
- European Commission Notice Brussels (2021) 6913 final 'Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2021); and
- European Commission (2022) Guidance document on Assessment of plans and projects in relation to Natura 2000 sites - A summary, Office for Official Publications of the European Communities, Luxembourg (EC, 2022).

There is also significant case law in the field of AA, comprising decisions and opinions from the Court of Justice of the European Union (CJEU), and also judgments from UK and Irish courts. This body of case law is reflected in the approach taken in the Stage 2 appraisals contained in this document.

3.2 Relevant European sites

The identification of relevant European sites to be included in this report was based on the identification of the Zone of Influence (ZoI) of the Project, a source-pathway-receptor model of effects, and the likely significance of any identified effects on any European site(s).

3.2.1 Zone of influence

The proximity of the Project to European sites, and more importantly QIs/SCIs of those European sites, is of importance when identifying potential likely significant and adverse effects. A conservative approach has been used, which minimises the risk of overlooking distant or obscure effect pathways, while also avoiding reliance on buffer zones (e.g. 15 km), within which all European sites should be considered.

This approach assesses an expansive list of all QIs/SCIs of European sites in Ireland and abroad (i.e. potential receptors), instead of listing European sites within buffer zones. This is in accordance with Irish guidance on AA:

> "*For projects, the distance could be much less than 15 km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects.*" (DoEHLG, 2010a; p.32)
>
> *"The zone of influence of a proposed development is the geographical area over which it could affect the receiving environment in a way that could have significant effects on the Qualifying Interests of a European site. This should be established on a case-by-case basis using the Source-Pathway-Receptor framework and not by arbitrary distances (such as 15 km),*" (OPR, 2021; p.8).

With cognisance of guidance set out in NRA (2009), the Project has been evaluated based on an identified ZoI with regard to the potential impact pathways to an ecological feature (e.g. mobile and static). The ZoI of the Project on mobile species (e.g. birds, mammals, and fish), and static species and habitats (e.g. saltmarshes, woodlands, and flora) is considered differently. Mobile species have a 'range' extending beyond the European site in which they are QI/SCI. The range of mobile QI/SCI species varies considerably, from several metres (e.g. in the case of whorl snails *Vertigo* spp.), to hundreds of kilometres (in the case of migratory waterbirds). Whilst static species and habitats are generally considered to have ZoIs within close proximity of the Project, they can be significantly affected at considerable distances from an effect source; for example, where an aquatic QI habitat or plant is located many kilometres downstream from a pollution source.

The ZoI varies with each impact source and receptor interaction. All ZoIs are contained within the study areas for each discipline, described in the subsections below.

3.2.1.1 Terrestrial and freshwater

Hydrological linkages between the Project and European sites (and their QIs/SCIs) can occur over significant distances; however, any effect will be site specific depending on the receiving water environment and nature of the potential impact. As a precautionary measure, a worst-case for freshwater pollution from the Project is considered to be the entire surface water catchment. In this assessment, the surface water catchment is defined at the scale of Catchment Management Unit (CMU), as adopted in the second cycle River Basin Management Plan (RBMP) for Ireland 2018-2021 (DoHLGH, 2018) and the draft third cycle (DoHLGH, 2022). See also appendix I: Onshore Biodiversity – Supporting Information.

3.2.1.2 Marine processes

Marine processes (i.e. currents, waves, and sediment transport) are not receptors in themselves; however, they are potential pathways for impacts on other receptors. Numerical modelling techniques were used to describe the tide, wave, and sediment transport regimes. The Marine Processes Study Area is defined as one spring tidal excursion[5] from the Project which results in a maximum tidal excursion of 3.5 km based on typical spring tidal conditions. The MIKE numerical modelling suite was used to define the extent on a typical tidal excursion (see appendix B: Marine Processes Technical Report). A model simulation of neutrally buoyant particles were released across the modelled extent of the offshore wind farm area and offshore cable corridor and the excursion of these particles was examined over the course of a simulated spring tide cycle. The modelled extent of movement of neutrally buoyant particles over a typical spring tide cycle represents the maximum extent of possible effects based on typical tidal condition.

3.2.1.3 Benthic, subtidal and intertidal ecology

The study area for benthic subtidal and intertidal ecology (see appendix D: Benthic Subtidal and Intertidal Ecology - Supporting Information) is up to one tidal excursion from the offshore wind farm area and offshore cable corridor. The outputs of the assessment on marine processes (see appendix B: Marine Processes Technical Report) have indicated a maximum tidal excursion of 3.5 km from the offshore wind farm area and offshore cable corridor (i.e. the extent within which plume effects would be expected to occur). The Benthic Subtidal and Intertidal Ecology Study Area encompasses the offshore wind farm area, offshore cable corridor (including intertidal habitats up to the HWM) plus a buffer of 10 km. The 10 km buffer from the offshore wind farm area and offshore cable corridor contains representative habitats from the wider area, encompasses one tidal excursion and is therefore, considered to be precautionary because likely significant effects on benthic and inter-tidal ecology will not extend beyond one tidal excursion.

3.2.1.4 Offshore ornithology

The study area for offshore ornithology is defined by the foraging range of each individual species (taken from Woodward et al., 2019). The Offshore Ornithology Study Area encompasses the maximum foraging range, which is up to 509.4 km for gannet, and the extent of the survey area for the site-specific boat-based ornithology surveys, digital aerial survey (DAS) and migratory species Vantage Point (VP) surveys (see appendix H: Offshore Ornithology – Supporting Information), and the extent of the offshore cable corridor up to the LWM. The boat and DAS covered a total area of 319.85 km^2 and encompassed the marine habitats within the offshore wind farm area, offshore cable corridor and an additional buffer of varying extent. The migratory geese surveys were undertaken from a single coastal VP at Cooley Point, County Louth.

The Offshore Ornithology Study Area covers a larger area than the potential area of impact. The impacts will be restricted to within a buffer around the array area and along the offshore cable corridor. The buffer size will vary depending on the species.

[5] A tidal excursion can be defined as: the horizontal distance over which a water particle moves during one tidal cycle of flood and ebb.

3.2.1.5 Fish and shellfish

Fish and shellfish ecology encompasses two study areas due to the temporal and spatial variability of fish and shellfish (see appendix E: Fish and Shellfish Ecology – Supporting Information).

The first (i.e. the Fish and Shellfish Ecology Study Area) includes the offshore wind farm area, the offshore cable corridor, and the area in the immediate vicinity of the intertidal area. This is the area where potential likely significant effects from the Project from the majority of impacts (e.g. subtidal habitat loss/disturbance, increases in suspended sediment concentrations (and associated sediment deposition) and electromagnetic Fields (EMF) from subsea electrical cabling on fish and shellfish) are expected to occur.

It is also necessary to define a second study area (the Western Irish Sea Fish and Shellfish Ecology Study Area) in the western portion of the Irish Sea from Ballyquintin Point (55.5 km north east of the offshore wind farm area) to Carnsore Point (191.5 km south of the wind farm area). This area is defined to assess the likely significant effects which may extend beyond the Project boundary (e.g. injury and/or disturbance to fish from underwater noise during pile-driving) and also to account for the highly mobile nature of some fish and shellfish species, in particular diadromous fish.

With respect to effects on Annex II species, the Western Irish Sea Fish and Shellfish Ecology Study Area is considered to be adequately precautionary to account for likely migratory routes for diadromous fish species to the relevant SACs considered (see migratory routes presented in ABPmer, 2014) and in particular potential disruption to migration to and from those SACs. Given the location of the Project within the western Irish Sea it is unlikely that any SACs located along the east Irish Sea coast would be affected by any of the predicted impacts; for example diadromous fish access to SACs located on the west coast of Britain, will be unaffected by noise (or other activities) associated with the Project and the Project could not present a barrier to migration due to its location within the western Irish Sea.

3.2.1.6 Marine Mammals and Megafauna

Marine mammals and megafauna are characterised by two study areas (see appendix F: Marine Mammals and Megafauna – Supporting Information).

The Marine Mammal and Megafauna Study Area (hereafter referred to as the ‘Marine Megafauna Study Area’): encompasses the offshore wind farm area and offshore cable corridor plus a minimum 4 km buffer (NatureScot, 2023; DCCAE, 2018), and is the area within which the site-specific marine mammal surveys were undertaken (i.e. boat-based surveys, site-specific aerial surveys, and Static Acoustic Monitoring; see appendix F: Marine Mammals and Megafauna – Supporting Information). This buffer was determined on the basis of the suitable area over which species specific marine mammal surveys should be carried out and was delineated by the offshore wind farm area.

The Regional Marine Mammal and Megafauna Study Area (hereafter referred to as the ‘Regional Marine Megafauna Study Area’) is defined by the wider Irish Sea geographic area. Marine mammals are highly mobile and may range over large distances and therefore it was important to understand the ecology of marine mammals in this wider geographic context. This is important where the ZoI for a given impact (e.g. subsea noise) may extend beyond the Marine Megafauna Study Area (as described above). A desktop study (using existing data and literature) was also undertaken to describe marine mammal ecology, (e.g. in terms of their distribution, abundance, seasonality etc.) within this wider Irish Sea geographic area.

3.2.2 Source-pathway-receptor model

The likely effects of the Project on European sites have been assessed using a source-pathway-receptor model, where:

- A ‘source’ is defined as the individual element of the proposed works that has the potential to impact on a European site, its QIs/SCIs and its COs;
- A ‘pathway’ is defined as the means or route by which a source can affect the ecological receptor; and
- A ‘receptor’ is defined as the Special Conservation Interests (SCI) of SPAs or Qualifying Interests (QI) of SACs for which COs have been set for the European sites being screened.

A source-pathway-receptor model is a standard tool used in environmental assessment. In order for an effect to be likely, all three elements of this model must be in place. The absence or removal of one of the elements will result in no likelihood for the effect to occur. The source-pathway-receptor model was used to identify a list of European sites, and their QIs/SCIs, with potential links to European sites. These are termed as relevant European sites/QIs/SCIs throughout this report.

3.2.3 Adverse effect on integrity

The European Commission's 2018 Notice (EC, 2019) advises that the purpose of the AA is to assess the implications of the plan or project in respect of the site's COs, either individually or in combination with other plans or projects. The conclusions should enable the competent authorities to ascertain whether the plan or project will adversely affect the integrity of the site concerned. The focus of the AA is therefore specifically on the species and/or the habitats for which the European site is designated.

EC (2019) also emphasises the importance of using the best scientific knowledge when carrying out the AA in order to enable the competent authorities to conclude with certainty that there will be no adverse effects on the integrity of the site. This guidance notes that it is at the time of adoption of the decision authorising implementation of the project that there must be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site in question.

The judgment of the CJEU confirmed in its ruling in Case C-258/11 that '*Article 6(3) of the Habitats Directive must be interpreted as meaning that a plan or project not directly connected with or necessary to the management of a site will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of SCIs, in accordance with the directive. The precautionary principle should be applied for the purposes of that appraisal*'. EC (2019) advises that the logic of such an interpretation would also be relevant to non-priority habitat types and to habitats of species.

As regards the meaning of 'integrity', this clearly relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation. EC (2021) advises that "*the 'integrity of the site' can be usefully defined as the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated*"; and also that "*the description of the site's integrity and the impact assessment should be based on the parameters that determine the conservation objectives and that are specific to the habitats and species of the site and their ecological requirements*".

EC (2019) notes that if the competent authority considers the mitigation measures are sufficient to avoid the adverse effects on site integrity identified in the AA, they will become an integral part of the specification of the final plan or project or may be listed as a condition for project approval.

EC (2020) advises that it is for the competent authorities, in the light of the conclusions made in the AA on the implications of a plan or project for the European site concerned, to approve the plan or project. This decision can only be taken after they have made certain that the plan or project will not adversely affect the integrity of the site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.

EC (2020) also reaffirms that the authorisation criterion laid down in the second sentence of Article 6(3) of the Habitats Directive integrates the precautionary principle and makes it possible effectively to prevent the protected sites from suffering adverse effects on their integrity as the result of the plans or projects. A less stringent authorisation criterion could not as effectively ensure the fulfilment of the objective of site protection intended under that provision. The onus is therefore on demonstrating the absence of adverse effects rather than their presence, reflecting the precautionary principle. It follows that the AA must be sufficiently detailed and reasoned to demonstrate the absence of adverse effects, in light of the best scientific knowledge in the field.

3.2.4 Consideration of *ex-situ* effects

EC (2019) advises that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards to be applied to any development pressures, including those which are external to European sites but which are likely to have significant effects on any of them.

The CJEU developed this point when it issued a ruling in case C-461/17 ("Brian Holohan and Others v An Bord Pleanála") that determined *inter alia* that Article 6(3) of Directive 92/43/EEC must be interpreted as meaning that an AA must on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the Project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the COs of the site.

In that regard, consideration has been given in this appraisal of implications for habitats and species located both inside and outside of the European sites considered and with reference to those sites' COs where effects upon those habitats and/or species are liable to affect the COs of the sites concerned.

3.2.5 Conservation objectives

The COs for each European site are to maintain or restore the favourable conservation condition of the QIs or the SCIs for which the site has been selected.

The favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable.

The favourable conservation status (or condition, at a site level) of a species is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The CJEU, in its judgment in Case C-849/19, Commission v Greece, confirmed that COs must be formally established and that these must be site specific, refer to the specific values present in the site, and be precise. Furthermore, the Court has repeatedly held that it is in the light of the COs that the scope of the obligation to carry out an AA of the effects of a plan or a project on a protected site should be determined. In other words, the decision as to whether the plan or project is likely to have significant impact on a Natura 2000 site should be taken in view of the site's COs. It is therefore essential that site specific COs are set without delay for all Natura 2000 sites and that these are made publicly available.

EC (2021) advises that site specific COs must be set for all protected habitats and species that are significantly present on the site (i.e. habitats and species with A, B or C, but not D, site assessment in the Natura 2000 Standard Data Form for the site). The COs must specify targets to be achieved for each of the attributes or parameters that determine the conservation condition of the protected features.

The COs of European sites published by the National Parks and Wildlife Service (NPWS) in Ireland note that an AA based on the most up to date COs (which are defined by a list of attributes and targets) will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available

when the assessment was carried out (e.g. COs for Rockabill to Dalkey Island SAC 003000, version 1 (NPWS, 2013a)).

The most up-to-date COs for the European sites being considered have been used in this appraisal, and they are set out in full in the Report to Inform Screening for Appropriate Assessment (Appendix A:). Details in relation to the QIs of SACs and SCIs of SPAs is based on publicly available data sourced from the relevant Statutory Nature Conservation Bodies (SNCBs) in Ireland and the UK in January 2024.

3.2.6 In-combination effects

Article 6(3) of the Habitats Directive requires that in-combination effects with other plans or projects are also considered. As set out in EC (2019), significance will vary depending on factors such as magnitude of impact, type, extent, duration, intensity, timing, probability, cumulative effects and the vulnerability of the habitats and species concerned.

EC (2020) notes that cumulative environmental effects can be defined as effects on the environment caused by the combined action of past, current and future activities while EC (2019) makes clear that the phrase 'in combination with other plans or projects' in Article 3(3) refers to cumulative effects caused by the projects or plans that are currently under consideration together with the effects of any existing or proposed projects or plans. Although the effects of one development may not be significant, the combined effects of several developments together can be significant. In-combination effects are relevant to wind energy deployment, given the continuously growing number of applications for wind energy production and the expected increase in capacity over the coming years.

EC (2020) also notes that the 'in combination' provision applies to plans or projects that are completed, approved but uncompleted, or proposed. In addition to the effects of the plans or projects that are the main subject of the assessment, it may be appropriate to consider the effects of already completed plans and projects. Although already completed plans and projects are themselves excluded from the assessment requirements of Article 6(3), it is still important to take them into consideration when assessing the effects of the current plan or project in order to determine whether there are any potential cumulative effects arising from the current Project in combination with other completed plans and projects. The effects of completed plans and projects would typically form part of the site's baseline conditions at this stage. Plans and projects that have been approved in the past but have not yet been implemented or completed should be included in the in-combination provision.

This mirrors the advice contained in EC (2019) which advises that other plans or projects which are completed, approved but uncompleted, or proposed should be considered. EC (2019) specifically advises that "*as regards other proposed plans or projects (i.e. other projects not proposed by the Applicant), on grounds of legal certainty it would seem appropriate to restrict the in-combination provision to those which have been actually proposed, i.e. for which an application for approval or consent has been introduced*".

EC (2021) additionally advises that –

- an in-combination assessment is often less detailed at the screening stage than in the appropriate assessment;
- there is still a need to identify all other plans or projects that could give rise to cumulative impacts with the plan or project in question; and
- if this analysis cannot reach definitive conclusions, it should at least identify any other relevant plans and projects that should be scrutinised in more detail during the appropriate assessment.

The ability for impacts arising from the Project to overlap with those from other projects, plans and activities to result in adverse effects has been assessed on a receptor basis for each group of QIs and SCIs. This means that, in most examples, an overlap of the physical extents of the impacts arising from the two (or more) projects, plans or activities must be established for an in-combination effect to arise. For example, for a cumulative sedimentation effect to be established between the Project and another project, it must be established that the extent of sediment release from both projects has the potential to overlap and may affect a receptor at the same location.

Exceptions to this exist for certain mobile receptors that may move between, and be subject to, two or more separate physical extents of impact from two or more projects. For example, marine mammals and megafauna may be affected by noise impacts from the Project, as well as those from other projects where the extent of another ensonified area does not directly overlap with that of the Project. Furthermore, individual receptors from the same population may be exposed to separate impacts from different projects occurring at the same time while the population is separated, leading to an effect upon the population as a whole.

Where relevant, these potential eventualities have been taken into consideration in the in-combination assessment and mitigation proposed as necessary to prevent adverse in-combination effects occurring.

Approach to 'in-combination assessment (ICA)

A staged approach as outlined in the PINS Advice Note 17 (*Planning Inspectorate (PINS) (2019) Advice Note 17: cumulative effects assessment relevant to nationally significant infrastructure projects*) has been followed in order to methodically and transparently screen the projects and plans that may be considered cumulatively alongside the Project. This involves a stepwise process that considers the level of detail available for projects and activities, as well as the potential for interactions on a conceptual, physical and temporal basis. A full description of the methodology used is provided in appendix J: Screening – In-combination Effects, however a summary of the approach is provided below:

Screening was undertaken using a three-staged approach to gather information on other projects and plans within the defined cumulative Zone of Influence (ZoI) for each topic considered in the NIS.

Stage 1 required that the cumulative ZoI was defined by each topic specialist. A desk study was then undertaken to search consent applications and any other available sources to identify projects falling within the largest defined ZoI (ornithology), which may have the potential to give rise to in-combination effects with the Project. This list of projects included other existing or approved developments, including those which are under construction, permitted but not yet implemented, submitted but not yet determined or pre-application projects that are at an early / concept stage but not in a consent application process.

Stage 2 provided a reduced list of projects following the application of project specific assumptions including whether or not temporal overlap of other projects with the Project during all phases of the development. Further information on the projects listed in Stage 2 was then gathered to inform the in-combination assessment by topic specialists. This involved a desk study to source publicly available information on projects using planning databases and internet searches. The relevant project parameters for the projects considered cumulatively have been drawn from consent applications (including supporting documents). Approximate distances to the Project were also provided for each project, to better understand any spatial overlap.

Stage 3 involved tailoring the list of projects from Stage 2 to the cumulative ZoI identified for each of the topics. Each of the topic authors then further screened the list of projects in accordance with a set of defined screening criteria to identify which projects should be considered in the assessment of cumulative effects.

Stage 4: The projects screened into the assessment were carried forward for assessment in the ICA of the relevant topics as provided in section 5.8.

Engagement with Phase 1 Project developers

To inform the in-combination assessment, the Applicant has engaged with the other Phase 1 developers on the east coast of Ireland as these projects fall within the ZoI for the following topic assessments:

- Fish and Shellfish Ecology;
- Marine Mammals and Megafauna;
- Offshore Ornithology;

These Phase 1 projects are expected to lodge an application for consent before end of June 2024. Therefore, should the Project receive consent, there is potential for all phases of the Project to occur at the same time as the other consented Phase 1 projects.

Engagement with the other Phase 1 developers commenced in August 2022. This involved regular discussions and workshops with the project teams including the relevant specialists involved in the assessments of the above topics. Project information was shared amongst teams and this was used to inform the assessments. Engagement continued into early 2024 and the teams will continue to engage as the application processes progress.

As a result of the engagement, the following aspects of the assessments were aligned (where possible) to inform the ICA:

- Approach and methodology used to identify other projects for ICA (i.e. discussion on the ZoI used and the reasoning for screening in/out projects);
- Approach and methodologies used to inform the above topic assessments including alignment on sensitivities and magnitudes where possible;
- Ornithology: Sharing of data and outputs from collisions risk modelling, displacement and Population Viability Analysis (PVA) to inform the assessment of potential in-combination impacts on offshore ornithology.

It should be noted that approaches to assessments across projects may vary, however, overall the collaboration on the above has provided more robust inputs and understanding of the nature and type of potential in-combination impacts.

It should also be noted that where information is not publicly available or provided through the above engagement, a number of assumptions have been used to inform the ICA. For example, where construction or operation programmes are not known, it is assumed that there is potential for projects to overlap.

4 STAGE 1 SUMMARY AND FINDINGS OF THE REPORT TO INFORM SCREENING FOR APPROPRIATE ASSESSMENT

4.1 Key findings

From the findings of the Stage 1 appraisal to inform screening for Appropriate Assessment presented in appendix A, the possibility of LSEs could not be excluded for 20 QIs of 16 European sites (SACs) and 47 SCIs (including wetlands and waterbirds) of 54 European sites (SPAs). The SACs and SPAs listed below for further consideration are shown in Figure 4-1, while Table 4-1 and Table 4-2 summarise the relevant QIs and SCIs for each site.

Special Areas of Conservation:

- Blackwater Bank SAC (IE002953)
- Boyne Coast and Estuary SAC (IE001957)
- Cardigan Bay/Bae Ceredigion SAC (UK0012712)
- Carlingford Shore SAC (IE002306)
- Codling Fault Zone SAC (IE003015)
- Dundalk Bay SAC (IE000455)
- Lambay Island SAC (000204)
- Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117)
- Murlough SAC (UK0016612)
- North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398)
- North Channel SAC (UK0030399)
- Pembrokeshire Marine/Sir Benfro Forol SAC (UK0013116)
- River Boyne and River Blackwater SAC (IE 002299)
- Rockabill to Dalkey Island SAC (IE003000)
- Slaney River Valley SAC (IE000781)
- West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397)

Special Protection Areas:

- Ailsa Craig SPA (UK9003091)
- Ballymacoda Bay SPA (IE004023)
- Beara Peninsula SPA (IE004155)
- Blacksod Bay/Broad Haven SPA (IE004037)
- Boyne Estuary SPA (IE004080)
- Carlingford Lough SPA (IE004078)
- Carlingford Lough SPA (UK9020161)
- Copeland Islands SPA (UK9020291)
- Dalkey Islands SPA (IE004172)
- Deenish Island and Scariff Island SPA (IE 004175)
- Dundalk Bay SPA (IE004026)
- Duvillaun Islands SPA (IE004111)
- Glannau Aberdaron ac Ynys Enlli SPA (UK9013121)
- Grassholm SPA (UK9014041)
- Greers Isle SPA (IE004082)
- Helvick Head to Ballyquin SPA (IE004192)
- Horn Head to Fanad Head SPA (IE004194)
- Howth Head Coast SPA (IE 004113)
- Inishglora and Inishkeeragh SPA (IE004084)
- Ireland's Eye SPA (IE004117)
- Irish Sea Front SPA (UK9020328)
- Lady's Island Lake SPA (IE004009)
- Lambay Island SPA (IE004069)
- Liverpool Bay SPA (UK9020294)
- Lough Foyle SPA (IE004087)
- Lough Swilly SPA (IE004075)
- Mersey Narrows and North Wirral Foreshore SPA (UK9020287)
- Mingulay and Berneray SPA (UK9001121)
- Morecambe Bay and Duddon Estuary SPA (UK9020326)
- North Colonsay and Western Cliffs SPA (UK9003171)
- North-west Irish Sea cSPA (IE004236)[6]
- Outer Ards SPA (UK9020271)
- Pembrokeshire SPA (UK9014051)
- Rathlin Island SPA (UK9020011)
- The Raven SPA (IE004019)
- Ribble and Alt Estuaries SPA (UK9005103)
- River Nanny Estuary and Shore SPA (IE004158)
- Rockabill SPA (IE004014)
- Rum SPA (UK9001341)
- Saltee Islands SPA (IE004002)
- Seas off Wexford SPA (IE004237)
- Shiant Isles SPA (UK9001041)

[6] The North-West Irish Sea candidate SPA (cSPA) was first notified to the pubic in July 2023, and conservation objectives were published in October 2023. The Minister proposes to classify this site as a SPA following statutory periods of consultation. The site will hereafter in this report be referred to as the "North-West Irish Sea SPA" and assessed as a classified SPA rather than a proposed or candidate SPA.

- Skelligs SPA (IE004007)
- Skerries Islands SPA (IE004122)
- Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)
- South Dublin Bay and Tolka Estuary SPA (IE 004024)
- St Kilda SPA (UK9001031)
- Stabannan-Braganstown SPA (IE004091)
- Strangford Lough SPA (UK9020111)
- The Murrough SPA (IE 004186)
- Tory Island SPA (IE004073)
- West Donegal Coast SPA (IE004150)
- Wexford Harbour and Slobs SPA (IE004076)
- Wicklow Head SPA (IE004127

Table 4-1: Summary of Stage 1 Screening Appraisal for SACs.

Qualifying Interest Habitats & Species	Relevant European Site(s) (code)
Annex I Habitats	
Annual vegetation of drift lines [1210]	Carlingford Shore SAC (IE002306)
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Dundalk Bay SAC (IE000455)
	Boyne Coast and Estuary SAC (IE001957)
	Murlough SAC (UK0016612)
Embryonic shifting dunes [2110]	Boyne Coast and Estuary SAC (IE001957)
	Murlough SAC (UK0016612)
Estuaries [1130]	Dundalk Bay SAC
	Boyne Coast and Estuary SAC (IE001957)
Mediterranean salt meadows (*Juncetalia maritimae)* [1410]	Dundalk Bay SAC (IE000455)
	Boyne Coast and Estuary SAC (IE001957)
Mudflats and sandflats not covered by seawater at low tide [1140]	Dundalk Bay SAC (IE000455)
	Boyne Coast and Estuary SAC (IE001957)
	Murlough SAC (UK0016612)
Salicornia and other annuals colonising mud and sand [1310]	Dundalk Bay SAC (IE000455)
	Boyne Coast and Estuary SAC (IE001957)
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]	Boyne Coast and Estuary SAC (IE001957)
	Murlough SAC (UK0016612)
Reefs [1170]	Rockabill to Dalkey Island SAC (IE003000)
	Lambay Island SAC (IE000204)
Sandbanks which are slightly covered by sea water all the time [1110]	Murlough SAC (UK0016612)
Annex II Marine Mammal Species	
Bottlenose Dolphin (*Tursiops truncatus*) [1349]	Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117)
	Cardigan Bay/Bae Ceredigion SAC (UK0012712)
Grey Seal (*Halichoerus grypus*) [1364]	Lambay Island SAC (IE000204)
	Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117)
	Cardigan Bay/Bae Ceredigion SAC (UK0012712)
	Pembrokeshire Marine/Sir Benfro Forol SAC (UK0013116)
Harbour porpoise (*Phocoena phocoena*) [1351]	Rockabill to Dalkey Island SAC (IE003000)
	Lambay Island SAC (IE000204)
	North Channel SAC (UK0030399)
	Codling Fault Zone SAC (IE003015)
	North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398)
	Blackwater Bank SAC (IE002953)
	West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397)
Harbour Seal (*Phoca vitulina*) [1365]	Murlough SAC (UK0016612)
	Lambay Island SAC (IE000204)
	Slaney River Valley SAC (IE000781)
Annex II terrestrial and freshwater mammal species	
Otter (*Lutra lutra*) [1355]	River Boyne and River Blackwater SAC (IE002299)
Annex II Fish Species	

Qualifying Interest Habitats & Species	Relevant European Site(s) (code)
Atlantic Salmon (*Salmo salar*) [1106]	Slaney River Valley SAC (IE000781)
	River Boyne and River Blackwater SAC (IE002299)
River Lamprey (*Lampetra fluviatilis*) [1099]	River Boyne and River Blackwater SAC (IE002299)
	Slaney River Valley SAC (IE000781)
Sea Lamprey (*Petromyzon marinus*) [1095]	Slaney River Valley SAC (IE000781)
Twaite Shad (*Alosa fallax fallax*) [1103]	Slaney River Valley SAC (IE000781)
Annex II Invertebrates	
Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]	Slaney River Valley SAC (IE000781)

Table 4-2: Summary of Stage 1 Screening Appraisal for SPAs.

Special Conservation Interests	Relevant European Site(s) (code)
Arctic Tern (*Sterna paradisaea*) [A194]	Rockabill SPA (IE004014)
	North-west Irish Sea SPA (IE004236)
Bar-tailed Godwit (*Limosa lapponica*) [A157]	Dundalk Bay SPA (IE004026)
Black-headed Gull (*Chroicocephalus ridibundus*) [A179]	Dundalk Bay SPA (IE004026)
	Wexford Harbour and Slobs SPA (IE004076)
	Lough Swilly SPA (IE 004075)
	Greers Isle SPA (IE 004082)
	Ballymacoda Bay SPA (IE004023)
	Lady's Island Lake SPA (IE004009)
	Dalkey Islands SPA (IE004172)
	The Murrough SPA (IE004186)
	Lough Foyle SPA (IE004087)
	North-west Irish Sea SPA (IE004236)
Black-tailed Godwit (*Limosa limosa*) [A156]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)
Common Gull (*Larus canus*) [A182]	Dundalk Bay SPA (IE004026)
	North-west Irish Sea SPA (IE004236)
Common Scoter (*Melanitta nigra*) [A065]	Dundalk Bay SPA (IE004026)
	North-west Irish Sea SPA (IE004236)
Common Tern (*Sterna hirundo*) [A193]	Rockabill SPA (IE004014)
	Carlingford Lough SPA (UK9020161)
	North-west Irish Sea SPA (IE004236)
Cormorant (*Phalacrocorax carbo*) [A017]	Skerries Islands SPA (IE004122)
	North-west Irish Sea SPA (IE004236)
Curlew (*Numenius arquata*) [A160]	Dundalk Bay SPA (IE004026)
Dunlin (*Calidris ariti*) [A149]	Dundalk Bay SPA (IE004026)
Fulmar (*Fulmarus glacialis*) [A009]	Lambay Island SPA (IE004069)
	Saltee Islands SPA (IE004002)
	Horn Head to Fanad Head SPA (IE004194)
	Tory Island SPA (IE004073)
	West Donegal Coast SPA (IE004150)
	Beara Peninsula SPA (IE004155)

Special Conservation Interests	Relevant European Site(s) (code)
	Duvillaun Islands SPA (IE004111)
	Deenish Island and Scariff Island SPA (IE 004175)
	Mingulay and Berneray SPA (UK9001121)
	Shiant Isles SPA (UK9001041)
	St Kilda SPA (UK9001031)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Gannet (*Morus bassanus*) [A016]	Ailsa Craig SPA (UK9003091)
	Grassholm SPA (UK9014041)
	Seas off Wexford SPA (IE004237)
Golden Plover (*Pluvialis apricaria*) [A140]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)
Great Black-backed Gull (*Larus marinus*) [A187]	North-west Irish Sea SPA (IE004236)
Great Crested Grebe (*Podiceps cristatus*) [A005]	Dundalk Bay SPA (IE004026)
Great skua (*Catharacta skua*)	St Kilda SPA (UK9001031)
Great Northern Diver (*Gavia immer*) [A003]	North-west Irish Sea SPA (IE004236)
Grey Plover (*Pluvialis squatarola*) [A141]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)
Greylag Goose (*Anser anser*) [A043]	Dundalk Bay SPA (IE004026)
	Stabannan-Braganstown SPA (IE004091)
Guillemot (*Uria aalge*) [A199]	Lambay Island SPA (IE004069)
	Ireland's Eye SPA (IE 004117)
	Rathlin Island SPA (UK9020011)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Herring Gull (*Larus argentatus*) [A184]	Dundalk Bay SPA (IE004026)
	River Nanny Estuary and Shore SPA (IE004158)
	Skerries Islands SPA (IE004122)
	Lambay Island SPA (IE004069)
	Ireland's Eye SPA (IE004117)
	North-west Irish Sea SPA (IE004236)
Kittiwake (*Rissa tridactyla*) [A188]	Lambay Island SPA (IE004069)
	Howth Head Coast SPA (IE004113)
	Ireland's Eye SPA (IE004117)
	Wicklow Head SPA (IE004127)
	Ailsa Craig SPA (UK9003091)
	Rathlin Island SPA (UK9020011)
	Horn Head to Fanad Head SPA (IE004194)
	Saltee Islands SPA (IE004002)
	Helvick Head to Ballyquin SPA (IE004192)
	North Colonsay and Western Cliffs SPA (UK9003171)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Knot (*Calidris canutus*) [A143]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)

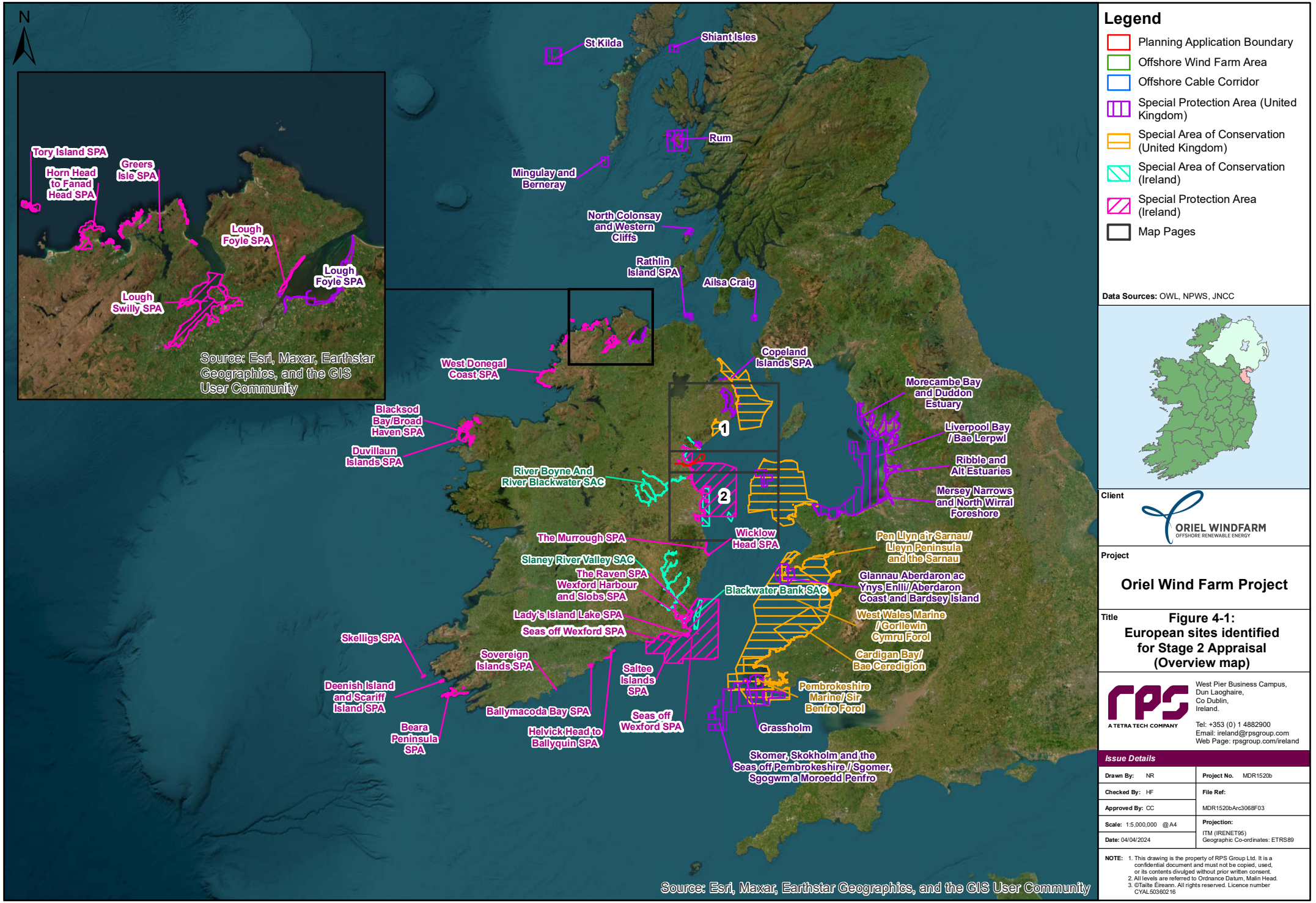
Special Conservation Interests	Relevant European Site(s) (code)
Lapwing (*Vanellus vanellus*) [A142]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)
Lesser Black-backed Gull (*Larus fuscus*) [A183]	Lambay Island SPA (IE004069)
	Ailsa Craig SPA (UK9003091)
	Morecambe Bay and Duddon Estuary SPA (UK9020326)
	Saltee Islands SPA (IE004002)
	Ribble and Alt Estuaries SPA (UK9005103)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Dundalk Bay SPA (IE004026)
	Carlingford Lough SPA (IE004078)
	Carlingford Lough SPA (UK9020161)
	Skerries Islands SPA (IE004122)
	South Dublin Bay and Tolka Estuary SPA (IE004024)
	Strangford Lough SPA (UK9020111)
	Outer Ards SPA (UK9020271)
Little Gull (*Larus minutus*) [A177]	Liverpool Bay SPA (UK9020294)
	Mersey Narrows and North Wirral Foreshore SPA (UK9020287)
	North-west Irish Sea SPA (IE004236)
Little Tern (*Sterna albifrons*) [A195]	North-west Irish Sea SPA (IE004236)
Mallard (*Anas platyrhynchos*) [A053]	Dundalk Bay SPA (IE004026)
Manx Shearwater (*Puffinus puffinus*) [A013]	Deenish Island and Scariff Island SPA (IE004175)
	Skelligs SPA (IE004007)
	Irish Sea Front SPA (UK9020328)
	Copeland Islands SPA (UK9020291)
	Glannau Aberdaron ac Ynys Enlli SPA (UK9013121)
	Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)
	Rum SPA (UK9001341)
	St Kilda SPA (UK9001031)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Oystercatcher (*Haematopus ostralegus*) [A130]	Dundalk Bay SPA (IE004026)
Pintail (*Anas acuta*) [A054]	Dundalk Bay SPA (IE004026)
Puffin (*Fratercula arctica*) [A204]	Lambay Island SPA (IE004069)
	Saltee Islands SPA (IE004002)
	Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Razorbill (*Alca torda*) [A200]	Lambay Island SPA (IE004069)
	Ireland's Eye SPA (IE004117)
	Rathlin Island SPA (UK9020011)
	North-west Irish Sea SPA (IE004236)
	Seas off Wexford SPA (IE004237)
Red-breasted Merganser (*Mergus serrator*) [A069]	Dundalk Bay SPA (IE004026)

Special Conservation Interests	Relevant European Site(s) (code)
Redshank (*Tringa aritim*) [A162]	Dundalk Bay SPA (IE004026)
Red-throated Diver (*Gavia stellata*) [A001]	North-west Irish Sea SPA (IE004236)
Ringed Plover (*Charadrius hiaticula*) [A137]	Dundalk Bay SPA (IE004026)
Roseate Tern (*Sterna dougallii*) [A192]	North-west Irish Sea SPA (IE004236)
Ruddy Turnstone (*Arenaria interpres*) [A169]	Boyne Estuary SPA (IE004080)
Sanderling (*Calidris alba*) [A144]	Boyne Estuary SPA (IE004080)
Sandwich Tern (*Sterna sandvicensis*) [A191]	Carlingford Lough SPA (UK9020161)
	Strangford Lough SPA (UK9020111)
Shag (*Phalacrocorax aristotelis*) [A018]	Skerries Islands SPA (IE004122)
	Lambay Island SPA (IE004069)
	North-west Irish Sea SPA (IE004236)
Shelduck (*Tadorna tadorna*) [A048]	Dundalk Bay SPA (IE004026)
	Boyne Estuary SPA (IE004080)
Storm Petrel (*Hydrobates pelagicus*) [A014]	Duvillaun Islands SPA (IE004111)
	Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)
	Inishglora and Inishkeeragh SPA (IE004084)
Teal (*Anas crecca*) [A052]	Dundalk Bay SPA (IE004026)
Wetlands and Waterbirds [A999]	Dundalk Bay SPA (IE004026)
	Carlingford Lough SPA (UK9020161)
	Boyne Estuary SPA (IE004080)
	River Nanny Estuary and Shore SPA (IE004158)
	Lough Swilly SPA (IE004075)
	Lough Foyle SPA (IE004087)
	Wexford Harbour and Slobs SPA (IE 004076)
	The Raven SPA (IE004019)
	Blacksod Bay/Broad Haven SPA (IE004037)
	Ballymacoda Bay SPA (IE004023)

4.2 Conclusion

The Stage 1 appraisal to inform screening for Appropriate Assessment (see appendix A) has concluded that, having regard to the methodology employed and the findings of the appraisal (see section 4.1), it cannot be excluded, on the basis of objective scientific information, individually or in combination with other projects, that the Project will have likely significant effects European sites, as outlined above and summarised in Table 4-1 and Table 4-2.

Accordingly, Stage 2 appraisal for Appropriate Assessment of the implications of the Project for these interests and sites is required and a NIS must be prepared in accordance with relevant guidance and regulations. It was concluded that the NIS must assess the adverse effect to site integrity to the SACs and SPAs identified in section 4.4 of the Report to Inform Screening for Appropriate Assessment (see appendix A). Where the report has concluded that, based on objective scientific information, likely significant effects on QIs of particular SACs and the SCIs of particular SPAs (as detailed in appendix A) can be excluded, these features and sites are not assessed further.



Legend

- Planning Application Boundary
- Offshore Wind Farm Area
- Offshore Cable Corridor
- Special Protection Area (United Kingdom)
- Special Area of Conservation (United Kingdom)
- Special Area of Conservation (Ireland)
- Special Protection Area (Ireland)
- Map Pages

Data Sources: OWL, NPWS, JNCC

Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 4-1: European sites identified for Stage 2 Appraisal (Overview map)

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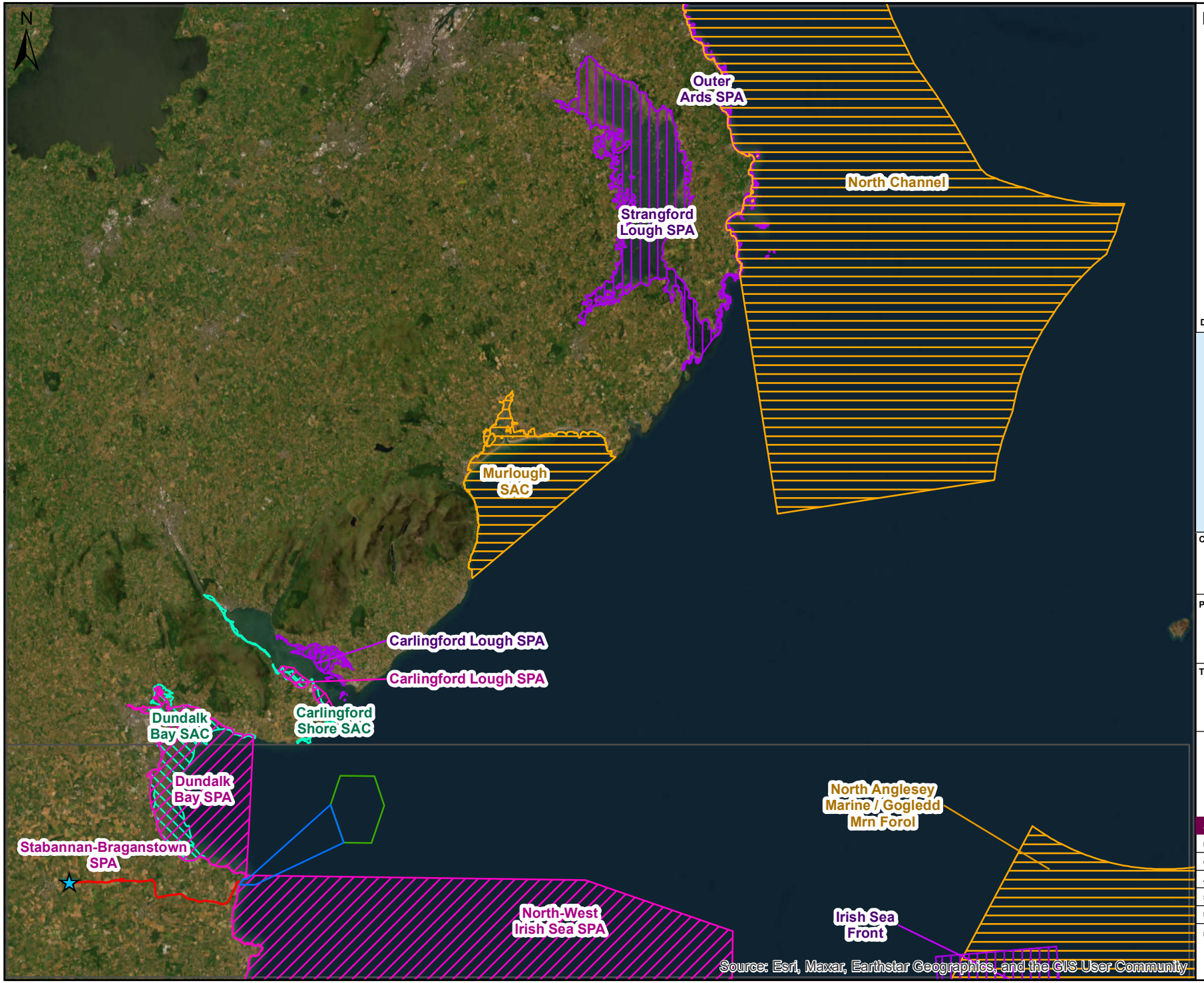
Issue Details

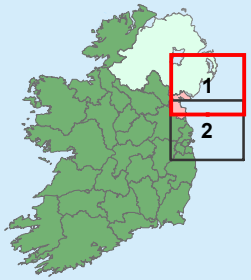
Drawn By: NR	**Project No.** MDR1520b
Checked By: HF	**File Ref:** MDR1520bArc3068F03
Approved By: CC	
Scale: 1:5,000,000 @A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 04/04/2024	



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Onshore Substation Site
- Special Protection Area (United Kingdom)
- Special Area of Conservation (United Kingdom)
- Special Protection Area (Ireland)
- Special Area of Conservation (Ireland)

Data Sources: OWL, NPWS, JNCC



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 4-1: European sites identified for Stage 2 Appraisal Map 1 of 2

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Issue Details

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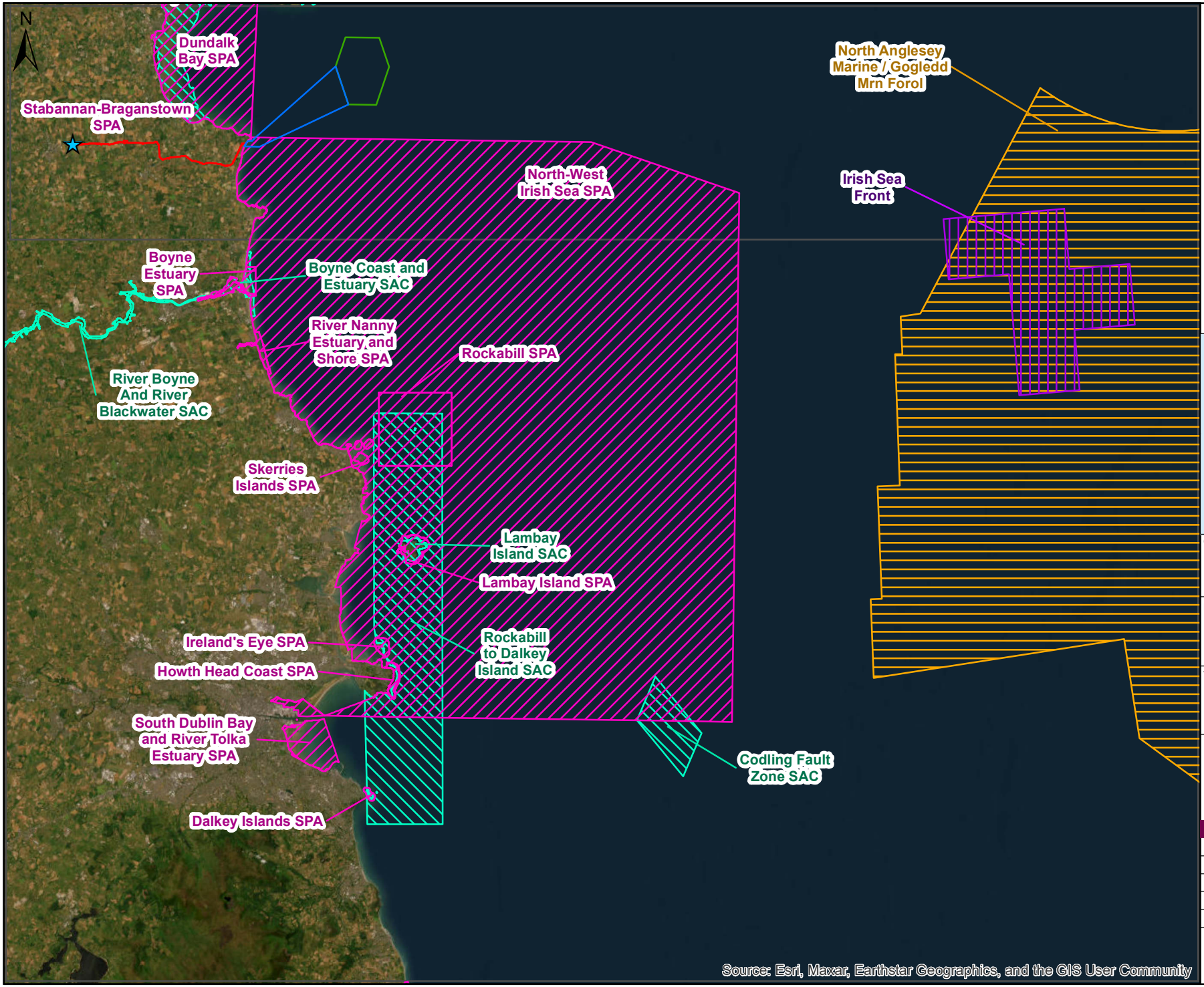
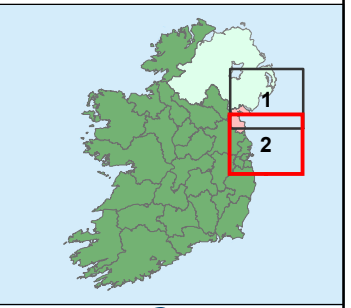
Date: 04/04/2024	



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Onshore Substation Site
- Special Protection Area (United Kingdom)
- Special Area of Conservation (United Kingdom)
- Special Protection Area (Ireland)
- Special Area of Conservation (Ireland)

Data Sources: OWL, NPWS, JNCC



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 4-1: European sites identified for Stage 2 Appraisal Map 2 of 2

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: HF	**File Ref:** MDR1520bArc3068F03
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Scale: 1:500,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 04/04/2024	

5 STAGE 2 APPRAISAL FOR APPROPRIATE ASSESSMENT: NATURA IMPACT STATEMENT

5.1 Required information

The requirement to carry out a NIS follows on from the conclusion of the Stage 1 screening appraisal (see section 4). In order to determine if the identified source-pathway-receptor linkages could result in an adverse effect to the integrity of any European site(s), the following steps have been taken:

1. Identification of the information required, including the Project, linkages to European sites, and description of relevant European sites;
2. Examination of the site-specific COs and attributes of QIs/SCIs of relevant European sites; and
3. Prediction of any adverse effect on the integrity of European site(s) of the Project, including in-combination effects.

5.1.1 Project

The Project has been described in detail in section 2 of this report.

5.1.2 Linkages to European sites

The connectivity between the Project and all relevant European sites has been assessed in the Report to Inform Screening for Appropriate Assessment (see appendix A). 16 SACs and 54 SPAs have been identified as relevant European sites for this NIS (see section 4). This NIS only assesses QIs and SCIs in relation to which it could not be excluded based on objective information following screening that the Project, either alone or in combination with other projects, would have a likely significant effect. This analysis is set out in the Report to Inform Screening for Appropriate Assessment (see appendix A), and the relevant QIs and SCIs and associated European sites are summarised in section 4 (see Table 4-1 and Table 4-2) of this report.

5.2 Annex I Habitats

5.2.1 European sites within the ZoI

5.2.1.1 Brief description of relevant sites

Carlingford Shore SAC (IE002306)

Carlingford Shore SAC is a 524 ha site located approximately 4.4 km from the Project. It comprises the entire southern shoreline of Carlingford Lough and continues round the tip of the Cooley Peninsula to just west of Cooley Point. Carlingford Mountain flanks the SAC to the south-west. The principal conservation interests of this SAC lie in two Annex I QI habitat types; perennial vegetation of stony banks and annual vegetation of drift lines. A number of other habitats can also be found in this SAC, including intertidal sand and mudflats, patches of saltmarsh, some areas of dry grassland, and an area of mixed deciduous woodland. The underlying rock within Carlingford Shore SAC is mainly carboniferous limestone, which outcrops in places in the form of bedrock shore or reefs. Granite boulders are occasionally found. Intertidal mudflats and sand/gravel banks also occur within this SAC (NPWS, 2014i).

Dundalk Bay SAC (IE000455)

Dundalk Bay SAC is a large open, shallow sea bay with an area of 5,196 ha, located approximately 3.3 km from the Project. This site is of significant conservation value as it supports good examples of a range of coastal habitats, with six Annex I QI habitat types. It comprises extensive saltmarshes and intertidal sand/mudflats, extending some 16 km from Castletown River on the Cooley Peninsula in the north, to Annagassan/Salterstown in the south. Dundalk Bay encompasses the mouths and estuaries of the Rivers Dee, Glyde, Fane, Castletown and Flurry (NPWS, 2014g).

Boyne Coast and Estuary SAC (IE001957)

Boyne Coast and Estuary SAC is a 629 ha coastal site located approximately 8.6 km from the Project. It comprises most of the tidal sections of the River Boyne, intertidal sand- and mudflats, saltmarshes, marginal grassland, and the stretch of coast from Bettystown to Termonfeckin that includes the Mornington and Baltray sand dune systems. This coastal complex supports good examples of eight Annex I QI habitat types, including one which is listed with priority status (NPWS, 2016a).

Rockabill to Dalkey Island SAC (IE003000)

Rockabill to Dalkey Island SAC is a very large site, c. 27,286 ha in area, located approximately 28.4 km from the Project. It includes a range of dynamic inshore and coastal waters in the western Irish Sea, encompassing Dalkey, Muglins and Rockabill islands. The site comprises sandy and muddy seabed, reefs, sandbanks and islands. It is of conservation importance for reefs, which is a QI habitat listed on Annex I, and Harbour Porpoise (*Phocoena phocoena*), which is a QI species listed on Annex II, of the E.U. Habitats Directive. The SAC extends southwards, in a strip approximately 7 km wide and 40 km in length, from Rockabill, running adjacent to Howth Head, and crosses Dublin Bay to Frazer Bank in south Co. Dublin (NPWS, 2014j).

Lambay Island SAC (IE000204)

Lambay Island is a large (250 ha), privately owned and inhabited island which lies 4 km off Portrane on the north Co. Dublin coast. Lambay Island SAC is approximately 404 ha in area and is located 40.9 km south of the Project. This SAC has two Annex I QI habitat types and three Annex II QI species, Grey Seal (*Halichoerus grypus*),Common (Harbour) Seal (*Phoca vitulina*) and Harbour porpoise (*Phocoena phocoena*). The island rises to 127 m and is surrounded to the north, east and south by steep cliffs, which contain a good diversity in height, slope and aspect. The west shore is low-lying and the land slopes gently eastwards to the summit in the centre of the island. The underlying geology of Lambay Island is dominated by igneous rocks (of andesitic type) and ash. However, the geology varies and also present are shales and limestones of Silurian origin, limestone conglomerates, and shales from the Old Red Sandstone era. The bedrock is exposed on the fringing cliffs and in rocky outcrops of the island; elsewhere it is overlain by varying depths of glacial drift (NPWS, 2024a).

Murlough SAC (UK0016612)

Murlough SAC is a large site of approximately 11,904 ha, located 22 km north of the Project. This SAC adjoins Dundrum Bay and includes the shallow waters of the Bay itself, of importance as the largest area of shallow sub-littoral sandbanks in Northern Ireland. There are also extensive inter-tidal sands and muds, and the beach area at Ballykinler is an important haul-out site for Common Seal (Harbour Seal). The Inner Bay also supports limited saltmarsh. The terrestrial element of this SAC comprises the major dunes systems of Murlough and Ballykinler, together with the low dunes and ridges of the Royal County Down golf club, which are relatively intact. These host a range of dune communities, but most important are the dune heath and grey dune grasslands. This site is of significant conservation interest, with eight Annex I QI habitat types and two Annex II QI species (DAERA, 2018b).

5.2.1.2 Conservation Objectives

Site specific COs for the relevant SACs were reviewed. The CO attributes which could potentially be adversely affected by the Project were then identified, for relevant QIs scoped into the Stage 2 assessment (i.e., QIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects) (Table 5-1).

Table 5-1: Conservation Objective attributes for relevant Annex I Habitats.

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Carlingford Shore SAC (IE002306) (NPWS, 2013b; Version 1, 15/07/2013)		
Annual vegetation of drift lines [1210]	To maintain the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Dundalk Bay SAC (IE000455) (NPWS, 2011a; Version 1, 19/07/2011)		
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	To maintain the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Estuaries [1130]	To restore the favourable conservation condition	Habitat area Community distribution
Mediterranean salt meadows (*Juncetalia maritimae*) [1410]	To maintain the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Mudflats and sandflats not covered by seawater at low tide [1140]	To maintain the favourable conservation condition	Habitat area Community distribution
Salicornia and other annuals colonising mud and sand [1310]	To restore the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Boyne Coast and Estuary SAC (IE001957) (NPWS, 2012b; Version 1, 31/10/2012)		
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	To maintain the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Embryonic shifting dunes [2110]	To restore the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Estuaries [1130]	To maintain the favourable conservation condition	Habitat area Community distribution
Mediterranean salt meadows (*Juncetalia maritimae*) [1410]	The status of Mediterranean salt meadows (*Juncetalia maritimi*) as a qualifying Annex I habitat for Boyne Coast and Estuary SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this habitat. However, in the absence of available site-specific conservation objectives (SSCOs) for Mediterranean salt meadows (*Juncetalia maritimae*) [1410] of the Boyne Coast and Estuary SAC (IE001957), the next closest	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
	European site along the east coast designated for this habitat type present under similar environmental conditions, has been used as a proxy. In this case, the next closest European site from which substitute SSCOs can be obtained is Dundalk Bay SAC (IE000455), located c. 13.6 km north of the Boyne Coast and Estuary SAC.	
Mudflats and sandflats not covered by seawater at low tide [1140]	To maintain the favourable conservation condition	Habitat area Community distribution
Salicornia and other annuals colonising mud and sand [1310]	To restore the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]	To restore the favourable conservation condition	Habitat area Habitat distribution Physical structure Vegetation structure Vegetation composition
Rockabill to Dalkey Island SAC (IE003000) (NPWS, 2013a; Version 1 07/05/2013)		
Reefs [1170]	To maintain the favourable conservation condition	Habitat area Habitat distribution Community structure
Lambay Island SAC (IE000204) (NPWS, 2013d; Version 1 22/07/2013)		
Reefs [1170]	To maintain the favourable conservation condition	Habitat area Distribution Community structure
Murlough SAC (UK0016612) (DAERA, 2018; Version 4 November 2018)		
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	To maintain (or restore where appropriate) to favourable condition	Area of saltmarsh Mobility Physical structure Saltmarsh community diversity Presence of associated semi-natural habitats Maintain frequency of positive indicators for low-level marsh Sward height Maintain frequency of positive indicators for middle marsh communities Maintain frequency of positive indicators for upper marsh communities Frequency and/or % cover of Spartina encroachment into the saltmarsh communities Frequency and % cover of negative indicators excluding Spartina Frequency and % cover of scrub/tree encroachment into transitional communities Cover of litter/thatch accumulation % cover of bare ground Saltmarsh hydrology

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
		Maintain distinctive elements at current extent/levels and/or in current locations
Embryonic shifting dunes [2110]	To maintain (or restore where appropriate) to favourable condition	Area Area of mosaic communities and associated habitats Frequency of community character species Presence of rare or scarce species specific to the site
Mudflats and sandflats not covered by seawater at low tide [1140]	To maintain (or restore where appropriate) to favourable condition	Morphological naturalness Characteristic biotopes at sites chosen so as to provide some indication of the distribution and extent of the Sub Feature Species composition of selected biotopes at monitoring sites Distribution of Zostera beds. Extent Taxonomic composition Density
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]	To maintain (or restore where appropriate) to favourable condition	Area Area of mosaic communities and associated habitats Bare ground Frequency of community character species Frequency of non-native species Frequency and % cover of Sea buckthorn encroachment Presence of rare or scarce species specific to the site
Sandbanks which are slightly covered by sea water all the time [1110]	To maintain (or restore where appropriate) to favourable condition	Extent and disturbance Characteristic biotopes at sites chosen so as to provide some indication of the distribution and extent

5.2.2 Baseline environment

The baseline environment for QI habitats has been fully characterised in appendix I: Onshore Biodiversity – Supporting Information and appendix D: Benthic Subtidal and Intertidal Ecology – Supporting Information.

5.2.2.1 Data validity and limitations

Data validity depends on the sensitivity of the baseline environment and the nature and type of potential impacts that arise as a result of the Project. Table 5-2 provides details on the validity of the survey data used to inform the assessment of Annex I habitats, and has been reviewed in line with the CIEEM Advice Note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019). CIEEM (2019) provides guidance on the age of survey data that can be used to inform the assessment. Where CIEEM does not provide guidance on a particular survey type, professional judgement has been provided.

Table 5-2: Baseline environment - data validity.

Survey Title	Period of survey	Recommended lifespan for the data	Is data valid? Yes /No Notes
Habitats	February, July and October 2019; September 2020; July and November 2022; and April 2023.	18 months - 3 years (CIEEM, 2019)	Yes. There has been limited (if any) change in the land management of the wider area of the Project. Therefore, there has been no significant change in the ecological function or condition of these habitats.
Protected Flora	As for habitats	18 months - 3 years (CIEEM, 2019)	Yes. There has been limited (if any) change in the land management of the wider area of the Project. Therefore, there has been no significant change in the ecological function or condition of habitats in the wider area of the Project, or the likely increase or decrease of the presence of protected flora or IAPS.
Invasive alien plants and animals	As for habitats	18 months - 3 years (CIEEM, 2019)	

In relation to desk study data limitations, sources of desk study information are neither exhaustive nor necessarily easily available, and an extensive effort was made to obtain ecological data in the public domain to inform the description of the baseline environment and its assessment. Additional information, not in the public domain, is likely to exist, but could not be obtained or assessed here. This limitation is acknowledged and incorporated into the assessment and is deemed to not affect the certainty or predictability of this report.

In relation to field study limitations, the receiving environment (i.e. baseline condition) may naturally vary through seasons and between years (NRA, 2008). All reasonable effort has been made to address this (e.g. combined use of desk and field survey data). This limitation is acknowledged and incorporated into the assessment and is deemed to not affect the certainty or predictability of this report. The timings of the surveys were considered to have been completed during the optimal survey periods (NRA, 2008), however assessment of variation between years has not been incorporated.

The lifespan of ecological data has been assessed against the outline timeframes suggested by CIEEM (2019), and using professional judgment on these timeframes and the likely impacts of the Project, the field studies have been deemed suitable for the purpose of this assessment. These limitations are acknowledged and incorporated into the assessment and are deemed to not affect the certainty or predictability of this report.

5.2.3 Project design parameters

Table 5-3 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on onshore biodiversity.

Table 5-4 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on benthic, subtidal and intertidal biodiversity.

The final location and layout of the Transition Joint Bay will be confirmed post consent on examination of the electrical and thermal properties of the selected offshore export cable and the ground conditions at the landfall (see design flexibility details in section 2 - Project Description). The assessment of adverse effects in section 5.2.5 considers two proposed options as outlined in Table 5-3.

Table 5-3: Project design parameters used for the assessment of potential impacts on onshore biodiversity.

Potential impact	Phase[1] C O D	Project design parameters	Justification
Disturbance from noise, vibration, lighting and human presence on ecological features	✓ x ✓	**Construction phase:** All construction activities (including mobilisation, site investigations, excavation, through to reinstatement) and machinery used to construct the onshore infrastructure including the TJB (TJB) (Option 1 / Option 2), 29 joint bays, 20.1 km of onshore cable, substation, grid connection and fibre optic cable connection, within the planning application boundary over a 27 month construction programme. This includes all excavations and potential for night time working for the installation of the onshore cable from the landfall to the onshore substation site; HDD activities at five locations, open trench crossings at three locations; seven temporary construction compounds, and all excavations and works to construct the onshore substation. Disturbance from construction activities also includes works between the LWM and HWM i.e. installation and trenching of the offshore cable for connection to the onshore cable at the transition joint bay. **Decommissioning phase:** Removal of onshore substation infrastructure and removal of onshore cable i.e. cable, joint bays and link boxes.	Activities within the planning application boundary that have the potential to result in disturbance.
Removal and/or fragmentation of important ecological features	✓ x x	Permanent removal of vegetation and habitats at onshore substation, TJB. Temporary removal of vegetation and habitats at passing bays (where located away from the public road), and installation of onshore cable.	The maximum spatial extent of habitats which will be removed (temporarily/permanently) in the planning application boundary.
Surface water run-off carrying suspended silt or contaminants into local watercourses	✓ x ✓	All excavations and works in the planning application boundary.	The area where surface water run-off carrying suspended silt or contaminants could arise and discharge into local watercourses.

1 C= Construction, O = Operation, D = Decommissioning

Due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore export cable and offshore inter array cables will be confirmed during construction (design flexibility, see section 2 – Project Description). For the purposes of the assessment presented in section 5.2.5, the maximum length of cables has been considered to ensure the potential for maximum impact is assessed. Should the lengths of cables be less than those specified, then the potential for effects will be less than what is outlined in section 5.2.5. An alternative route within the offshore wind farm area of offshore cable corridor won't change the assessment presented in section 5.2.5.

Table 5-4: Project design parameters used for the assessment of potential impacts on benthic subtidal and intertidal ecology.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
Temporary subtidal habitat loss/disturbance	✓	✓	✓	**Construction phase** 709,500 m^2 of temporary habitat loss/disturbance due to: • Use of jack-up vessels during foundation installation, with two jack-up events per WTG and four jack-up events for the OSS; • Installation of 41 km inter-array cables and 16 km offshore export cable with seabed disturbance width of 10m; and • Sand wave clearance for 10% of inter-array cables and 10% of the export cable. Offshore construction phase duration of 15 months. **Operational and maintenance phase** 387,000 m^2 of temporary habitat loss/disturbance due to: • Component replacement activities using jack-up vessel associated with 25 WTGs (average of two major component replacements per year) and OSS; • Inter-array cables: seven repair events and seven reburial events over the lifetime of the Project; and • Offshore cable: three subtidal repair events and three reburial events over the lifetime of the Project. Operational phase of 40 years. **Decommissioning phase** 624,000 m^2 of temporary habitat loss/disturbance. Parameters are assumed to be the same as for the construction phase however seabed preparation and seabed clearance (prior to foundation installation) will not take place during the decommissioning phase.	These values accounts for project specific WTG and OSS foundation types, and maximum length of cables resulting in greatest extent of temporary habitat loss. Maximum proportion of cables requiring seabed clearance prior to cable installation.
Injury and/or disturbance to fish from underwater noise during pile-driving	✓	✗	✗	**Construction phase** Maximum spatial: • 26 monopiles (WTGs and OSS) of 9.6 m diameter; • Average maximum hammer energy of 2,500 kJ (absolute maximum of up to 3,500 kJ); • Average 5 hours piling per pile (maximum of 8 hours) with one pile expected to be installed in each 24-hour period; • Maximum of up to 208 hours piling over a total of 26 days.	The assessment considers the maximum hammer energies and maximum piling duration for monopile installation. In many cases, monopile installation will require lower hammer energies and shorter piling durations.
Increased suspended sediment concentrations and associated sediment deposition	✓	✓	✓	**Construction phase** WTGs and OSS installed on monopile foundations: • Drilled installation of 9.6 m diameter pile. • Installation of inter-array and offshore cables: – Disturbance of seabed material from a 3 m wide and 3 m deep trench for offshore cable and 1 m wide and 3 m deep for inter-array cables; and – Modelled cable lengths over areas of sand and muddy sand.	Greatest volume of sediment released into the water column.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
				Operational and maintenance phase Cable repair/reburial activities: • Inter-array cables: seven repair events and seven reburial events over the lifetime of the project; and • Offshore cable: three repair events and three reburial events over the lifetime of the project. **Decommissioning phase** WTGs and OSS on monopile foundations: • Cutting and removal of monopile foundations to approximately 2 m below seabed. Removal of inter-array and offshore cables: • Disturbance of seabed material from a 3 m wide and 3 m deep trench for offshore cable and 1 m wide and 3 m deep for inter-array cables.	
Long-term subtidal habitat loss	✗	✓	✗	**Operational and maintenance phase** 332,121 m^2 of long-term habitat loss due to: • Presence of 26 (i.e. 25 x WTG + 1 x OSS) monopile foundations with diameter of 9.6 m and associated scour protection; and • Presence of cable protection associated with 41 km inter-array cables and 16 km offshore cables. Assumes up to 50% of inter-array cable route and up to 50% of offshore cable corridor may require cable protection. Operational phase up to 40 years.	These values account for the WTG and OSS foundation types and associated scour protection, maximum length of cables and cable protection resulting in greatest extent of habitat loss.
Electromagnetic Fields (EMF) from subsea electrical cabling	✗	✓	✗	**Operational and maintenance phase** Presence of inter-array and offshore export cables: • 41 km of 66 kV AC inter-array cable • 16 km of 220 kV export cables; • Burial depths of between 0.5 m and 3 m; • 50% of inter-array cable route and 50% of offshore cable corridor may require cable protection. Operational phase of 40 years.	Maximum length of cables and minimum burial depth (greater the depth the more the EMF is attenuated).

1 C = Construction, O = Operation, D = Decommissioning

5.2.4 Measures included in the Project

As part of the project design process (see section 2), a number of measures have been proposed to reduce the potential for impacts on onshore biodiversity and benthic, subtidal and intertidal ecology receptors. These measures were not taken into account at the Stage 1 screening appraisal described in the Report to Inform Screening for Appropriate Assessment (see appendix A) in accordance with guidance and prevailing case law but can lawfully be taken into account for the Stage 2 appraisal.

These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 5.2.5. These measures are considered standard industry practice for this type of development. This approach has taken regard of the mitigation hierarchy as described by CIEEM (2018), where a sequential process is adopted to avoid, mitigate and compensate negative ecological impacts and effects.

Measures relevant to Annex I terrestrial features are presented in Table 5-5. Measures relevant to Annex I intertidal and benthic receptors are presented in Table 5-6.

Table 5-5: Measures included in the Project – onshore biodiversity.

Measures included in the Project	Justification
Construction and Environmental Management Plan (CEMP) For overall Onshore Biodiversity management, a CEMP has been prepared and will be implemented (see appendix K: Management Plans). The CEMP will cover the construction phase of the Project and will include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. The CEMP will be updated by the Contractor following receipt of planning consent to ensure that all relevant planning conditions are incorporated as environmental management measures to be applied during the construction phase.	Measures will be adopted to ensure that the potential for release of pollutants from the construction phase is minimised. In this manner, accidental release or potential release of contaminants from vehicles will be strictly controlled, thus providing protection for important ecological features.
Reduction of impact on sites designated for nature conservation Timing of the works at the landfall location (i.e. transition joint bay, the onshore cable route construction, and the offshore cable construction where it occurs between the LWM and HWM) will avoid the peak season for intertidal birds (October to April, inclusive). Timing of vegetation removal works will avoid the bird nesting season (March to August, inclusive).	These measures have been included in the Project to reduce the impact on designated sites for nature conservation (including European sites).
Pre-construction surveys Pre-construction surveys (complete protected and invasive species survey, including breeding bird assessment). See appendix I: Biodiversity – Supporting Information for specific detailed measures.	This is a standard measure to account of any changes in important ecological features between the time when surveys are completed and time of commencement of construction.
Disturbance measures Timing of the works at the landfall to avoid the peak season for overwintering birds using intertidal wetland areas of SPA sites (October to April, inclusive). Timing of vegetation removal works to avoid the bird nesting season (March to August, inclusive). Avoidance of light spill during night-time hours, and badger buffer zones between 30 m and 150 m depending on works type and season. See appendix I: Biodiversity – Supporting Information for specific detailed measures.	These measures have been designed into the Project to reduce the potential disturbance effects on protected species and their use of habitats upon which they depend.
Removal and/or fragmentation measures Timing of the works to avoid the bird nesting season (March to August, inclusive), replacement of all removed hedgerows, retention of trees with moderate suitability to roosting bats, and soft felling of trees with low suitability for roosting bats. See appendix I: Biodiversity – Supporting Information for specific detailed measures.	These measures have been designed into the Project to reduce the potential removal and/or fragmentation effects on protected species and their use of habitats upon which they depend.
Surface water pollution measures Timing of the instream works to avoid the IFI recommended 'closed season' (October to May, inclusive), and protection of watercourses from siltation, hydrocarbons and other pollutants using suitable material storage, procedures, buffer zones, and sediments control measures. See appendix I: Biodiversity – Supporting Information for specific detailed measures.	These measures have been designed into the Project to reduce the potential surface water pollution effects on protected species and habitats.
Groundwater pollution measures Dewatering all groundwater from the trench, joint bays and substation will be managed. Groundwater and surface water accumulating in the base of trenches will not be pumped directly to roadside drains or watercourses unless it is clean and free from solids. Solids-contaminated water will be discharged to a designated percolation area designated by a competent person if the soil is not waterlogged. In the case of heavy contamination, the water will either be removed off-site for disposal in a licensed facility by tank truck or pumped to a portable on-site settlement tank for treatment. These operations will be monitored by a designated competent member of the construction team on a regular basis to ensure that they are working effectively. See appendix I: Biodiversity – Supporting Information, for specific detailed measures.	These measures have been designed into the Project to reduce the potential groundwater pollution effects on protected species and habitats.
Invasive alien plant species Invasive Alien Plant Species (IAPS) avoidance and management measures will be implemented to identify the known IAPS locations and provide detailed buffer zones for working (e.g. 10 m of all occurrences), and protocols for groundworks and contaminated material removal. See appendix I: Biodiversity – Supporting Information, for specific detailed measures.	These measures have been designed into the Project to reduce the potential spread of invasive alien plant species.

Table 5-6: Measures included in the Project – benthic subtidal and intertidal ecology.

Measures included as part of the Project	Justification
An Environmental Management Plan (EMP) (offshore) (see appendix K: Management Plans) has been prepared and will be implemented during the construction, operational and maintenance and decommissioning phases of the Project. The EMP includes Project specific measures and commitments and a Marine Pollution Contingency Plan (MPCP) (see appendix K: Management Plans). Measures also include: designated areas for refuelling where spillages can be easily contained, storage of chemicals in secure designated areas in line with appropriate regulations and guidelines, double skinning of pipes and tanks containing hazardous substances, and storage of these substances in impenetrable bunds.	To ensure that the potential for release of pollutants from construction, operational and maintenance, and decommissioning plant is minimised. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project development.
A pre-construction survey will be undertaken within the offshore wind farm area and offshore cable corridor to identify any areas of reef habitat (particularly *Modiolus* beds and *S. spinulosa* reef habitats). This will include a geophysical survey and drop down video survey to determine the extent, distribution and quality/condition of any reef. Should reef areas be identified during pre-construction surveys, appropriate measures will be agreed with regulatory and nature conservation bodies to avoid direct impact on these features. Where possible, features will be avoided by layout refinement of foundations and cables.	Biogenic reef habitats have been identified as having the potential to occur in the offshore wind farm area however no evidence of these have been recorded during site-specific surveys. As these are OSPAR habitats and/or Annex I habitats protected under the Habitats Directive, direct impacts on these habitats should be avoided wherever possible. Pre-construction surveys to determine extent, distribution and quality/condition of reef habitats will inform appropriate mitigation measures (e.g. layout refinement) to avoid such impacts.
A Marine Invasive Non-native Species Management Plan (see appendix K: Management Plans) has been prepared and will be agreed with statutory consultees prior to implementation. The plan outlines measures to ensure vessels comply with the International Maritime Organisation (IMO) ballast water management guidelines, it will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted in the event that a high alert species is recorded.	To manage and minimise the risk of potential introduction and spread of Invasive Non-Indigenous Species.
Reinstatement of rock in the intertidal zone following cable installation. Any cut rock will be placed back on top of the cable to backfill the trench.	To promote recovery of associated communities within the area affected.

5.2.5 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project is outlined in Table 5-7.

Table 5-7: Prediction of adverse effects on site integrity during the construction, operational and maintenance, and decommissioning phases of the Project.

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
Carlingford Shore SAC (IE002306) (NPWS, 2013b; Version 1, 15/07/2013) (NPWS, 2019)			
Annual vegetation of drift lines [1210]	Surface water pollution.	Bottom culture (F01.03); Regular motorized driving (G01.03.01); Suspension culture (F01.02); Marine and Freshwater Aquaculture (F01); Fishing and harvesting aquatic resources (F02); Other human intrusions and disturbances (G05); Other (i.e. drift nets) (F05.07); Hand raking (F04.02.01); Pollution to surface waters (limnic, terrestrial,	**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified.

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
		marine & brackish) (H01); Pollution to surface waters by industrial plants (H01.01); Motorised vehicles (G01.03).	**Vegetation composition** -Potential identified.
Dundalk Bay SAC (IE000455) (NPWS, 2011a; Version 1, 19/07/2011) (NPWS, 2020b)			
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Surface water pollution.	Diffuse pollution to surface waters due to transport and infrastructure without connection to canalization/sweepers (H01.06); Sea; Erosion (K01.01); Invasive non-native species (I01); Biocenotic evolution, succession (K02); Shallow surface abrasion/ mechanical damage to seabed surface (G05.02); Competition (floral relations) (K04.01); Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Disposal of inert materials (E03.03); Reduction or loss of specific habitat features (J03.01); Anthropogenic reduction of habitat connectivity (J03.02).	**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Estuaries [1130]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Community distribution** -Potential identified.
Mediterranean salt meadows (*Juncetalia maritimae*) [1410]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Mudflats and sandflats not covered by seawater at low tide [1140]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Community distribution** -Potential identified.
Salicornia and other annuals colonising mud and sand [1310]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Boyne Coast and Estuary SAC (IE001957) (NPWS, 2012b; Version 1, 31/10/2012) (NPWS, 2018d)			
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Surface water pollution.	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Biocenotic evolution, succession (K02);	**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
		Removal of sediments (i.e. mud) (J02.02); Off-road motorized driving (G01.03.02); Storage of materials (E05).	-Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Embryonic shifting dunes [2110]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Estuaries [1130]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Community distribution** -Potential identified.
Mediterranean salt meadows (*Juncetalia maritimae*) [1410]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Mudflats and sandflats not covered by seawater at low tide [1140]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Community distribution** -Potential identified.
Salicornia and other annuals colonising mud and sand [1310]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]			**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
			-Potential identified. **Physical structure** -Potential identified. **Vegetation structure** -Potential identified. **Vegetation composition** -Potential identified.
Rockabill to Dalkey Island SAC (IE003000) (NPWS, 2013a; Version 1 07/05/2013) (NPWS, 2019d)			
Reefs [1170]	Surface water pollution.	Shipping lanes (D03.02); Discharges (E03); Utility and service lines (D02); Noise nuisance, noise pollution (H06.01).	**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Habitat distribution** -Potential identified. **Community structure** -Potential identified.
Lambay Island SAC (000204) (NPWS, 2013d; Version 1; 22/07/2013) (NPWS, 2019e)			
Reefs [1170]	Surface water pollution.	Industrial or commercial areas (E02).	**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat. **Distribution** -Potential identified. **Community structure** -Potential identified.
Murlough SAC (UK0016612) (DAERA, 2018; Version 4; November 2018) (Joint Nature Conservation Committee (JNCC), 2015h)			
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Surface water pollution.	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Changes in abiotic conditions (M01); Biocenotic evolution, succession (K02); Problematic native species (I02); Invasive non-native species (I01).	**Area of saltmarsh** -None predicted as Project avoids activity within and/or removal of this habitat. **Mobility** -Potential identified. **Saltmarsh community diversity** -Potential identified. **Presence of associated semi-natural habitats** -Potential identified. **Maintain frequency of positive indicators for low-level marsh** -Potential identified. **Sward height** -Potential identified. **Maintain frequency of positive indicators for low-level marsh communities** -Potential identified. **Maintain frequency of positive indicators for middle marsh communities** -Potential identified. **Maintain frequency of positive indicators for upper marsh communities** -Potential identified. **Frequency and/or % cover of Spartina encroachment into the saltmarsh communities**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
			-Potential identified. **Frequency and % cover of negative indicators excluding Spartina** -Potential identified. **Frequency and % cover of scrub/tree encroachment into transitional communities** -Potential identified. **Cover of litter/thatch accumulation** -Potential identified. **% cover of bare ground** -Potential identified. **Maintain distinctive elements at current extent/levels and/or in current locations** -Potential identified.
Embryonic shifting dunes [2110]			**Area** -None predicted as Project avoids activity within and/or removal of this habitat. **Area of mosaic communities and associated habitats** -None predicted as Project avoids activity within and/or removal of this habitat. **Frequency of community character species** None predicted as Project avoids activity within and/or removal of this habitat. **Presence of rare or scarce species specific to the site.** None predicted as Project avoids activity within and/or removal of this habitat.
Mudflats and sandflats not covered by seawater at low tide [1140]			**Morphological naturalness** -Potential identified. **Characteristic biotopes at sites chosen so as to provide some indication of the distribution and extent of the Sub Feature.** -Potential identified. **Species composition of selected biotopes at monitoring sites.** -Potential identified. **Distribution of Zostera beds.** -Potential identified. **Extent** -None predicted as Project avoids activity within and/or removal of this habitat. **Taxonomic composition** -Potential identified. **Density** -Potential identified.
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]			**Area** -None predicted as Project avoids activity within and/or removal of this habitat. **Area of mosaic communities and associated habitats** -None predicted as Project avoids activity within and/or removal of this habitat.

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
			Bare ground -None predicted as Project avoids activity within and/or removal of this habitat. **Frequency of community character species** -None predicted as Project avoids activity within and/or removal of this habitat. **Frequency of non-native species** -None predicted as Project avoids activity within and/or removal of this habitat. **Frequency and % cover of Sea buckthorn encroachment.** -None predicted as Project avoids activity within and/or removal of this habitat. **Presence of rare or scarce species specific to the site**. -None predicted as Project avoids activity within and/or removal of this habitat.
Sandbanks which are slightly covered by sea water all the time [1110]			**Extent and disturbance** -None predicted as Project avoids activity within and/or removal of this habitat. **Characteristic biotopes at sites chosen so as to provide some indication of the distribution and extent.** -Potential identified.

5.2.5.1 Construction/decommissioning phase

As previously noted in the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A), there is no spatial overlap between the Project and any of the relevant Annex I coastal/marine habitats. In this case, direct impacts (e.g. habitat loss) will not occur. As such, adverse effects on the COs targets for 'habitat area' associated with the QIs of all relevant European sites will not occur.

For the remaining CO attributes (i.e. distribution, physical structure, vegetation composition, vegetation structure, community structure, mobility, community diversity, mobility, associated semi-natural habitat, positive indicators etc., see Table 5-7) potential for adverse effects are associated with water pollution and more specifically, suspended sediments causing sedimentation. However, using numerical modelling to inform the predictions made with respect to increases in suspended sediment and subsequent deposition, adverse effects will not occur (see appendix B: Marine Processes Technical Report; and appendix D: Benthic Subtidal and Intertidal Ecology – Supporting Information). A summary of the results of this analysis are detailed below:

- Computational modelling (based on a worst case scenario) to analyse the spread of sediment brought into suspension during the construction phase alongside wave climate and tidal currents was carried out by RPS (see appendix B: Marine Processes Technical Report). The modelling analysis concluded that during the course of the installation of wind turbine structures, increases in suspended sediment concentrations do not even extend to the closest designated area of Dundalk Bay SAC. For the installation of drilled structures in the northeast of the site, analysis did indicate that on occasion sediment plumes extend to the mouth of Carlingford Lough, however maximum concentrations are < 5 mg/l (average values are less than 3 mg/l) and do not persist through multiple tidal cycles or result in discernible sedimentation.

- Additionally, sediment plumes originating from inter-array trenching activities were shown to not extend to any of the European sites. Similarly, the offshore cable installation does not affect the nearby Carlingford shore SAC or the Dundalk SAC. Plumes may reach the outer extent of Dundalk SPA at the southern end of the Bay and maximum concentrations may reach 300 mg/l on occasion (which is akin to turbidity levels experienced during storm conditions, see appendix B: Marine Processes Technical Report), but typical values are one hundredth of this, elevated levels do not persist through multiple tidal cycles and no discernible sedimentation occurs following the installation.

- Based on this analysis, any elevated concentrations of suspended sediments arising during the construction phase would decrease in the water column of the open sea over time and with distance and across the normal tidal cycle as sediments and concentrations of pollutants disperse and dilute to background levels.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.2.5.2 Operational and maintenance phase

As previously noted in the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A), there is no spatial overlap between the Project and any of the relevant Annex I coastal/marine habitats. In this case, direct impacts (e.g. habitat loss) will not occur. As such, adverse effects on the COs targets for habitat area associated with the QIs of all relevant European sites (i.e. 'stable or increasing, subject to natural processes, including erosion and succession') will not occur.

For the remaining CO targets, (i.e. distribution, physical structure, vegetation composition, vegetation structure, community structure, mobility, community diversity, mobility, associated semi-natural habitat, positive indicators etc., see Table 5-7) potential for adverse effects were associated with water pollution and more specifically, suspended sediments causing sedimentation. However, when considering numerical modelling used to inform the predictions made with respect to increases in suspended sediment and subsequent deposition, no predicted adverse effect can occur (see appendix B: Marine Processes Technical Report; and appendix D: Benthic Subtidal and Intertidal Ecology – Supporting Information). A summary of the results of this analysis is detailed below:

- Computational modelling to analyse the spread of sediment brought into suspension during the operational and maintenance phase (post-construction) alongside wave climate and tidal currents was carried out by RPS (see appendix B: Marine Processes Technical Report). For the analysis, the post-construction residual current was calculated over the course of one complete typical tidal cycle and compared with the baseline.

- The modelling analysis concluded that the presence of wind turbine structures have little influence on the flow domain and that the Project will have no discernible effect on sediment transport during operation, given that the baseline transport is limited and that any changes to the residual currents which drive transport are minimal.

Based on this analysis, sediment associated with the operational and maintenance phase of the Project will not jeopardise the conservation targets for habitat distribution; community distribution; physical structure; vegetation structure; and vegetation composition of coastal/marine habitats as it will not make any significant changes to the existing sediment transport regime.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.3 Annex II Marine Mammals and Megafauna

5.3.1 European sites within the ZoI

5.3.1.1 Brief description of relevant sites

Slaney River Valley SAC (IE000781)

Slaney River Valley is a large SAC with an area of 6,018 ha. The Slaney River flows through the counties of Wicklow, Carlow and Wexford. It is located approximately 93.4 km south of the Project. Slaney River Valley is of considerable conservation significance, supporting eight Annex II QI species and seven Annex I QI habitat types, one of which is listed with priority status. The site comprises the freshwater stretches of the River Slaney as far as the Wicklow Mountains; a number of tributaries, the larger of which include the Bann, Boro, Glasha, Clody, Derry, Derreen, Douglas and Carrigower Rivers; the estuary at Ferrycarrig; and Wexford Harbour. The site supports regionally significant numbers of Common Seal. A number of towns are located adjacent to but not within the SAC, including Baltinglass, Hacketstown, Tinahely, Tullow, Bunclody, Camolin, Enniscorthy and Wexford. Slaney River is up to 100 m wide in places and is tidal at the southern end from Edermine Bridge below Enniscorthy. The geology consists of granite in the upper and central regions, almost as far as the confluence with the Derry River, and the Slaney river has cut a gorge into the granite plain above Kilcarry Bridge. The Derry and Bann Rivers are bounded by a narrow line of uplands which corresponds to schist outcrops. Where these tributaries cut through this belt of hard rocks they have carved deep gorges, which are more than two miles long at Tinahely and Shillelagh. The Slaney flows through an area of Ordovician slates and grits south of Kildavin (NPWS, 2015i).

Rockabill to Dalkey Island SAC (IE003000)

See section 5.2.1.1.

Lambay Island SAC (IE000204)

See section 5.2.1.1.

Murlough SAC (UK0016612)

See section 5.2.1.1.

North Channel SAC (UK0030399)

North Channel is a very large SAC, approximately 160,367 ha in area. It is located along the eastern coast of Northern Ireland, c. 47.8 km from the Project. This site has been identified as an important winter area for

harbour porpoise, which is an Annex II species and therefore a qualifying interest for this SAC. It is estimated that the North Channel supports 1.2 % of the UK Celtic and Irish Seas Management Unit population of this species. The site includes important locations where large groups of up to 100 harbour porpoises have been observed. Habitats within the North Channel consist mainly of coarse or sandy sediments, with smaller patches of rock and mud. Along the eastern boundary of the site, water depths reach a maximum of 150 m, but much of the site lies between 10 m and 40 m. 85% of the site lies in the Northern Irish inshore waters (DAERA & JNCC, 2017a; DAERA & JNCC, 2019).

North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398)

North Anglesey Marine/Gogledd Môn Forol SAC is a large site with an area of 324,949 ha, reaching north-west from the island of Anglesey into the Irish Sea. The site sits at the northern end of St. George's Channel, extending approximately half way across to the Republic of Ireland, skirting the national waters of the Isle of Man. It is located 56 km from the Project. This site has been recognised as an area with predicted persistent high densities of harbour porpoise, which is an Annex II species and therefore a qualifying interest for this SAC. Habitats within this SAC include a mixture of hard substrate and sediments, including rock, coarse sediment, sand and mud. Water depths range between Mean Low Water Tide and 100 m. Away from the coastal areas, the depths largely fall within the range of 40-50 m (NRW & JNCC, 2017a; JNCC, 2019c).

Codling Fault Zone SAC (IE003015)

Codling Fault Zone SAC is located 63 km south of the offshore wind farm area and has been selected for the presence of Submarine structures made by leaking gases and also for harbour porpoise. Structures made by leaking gases in the marine environment can form two described habitat types: Bubbling Reefs and Structures within Pockmarks. The habitat recognised in the Irish Sea conforms to the definition of bubbling reefs (NPWS, 2024b). The Codling Fault Zone has been documented to have in excess of 23 seep mounds generated as a result of currently active gas emissions from deep gas reserves. At this site, these features tend to form elongated structures, from 60-80 metres in width, raised a couple of metres proud of the surrounding seabed, which trace the movement of the strike/slip fault zone and can extend up to several hundred metres in length. A variety of fauna can be found here including hydroids, anemones, crab, lobster, sponges, feather star, and fish species (NPWS, 2024b). There are no quoted population estimates for harbour porpoise included in the site synopsis for this site.

West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397)

The West Wales Marine/Gorllewin Cymru Forol SAC is a very large marine site, c. 737,614 ha in area. It extends into the Irish Sea from the Llŷn peninsula in North Wales to Pembrokeshire in West Wales. It extends almost to the mid-line (UK EEZ) between the Republic of Ireland and Wales, approximately 136 km from the Project. The site comprises a mixture of hard substrate and sediments, including rock, coarse sediment, sand and mud, with fully saline waters. Water depths range between Mean Low Water Tide and 100m. The site has one qualifying feature, the Habitats Directive Annex II species harbour porpoise. This SAC has been recognised as an area with the top 10% predicted persistent high densities of harbour porpoise. In particular, the site covers important summer habitat for porpoises and was selected on the basis of its long-term, preferential use by the species in contrast to other areas of the UK portion of the Irish Sea (JNCC, 2016c; NRW and JNCC, 2015).

Blackwater Bank SAC (IE002953)

Blackwater Bank SAC is located 145.3 km south of the offshore wind farm area, spanning an area of approximately 12,407 ha. Blackwater Bank SAC consists of a series of sandbanks running roughly parallel to the coastline from Cahore Point, in the north, extending almost as far southwards as Rosslare, Co. Wexford. These banks are characterised predominantly by fine sand to medium sand with smaller percentages of very fine sand. High hydrodynamic activity and currents do not allow for the settling out of finer particles of organic and inorganic matter, making sediments quite mobile. Typical species recorded from the area include crustaceans, segmented worms and molluscs (NPWS, 2024c). There are no quoted population estimates for harbour porpoise included in the site synopsis for this site.

Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117)

The Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC is a very large, primarily marine site with an area of 146,010 ha. It is situated in northwest Wales, c. 139.3 km from the Project. The site encompasses areas of sea, coast and estuary that support a wide range of wildlife and marine habitats, such as mudflats

and sandflats, estuaries, coastal lagoons and reefs. This site is of significant conservation value as it supports good examples of a range of marine habitats, with nine Annex I habitat features for which it was selected as an SAC. The area is also considered to support a significant presence of three Annex II species, otter, bottlenose dolphin and grey seal, which are also qualifying interests for this SAC (NRW, 2018a).

Cardigan Bay/Bae Ceredigion SAC (UK0012712)

Cardigan Bay/ Bae Ceredigion SAC comprises one of the largest bays in the British Isles. The bay measures over 100 km across its westernmost extent from the Lleyn Peninsula to St David's Head. This marine SAC, which is located 196.5 km from the Project, has an area of c. 95,857 ha and covers a proportion of the bay, between Aberarth and Moylgrove, south of Cardigan. Cardigan Bay was first selected as an SAC for the significant numbers of bottlenose dolphins that occur there. However, the site is a multiple interest site which supports a range of habitats, including three Annex I marine habitats; reefs, submerged or partially submerged sea caves and sandbanks which are slightly covered by seawater all the time. The site also supports a significant presence of four Annex II species; bottlenose dolphin, grey seal, river lamprey and sea lamprey (NRW, 2018b).

Pembrokeshire Marine/Sir Benfro Forol SAC (UK0013116)

Pembrokeshire Marine/Sir Benfro Forol SAC is a large marine site with an approximate area of 138,038 ha. It extends from just north of Abereiddy on the north Pembrokeshire coast to just east of Manorbier in the south, and includes the coast of the islands of Ramsey, Skomer, Grassholm, Skokholm, the Bishops and Clerks and The Smalls. This SAC comprises areas of sea, coast and estuary that support a wide range of different marine habitats and wildlife and is situated c. 216.8 km from the Project. It was selected as an SAC for the presence of eight Annex I habitats and seven Annex II species. In particular, Pembrokeshire Marine SAC has good examples of large shallow inlets and bays, estuaries and reefs, and supports significant numbers of grey seal. Of the seven qualifying interest species, there is one plant species, shore dock. This SAC is considered to be one of the best areas in the United Kingdom for this species (NRW, 2018c).

5.3.1.2 Conservation objectives

Site specific COs for the relevant SACs were reviewed. The CO attributes which could potentially be adversely affected by the Project were identified, for relevant QIs scoped into the Stage 2 assessment (i.e., QIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects), and are outlined in Table 5-8.

Table 5-8: Conservation Objective Attributes for relevant Annex II marine mammals.

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Slaney River Valley SAC (IE000781) (NPWS, 2011b; Version 1 21/10/2011)		
Harbour Seal (*Phoca vitulina)* [1365]	To maintain the favourable conservation condition	Access to suitable habitat Breeding behaviour Moulting behaviour Resting behaviour Disturbance
Rockabill to Dalkey Island SAC (IE003000) (NPWS, 2013a; Version 1 07/05/2013)		
Harbour porpoise (*Phocoena phocoena*) [1351]	To maintain the favourable conservation condition	Access to suitable habitat Disturbance
Lambay Island SAC (IE000204) (NPWS, 2013d; Version 1 22/07/2013)		
Grey Seal (*Halichoerus grypus*) [1364]	To maintain the favourable conservation condition	Access to suitable habitat Breeding behaviour Moulting behaviour Resting behaviour Disturbance
Harbour Seal (*Phoca vitulina*) [1365]	To maintain the favourable conservation condition	Access to suitable habitat Breeding behaviour

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
		Moulting behaviour Resting behaviour Disturbance
Harbour porpoise (*Phocoena phocoena*) [1351]	In the absence of conservation objectives for harbour porpoise of Lambay Island SAC, the overall aim of the Habitats Directive has been included, which is: To maintain or restore the species to favourable conservation status. Additionally, in the absence of available site-specific conservation objectives (SSCOs) for harbour porpoise of Lambay Island SAC (IE000204), the next closest European site along the east coast designated for this species, has been used as a proxy. In this case, the next closest European site from which substitute SSCOs can be obtained is Rockabill to Dalkey Island SAC (IE003000). Rockabill to Dalkey Island SAC shares a boundary with Lambay Island SAC.	Access to suitable habitat Disturbance
Murlough SAC (UK0016612) (DAERA, 2018; Version 4 November 2018)		
Harbour Seal (*Phoca vitulina*) [1365]	To maintain (or restore where appropriate) to favourable condition	Population Pups Haul-outs Disturbance
North Channel SAC (UK0030399) (JNCC, 2019a; February 2019)		
Harbour porpoise (*Phocoena phocoena*) [1351]	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour porpoise in UK waters	Viable component of site Disturbance Supporting habitats and processes Availability of prey
North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398) (JNCC, 2019b; March 2019)		
Harbour porpoise (*Phocoena phocoena)* [1351]	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for Harbour porpoise in UK waters	Viable component of site Disturbance Supporting habitats and processes Availability of prey
Codling Fault Zone SAC (IE003015) (NPWS, 2023c)		
Harbour porpoise (*Phocoena phocoena)* [1351]	In the absence of conservation objectives for harbour porpoise of Codling Fault Zone SAC, the overall aim of the Habitats Directive has been included, which is: To maintain or restore the species to favourable conservation status. Additionally, in the absence of available site-specific conservation objectives (SSCOs) for harbour porpoise of Codling Fault Zone SAC (IE003015), the next closest European	Access to suitable habitat Disturbance

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
	site along the east coast designated for this species, has been used as a proxy. In this case, the next closest European site from which substitute SSCOs can be obtained is Rockabill to Dalkey Island SAC (IE003000). Rockabill to Dalkey Island SAC is located 19 km west of Codling Fault Zone SAC.	
West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397) (JNCC, 2019)		
Harbour porpoise (*Phocoena phocoena*) [1351]	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining FCS	Viable component of site Disturbance Supporting habitats and processes Availability of prey
Blackwater Bank SAC (IE002953) (NPWS, 2023d)		
Harbour porpoise (*Phocoena phocoena)* [1351]	In the absence of conservation objectives for harbour porpoise of Blackwater Bank SAC, the overall aim of the Habitats Directive has been included, which is: To maintain or restore the species to favourable conservation status. Additionally, in the absence of available site-specific conservation objectives (SSCOs) for harbour porpoise of Blackwater Bank SAC (IE002953), the next closest European site along the east coast designated for this species, has been used as a proxy. In this case, the next closest European site from which substitute SSCOs can be obtained is Rockabill to Blackwater Bank SAC (IE003000). Rockabill to Dalkey Island SAC is located 81 km north of Blackwater Bank SAC.	Access to suitable habitat Disturbance
Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117) (JNCC, 2009a)		
Bottlenose Dolphin (*Tursiops truncatus*) [1349	To achieve favourable conservation status	Populations Range Supporting Habitats and Species
Grey Seal (*Halichoerus grypus*) [1364]		
Cardigan Bay/Bae Ceredigion SAC (UK0012712) (JNCC, 2009b)		
Bottlenose Dolphin (*Tursiops truncatus*) [1349]	To achieve favourable conservation status	Populations Range Supporting Habitats and Species
Grey Seal (*Halichoerus grypus*) [1364]		
Pembrokeshire Marine/Sir Benfro Forol SAC (UK0013116) (JNCC, 2009c)		
Grey Seal (*Halichoerus grypus*) [1364]	To achieve favourable conservation status	Populations Range Supporting Habitats and Species

5.3.2 Baseline environment

The baseline environment of Annex II marine mammals has been fully characterised in appendix F: Marine Mammals and Megafauna – Supporting Information and appendix G: Marine Mammals and Megafauna Technical Report.

5.3.2.1 Data validity and limitations

The data assumptions and limitations highlighted in appendix G: Marine Mammals and Megafauna Technical Report are typical of difficulties encountered with undertaking field surveys of marine mammals using boat-based methods. Initially (first three months) the 2018-2020 boat-based surveys were conducted using the same observers as used for recording seabirds; this was subsequently amended by introducing dedicated Marine Mammal Observers (MMOs) to reduce the likelihood that marine mammals are missed during the surveys. Detection probability is also a limiting factor in recording marine mammals with weather conditions playing a significant role in the ability to detect a marine mammal from the observation platform. Identification to species-level can sometimes be difficult, particularly when distinguishing between grey seal and harbour seal at sea. Since there were a number of sightings recorded as 'seal species', these unidentified seals were allocated to each species (grey seal or harbour seal), based on the relative proportion that each species contributed to the overall number of identified seals present. In this way, all seal sightings could be used in the data analyses, which is important where the number of sightings in general is relatively low. Site-specific aerial surveys were also conducted in 2020, to provide additional data support to the site-specific vessel surveys (2018-2020). Data were analysed appropriately for each survey method and the most precautionary estimate of density was taken forward for assessment (where sightings were sufficient to do so; see appendix G: Marine Mammals and Megafauna Technical Report).

In the professional opinion of the author, it is considered that two years of pre-construction surveys to be the minimum requirement for pre-construction surveys, to which the Oriel site-specific surveys (2018-2020) meet.

In relation to the baseline characterisation that underpins this assessment site-specific data gathered 2018-2020 were corroborated by information collated via the detailed desktop review, including the most recent SCANS-IV data (Gilles *et al.,* 2023) for cetaceans and recently published seal data (Carter *et al.,* 2022; SCOS, 2021; SCOS, 2020). Therefore, the baseline characterisation for the Marine Megafauna Study Area is considered to be fit for purpose for understanding potential impacts and the precaution built into the assessment will capture any potential for data variation.

5.3.3 Project design parameters

Table 5-9 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on marine mammals and megafauna.

Due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore export cable and offshore inter array cables will be confirmed post consent (see design flexibility details in section 2 – Project Description). For the purposes of the assessment presented in section 5.3.5, the maximum length of cables has been considered to ensure the potential for maximum impact is assessed. Should the final lengths of cables be less than those specified, then the potential for effects will not change the assessment outlined in section 5.3.5. An alternative route within the offshore wind farm area of offshore cable corridor will also not change the assessment presented in section 5.3.5.

Table 5-9: Project design parameters used for the assessment of potential impacts on marine mammals and megafauna.

Potential impact	Phase[1]			Project design parameters	Justification
	C	O	D		
Injury and/or disturbance to marine megafauna from underwater	✓	✗	✗	• 26 monopiles (25 x WTGs and 1 x OSS) of 9.6 m diameter; • Absolute maximum hammer energy of 3,500 kJ;	The spatial extent of noise impacts is driven by key parameters including monopile diameter and hammer

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
noise during pile-driving				• On average, a maximum of 5 hours piling per pile across all WTG locations (no more than 8 hours at selected locations) with one pile expected to be installed in each 24-hour period; and • Maximum days piling = 26 days.	size, as well as associated hammer energy required to pile a monopile of this size (see appendix C: Subsea Noise Technical Report). The minimum number of piles within a 24-hour period is likely to lead to the maximum period (number of piling days) over which piling could occur and the maximum within 24 hours would lead to the longest duration on any one day.
Injury and/or disturbance to marine megafauna from elevated underwater noise during routine geophysical surveys	✗	✓	✗	Routine geophysical surveys of wind turbine foundations, inter-array cables and offshore cable: • Multibeam echosounder (MBES) expected to be the only method of geophysical survey to be employed; • Survey campaigns estimated to occur once every five years for 40-year lifetime of Project; • Surveys to be conducted using one survey vessel; • Duration of 14 days per survey; • 42-day duration per survey campaign (three surveys per campaign); • 42 vessel round trips per survey campaign; and • Maximum total of 294 survey vessel round trips for lifetime of Project.	First survey campaign expected to occur in year 5, and final campaign in year 35, equating to seven survey campaigns. Assumes daily vessel trip for every day of each 14-day survey window.
Injury and/or disturbance to marine megafauna from vessels and other construction activities	✓	✓	✓	Vessel types include jack-up barges, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels, crew transfer vessels (CTVs). 475 vessel round trips during the construction phase, 352 vessel round trips per year during the operational and maintenance phase and 475 vessel round trips during the decommissioning phase. Other construction includes: • Monopile drilling at each location with six days drilling for each monopile = cumulative total of 156 days drilling over construction phase; • Cable trenching for inter-array and offshore cable; and • Cable laying for inter-array and offshore cable. Offshore construction may take place over a period of 15 months. Operational and maintenance phase is 40 years. Decommissioning duration assumed to be similar to that for construction.	Greatest range of vessel types and greatest number of round trips.
Changes in the fish and shellfish community affecting marine megafauna prey resources	✓	✓	✓	Project design parameters as described in appendix E: Fish and Shellfish Ecology – Supporting Information for the following impacts: • Temporary subtidal habitat loss/disturbance; • Injury and/or disturbance to fish from underwater noise during pile driving; • Increased suspended sediment concentrations and associated sediment deposition;	See appendix E: Fish and Shellfish Ecology – Supporting Information.

Potential impact	Phase[1] C O D	Project design parameters	Justification
		• Long-term habitat loss; and • Electromagnetic Fields (EMF) from subsea electrical cabling.	

1 C = Construction, O = Operation, D = Decommissioning

5.3.4 Measures included in the Project

As part of the project design process (see section 2), a number of measures have been proposed to reduce the potential for impacts on marine mammals and megafauna. These measures were not taken into account at the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A) in accordance with guidance and prevailing case law but can lawfully be taken into account for the Stage 2 appraisal.

These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 5.3.5. These measures are considered standard industry practice for this type of development. This approach has taken regard of the mitigation hierarchy as described by CIEEM (2018), where a sequential process is adopted to avoid, mitigate and compensate negative ecological impacts and effects.

Measures relevant to Annex II marine mammal species are presented in Table 5-10.

Table 5-10: Measures included in the Project – marine mammals and megafauna.

Measures included in the Project	Justification
An EMP (see appendix K: Management Plans) has been prepared and will be implemented during the construction, operational and maintenance, and decommissioning phases of the Project. The EMP includes Project specific measures and commitments and a Marine Pollution Contingency Plan (MPCP) which includes key emergency contact details (e.g. Environmental Protection Agency (EPA)). The EMP includes measures such as designated areas for refuelling where spillages can be easily contained, storage of chemicals in secure designated areas in line with appropriate regulations and guidelines, double skinning of pipes and tanks containing hazardous substances, and storage of these substances in impenetrable bunds. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project.	Measures will be included to ensure that the potential for release of pollutants from construction, operational and maintenance, and decommissioning plant is minimised.
A Marine Megafauna Mitigation Plan (MMMP) (see appendix K: Management Plans) will be implemented prior to construction. The MMMP sets out the measures to apply in advance of and during piling activity, including the implementation of a mitigation zone, and monitoring by MMOs and Passive Acoustic Monitoring (PAM).	The implementation of an approved MMMP will mitigate for the risk of physical or permanent auditory injury to marine mammals within a 'mitigation zone'. The mitigation zone is determined considering the potential for instantaneous auditory injury based on the initial hammer strike at 10-15% of the maximum hammer energy (i.e. soft-start hammer energy). The use of an approved MMMP will also minimise the potential for collision risk, or potential injury to, marine mammals.
During piling operations, soft starts will be used, following Department of Arts Heritage and the Gaeltacht (DAHG) (2014) guidelines. This will involve the implementation of lower hammer energies (i.e. approximately 10-15% of the maximum hammer energy)	The soft-start will provide an audible cue to allow marine mammals to flee the area before piling at increased hammer energy commences. The soft/slow-start will help to mitigate any potential auditory injury.

Measures included in the Project	Justification
at the beginning of the piling sequence before energy input is 'ramped up' (increased) over time to required higher levels (also known as a soft-start).	
The Applicant commits to implementing phased piling alongside other adjacent offshore wind farms in the western Irish Sea as part of a Piling Strategy. This strategy will be prepared post consent and will set out measures for collaboration with other projects to reduce the potential for an in-combination effect. This will include a stepped strategy which follows the mitigation hierarchy - avoid, reduce, mitigate. Consequently, if phased piling is required a collaborative approach will be explored and information presented to demonstrate how a phased piling approach can contribute to the reduction in underwater sound from piling.	To minimise the potential for permanent auditory injury to marine mammals. To minimise the area of habitat affected by underwater noise at any one time.
Geophysical surveys undertaken during the operational and maintenance phase will adopt similar measures as for piling operations, including the implementation of an approved MMMP and Vessel Code of Conduct (see appendix K: Management Plans). Measures include the use of a mitigation zone around operations, within which MMOs and PAM will ensure that no marine mammals are present in the vicinity of the geophysical survey vessel, and the use of a soft-start to survey operations, where possible. It is acknowledged that further consultation with the NPWS and wildlife derogation licences may be required.	The implementation of an approved MMMP will mitigate for the risk of physical or permanent auditory injury to marine mammals within a 500 m radial mitigation zone as determined by NPWS guidance (NPWS, 2014)[7]. The soft-start will use a lower-energy output, increasing over a 20-minute period to the maximum data-acquisition energy output to provide an audible cue to allow marine mammals to flee the area before geophysical surveying commences.
A Vessel Code of Conduct (see appendix K: Management Plans) will be issued to all Project vessel operators, requiring them to: • refrain from approaching animals in the water; • keep vessel speed to a minimum, including near haul-outs; and • avoid abrupt changes in course or speed should marine mammals approach the vessel to bow-ride. The Marine Megafauna: Vessel Code of Conduct will be adhered to at all times.	To minimise the potential for collision risk, or potential injury to, marine mammals.
Burial and protection of cables - cables will be buried below the seabed wherever possible, to a minimum burial depth of 0.5 m and a maximum burial depth of 3 m. The appointed contractor will be required prior to the construction phase to submit details on the cable specification and installation methodology. This will include details on the cable laying, including geotechnical data, cable laying techniques and a cable burial risk assessment. Also, in advance of any cable repair, the contractor will be required to submit details on the parameters of the repair or reburial activities and the proposed methodology.	While burial of cables will not reduce the strength of EMF, it does increase the distance between cables and marine mammal receptors, thereby potentially reducing the effect on those receptors.

5.3.5 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project is outlined in Table 5-11.

[7] It is expected that this guidance will be updated in 2024. The final guidance will be included in this measure.

Table 5-11: Prediction of adverse effects on site integrity during the construction, operational and maintenance, and decommissioning phases of the Project.

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
Slaney River Valley SAC (IE000781) (NPWS, 2011b; Version 1 21/10/2011); (NPWS, 2018c)			
Harbour Seal (*Phoca vitulina)* [1365]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities; Changes in the fish and shellfish community affecting prey resources.	Siltation rate changes, dumping, depositing of dredged deposits (J02.11); Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01).	**Access to suitable habitat** -Potential identified. **Breeding behaviour** -None predicted as Project avoids activity within and/or removal of this habitat **Moulting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Resting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Disturbance** -Potential identified.
Rockabill to Dalkey Island SAC (IE003000) (NPWS, 2013a; Version 1 07/05/2013) (NPWS, 2019d)			
Harbour porpoise (*Phocoena phocoena*) [1351]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Utility and service lines (D02); Noise nuisance, noise pollution (H06.01).	**Access to suitable habitat** -Potential identified. **Disturbance** -Potential identified.
Lambay Island SAC (IE000204) (NPWS, 2013d; Version 1 22/07/2013); (NPWS, 2019e)			
Grey Seal (*Halichoerus grypus*) [1364]	Injury and/or disturbance to from underwater noise during pile-driving; Injury and/or disturbance to from vessel and other construction activities; Changes in the fish and shellfish community affecting prey resources.	None relevant.	**Access to suitable habitat** -Potential identified. **Breeding behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Moulting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Resting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Disturbance** -Potential identified.
Harbour Seal (*Phoca vitulina*) [1365]			**Access to suitable habitat** -Potential identified. **Breeding behaviour**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
			-None predicted as Project avoids activity within and/or removal of this habitat. **Moulting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Resting behaviour** -None predicted as Project avoids activity within and/or removal of this habitat. **Disturbance** -Potential identified.
Harbour porpoise (*Phocoena phocoena*) [1351]			**Access to suitable habitat** -Potential identified. **Disturbance** -Potential identified.
Murlough SAC (UK0016612) (DAERA, 2018b; Version 4 November 2018); (JNCC, 2015b)			
Harbour Seal (*Phoca vitulina*) [1365]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Changes in abiotic conditions (M01); Biocenotic evolution, succession (K02); Problematic native species (I02); Invasive non-native species (I01).	**Population** -Potential identified. **Pups** -None predicted as Project avoids activity within and/or removal of this habitat. **Haul-outs** -None predicted as Project avoids activity within and/or removal of this habitat. **Disturbance** -Potential identified.
North Channel SAC (UK0030399) (JNCC, 2019a; February 2019) (JNCC, 2019d)			
Harbour porpoise (*Phocoena phocoena*) [1351]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Marine water pollution (H03)	**Viable component of site** -None predicted as Project avoids activity within and/or removal of this habitat. **Disturbance** -Potential identified. **Supporting habitats and processes** -None predicted as Project avoids activity within and/or removal of this habitat. **Availability of prey** -Potential identified.
North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398) (JNCC, 2019b; March 2019); (JNCC, 2019d)			
Harbour porpoise (*Phocoena phocoena)* [1351]	Injury and/or disturbance to a from underwater noise during pile-driving; Injury and/or disturbance to from vessel and other construction activities	Marine water pollution (H03).	**Viable component of site** -None predicted as Project avoids activity within and/or removal of site. **Disturbance** -Potential identified. **Supporting habitats and processes**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
	Changes in the fish and shellfish community affecting prey resources.		-None predicted as Project avoids activity within and/or removal of supporting habitat. **Availability of prey** -Potential identified.
Codling Fault Zone SAC (IE003015) (NPWS, 2023c)			
Harbour porpoise (*Phocoena phocoena)* [1351]	Injury and/or disturbance to a from underwater noise during pile-driving; Injury and/or disturbance to from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	In the absence of an updated Natura 2000 Data Form which includes harbour porpoise, relevant site-level threats have been derived from a review of the ARCs (activities requiring consent)[8], and include the following: • Blasting, drilling, dredging or otherwise removing or disturbing fossils, rock, minerals, mud, sand, gravel or other sediment; • Introduction, or re-introduction, of plants or animals not found in the area; and • Undertaking active acoustic surveys in the marine environment.	**Access to suitable habitat** -Potential identified. **Disturbance** -Potential identified.
West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397) (NWR and JNCC, 2019) (JNCC, 2019e)			
Harbour porpoise (*Phocoena phocoena*) [1351]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Marine water pollution (H03).	**Viable component of site** **-**None predicted as Project avoids activity within and/or removal of site. **Disturbance** **-**Potential identified. **Supporting habitats and processes** -None predicted as Project avoids activity within and/or removal of supporting habitat. **Availability of prey** **-**Potential identified.
Blackwater Bank SAC (IE002953) (NPWS, 2023d)			
Harbour porpoise (*Phocoena phocoena)* [1351]	Injury and/or disturbance to a from underwater noise during pile-driving;	In the absence of an updated Natura 2000 Data Form which includes harbour porpoise, relevant site-level threats have been derived from a review of the ARCs[9] and include the following:	**Access to suitable habitat** -Potential identified. **Disturbance** -Potential identified.

[8] Codling Fault Zone SAC – Activities Requiring Consent (ARCs): chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.npws.ie/sites/default/files/protected-sites/amendment_notifications/AN003015.pdf

[9] Blackwater Bank SAC – Activities Requiring Consent (ARCs): chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.npws.ie/sites/default/files/protected-sites/amendment_notifications/AN002953.pdf

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
	Injury and/or disturbance to from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	• Blasting, drilling, dredging or otherwise removing or disturbing fossils, rock, minerals, mud, sand, gravel or other sediment; • Introduction, or re-introduction, of plants or animals not found in the area; and • Undertaking active acoustic surveys in the marine environment.	
Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC (UK0013117) (NRW, 2018a) (JNCC, 2015i)			
Bottlenose Dolphin (*Tursiops truncatus*) [1349] Grey Seal (*Halichoerus grypus*) [1364]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance to from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Marine water pollution (H03); Invasive non-native species (I01); Changes in abiotic conditions (M01); Other human intrusions and disturbances (G05).	**Population** -Potential identified. **Range (within site)** -None predicted as Project avoids activity within and/or removal of site. **Supporting habitats and species** -None predicted as Project avoids activity and /or removal of supporting habitat. -Potential identified as result of underwater noise e.g., pile driving, site investigation surveys, vessel movements and other construction activities.
Cardigan Bay/Bae Ceredigion SAC (UK0012712) (NRW, 2018b) (JNCC, 2015j)			
Bottlenose Dolphin (*Tursiops truncatus*) [1349] Grey Seal (*Halichoerus grypus*) [1364]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Other human intrusions and disturbances (G05); Marine water pollution (H03); Invasive non-native species (I01).	**Population** -Potential identified. **Range (within site)** -None predicted as Project avoids activity within and/or removal of site. **Supporting Habitats and Species** -None predicted as Project avoids activity and /or removal of supporting habitat. -Potential identified as result of underwater noise e.g., pile driving, site investigation surveys, vessel movements and other construction activities.
Pembrokeshire Marine/Sir Benfro Forol SAC (UK0013116) (NRW, 2018c; JNCC, 2015k)			
Grey Seal (*Halichoerus grypus*) [1364]	Injury and/or disturbance from underwater noise during pile-driving; Injury and/or disturbance from vessel and other construction activities Changes in the fish and shellfish community affecting prey resources.	Human induced changes in hydraulic conditions (J02); Other human intrusions and disturbances (G05); Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01); Changes in abiotic conditions (M01); Invasive non-native species (I01); Marine water pollution (H03).	**Population** -Potential identified. **Range (within site)** -None predicted as Project avoids activity within and/or removal of site. **Supporting habitats and species** -None predicted as Project avoids activity and /or removal of supporting habitat. -Potential identified as result of underwater noise e.g., pile driving, site investigation surveys, vessel movements and other construction activities.

5.3.5.1 Construction/decommissioning phase

Suitable habitat, disturbance, population, availability of prey, supporting habitats and species

Injury and/or disturbance from underwater noise during pile-driving

A summary of the criteria (acoustic thresholds) for the onset of injury (Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)) and disturbance used in the marine mammal noise assessment is provided in Table 6-3 and Table 6-4 of appendix F: Marine Mammals and Megafauna – Supporting Information.

A detailed underwater noise modelling assessment has been carried out to investigate the potential for injurious and behavioural effects on qualifying marine mammal features as a result of piling (impulsive sounds), using the latest criteria which is drawn upon in the assessment presented below. Full details of this approach are provided in appendix C: Subsea Noise Technical Report.

In summary, the dual criteria (SPL_{pk} and SEL_{cum}) approach was employed in the subsea noise assessment in order to estimate the ranges over which PTS and TTS could occur and to assess the potential for auditory injury (PTS and TTS) to occur in marine mammals. Injury ranges were predicted based on (i) exposure to SPL_{pk} from a single hammer strike at different energy levels; and (ii) a marine mammal being exposed to impulsive noise from multiple hammer strikes over a prolonged period (SEL_{cum}). Noting that using a threshold for the onset of TTS would typically result in overestimates of potential ranges at which ecologically significant effects could occur; this, coupled with the precautionary assumptions in the model, particularly with respect to the SEL_{cum} metric, means that estimates of TTS are likely to be unrealistic and therefore should be interpreted with caution. For disturbance, subsea noise modelling was undertaken using a dose-response approach with SEL single-strike (SEL_{ss}) contours modelled in 5 dB increments to determine the number of animals that may potentially respond behaviourally to received noise levels during piling (noting that approaches for pinnipeds and cetaceans differ). As above, noise modelling adopted a precautionary approach at all stages and such layering of conservatism is likely to lead to a very precautionary assessment.

Injury-Harbour Porpoise

As detailed above, Project specific noise modelling (appendix C: Subsea Noise Technical Report) was conducted for all marine mammal species. The noise assessment considered the maximum adverse spatial scenario of installation of 9.6 m diameter monopiles with a hammer energy of 3,500 kJ. The piling parameters and resulting source sound levels for monopiles are set out in Table 6-1 of appendix F: Marine Mammals and Megafauna – Supporting Information.

Based on the modelling, the resultant injury (PTS and TTS) ranges for marine mammal species have been set out in Table 6-5 and Table 6-6 of appendix F: Marine Mammals and Megafauna – Supporting Information. The number of marine mammals potentially affected by PTS or TTS as a result of pile drilling have been calculated based on the most up to date species-specific density estimates and where ranges for density estimates have been applied numbers have been based on the upper density value as a precautionary approach. Estimates of abundance within associated Management Units (MU) have been used to present these values as a proportion of the population.

With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, harbour porpoise could be affected by PTS (SPL_{pk}) out to 236 m (i.e. 7.85 x 10^{-5} - 0.0004% of the population) and TTS (SPL_{pk}) out to 344 m (i.e. 0.0002 - 0.0008% of the population), which equates to less than one harbour porpoise in both cases.

With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, harbour porpoise could be affected by PTS (SEL_{cum}) out to 168 m (i.e. 3.97 x 10^{-5} - 0.0002 of the population) and TTS (SEL_{cum}) out to a maximum of 5,980 m (i.e. 0.0504 - 0.239% of the population). PTS predictions found that less than one harbour porpoise would be affected by PTS, while TTS using the SEL_{cum} threshold suggests that between 32 and 150 harbour porpoise (0.0504 - 0.239% of the population) may be within the ensonified area. These numbers represent very small proportions of the MU populations.

The assessment shows that over the ensonified area, only small numbers of harbour porpoise animals are likely to occur within the injury zones. With measures in place including soft start and an MMMP (section 5.3.4), the range of effect reduces and the possibility of PTS diminishes within the distance which can be managed via the MMMP. The possibility of TTS may extend beyond the distance which can be managed by the MMMP, however this TTS effect as described above is considered to be an overestimation of the impact which accounts for a level of conservatism built into the subsea noise model. Furthermore, harbour porpoise exposed to noise levels that have the potential to induce TTS are likely to actively avoid hearing damage by moving away from the area. To reduce the risk of permanent and temporary auditory injury (PTS and TTS), designed-in and management measures (controls) will be implemented as part of a MMMP (see section 5.3.4). There will be no adverse effects.

In addition to the measures included in the Project, an Acoustic Deterrent Device (ADD) which has been shown to be effective in deterring marine mammals from proximity to piling which may result in injury (McGarry *et al.,* 2017; Gordon *et al.,* 2019) will be implemented as part of the MMMP, subject to discussion with stakeholders. The use of an ADD is considered as mitigation and discussed in section 6.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project and an Acoustic Deterrent Device (ADD), there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury-Bottlenose dolphin

With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, bottlenose dolphin could be affected by PTS (SPL_{pk}) out to 41 m (i.e. up to 8.29 x 10^{-5} % of the IAMMWG, 2023[10] abundance estimate or 1.49 x 10^{-5}% of the SCANS IV abundance estimate) and TTS (SPL_{pk}) out to 59 m (i.e. up to 0.0002% of the IAMMWG, 2023 abundance estimate or 3.09 x 10^{-5} % of the SCANS IV abundance estimate), which equates to less than one bottlenose dolphin in all cases.

The threshold for PTS (SEL_{cum}) with regards to bottlenose dolphin was not exceeded. With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, bottlenose dolphin could be affected by TTS (SEL_{cum}) out to 12 m (i.e. up to 7.10 x 10^{-6} % of the IAMMWG, 2023 abundance estimate or 1.28 x 10^{-6} % of the SCANS IV abundance estimate). TTS predictions using the SEL_{cum} threshold found that less than one bottlenose dolphin may be in the ensonified area.

The assessment shows that over the ensonified area, it is likely that less than one individual bottlenose dolphin will occur within the injury zones. With measures in place including soft start and an MMMP (section 5.3.4), the range of effect reduces and the possibility of TTS diminishes within the distance which can be managed via the MMMP. In relation to PTS, the threshold was not exceeded. Furthermore, bottlenose dolphin exposed to noise levels that have the potential to induce TTS are likely to actively avoid hearing damage by moving away from the area. To reduce the risk of permanent and temporary auditory injury, designed-in and management measures will be implemented as part of a MMMP (see section 5.3.4). There will be no adverse effects.

In addition to the measures included in the Project, an Acoustic Deterrent Device (ADD) which has been shown to be effective in deterring marine mammals from proximity to piling which may result in injury (McGarry *et al.,* 2017; Gordon *et al.,* 2019) will be implemented as part of the MMMP, subject to discussion with stakeholders. The use of an ADD is considered as mitigation and discussed in section 6.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project and an ADD, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury-Seals

With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, both grey seal and harbour seal could be affected by PTS (SPLpk) out to 86 m (i.e. up to 0.0001% of the grey

[10] IAMMWG (2023) Updated abundance estimates for cetacean Management Units in UK waters.

seal population and up to 0.0004% of the harbour seal population), and TTS (SPL_{pk}) out to 126 m (i.e. up to 0.0003% of the grey seal population and 0.0009% of the harbour seal population), which equates to less than one seal in both cases.

With the implementation of measures included in the Project (section 5.3.4) such as soft start initiation, both grey seal and harbour seal could be affected by PTS (SEL_{cum}) out to 19 m (i.e. up to 6.3 x 10^{-6} % of the grey seal population and up to 1.94 x10^{-5}% of the harbour seal population) and TTS (SEL_{cum}) out to 1,330 m (i.e. up to 0.031% of the grey seal population and up to 0.095% of the harbour seal population). PTS predictions found that less than one seal could be affected by PTS in both cases, while TTS using the SEL_{cum} threshold suggests that up to two grey seal (i.e. 0.0031% of the population) and up to two harbour seal (i.e. 0.095% of the population) may be within the ensonified area. These numbers represent very small proportions of the MU populations.

The assessment shows that over the ensonified area, only small numbers of grey and harbour seals are likely to occur within the injury zones. With measures in place including soft start and an MMMP (section 5.3.4), the range of effects reduces and the possibility of PTS diminishes within the distance which can be managed via MMMP. The possibility of TTS may extend beyond the distance which can be managed by the MMMP, however this TTS effect as described above is considered to be an overestimation of the impact which accounts for a level of conservatism built into the subsea noise model. Furthermore, grey and harbour seal exposed to noise levels that have the potential to induce TTS are likely to actively avoid hearing damage by moving away from the area. To reduce the risk of permanent and temporary auditory injury, designed-in and management measures will be implemented as part of a MMMP (see section 5.3.4). There will be no adverse effects.

In addition to the measures included in the Project, an Acoustic Deterrent Device (ADD) which has been shown to be effective in deterring marine mammals from proximity to piling which may result in injury (McGarry *et al.,* 2017; Gordon *et al.,* 2019) will be implemented as part of the MMMP, subject to discussion with stakeholders. The use of an ADD is considered as mitigation and discussed in section 6.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project and an ADD, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Harbour Porpoise

Based on a dose-response approach (Graham *et al.,* 2017) within unweighted SEL_{ss} contours and a threshold-based approach (National Marine Fisheries Service (NMFS), 2005), within unweighted SEL_{ss} noise contours, the number of marine mammals predicted to be disturbed as a result of impact piling of monopiles have been set out in Table 6-9 of appendix F: Marine Mammals and Megafauna – Supporting Information.

Applying a dose-response approach (Graham *et al.,* 2017), the most conservative estimate of disturbance predicted that between 153 and 725 harbour porpoise have the potential to be disturbed by piling (representing 0.245% to 1.160% of the MU population). However, this represents the maximum number across the entire range of disturbance responses (from slight changes in behaviour, such as changes in swimming speed or direction through to displacement).

The threshold-based approach derived using NMFS criteria suggests that only 64 harbour porpoise are predicted to experience strong disturbance (above 160 dB re 1µ Pa (rms)) representing 0.101% of the MU population, whilst up to 2,111 are predicted to experience mild disturbance (140 - 160 dB re 1µ Pa (rms)) representing 3.76% of the population (see Table 6-9 in appendix F: Marine Mammals and Megafauna – Supporting Information).

Strong and mild disturbance contours (160 dB re 1µ Pa (rms) and 140 dB re 1µ Pa (rms), respectively) modelled for the Project are predicted to extend to 3.2 km and 17 km from the Project, respectively (see appendix F: Marine Mammals and Megafauna – Supporting Information). This shows that the modelled Project disturbance contours do not overlap with any European site with marine mammals listed as a qualifying feature. Acknowledging the limitations of the single step-threshold approach for strong disturbance and mild disturbance (i.e. does not account for inter-, or intra-specific variance or context-based variance), harbour porpoise within the area modelled as ‘strong disturbance’ would be most sensitive to behavioural effects. Although harbour porpoise may be able to avoid the disturbed area and forage elsewhere, there may

be a potential effect on reproductive success of some individuals. It is anticipated that there would be some adaptability to the elevated noise levels from piling and therefore survival rates are not likely to be affected. Harbour porpoise is deemed to have some sensitivity to strong and mild disturbance, but piling only comprises a small fraction of the construction period, and the proportion of the population to be affected at any one time by strong disturbance is likely to be small.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Bottlenose dolphin

Disturbance is expected to affect fewer bottlenose dolphin during piling, however the bottlenose dolphin population estimates (n=293, from IAMMWG, 2023; and n=8,326, derived from Gilles *et al.,* 2023) are significantly smaller than the relevant harbour porpoise population (n=62,517).

Therefore, based on a dose-response approach (Graham *et al.,*2017), the most conservative estimate of disturbance predicted that between 26 and 129 bottlenose dolphin have the potential to be disturbed by piling (representing 8.63% of the IAMMWG, 2023 abundance estimate or 1.5449 % of the SCANS IV abundance estimate).

The threshold-based approach derived using NMFS criteria suggests that only 12 bottlenose dolphin are predicted to experience strong disturbance (above 160 dB re 1µ Pa (rms)) representing 0.134% of the population, whilst up to 374 are predicted to experience mild disturbance (140 - 160 dB re 1µ Pa (rms)) representing 4.482 % of the population.

Strong and mild disturbance contours (160 dB re 1µ Pa (rms) and 140 dB re 1µ Pa (rms), respectively) modelled for the Project are predicted to extend to 3.2 km and 17 km from the Project, respectively (see appendix F: Marine Mammals and Megafauna – Supporting Information). This shows that the modelled Project disturbance contours do not overlap with any European site with marine mammals listed as a qualifying feature.

Bottlenose dolphin are not thought to be as vulnerable to disturbance as harbour porpoise, as foraging requirements are less frequent. Bottlenose dolphin likely to be foraging in the area form part of the Irish Sea (IS) MU, which is far smaller, and therefore any effect on the individual is more likely to have an impact at the population level. Bottlenose dolphin could tolerate the effects of disturbance and whilst there may be some impacts on reproduction in the area of ‘strong disturbance’ there is not likely to be an impact on survival rates with some tolerance built up over the course of the piling. It is anticipated that animals would return to previous activities once the impact had ceased, even when taking into account the project design parameters. While bottlenose dolphin is deemed to have some sensitivity to strong and mild disturbance, piling only comprises a small fraction of the construction period (i.e. maximum no. of days piling is 26 days), and the proportion of the population (i.e. 0.134% - 4.482%) and to be affected at any one time by strong disturbance is likely to be small.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Seals

Applying a dose-response approach (Whyte *et al.,* 2020), the most conservative estimate of disturbance predicted that up to 21 grey seal (0.357 % of the Grey Seal Reference Population (GSRP)) and up to 16 harbour seal (up to 0.979% of the Harbour Seal Reference Population (HSRP)) have the potential to be disturbed by piling. The threshold-based approach derived using NMFS criteria suggests that of these, up to 18 grey seal and 14 harbour seal have the potential to experience strong disturbance (above 160 dB re 1µ Pa (rms)) representing up to 0.30% and 0.812% of the GSRP and HSRP populations, respectively. Up to 33 grey seal, and 25 harbour seal have the potential to experience mild disturbance (140 - 160 dB re 1µ Pa (rms)) representing up to 0.55% and 1.49% of the GSPR and HSPR populations, respectively.

Mild disturbance for seals has previously been considered theoretically to occur over a larger area than strong disturbance, and therefore has the potential to affect larger numbers of each species. However,

Whyte *et al.,* (2020) showed for harbour seal, that beyond 25 km (below 145 dB re 1µ Pa (rms)) from the piling noise source, no significant changes in seal density were detected. Therefore, modelling (Figure 6-3 and Figure 6-4 of appendix F: Marine Mammals and Megafauna - Supporting Information) has predicted that

modelled Project disturbance contours do not overlap with any European site with marine mammals listed as a qualifying feature and the range of effect in which strong and mild disturbance could occur is not likely to extend to haul-out sites in the vicinity of the offshore wind farm area for either grey seal or harbour seal.

Strong disturbance could result in displacement of seals from an area. Mild disturbance constitutes only slight changes in behaviour, such as changes in swimming speed or direction, and is unlikely to result in population-level effects. Although there is likely to be alternative foraging sites for both harbour seal and grey seal, barrier effects as a result of installation of monopiles could either prevent seals from travelling to forage from haul-out sites, particularly at Carlingford Lough, or force seals (particularly harbour seal) to travel greater distances than is usual. Grey seal and harbour seal are deemed to have some sensitivity to strong and mild disturbance, but piling only comprises a small fraction of the construction period (i.e. maximum no. of days piling is 26 days), and the proportion of the population (i.e. 0.055% – 1.49%) to be affected at any one time by strong disturbance is likely to be small.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) resulting from disturbance to seals from underwater noise during pile-driving, due to the Project alone and no reasonable scientific doubt remains as to the absence of such effects. Any potential for adverse effects on the integrity of European sites have been mitigated through the measures described in section 5.3.4.

Injury and/or disturbance to marine megafauna from vessels and other construction activities

Increased vessel movement during the construction and decommissioning phases has the potential to result in a range of impacts on marine mammals. Other construction activities, with the potential to generate underwater noise, and therefore injury and/or disturbance to qualifying marine mammal features, include pile drilling, cable trenching and cable laying. Pile drilling will be required at each pile location following pile driving. These have the potential to result in elevated levels of subsea noise that are detectable by marine mammals above background levels and could result in injurious or behavioural effects on qualifying marine mammal features. The impact ranges for both cable trenching and cable laying are considered to be smaller than that of the vessels which will be used to carry out these activities, therefore the impact ranges for vessels have been assessed as a proxy (project design parameters). Noise impacts as a result of cable trenching and laying are therefore not considered further in this assessment.

A summary of the criteria (acoustic thresholds) for the onset of injury PTS and TTS and disturbance used in the marine mammal noise assessment is provided in Table 6-3 and Table 6-4 of appendix F: Marine Mammals and Megafauna – Supporting Information. A detailed underwater noise modelling assessment has been carried out to investigate the potential for injurious and behavioural effects on qualifying marine mammal features as a result of increased vessel noise (non-impulsive sound), using the latest criteria, and is used to inform the assessment presented below. Full details of the approach undertaken to model the effects of injury and disturbance to marine mammal species are provided in (appendix C: Subsea Noise Technical Report).

Injury (auditory injury and collision risk)- Harbour Porpoise

As detailed above, Project specific noise modelling (appendix C: Subsea Noise Technical Report) was conducted for all marine mammal species. The project design includes for a maximum 475 vessel round trips during the offshore construction phase (15 months), with vessel types including jack-up barges, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels, and crew transfer vessels (CTVs). Source sound data for vessels likely to utilised are set out in Table 6-13 (appendix F: Marine Mammals and Megafauna – Supporting Information).

Based on the modelling, the resultant injury (PTS and TTS) ranges for marine mammal species have been set out in appendix F: Marine Mammals and Megafauna – Supporting Information, Table 6-15. The number of marine mammal species potentially affected by PTS or TTS as a result of vessel noise have been calculated based on the most up to date species-specific density estimates and where ranges for density estimates have been applied numbers have been based on the upper density value as a precautionary

approach. Estimates of abundance within associated MU have been used to present these values as a proportion of the population, see appendix F: Marine Mammals and Megafauna – Supporting Information, Table 6-15.

In relation to auditory injury and pile drilling, with the implementation of measures included in the Project (section 5.3.4) such as an approved MMMP and soft starts, the threshold for PTS the noise modelling assessment showed that based on the more precautionary ranges modelled (i.e. SELcum), , for vessel movements was exceeded only for harbour porpoise where PTS could occur out to a maximum of < 15 m for five types of vessel. In respect of TTS the greatest effect ranges were predicted for harbour porpoise from noise associated with vessels such as survey vessels and seabed preparation vessels (1,670 m). There is the potential for up to 12 harbour porpoise to experience TTS at any one time as a result of vessel noise, which equates to < 0.01% of the MU. No other marine mammal species is predicted to experience TTS.

As TTS is a recoverable injury, the impact of elevated noise from vessels leading to injury is predicted to be reversible. Whilst the numbers of animals likely to be affected at any one time are extremely low, the offshore construction phase is expected to last for 15 months. Auditory injury (PTS and TTS) to harbour porpoise as a result of vessels involved in the construction and decommissioning phase is considered to be localised, reversible and of a low magnitude.

In relation to collision risk, vessel traffic associated with the Project has the potential to lead to an increase in vessel movements within the Marine Megafauna Study Area, which could lead to an increase in interactions between marine mammals and vessels during offshore construction. A total of 28 vessels were recorded within a 5 nautical mile (nm) buffer of the offshore wind farm area and offshore cable corridor over the month of January 2019 (one to three vessels per day), with 78 vessels recorded over the month of July 2019 (1 to 6 vessels per day), based on AIS data, and comprising of cargo vessels, fishing vessels, service vessels, tankers, recreational vessels and other vessels. A vessel traffic validation exercise undertaken in 2022 found no significant differences in vessel traffic volumes or patterns between 2019 and 2022. Vessel traffic was recorded transiting to/from Clogherhead, Dundalk Harbour and Carlingford Lough. It is highly likely that a proportion of the Project vessels will be stationary or slow moving throughout construction activities for significant periods of time.

Vessels travelling at 7 m/s- or faster are those most likely to cause death or serious injury (as per the NMFS definition) to marine mammals (Laist *et al*., 2001; Wilson *et al*., 2007). However, vessels involved in the construction phase are likely to be travelling considerably slower than this (except CTVs) and all vessels will be required to follow a Vessel Code of Conduct (see appendix K: Management Plans) to minimise interaction with marine mammals (see section 5.3.4). In addition, the noise emissions from vessels involved in the construction phase are likely to deter animals from the potential zone of impact. As such, collision risk as a result of vessels involved in the construction phase is considered to be localised, intermittent and of high reversibility.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury (auditory injury and collision risk)- Bottlenose Dolphin

With the implementation of measures included in the Project (section 5.3.4) such as an MMP and soft starts, the threshold (based on the more precautionary ranges modelled (i.e. SEL_{cum})), for PTS and TTS for bottlenose dolphin for vessel movements and other construction activities was not exceeded. Bottlenose dolphin is not expected to experience PTS or TTS, and since TTS is a recoverable injury the impact of elevated noise from vessels leading to injury is predicted to be reversible. The magnitude is therefore, considered to be low.

Impacts from vessel traffic associated with the Project are similar to that of Harbour porpoise above and are not reiterated here.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury (auditory injury and collision risk)- Seals

With the implementation of measures included in the Project (section 5.3.4) such as an approved MMMP and soft starts, the threshold (based on the more precautionary ranges modelled (i.e. SEL_{cum})), for PTS and TTS for grey and harbour seals for vessel movements and other construction activities are not predicted to be exceeded. Seals are not expected to experience PTS or TTS, and since TTS is a recoverable injury the impact of elevated noise from vessels leading to injury is predicted to be reversible. The magnitude is therefore, considered to be low.

Impacts from vessel traffic associated with the Project are similar to that of harbour porpoise and bottlenose dolphin above and are not reiterated here.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance- Harbour Porpoise

As detailed above, Project specific noise modelling (appendix C: Subsea Noise Technical Report) was conducted for all marine mammal species. The project design includes for a maximum 475 vessel round trips during the offshore construction phase (15 months), with vessel types including jack-up barges, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels, and CTVs. Source sound data for vessels likely to utilised are set out in Table 6-13 (appendix F: Marine Mammals and Megafauna – Supporting Information).

The number of marine mammals with the potential to be disturbed by construction vessels and pile drilling are presented in Table 6-15 of appendix F: Marine Mammals and Megafauna – Supporting Information, and are based on the most up to date species-specific density estimates, noting that there is likely to be a proportionate disturbance response of animals within the modelled contours (i.e. not all animals will be disturbed to the same extent) (Graham *et al.,* 2017).

Noise modelling which was carried out to estimate the maximum ranges for the onset of disturbance in marine mammals based on exceeding the 120 dB re 1 µPa (rms) threshold applicable for all marine mammals noting that this threshold is for 'mild disturbance' and therefore is not likely to result in displacement of animals. These values have been set out in appendix F: Marine Mammals and Megafauna – Supporting Information, Table 6-15.

It is predicted that up to 302 harbour porpoises have the potential to be disturbed by construction vessels (up to 0.48% of the population) over the largest disturbance range at any one time. However, this represents the maximum number across the entire range of disturbance responses (from slight changes in behaviour, such as changes in swimming speed or direction through to displacement). It is predicted that three harbour porpoises (0.001 - 0.003% of the population) has the potential to be disturbed by boulder clearance out to 760 m. Up to five harbour porpoises (0.002 - 0.008% of the population) has the potential to be disturbed by pile drilling out to 1.083 km. The threshold was not exceeded for a jack up rig.

Harbour porpoise are distributed widely throughout the Irish Sea and therefore it can be assumed (since they have a requirement to feed regularly) that there is suitable foraging habitat across their range. Therefore, localised disturbance within the Marine Megafauna Study Area is unlikely to lead to any population-level effects on this species. The impact of disturbance from vessel traffic on the harbour porpoise population is considered to be localised, reversible and of a low magnitude.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Bottlenose Dolphin

It is predicted that up to 54 bottlenose dolphins have the potential to be disturbed by construction vessels (up to 0.64% of the population) of the SCANS-III abundance estimate for the Irish Sea (the IS MU), and up to 11 bottlenose dolphin have the potential to be disturbed by construction vessels (up to 3.56% of the population)

of the SCANS-IV abundance estimate for the Irish Sea. However, this represents the maximum number across the entire range of disturbance responses (from slight changes in behaviour, such as changes in swimming speed or direction through to displacement). It is predicted that less than one bottlenose dolphin (0.03 – 0.005% of the population) has the potential to be disturbed by boulder clearance out to 760 m. Less than one bottlenose dolphin (0.06 – 0.01% of the population) has the potential to be disturbed by pile drilling out to 1.083 km. The threshold was not exceeded for a jack up rig.

Disturbance is likely to be greater in dolphins in the presence of smaller fast-moving vessels as they are more sensitive to high frequency noise but given the existing levels of traffic in the Marine Megafauna Study Area, the additional vessels associated with the Project are unlikely to increase the risk of disturbance to bottlenose dolphin. It is expected that bottlenose dolphin could tolerate the effects of disturbance without any impact on reproduction and survival rates and would return to previous activities once the impact had ceased. Given their high resilience to the effect with minor impairment of ecological functioning, and high recoverability, their sensitivity is considered to be low.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Seals

It is predicted that 85 grey seals have the potential to be disturbed by construction vessels (1.434% of the population) and 64 harbour seal have the potential to be disturbed by construction vessels (3.885% of the population). However, this represents the maximum number across the entire range of disturbance responses (from slight changes in behaviour, such as changes in swimming speed or direction through to displacement). It is predicted that less than one grey seal (0.011% of the population) and less than one harbour seal (0.031% of the population) has the potential to be disturbed by boulder clearance out to 760 m. Up to two grey seal (0.023% of the population) and up to two harbour seal (0.063% of the population) have the potential to be disturbed by pile drilling out to 1.083 km. The threshold was not exceeded for a jack up rig.

Seals are particularly sensitive to disturbances in regions where vessel traffic overlaps with productive coastal waters (Robards *et al*., 2016). The presence of vessels in foraging grounds could result in reduced foraging success, particularly in harbour seal given reduced foraging ranges (~50 km from haul-outs) when compared to grey seal (~150 km from haul-outs) (SCOS, 2017). The closest haul-out to the offshore wind farm area for both grey seal and harbour seal is 4.5 km to the north at Carlingford Lough, and 10 km to the south at Clogherhead. Vessels could transit to and from the offshore wind farm area from an offshore operations and maintenance (O&M) base located at an existing harbour in County Louth or County Down. Three harbours (Kilkeel, Warrenpoint and Greenore) have suitable facilities and are approximately 1 hour sailing time from the offshore wind farm area. Given the proximity of these haul-outs to existing vessel routes (see section 2: Project description, of the NIS for information on vessel numbers), disturbance at haul-out sites is unlikely to be increased by the construction phase of the Project (see section 2: Project Description for detail on vessel numbers). Given the existing levels of traffic in the Marine Megafauna Study Area, the additional vessels associated with the Project are unlikely to increase the risk of disturbance to seals. It is expected that seals could tolerate the effects of disturbance without any impact on reproduction and survival rates and would return to previous activities once the impact had ceased. Given their high resilience to the effect with minor impairment of ecological functioning, and high recoverability, their sensitivity is considered to be low.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Changes in the fish and shellfish community affecting marine mammal prey resources

Potential effects on the fish assemblages during the construction and decommissioning phases of the Project, as identified in appendix E: Fish and Shellfish Ecology – Supporting Information, may have indirect effects on marine mammal species. Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish species, with demersal fish and shellfish, and demersal spawning species the most vulnerable. The project design parameters assessed in appendix E: Fish and Shellfish

Ecology – Supporting Information, includes for 709,500 m^2 of temporary habitat loss/disturbance during the construction phase, which equates to 1.3% of the offshore wind farm area and offshore cable corridor, therefore representing a very small proportion of the Project site. Due to the localised nature of the effects and the small proportion of the Fish and Shellfish Ecology Study Area affected, temporary loss of habitat was considered unlikely to diminish ecosystem functions for fish and shellfish species and in turn possibility of affecting marine mammal prey resources is low.

Injury and/or disturbance to fish from underwater noise during pile driving could adversely affect fish and shellfish species as a result of mortality, impairment or behavioural effects. The project design parameter assessed in appendix E: Fish and Shellfish Ecology – Supporting Information, is represented by the installation of monopiles via impact/percussive piling with an average maximum hammer energy of 2,500 kJ and absolute maximum hammer energy of 3,500 kJ. Subsea noise modelling showed that mortality or recoverable injury ranges could extend out to a maximum distance of 217 m from the source, as a result of installation of monopiles (SPL_{pk} metric) and TTS could occur out to a maximum distance of 1,750 m as a result of installation of monopiles (SPL_{cum} metric). The potential risk of onset of behavioural effects in fish from installation of piles was based on qualitative criteria set out by Popper *et al.* (2014) and categorises risk of effects in relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e. tens of metres), “intermediate” (i.e. hundreds of metres) or “far” (i.e. thousands of metres). The fish and shellfish assessment reported that proposed piling activities are unlikely to result in mortality, but some recoverable injury is possible within 1 km of the piling works (in the most precautionary scenario), particularly for salmonids, scombridae, gadoids and eels, herring, sprat and shads. Behavioural responses were reported to be more likely for gadoids and eels, herring, sprat and shads within hundreds to thousands of metres from the piling source.

An increase in suspended sediment concentrations (SSC) may lead to short term avoidance of affected areas by sensitive fish and shellfish species, although many species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea. The project design parameters assessed in appendix E: Fish and Shellfish Ecology – Supporting Information, assumed all wind turbine and offshore substation foundations will be installed by drilling 9.6 m diameter piles and installation of inter-array cables through ploughing/jetting. Fish and shellfish species that are likely to be affected by sediment deposition are those that feed or spawn on or near the seabed. Adult fish species are less susceptible to physiological effects from increases in SSC than juveniles. Modelling of SSC associated with the foundation installation showed low levels of suspended sediments with peaks of 100 mg/l extending beyond the offshore wind farm area in all modelled parameters. The average SSC beyond the immediate vicinity of the offshore wind farm area are generally less than 30 mg/l with most of the sediment plume envelope having a SSC of less than 10 mg/l. Sediment deposition is predicted to be indiscernible from the background due to the limited quantity of material released, with the exception of directly at the drill site where cuttings fall to the seabed. Therefore, the impact for all marine mammal species is considered to be localised, reversible and of a low magnitude.

The fish and shellfish communities found within the Fish and Shellfish Ecology Study Area were characteristic of the fish and shellfish assemblages in the wider western Irish Sea (appendix E). Therefore, whilst the offshore wind farm area is located within and close to spawning and nursery grounds (e.g. herring spawning ground) and could potentially be adversely affected by impacts such as temporary habitat loss, underwater noise, and increased SSC. It is expected that all marine mammal species would be able to tolerate the potential aforementioned effects without any impact on reproduction and survival rates and would be able to return to previous activities once the impact had ceased. Given their high resilience to the effect with minor impairment of ecological functioning, and high recoverability, their sensitivity is considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.3.5.2 Operational and maintenance phase

Suitable habitat, disturbance, population, availability of prey, supporting habitats and species

Injury and/or disturbance to marine megafauna from elevated underwater noise during routine geophysical surveys

Routine geophysical surveys are planned to allow inspection of offshore infrastructure foundations, inter-array cables and offshore cable corridor during the operational and maintenance phase of the Project, and these have the potential to cause direct or indirect effects (including injury or disturbance) on marine mammal species. An underwater noise modelling assessment was carried out to investigate the potential for injurious and behavioural effects on marine mammals as a result of geophysical surveys using the latest criteria (Popper *et al.,* 2014) (appendix C: Subsea Noise Technical Report), which is drawn upon in the assessment below.

For sonar-like sources the signal is highly directional, acting like a beam, and is emitted in pulses. Sonar-based sources are considered as continuous (non-impulsive) because they generally comprise a single (or multiple discrete) frequency as opposed to a broadband signal with high kurtosis, high peak pressures and rapid rise times.

Injury- Harbour Porpoise

As detailed above, Project specific noise modelling (appendix C: Subsea Noise Technical Report) was conducted. The noise assessment was based upon the likely parameters of the equipment expected to be employed. Here, the Kongsberg EM710 MBES unit has been modelled operating at 105 kHz, 231 dB re 1µPa re 1 m (rms) in Table 6-11 of appendix F: Marine Mammals and Megafauna – Supporting Information.

Based on the modelling, the resultant injury (PTS and TTS) ranges for harbour porpoise have been set out in Table 6-12 of appendix F: Marine Mammals and Megafauna – Supporting Information. The impact ranges of harbour porpoise potentially affected by PTS or TTS as a result of operational and maintenance phase site investigation surveys have been calculated based on the most up to date species-specific density estimates which are based on comparison to Southall *et al*., (2019) SEL thresholds.

With the implementation of measures included in the Project (see section 5.3.4), harbour porpoise could potentially be affected by PTS (SEL thresholds dB re 1 μPa^2s) out to 227 m and TTS (SEL thresholds dB re 1 μPa^2s) out to 449 m from the sound source. Due to low predicted injury ranges, for all marine mammal species, there is the potential for no more than one animal to experience PTS or TTS as a result of routine geophysical surveys.

The geophysical surveys are considered to be short term as inspection of inter-array cables and offshore cables will be undertaken across a survey campaign duration of up to 14 days per survey (i.e. one 14-day survey window for inspection of inter-array cables; one 14-day survey window for inspection of export cable), up to a maximum of once every five years over the 40-year lifetime of the Project. Similarly, inspection of offshore wind turbine foundations will be conducted up to a maximum of every five years during the Project lifespan, and each survey campaign will last up to 14 days. If all survey campaigns were to be carried out consecutively, this would represent a maximum of 42 days of geophysical surveying every five years, however actual surveying is not expected to occur for the entire survey window, as time has been included here to account for weather and technical downtime. To reduce the potential risk of permanent and temporary auditory injury, designed-in and management measures will be implemented as part of a MMMP including application of DAHG (2014) guidance (see section 5.3.4).

Overall, with measures included in the project applied, the impact of operational and maintenance phase geophysical site investigation surveys is predicted to be of very limited spatial extent, of medium-term and intermittent. Whilst the impact itself would occur during the operational and maintenance phase only, the effect of PTS should it occur, would be permanent. The effect of TTS and the impact itself (i.e. during the geophysical surveys) is reversible. The impact could lead to PTS and/or TTS in a small number of animals but this would not be at a scale that would lead to any measurable population-level effects. The magnitude for PTS and TTS is, therefore, considered to be low.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury-Bottlenose Dolphin

With the implementation of measures included in the Project (see section 5.3.4), bottlenose dolphin could potentially be affected by PTS (SEL thresholds dB re 1 μPa^2s) out to 124 m and TTS (SEL thresholds dB re 1 μPa^2s) out to 172 m from the sound source. Due to low predicted injury ranges, for all marine mammal species, there is the potential for no more than one animal to experience PTS or TTS as a result of operational and maintenance phase geophysical site investigation surveys.

As stated above, site-investigation surveys are considered to be short term (i.e. one 14-day survey window and up to a maximum of once every five years over the 40-year lifetime of the Project, with a maximum of 42 days of geophysical surveying every five years including weather and technical downtime). Overall, with mitigation measures applied (see section 5.3.4), the impact of operational and maintenance phase geophysical site investigation surveys is predicted to be of very limited spatial extent, of medium-term duration and intermittent. The impact could lead to PTS and/or TTS in a small number of animals but this would not be at a scale that would lead to any measurable population-level effects. The magnitude for PTS and TTS is, therefore, considered to be low.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury-Seals

With the implementation of measures included in the Project (section 5.3.4), both grey and harbour seal could potentially be affected by PTS (SEL thresholds dB re 1 μPa^2s) out to 34 m and TTS (SEL thresholds dB re 1 μPa^2s) out to 123 m from the sound source. Due to low predicted injury ranges, for all marine mammal species, there is the potential for no more than one animal to experience PTS or TTS as a result of operational and maintenance phase geophysical site investigation surveys.

As stated above, site-investigation surveys are considered to be short term (i.e. one 14-day survey window and up to a maximum of once every five years over the 40-year lifetime of the Project, with a maximum of 42 days of geophysical surveying every five years including weather and technical downtime). Overall, with mitigation measures applied (see section 5.3.4), the impact of operational and maintenance phase geophysical site investigation surveys is predicted to be of very limited spatial extent, of medium-term duration and intermittent. The impact could lead to PTS and/or TTS in a small number of animals but this would not be at a scale that would lead to any measurable population-level effects.The magnitude for PTS and TTS is, therefore, considered to be low.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Harbour Porpoise

As detailed above, Project specific noise modelling (appendix C: Subsea Noise Technical Report) was conducted. The noise assessment was based upon the likely parameters of the equipment expected to be employed. Here, the Kongsberg EM710 MBES unit has been modelled operating at 105 kHz, 231 dB re 1µPa re 1 m (rms) (Table 6-11 in appendix F: Marine Mammals and Megafauna– Supporting Information). The estimated maximum range for onset of disturbance is based on underwater noise levels being greater than the 120 dB re 1 µPa (rms) threshold applicable for all marine mammals.

Based on the modelling and disturbance criteria (NMFS, 2005), the number of harbour porpoise predicted to be disturbed by operational and maintenance phase geophysical site investigation surveys based on maximum density estimates have been set out in Table 6-12 of appendix F: Marine Mammals and Megafauna – Supporting Information. However, disturbance impacts will not be continuous over the operational and maintenance phase, geophysical site investigation surveys will instead be carried out over a

period of days within any given survey window. Therefore, given the limited quantitative information available any simplified calculation is likely to produce an overestimation of the number of animals potentially disturbed, particularly given the intermittent and highly directional nature of sound from sonar-based survey methods like MBES.

It is predicted that between two and nine harbour porpoise have the potential to be disturbed from geophysical site investigation surveys (0.003-0.013% of the population).

However, all geophysical surveys will be very short duration (up to several months), activities are likely to be intermittent, and animals are expected to recover quickly after cessation of the survey activities. The magnitude of the impact could result in a minor alteration to the distribution of marine mammals. The impact of geophysical surveys leading to behavioural effects is predicted to be of local spatial extent, short term duration, intermittent and the effect of disturbance is of high reversibility (with animals returning to baseline levels soon after surveys have ceased). The impact could lead to changes to behaviour and distribution in a small number of individuals but this would not be at a scale that would lead to any measurable population-level effects. The magnitude is therefore considered to be low.

On this basis, in light of site COs for harbour porpoise and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Bottlenose Dolphin

It is predicted that less than one bottlenose dolphin have the potential to be disturbed from operational and maintenance phase site investigation surveys (representing 0.098% of the SCANS-IV abundance estimate or 0.018% of the SCANS-IV abundance estimate for the Irish Sea) (see Table 6-12 in appendix F: Marine Mammals and Megafauna – Supporting Information).

Magnitude of impact and sensitivity from elevated underwater sound during geophysical site investigation surveys is explained above and is similar to that of harbour porpoise and is not reiterated here.

On this basis, in light of site COs for bottlenose dolphin and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance-Seals

It is predicted that up to two harbour seal (0.107% of the population) and three grey seal (0.039% of the population) have the potential to be disturbed from site investigation surveys (see Table 6-12 in appendix F: Marine Mammals and Megafauna– Supporting Information).

Magnitude of impact and sensitivity from elevated underwater sound during operational and maintenance phase site investigation surveys is explained above and is similar to that of harbour porpoise and bottlenose dolphin and is not reiterated here.

On this basis, in light of site COs for grey seal and harbour seal and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Injury and/or disturbance to marine megafauna from vessels and other construction activities

Operational and maintenance activities may lead to injury and/or disturbance to marine mammal species from vessel activities.

The design includes for a maximum 352 vessel round trips per year over the Project lifetime (see section 5.3.3). An overview of the potential for auditory injury and/or disturbance and injury from collisions with vessels to marine mammal species as a result of Project vessels is given above for the construction phase and is not reiterated here. Vessel types which will be required during the operational and maintenance phase include jack-up vessels, CTVs and survey vessels and therefore the size and noise outputs from these vessels will result in a similar maximum adverse spatial parameters as the construction phase. The impact is

predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the marine mammal species directly. The likelihood of a vessel strike occurring is considered to be very low due to avoidance behaviour, particularly where vessels follow defined routes. The magnitude is therefore, considered to be low (for both auditory injury and disturbance from vessel noise) and negligible (collision risk), for all marine mammal qualifying features.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Changes in the fish and shellfish community affecting marine mammal prey resources

Potential effects on the fish assemblages during the operational and maintenance phases of the Project, may have indirect effects on marine mammal species. Temporary subtidal habitat loss/disturbance could occur as a result of component replacement activities and cable repair/reburial activities. The project design parameters assessed for fish and shellfish (see section 5.5.3) is for 387,000 m^2 of temporary habitat loss/disturbance during the operational and maintenance phase, equating to 0.06% of the offshore wind farm area and offshore cable corridor combined, with only a small proportion of the total habitat loss/disturbance likely to be occurring at any one time over the 40-year operational maintenance phase of the Project. Due to the localised nature of the effects and the small proportion of the Fish and Shellfish Ecology Study Area affected, temporary loss of habitat/disturbance was considered unlikely to diminish ecosystem functions for fish and shellfish species and in turn possibility of affecting marine mammal prey resources is low.

Increased SSC could occur as a result from repair or reburial of the inter array and offshore export cables. The project design parameters assessed for fish and shellfish (see section 5.5.3), assumed seven inter-array cable repair, seven reburial events and three offshore export cable repair and three reburial events over the Project lifetime, using similar methods as those for cable installation activities (i.e. trenching/jetting). The Fish and Shellfish Ecology impact assessment considered that any SSC and associated deposition will be similar or lower than that assessed for the construction phase. Therefore, the impact for all marine mammal species is considered to be localised, reversible and of a low magnitude.

Long-term subtidal habitat loss (for the duration of the 40-year operational and maintenance phase) will occur under all foundation structures, associated scour protection and any required cable protection, and may result in impacts on fish and shellfish species. The project design parameters assessed for fish and shellfish (see section 5.5.3), assumed up to 332,060 m^2 of long-term habitat loss, equating to 0.4% of the offshore wind farm area and offshore cable corridor combined. Fish and shellfish species that are reliant upon the presence of suitable sediment/habitat for their survival are considered to be more vulnerable to change. The fish species most vulnerable to habitat loss include sandeel which are demersal spawning species (i.e. eggs are laid on the seabed), as these have specific habitat requirements for spawning (i.e. sandy sediments). However, the proportion of habitat affected within the offshore wind farm area and offshore cable corridor is small and this area is smaller still in the context of the known sandeel habitats and the potential sandeel habitats in the wider Western Irish Sea Fish and Shellfish Ecology Study Area.

The sensitivity of marine mammal species during the operational and maintenance phase are not expected to significantly differ from the construction phase despite the potential for long-term loss of fish and shellfish habitat or EMF. This is due to the very small scale and localised nature of the impact. It is expected that all marine mammal receptors would be able to tolerate the effect without any impact on reproduction and survival rates, and therefore the sensitivity of all marine mammal species is considered to be low. The magnitude is considered to be low for both short-term and long-term impacts. It is predicted that for temporary habitat loss and increased SSC impacts for all marine mammals is considered to be localised, reversible and of a low magnitude. For long-term habitat loss and EMF, the impact for all marine mammal species is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the species indirectly.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.4 Annex II Terrestrial and Freshwater Mammals

5.4.1 European Sites within the ZoI

5.4.1.1 Brief description of relevant European sites

River Boyne and River Blackwater SAC (IE002299)

River Boyne and River Blackwater is a large SAC of approximately 2318 ha, located c. 12.3 km south of the Project. It has three Annex II QI species and two Annex I QI habitat types, as well as examples of other important habitat types. This SAC comprises the freshwater element of the River Boyne as far as the Boyne Aqueduct, the Blackwater as far as Lough Ramor and the Boyne tributaries including the Deel, Stoneyford and Tremblestown Rivers. These riverine stretches drain a considerable area of Meath and Westmeath, as well as smaller areas of Cavan and Louth. The underlying geology of this SAC is predominately Carboniferous Limestone, with areas of Upper, Lower and Middle well represented. Silurian Quartzite is present in the vicinity of Kells, while Carboniferous Shales and Sandstones are also present close to Trim. A number of large towns are located adjacent to but not within the SAC, including Slane, Navan, Kells, Trim, Athboy and Ballivor.

5.4.1.2 Conservation objectives

COs for the relevant SAC were reviewed (NPWS, 2021b). (Table 5-12 identifies the CO attributes which could potentially be adversely affected by the Project, for relevant QIs scoped into the Stage 2 assessment (i.e. QIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects).

Table 5-12: Conservation Objective Attributes for relevant Annex II terrestrial and freshwater mammals

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
River Boyne and River Blackwater SAC (IE002299) (NPWS, 2021b; Version 1)		
Otter (*Lutra lutra*) [1355]	To maintain the favourable conservation condition	Distribution Extent of terrestrial habitat Extent of freshwater (river) habitat Extent of freshwater (lake) habitat Couching sites and holts: Fish biomass available Barriers to connectivity

5.4.2 Baseline environment

The baseline environment of QI terrestrial and freshwater mammals has been fully characterised in appendix I: Onshore Biodiversity – Supporting Information.

5.4.2.1 Data validity and limitations

Data validity depends on the sensitivity of the baseline environment and the nature and type of potential impacts that arise as a result of the Project. Table 5-13 provides details on the validity of the survey data used to inform the assessment of Annex II terrestrial and freshwater mammals, and has been reviewed in line with the CIEEM Advice Note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019). CIEEM (2019) provides guidance on the age of survey data that can be used to inform the assessment. Where CIEEM does not provide guidance on a particular survey type, professional judgement has been provided.

Table 5-13: Baseline environment - data validity.

Survey Title	Period of survey	Recommended lifespan for the data	Is data valid? Yes /No Notes
Otter	October and December 2019; February 2021; July 2022 and April 2023.	12 months (CIEEM, 2019)	Yes. Otters are mobile species, and the Project utilises HDD method in order to avoid suitable freshwater habitat. These data are considered valid for one year (and more based on the Project parameters),and meets the CIEEM recommended advice note of 12 months for mobile-species.

Data limitations in relation to both desktop and field studies are described under section 5.2.2.1.

5.4.3 Project design parameters

The project design parameters for terrestrial and freshwater mammals has been fully described in section 5.2.3 under onshore biodiversity.

5.4.4 Measures included in the Project

The measures for terrestrial and freshwater mammals has been fully described in section 5.2.4 under onshore biodiversity.

5.4.5 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project is outlined in Table 5-14.

Table 5-14: Prediction of adverse effects on site integrity during construction, operation, maintenance, and decommissioning phases of the Project

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s)
River Boyne and River Blackwater SAC (IE002299) NPWS, 2021b; Version 1 03/12/2021)			
Otter (*Lutra lutra*) [1355]	Surface water pollution Disturbance (i.e. noise, vibration and human presence).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01).	**Distribution** -Predicted impacts from surface water pollution indirectly affecting food source. **Extent of terrestrial habitat** -None predicted as project avoids activity within and the removal of this habitat. **Extent of freshwater (river) habitat** -None predicted as project avoids activity within and the removal of this habitat. **Extent of freshwater (lake) habitat** -None predicted as project avoids activity within and the removal of this habitat. **Couching sites and holts** -None predicted as project avoids activity within and the removal of this habitat. **Fish biomass available** -Predicted impacts from surface water pollution affecting the availability of fish. **Barriers to connectivity**

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s)
			-None predicted as the project will not interfere with the movement of otter.

5.4.5.1 Construction/decommissioning phase

Of the SAC qualifying interests considered, one is a freshwater Annex II mammal. No Annex II terrestrial mammal features are associated with the European sites listed in Table 5-12. Otter (*Lutra lutra)* can be found in various habitats across the country, from small streams to large rivers, as well as lakes, wetlands, estuaries and beaches. Otter is associated with four European sites within the Terrestrial and Freshwater Study Area. with territories that can range to 21 km (Ó Néil *et al*., 2009) depending on food availability in the area. The territories of males tend to be larger than females and have been known to forage up to distances of 32 km and 40 km (NatureScot 2021; National Trust, 2021). Only one European site within the Terrestrial and Freshwater Study Area is within 40 km of the Project, and therefore within the ZoI for QI otter.

The River Boyne and River Blackwater SAC is hydrologically connected to the Project and is located 12.3 km south. Otter can be found throughout this site which is also known to support both river lamprey and Atlantic salmon. River lamprey is present in the lower reaches of the site while Atlantic salmon use the tributaries and headwaters as spawning grounds (NPWS, 2014d).

As the site is located <20 km from the Project, and otter have a wide foraging range (up to 40 km) it is likely that otter associated with the River Boyne and River Blackwater SAC are at least passing through the network of rivers which intersect the Project. Additionally, an otter sighting was recorded by RPS ecologists in 2021 along the River Dee (approximately 100 m north of the N33 bridge crossing the River Dee). This means they could be subject to potential localised and temporary disturbance (e.g. noise, vibration and human presence) ultimately affecting their distribution in terms of foraging. As such, effects on the COs of this terrestrial Annex II mammal could occur and likely significant effects could not be excluded at the screening for AA stage (see appendix A).

Distribution

Potential effects on the fish assemblages during the construction and decommissioning phases of the Project could include increased suspended sediment concentrations (SSC) or accidental pollution, which may have indirect effects on otter in terms of their distribution. Potential effects during the construction and decommissioning phases of the project could also include disturbance which may impact otter distribution when foraging within the area of the Project.

The SAC is located 12.3 km south of the Project. The Project will not introduce any barriers to the movement of otter or directly cause any habitat loss affecting couching sites or holts within the SAC. However, indirect impacts from exposure to localised and temporary suspended sediment or accidental pollution could include short- and long-term reductions in food availability. As fish species can range widely from their core areas, there is the potential for fish assemblages (of which otter are reliant) to travel nearer to or within the offshore wind farm area. Further detail on the effects of suspended sediment or accidental pollution events on fish are detailed in section 5.5, which concludes no adverse effect on fish community assemblages.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.4.5.2 Operational and maintenance phase

Distribution

Any suspended sediments and associated deposition within the offshore wind farm area and offshore cable corridor will be of the same magnitude, or lower as for construction. For the purposes of this assessment, the impacts of the operational and maintenance activities on disturbance, prey availability and surface water pollution for otter are predicted to be similar to those for construction and are not reiterated here.

Otters could be subject to potential localised and temporary disturbance (e.g. noise, vibration and human presence) ultimately affecting their distribution in terms of foraging. These impacts are deemed likely to be small-scale during the lifetime of the Project (i.e. maintenance personnel associated with the onshore infrastructure, maintenance personnel/transfer vessels associated with an operations and maintenance (O&M) base for the purpose of maintaining offshore infrastructure) and the magnitude of the effect is likely to be localised.

Changes in EMF from subsea electrical cabling has also been identified as an impact during the operational and maintenance phase of the Project as it has the potential to emit a localised EMF, which may affect prey availability for otter. This is described in detail in the section below and not reiterated here.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Fish biomass available

Any suspended sediments and associated deposition as a result of the installation/removal of foundations and installation/removal of inter-array and offshore cables will be of the same magnitude, or lower as for construction. For the purposes of this assessment, the impacts of the operational and maintenance activities on prey availability and surface water pollution for otter are predicted to be similar to those for construction and are not reiterated here.

Changes in EMF from subsea electrical cabling has also been identified as it has the potential to emit a localised EMF. EMF could potentially affect the sensory mechanisms of some species of fish and shellfish, particularly electrosensitive and magnetosensitive species such as Annex II migratory fish species (i.e. behavioural changes in individuals of the species, physical injury, hearing damage, disturbance or displacement by underwater noise levels generated), which may have indirect effects on otter relating to prey availability. Background measurements of the magnetic field are approximately 50 µT in the North Sea, and the naturally occurring electric field in the North Sea is approximately 25 µV/m (Tasker *et al.,* 2010). The strength of the magnetic field (and consequently, induced electrical fields) decreases rapidly horizontally and vertically with distance from source. In summary, the range over which these species can detect electric fields is limited to centimetres, rather than metres, around these species (CSA, 2019). The impact of EMFs is predicted to be of local spatial extent, long term duration (i.e. the lifetime of the Project), continuous and irreversible during the operational and maintenance phase (recoverability is possible following completion of decommissioning). It is predicted that the impact has the potential to affect receptors directly. The magnitude is therefore, considered to be low. As pelagic species generally swim well above the seafloor and can be expected to rarely be exposed to the EMF at the lowest levels from Alternating Current (AC) undersea power cables buried in the seafloor, resulting in impacts that would therefore be localised and transient.

Operational and maintenance activities within the offshore wind farm area and offshore cable corridor may lead to temporary subtidal habitat loss/disturbance, as a result of the use of jack-up vessels during any component replacement activities and during any inter-array and offshore cable repair activities. This may affect fish biomass in turn affecting prey resource availability for otters. The project design parameters is for 387,000 m^2 (0.7% of the Project area). Therefore this represents a very small proportion of the offshore wind farm area and offshore cable corridor combined. The impacts are predicted to be localised, reversible and of a negligible magnitude.

Long-term habitat loss is expected due to the Project infrastructure (332,060 m^2 or 0.4% of the offshore wind farm area and offshore cable corridor combined) therefore this represents a very small proportion of the offshore wind farm area and offshore cable corridor combined. There is some evidence of increases in numbers of species associated with hard substrates) Degraer *et al.,* 2020). Long-term habitat loss/disturbance is predicted to be localised, reversible of a low magnitude.

There is potential for effects on prey availability which may impact otter prey resources due to EMFs associated with the project during its operational lifetime. Magnitude is predicted to be low and as portrayed in Table 6-5 (appendix E) there is little evidence of disturbance due to geomagnetic field detection and electrosensitivity.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.5 Annex II Fish Species

5.5.1 European Sites within the ZoI

5.5.1.1 Brief description of relevant European sites

Slaney River Valley SAC (IE000781)

See section 5.3.1.1.

River Boyne and River Blackwater SAC (IE002299)

See section 5.4.1.1.

5.5.1.2 Conservation Objectives

COs for the River Boyne and River Blackwater SAC (IE002299) (NPWS, 2021b) and Slaney River Valley SAC (IE000781) (NPWS, 2011b) were reviewed. Table 5-15 identifies the CO attributes which could potentially be adversely affected by the Project, for relevant QIs scoped into the Stage 2 assessment (i.e. QIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects).

Table 5-15: Conservation Objective Attributes for relevant Annex II fish species.

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
River Boyne and River Blackwater SAC (IE002299) (NPWS, 2021b; Version 1 03/12/2021)		
Atlantic Salmon (*Salmo salar*) [1106]	To restore the favourable conservation condition	Distribution: extent of anadromy Adult spawning fish Salmon fry abundance Out-migrating smolt abundance Number and distribution of redds Water quality
River Lamprey (*Lampetra fluviatilis*) [1099]	To restore the favourable conservation condition	Distribution Distribution of larvae Population structure of larvae Larval lamprey density in fine sediment Extent and distribution of spawning habitat
Slaney River Valley SAC (IE000781) (NPWS 2011b; Version 1 21/10/2011)		
Atlantic Salmon (*Salmo salar*) [1106]	To restore the favourable conservation condition	Distribution: extent of anadromy Adult spawning fish Salmon fry abundance Out-migrating smolt abundance Number and distribution of redds Water quality
Sea Lamprey (*Petromyzon marinus*) [1095]	To restore the favourable conservation condition	Distribution: extent of anadromy Population structure of juveniles Juvenile density in fine sediment

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
		Extent and distribution of spawning habitat Availability of juvenile habitat
River Lamprey (*Lampetra fluviatilis*)	To restore the favourable conservation condition	Distribution: extent of anadromy Population structure of juveniles Juvenile density in fine sediment Extent and distribution of spawning habitat Availability of juvenile habitat
Twaite Shad (*Alosa fallax fallax*) [1103]	To restore the favourable conservation condition	Distribution: extent of anadromy Population structure- age classes Extent and distribution of spawning habitat Water quality- oxygen levels Spawning habitat quality: Filamentous algae; macrophytes; sediment

5.5.2 Baseline environment

The baseline environment of QI fish species has been fully characterised in appendix E: Fish and Shellfish Ecology – Supporting Information and appendix I: Onshore Biodiversity – Supporting Information.

5.5.2.1 Data validity and limitations

Within the offshore environment, the data sources used to inform the assessment on Annex II fish species are detailed appendix E: Fish and Shellfish Ecology – Supporting Information. The desktop data used are the most up to date publicly available information which can be obtained from the applicable data sources as cited. Data that has been collected is based on long-term existing literature, consultation with stakeholders, wider available survey data and identification of habitats to inform likely fish and shellfish species. No site-specific surveys have been carried out to inform the assessment, therefore, it is possible that fish and shellfish species within the offshore environment have not been identified. However, given the detailed desktop study completed and the conservative approach adopted, which has included identification of a regional Fish and Shellfish Ecology Study Area (i.e. the Western Irish Sea Fish and Shellfish Ecology Study Area), it is unlikely that key species have been omitted.

Within the onshore environment, Table 5-16 provides details on the validity of the survey data used to inform the Annex II fish species assessment, and has been reviewed in line with the CIEEM Advice Note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019). CIEEM (2019) provides guidance on the age of survey data that can be used to inform the assessment. Where CIEEM does not provide guidance on a particular survey type, professional judgement has been provided.

Table 5-16: Baseline environment - data validity.

Survey Title	Period of survey	Recommended lifespan for the data	Is data valid? Yes /No Notes
Fish	October 2019; and July 2023.	18 months (CIEEM, 2019)	Yes. Where there has been no significant landuse change (e.g. fish kills, land management changes, tree felling) , data are considered valid for 1.5 years, and meets the CIEEM recommended advice note of 18 months.

Data limitations in relation to both desktop and field studies within the onshore environment are described under section 5.2.2.1.

5.5.3 Project design parameters

5.5.3.1 Above high water mark

The project design parameters for fish and shellfish ecology above the high water mark has been fully described in section 5.2.3 under onshore biodiversity.

5.5.3.2 Below high water mark

Table 5-17 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on fish and shellfish.

Due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore export cable and offshore inter array cables will be confirmed during construction (see design flexibility details in section 2 – Project Description). For the purposes of the assessment presented in section 5.5.5, the maximum length of cables has been considered to ensure the potential for maximum impact is assessed. Should the lengths of cables be less than those specified, then the potential for effects will not change the assessment outlined in section 5.5.5. An alternative route within the offshore wind farm area of offshore cable corridor will also not change the assessment presented in section 5.5.5.

Table 5-17: Project design parameters considered for the assessment of potential impacts on Fish and Shellfish Ecology.

Potential impact	Phase[1]			Project design parameters	Justification
	C	O	D		
Temporary subtidal habitat loss/disturbance	✓	✓	✓	**Construction phase** 709,500 m^2 of temporary habitat loss/disturbance due to: • 54,000 m^2 due to the use of jack-up vessels during foundation installation, with two jack-up events per wind turbine generator (WTG) and four jack-up events for the offshore substation (OSS); • 570,000 m^2 due to the installation of 41 km inter-array cables and 16 km offshore cable with seabed disturbance width of 10 m; and • 85,500 m^2 due to sand wave clearance for 10% of inter-array cables and 10% of the offshore cable. Offshore construction phase duration of 15 months. **Operational and maintenance phase** 387,000 m^2 of temporary habitat loss/disturbance due to: • 51,000 m^2 due to component replacement activities using jack-up vessel associated with 25 WTGs and OSS; • 210,000 m^2 due to inter-array cables: seven repair events and seven reburial events over the lifetime of the Project; and • 126,000 m^2 due to offshore cable: three repair events and three reburial events over the lifetime of the Project (three intertidal and three subtidal). Operational phase of 40 years. **Decommissioning phase** 624,000 m^2 of temporary habitat loss/disturbance. Parameters are assumed to be the same as for the construction phase with the exception that that	The accounted number of WTGs and OSS and the maximum length of cables resulting in greatest extent of temporary habitat loss.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
				there will be no sand wave clearance or seabed clearance associated with foundation installation.	
Injury and/or disturbance to fish from underwater noise during pile-driving	✓	×	×	**Construction phase** • 26 monopiles (WTGs and OSS) of 9.6 m diameter; • Average maximum hammer energy of 2,500 kJ (absolute maximum of up to 3,500 kJ); • Average five hours piling per pile (maximum of eight hours) with one pile expected to be installed in each 24-hour period; • Maximum of 208 hours piling over a total of 26 days.	The assessment of potential impacts considers the maximum hammer energies and maximum piling duration for monopile installation. In many cases, monopile installation will require lower hammer energies and shorter piling durations.
Increased suspended sediment concentrations and associated sediment deposition	✓	✓	✓	**Construction phase** WTGs and OSS installed on monopile foundations: • Drilled installation of 9.6 m diameter pile. Installation of inter-array cables and offshore cable: • Disturbance of seabed material from a 1 m wide trench for inter-array cables, 3 m wide trench for offshore cable and 3 m deep trench; and • Modelled cable lengths over areas of sand and muddy sand. **Operational and maintenance phase** Cable repair/reburial activities: • Inter-array cables: seven repair events and seven reburial events; and • Offshore cable: three repair events and three reburial events (three subtidal and three intertidal). **Decommissioning phase** WTGs and OSS on monopile foundations: • Cutting and removal of monopile foundations to approximately 2 m below seabed. Removal of inter-array cables and offshore cable: • Disturbance of seabed material from a 1 m wide trench for inter array cables, 3 m wide trench for offshore cable and 3 m deep trench.	Greatest volume of sediment released into the water column. See appendix B: Marine Processes Technical Report for further justification.
Long-term subtidal habitat loss	×	✓	×	**Operational and maintenance phase** 332,060 m^2 of long-term habitat loss due to: • Presence of 26 (i.e. 25 x WTG + 1 x OSS) monopile foundations with base diameter of 9.6 m and associated scour protection; and • Presence of cable protection associated with 41 km inter-array cables and 16 km offshore cable. Assumes 50% of inter-array cable route and 50% of offshore cable may require cable protection. Operational phase 40 years.	The accounted number of WTG and OSS foundation type and associated scour protection; maximum length of cables and cable protection resulting in greatest extent of habitat loss.
Electromagnetic Fields (EMF) from subsea electrical cabling	×	✓	×	**Operational and maintenance phase** Presence of inter-array cables and offshore cable: • 41 km of 66 kV AC inter-array cables; • 16 km of 220 kV offshore cable; • Burial depths of between 0.5 m and 3 m; and • 50% of inter-array cable route and 50% of offshore cable corridor may require cable protection.	Maximum length of cables and minimum burial depth (the greater the depth the more the EMF is attenuated).

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
				Operational phase of 40 years.	

1 C= Construction, O = Operation, D = Decommissioning

5.5.4 Measures included in the Project

5.5.4.1 Above high water mark

See section 5.2.4 for measures related to onshore biodiversity.

5.5.4.2 Below high water mark

As part of the project design process (see section 2), a number of measures have been proposed to reduce the potential for impacts on fish receptors. These measures were not taken into account at the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A) in accordance with guidance and prevailing case law but can lawfully be taken into account for the Stage 2 appraisal.

These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 5.5.5. These measures are considered standard industry practice for this type of development.

Measures relevant to Annex II fish are presented in Table 5-18 below. See also Table 5-5 which includes relevant water quality protection measures. This approach has taken regard of the mitigation hierarchy as described by CIEEM (2018), where a sequential process is adopted to avoid, mitigate and compensate negative ecological impacts and effects.

Table 5-18: Measures included in the Project – fish and shellfish.

Measures included in the Project	Justification
An EMP (see appendix K: Management Plans) has been prepared will be implemented during the construction, operational and maintenance and decommissioning phases of the Project. The EMP includes project specific measures and commitments and a Marine Pollution Contingency Plan (MPCP). Measures also include: designated areas for refuelling where spillages can be easily contained, storage of chemicals in secure designated areas in line with appropriate regulations and guidelines, double skinning of pipes and tanks containing hazardous substances, and storage of these substances in impenetrable bunds.	To ensure that the potential for release of pollutants from construction, operational and maintenance and decommissioning plant is minimised. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project.
Burial and protection of cables - The cables will be buried below the seabed wherever possible, to a minimum burial depth of 0.5 m and a maximum burial depth of 3 m. The appointed contractor will be required prior to the construction phase to submit details on the cable specification and installation methodology. This will include details on the cable laying, including geotechnical data, cable laying techniques and a cable burial risk assessment. Also, in advance of any cable repair, the contractor will be required to submit details on the parameters of the repair or reburial activities and the proposed methodology.	While burial of cables will not reduce the strength of EMF, it does increase the distance between cables and marine mammal and megafauna (and fish and shellfish) receptors, thereby potentially reducing the effect on those receptors.
During piling operations, soft starts will be used (in accordance with international best practices for underwater noise, which includes the 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014)). This will involve the implementation of lower hammer energies (i.e. approximately 10-15% of the maximum hammer energy; see section 6.2 below) at the beginning of the piling sequence before energy input is 'ramped up' (increased) over time to required higher levels.	This measure will minimise the risk of injury to fish species in the immediate vicinity of piling operations, allowing individuals to flee the area before noise levels reach a level at which injury may occur.

5.5.5 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project is outlined in Table 5-19.

Table 5-19: Prediction of adverse effects on site integrity during the construction, operational and maintenance, and decommissioning phases of the Project.

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s)
River Boyne and River Blackwater SAC (IE002299) (NPWS, 2021b; Version 1 03/12/2021)			
Atlantic Salmon (*Salmo salar*) [1106]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01).	**Distribution: extent of anadromy** -Predicted impacts from both suspended sediments and disturbance affecting distribution. **Adult spawning fish** -Predicted impacts from suspended sediments and disturbance on adults returning to spawn in rivers from the marine environment. **Salmon fry abundance** -None predicted as Project avoids spawning habitat where fry emerge and remain for up to one year or more. **Out-migrating smolt abundance** -Predicted impacts from suspended sediments and disturbance on adults arriving in estuaries as they migrate toward the ocean. **Number and distribution of redds** **-**None predicted as Project avoids spawning habitat where adult salmon create their redds. **Water quality** -None predicted. Potential water quality impacts are highly unlikely. Measures included in the Project will minimise (should they occur) any accidental release of pollutants,
River Lamprey (*Lampetra fluviatilis*) [1099]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01).	**Distribution** **-**Predicted impacts from both suspended sediments and disturbance affecting distribution. **Distribution of larvae** -Predicted impacts from both suspended sediments and disturbance affecting distribution. **Population structure of larvae** -None predicted as the Project does not interact with the larval stage which remain in the soft sediment of freshwater habitat for several years. **Larval lamprey density in fine sediment** -None predicted as Project avoids slow flowing fine sediment habitat where juvenile river lamprey grow for several years.

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s)
			Extent and distribution of spawning habitat -None predicted as Project avoids spawning habitat.
Slaney River Valley SAC (IE000781) (NPWS, 2011b; Version 1 21/10/2011); (NPWS, 2018c)			
Atlantic Salmon (*Salmo salar*) [1106]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01) and siltation rate changes, dumping, depositing of dredged deposits (J02 11).	**Distribution: extent of anadromy** -Predicted impacts from both water pollution and disturbance affecting distribution. **Adult spawning fish** -Predicted impacts from water pollution and disturbance on adults returning to spawn in rivers from the marine environment. **Salmon fry abundance** -None predicted as Project avoids spawning habitat where fry emerge and remain for up to one year or more. **Out-migrating smolt abundance** -Predicted impacts from water pollution and disturbance on adults arriving in estuaries as they migrate toward the ocean. **Number and distribution of redds** -None predicted as project avoids spawning habitat where adult salmon create their redds. **Water quality** -None predicted. Potential water quality impacts are highly unlikely. Measures included in the Project will minimise (should they occur) any accidental release of pollutants,
Sea Lamprey (*Petromyzon marinus*) [1095]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01) and siltation rate changes, dumping, depositing of dredged deposits (J02 11).	**Distribution: extent of anadromy** -Predicted impacts from both suspended and disturbance affecting distribution. **Population structure of juveniles** -None predicted as Project does interact with the juvenile life cycle stage which remain in the soft sediment of freshwater habitat for several years. **Juvenile density in fine sediment** -None predicted as Project avoids slow flowing fine sediment habitat where juvenile river lamprey grow for several years. **Extent and distribution of spawning habitat** -None predicted as Project avoids spawning habitat. **Availability of juvenile habitat** -None predicted as Project avoids slow flowing spawning habitat where juvenile sea lamprey grow for several years.

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s)
River Lamprey (*Lampetra fluviatilis*) [1099]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01) and siltation rate changes, dumping, depositing of dredged deposits (J02 11).	**Distribution: extent of anadromy** Predicted impacts from both suspended sediment and disturbance affecting distribution and therefore potentially affecting anadromous behaviour. **Population structure of juveniles** None predicted as temporary impacts are not considered to alter significantly the population structure of River Lamprey. **Juvenile density in fine sediment** -None predicted as Project avoids slow flowing fine sediment habitat where juvenile river lamprey grow for several years. **Extent and distribution of spawning habitat** **-**None predicted as Project avoids spawning habitats. **Availability of juvenile habitat** -None predicted as Project avoids slow flowing spawning habitat where juvenile river lamprey grow for several years.
Twaite Shad (*Alosa fallax fallax*) [1103]	Suspended sediments. Injury and/or disturbance (i.e. noise, vibration and electromagnetic fields).	Pollution to surface waters (limnic, terrestrial, marine & brackish) (H01) and siltation rate changes, dumping, depositing of dredged deposits (J02 11).	**Distribution: extent of anadromy** **-**Predicted impacts from both suspended sediment and disturbance affecting distribution and therefore potentially affecting anadromous behaviour. **Population structure - age classes** **-**None predicted as temporary impacts are not considered to alter significantly the population structure and age classes of Twaite shad. **Extent and distribution of spawning habitat** **-**None predicted as Project avoids rocky river substrates where twaite shad spawn. **Water quality: oxygen levels** -None predicted. Potential water quality impacts are highly unlikely. Measures included in the Project will minimise any accidental release of pollutants. **Spawning habitat quality: Filamentous algae; macrophytes; sedimen**t -None predicted as project avoids rocky twaite shad spawning habitats.

5.5.5.1 Construction/decommissioning phases

Distribution: extent of anadromy and larvae

The focus of this CO is that rivers should be accessible from coastal and estuarine waters to allow the migration of adults in order to prevent them being limited to spawning habitat in the lower stretches of a river.

The Project will not introduce any barriers to the movement of fish but could have potential effects as a result of increased suspended sediment (i.e. habitat disturbance) and disturbance as a result of underwater noise during pile-driving. Such effects could occur on individuals attempting upstream migration from marine waters, therefore indirectly affecting anadromous distribution and larvae fish species.

Increases of suspended sediments and associated sediment deposition are predicted to occur as a result of the installation/removal of foundations and installation/removal of inter-array and export cables. Modelling of suspended sediments associated with the foundation installation showed low levels of suspended sediments with peaks of 100 mg/l extending beyond the offshore wind farm area in all modelled events (see appendix B: Marine Processes Technical Report). The average sediment concentration beyond the immediate vicinity of the offshore wind farm area are generally less than 30 mg/l with most of the sediment plume envelope having a suspended sediment concentration of less than 10 mg/l. In terms of the installation of the inter-array cables, sediment modelling showed a peak concentration of 2,000 mg/l in the immediate vicinity of cable installation, with averages less than 3 mg/l, which is comparable to background levels (i.e. see appendix B: Marine Processes Technical Report). Sediment plumes (inter-array cables) are only expected to persist for a maximum of 2-3 hours in any location. Sedimentation will occur in the immediate vicinity of the inter-array cable installation activities, with no discernible levels of sedimentation modelled to occur beyond the offshore wind farm area. For the offshore cable, modelling showed peak concentrations of 300mg/l which is equivalent to turbidity levels during storm conditions. Sediment plumes (offshore cable) are only expected to persist for a maximum of 3-4 hours in any location (as the tide turns). Sedimentation will occur in the immediate vicinity of the offshore cable installation activities.

Increased SSC and associated sediment deposition are predicted to be localised, of temporary short-term duration and of a low magnitude. Migratory fish species known to occur in the area are expected to have some tolerance to naturally high SSC, given their migration routes typically pass through estuarine habitats for which background SSC are considerably higher than those expected in the offshore areas of the western Irish Sea Fish and Shellfish Ecology Study Area. As it is predicted that construction activities associated with the Project will produce temporary and short lived increases in SSC, any migratory fish species should only be temporarily affected (if they are affected at all). Any adverse effects on these species are likely to be short-term behavioural effects (i.e. avoidance) and are not expected to create a barrier to migration to rivers or estuaries used by these species in the western Irish Sea Fish and Shellfish Ecology Study Area. All migratory fish receptors within the Fish and Shellfish Ecology Study Area are deemed to be of low vulnerability, high recoverability and of international importance. The sensitivity of the receptor is therefore, considered to be low.

Disturbance is expected to occur in the form of underwater noise as a result of construction and decommissioning activities such as the installation of foundations and pile driving within the offshore wind farm area. Subsea noise modelling was undertaken with full details presented in appendix C: Subsea Noise Technical Report. Table 6-1 of appendix E sets out the criteria for onset injury/disturbance to fish due to impulsive piling based on Popper *et al.* (2014). Table 6-2 and Table 6-3 of appendix E display the predicted injury/disturbance range for peak sound pressure levels (SPL_{pk}) and cumulative sound exposure level (SEL_{cum}), respectively.

For peak pressure noise levels when piling energy is at its maximum (i.e. 3,500 kJ), recoverable injury to fish may occur within approximately 357 m of the piling activity. The potential for mortality or mortal injury to fish eggs would also occur at distances of up to 357 m. It should be noted that these ranges are the maximum ranges for the maximum hammer energy, and it is unlikely that injury/disturbance will occur in this range due to the implementation of soft starts during piling operations (see section 5.5.4). These measures will allow fish to move away from the areas of highest noise levels, before they reach a level that would cause an injury/disturbance. The initial injury/disturbance ranges for soft start initiation are considerably lower (i.e. approximately 118 m to approximately 172 m).

For cumulative noise levels over a period of 24 hours, recoverable injury/disturbance to fish may occur within approximately 20 m of the piling activity, while for eggs and larvae mortality could occur to ranges of up to 362 m. The risk of fish injury/disturbance will be considerably lower due to the hammer energies being lower than the absolute maximum modelled, the expected fleeing behaviour of fish from the area affected when exposed to high levels of noise and the soft start procedure which will be employed for all piling to ensure that fish have sufficient time to vacate the areas where injury may occur prior to noise levels reaching that level. Disturbance in fish species can also trigger a behavioural responses such as startle responses (also

known as C-turn responses), strong avoidance behaviour, changes in swimming or schooling behaviour or changes of position in the water column.

The modelled outputs show that noise attenuation is rapid with distance from foundation location. They also indicate that, based on a behavioural response occurring at levels in excess of 160 dB re 1 µPa SPL_{peak}, fish may exhibit behavioural responses within approximately 7 km from the source which would not fully extend to the coastline. Therefore, there is a large area for fish to navigate along the coast whilst avoiding the noise source when migrating to and from rivers in which these species may spawn (e.g. River Boyne and River Blackwater SAC). As such, there is no potential for diadromous species to experience barriers to migration when moving from freshwater systems into and within the marine environment. In summary, proposed piling activities are unlikely to result in mortality of fish.

The implementation of the soft start procedure will result in fish swimming away from the noise source prior to piling noise reaching maximum energy levels. Behavioural responses are also more likely to be observed for gadoids and eels, herring, sprat and shads within hundreds to thousands of metres from the piling source during piling activity before returning to baseline conditions on completion of works. Given the varying levels of sensitivity associated with identified fish receptors (e.g. lamprey- fishes lacking swim bladders. These species are only sensitive to particle motion, not sound pressure and show sensitivity to only a narrow band of frequencies) are deemed to be of low vulnerability and medium recoverability. The sensitivity of these fish receptors is therefore considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Adult spawning fish

Adult fish return to rivers from the marine environment arriving at their spawning grounds typically during the summer months. Potential effects during the construction and decommissioning phases of the project include increased suspended sediments (i.e. habitat disturbance) and disturbance as a result of underwater noise during pile-driving which may impact Annex II adult spawning fish during their migration through the marine environment. These impacts are predicted to be similar to the “distribution: extent of anadromy and larvae” described above and are not reiterated here. Based on these findings, there will be no adverse effect.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Out-migrating smolt abundance

The juvenile lifecycle of Atlantic salmon typically lasts between one to four years before migrating to the sea. Juvenile Atlantic salmon, known as smolts, migrate to the sea from their natal rivers as part of their natural life cycle and arrive in estuaries as they migrate toward the ocean. Potential effects during the construction and decommissioning phases of the Project include increased suspended sediment and disturbance as a result of underwater pile-driving which may lead to adverse effects on smolts during their marine phase. These impacts are predicted to be similar to those as described above under ‘distribution: extent of anadromy and larvae’ and ‘adult spawning fish’ above and are not reiterated here. Based on the findings, no adverse effects have been identified.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.5.5.2 Operational and maintenance phase

Distribution: extent of anadromy and larvae

The focus of this CO is that rivers should be accessible from coastal and estuarine waters to allow the migration of adults in order to prevent them being limited to spawning habitat in the lower stretches of a river. During the operational phase, potential effects may arise due to changes in EMF.

Changes in EMF from subsea electrical cabling has been identified as an impact during the operational and maintenance phase of the Project as it has the potential to emit a localised EMF, potentially affecting the sensory mechanisms of some species of fish, particularly electrosensitive and magneto-sensitive species such as Annex II migratory fish species.

As described in appendix E: Fish and Shellfish Ecology – Supporting Information, the strength of the magnetic field (and consequently, induced electrical fields) decreases rapidly horizontally and vertically with distance from source (i.e. within a few metres from the cable). A recent study conducted by CSA (2019) found that inter-array and export cables buried between depths of 1 m to 2 m reduces the magnetic field at the seabed surface four-fold. A number of field study observations have also found no evidence that fish species are either attracted or repelled to EMF from energised power cables (Love *et al.,* 2016).

In relation to lamprey, they possess specialised ampullary electroreceptors that are sensitive to weak, low frequency electric-fields (Bodznick and Northcutt, 1981; Bodznick and Preston, 1983), but information regarding what use they make of the electric sense is limited. Chung-Davidson *et al*. (2008) found that weak electric fields may play a role in the reproduction of sea lamprey and it was suggested that electrical stimuli mediate different behaviours in feeding-stage and spawning-stage individuals. This study (Chung-Davidson *et al.*, 2008) showed that migration behaviour of sea lamprey was affected (i.e. adults did not move) when stimulated with electrical fields of intensities of between 2.5 and 100 mV/m, with normal behaviour observed at electrical field intensities higher and lower than this range (Chung-Davidson *et al.*, 2008). These levels were considerably higher than modelled induced electrical fields expected from AC subsea cables, which are expected to be considerably lower (i.e. potentially by an order of magnitude; CSA, 2019).

In relation to salmon, it has been found to possess magnetic material of a size suitable for magnetoreception, and can use the earth's magnetic field for orientation and direction finding during migration (Gill and Bartlett, 2010; CSA, 2019). Research conducted at the Trans Bay cable, a DC undersea cable near San Francisco, California, found that migration success and survival of chinook salmon (*Oncorhynchus tshawytscha*) was not impacted by the cable. However, behavioural changes were noted when these fish were near the cable (Kavet *et al.,* 2016) with salmon appearing to remain around the cable for longer periods. These studies demonstrate that while DC undersea power cables can result in altered patterns of fish behaviour, these changes are temporary and do not interfere with migration success or population health.

In relation to shad, research is limited when compared to that of Atlantic salmon and lamprey. However, shad are generally pelagic fish in their marine phase – they will swim in the middle/top of the water column, often occurring in shoals with other clupeid species, i.e. herring and sprat. As such, they are not considered as vulnerable to EMF associated with buried cables on the seabed. As described below, any effects of EMF will be limited to within a few metres from the seabed, so it is unlikely they would be affected.

In summary, the range over which these species can detect EMFs is limited to metres (CSA, 2019, see Figure 9) and any effects in this range, should they occur at all, will be temporary and not affect migration to or from SACs.

The impact of EMFs is predicted to be of local spatial extent (restricted to within a few metres of buried cables), long term duration (i.e. the lifetime of the Project), continuous and irreversible during the operational and maintenance phase (EMFs will not be present once the project is decommissioned). As impacts would be limited in spatial extent, and the migration of lamprey, salmon and shad would remain unaffected the magnitude is therefore, considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Adult spawning fish

The impacts on adult fish during marine migration, including increases in SSC (i.e. from water pollution), are predicted to be similar to or lower than that assessed for the construction and decommissioning phase as described in "distribution: extent of anadromy and larvae" above and are not reiterated here. Potential disturbance (i.e. from EMFs) are described above where impact of EMFs is predicted to be of local spatial extent and long term duration therefore magnitude is considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Out-migrating smolt abundance

Potential effects on smolts in their marine phase during the operational and maintenance phases of the Project include water pollution (i.e. increases in SSC) are predicted to be similar to or lower than that assessed for the construction and decommissioning phase as described in "distribution: extent of anadromy and larvae" above and are not reiterated here. Potential disturbance (i.e. from EMFs) are described above where impact of EMFs is predicted to be of local spatial extent and long term duration therefore magnitude is considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.6 Annex II Invertebrates

5.6.1 European Sites within the ZoI

5.6.1.1 Brief description of relevant European sites

Slaney River Valley SAC (IE000781)

See section 5.3.1.1.

5.6.1.2 Conservation objectives

Site specific COs for the relevant SACs were reviewed. Table 5-20 identifies the CO attributes which could potentially be adversely affected by the Project, for relevant QIs scoped into the Stage 2 assessment (i.e., QIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects).

Table 5-20: Conservation Objective Attributes for relevant Annex II Invertebrates

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Slaney River Valley SAC (IE000781) (NPWS, 2011b; Version 1 21/10/2011)		
Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]	The status of the freshwater pearl mussel (*Margaritifera margaritifera*) as a qualifying Annex II species for the Slaney River Valley SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this species.	Distribution Population size Population structure Suitable habitat Water quality Substratum quality Hydrological regime Host fish Foraging habitat

5.6.2 Baseline environment

The baseline environment of QI invertebrates has been fully characterised in appendix I: Onshore Biodiversity – Supporting Information and appendix E: Fish and Shellfish Ecology – Supporting Information.

5.6.2.1 Data validity and limitations

Data validity depends on the sensitivity of the baseline environment and the nature and type of potential impacts that arise as a result of the Project. Table 5-21 provides details on the validity of the survey data used to inform the assessment of Annex II invertebrates, and has been reviewed in line with the CIEEM Advice Note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019). CIEEM (2019) provides guidance on the age of survey data that can be used to inform the assessment. Where CIEEM does not provide guidance on a particular survey type, professional judgement has been provided.

Table 5-21: Baseline environment - data validity.

Survey Title	Period of survey	Recommended lifespan for the data	Is data valid? Yes /No Notes
Invertebrates	October 2019; and July 2023.	18 months (CIEEM, 2019)	Yes. Where there has been no significant landuse change (e.g. fish kills, land management changes, tree felling) , data are considered valid for 1.5 years, and meets the CIEEM recommended advice note of 18 months.

Data limitations in relation to both desktop and field studies are described under section 5.2.2.1.

5.6.3 Project design parameters

5.6.3.1 Above High Water Mark

The project design parameters for invertebrates have been fully described in section 5.2.3 under onshore biodiversity.

5.6.3.2 Below High Water Mark

The project design parameters for invertebrates have been fully described in section 5.5.3.2 under fish and shellfish ecology.

5.6.4 Measures included in the Project

5.6.4.1 Above high water mark

The measures for invertebrates have been fully described in section 5.2.4 under onshore biodiversity.

5.6.4.2 Below high water mark

The measures for invertebrates have been fully described in section 5.5.4.2 under fish and shellfish ecology.

5.6.5 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project is outlined in Table 5-22.

Table 5-22: Prediction of adverse effects on site integrity during the construction, operational and maintenance, and decommissioning phases of the Project.

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]	Direct effects on host species (Atlantic salmon) as a result of water pollution and injury	Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05); Forest and Plantation management & use (B02); Fertilization (A08); Invasive	**Distribution:** -Potential indirect effects due to direct effects on Atlantic salmon (host species of FWPM).

Relevant Qualifying Interest	Effect pathway (s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant QI
	and/or disturbance causing indirect effects on FWPM.	non-native species (I01); Cultivation (A01).	**Population size:** -Potential indirect effects due to direct effects on Atlantic salmon (host species of FWPM). **Population structure:** -Potential indirect effects due to direct effects on Atlantic salmon (host species of FWPM). **Suitable habitat:** -None predicted as Project avoids activity within and the removal of this habitat. **Water quality:** -None predicted as project avoids activity within and the removal of this habitat. **Substratum quality:** -None predicted as Project avoids activity within FWPM habitat. **Hydrological regime:** -None predicted as Project is located too far by virtue of distance to effect the hydrological regime in this SAC. **Host fish:** -Potential indirect effects due to direct effects on Atlantic salmon (host species of FWPM). **Foraging habitat:** -None predicted as project avoids activity within and the removal of this habitat.

5.6.5.1 Construction/decommissioning phase

Distribution, population size, and population structure, host species

With respect to the QI freshwater pearl mussel, Atlantic salmon *Salmo salar* are host species during a critical parasitic phase of the pearl mussel lifecycle. There is potential for an indirect impact upon the distribution, population size and population structure of freshwater pearl mussel of the Slaney River Valley SAC if the salmon population is adversely affected. It will not be. For further detail on impacts of the Project on Atlantic salmon, see section 5.5.5 which concluded that no adverse effects are predicted and this is the case in the absence of mitigation measures.

On this basis, in light of site COs for freshwater pearl mussel and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.6.5.2 Operational and maintenance phase

Increases in suspended sediments and associated sediment deposition are also predicted to occur during the operational and maintenance phase due to inter-array and offshore export cable repair and reburial events. The impacts are predicted to be similar to those for the construction and decommissioning phases. No disturbance is expected during the operation and maintenance phase.

In addition, a disturbance impact with potential to occur during the operational and maintenance phase-changes in EMF from subsea electrical cabling, has the potential to emit a localised EMF which could potentially affect the sensory mechanisms of some species of fish, particularly electrosensitive and magnetosensitive species such as Annex II migratory fish species. The impacts are described under section

5.5.5.2 for QI fish assessment, which states that the range over which these species can detect electric fields is limited to centimetres, rather than metres, around these species (CSA, 2019).

On this basis, in light of site COs for freshwater pearl mussel and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.7 Birds Directive SCI Species

5.7.1 Scoping of effects

For Birds Directive SCI species, a number of birds identified during the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A) have been scoped out from further assessment in line with the results of site-specific surveys prior to Stage 2 appraisal for Appropriate Assessment, as no pathway has been identified between the particular SCI species and the Project.

5.7.1.1 Seabirds

The relevant SCI seabirds of SPAs included within the assessment are those species within a mean maximum foraging range (during the breeding season) or where non-trivial connectivity may exist (during migration or winter) with more distant SPAs, which were recorded during the surveys and could be potentially affected by the Project.

Where seabirds were not recorded at all over the duration of site-specific surveys (18 surveys), it is considered objectively reasonable using expert judgement to exclude them from further assessment. Seabirds not recorded would likely not use the offshore wind farm area in numbers large enough to warrant further consideration. Therefore the seabirds, and their relevant SPAs, detailed in Table 5-23, which were not recorded at all during site-specific surveys have been excluded from further assessment.

For seabirds that were recorded in very small numbers or very infrequently (i.e. very low, < 49 individuals) throughout the combined site-specific surveys, it is concluded that no adverse impact would occur during any phase of the Project (Table 5-24) and have been excluded from any further assessment as the risk of additional mortality in their populations is considered negligible (see appendix H: Offshore Ornithology – Supporting Information).

For seabirds recorded in low numbers (50 to 199 individuals) across all site-specific surveys (18 surveys) (Table 5-25), a further screening of SPAs within the connectivity range was undertaken to account for small populations of species recorded in low numbers. A species was taken forward to further assessment if the peak count during one survey represents >10% of a single SPAs population. At least 10 % of a single SPAs population was used, as in reality, birds come from multiple different SPAs (and non-SPA) colonies, and therefore it is highly unlikely that all individuals within the survey area would come from one individual SPA (see appendix H: Offshore Ornithology – Supporting Information).

Species which are recorded in at least moderate numbers (i.e. moderate, 200 to 999 individuals) are instantly taken through for additional assessment (Table 5-26).

It should be noted that assessments for other wind farm projects may take a different approach to what is outlined above due to the differences in geographic location and peak site-specific survey counts for seabirds. Differences in seabird peak counts between projects is expected to vary and will result in differences in which seabirds are included/ excluded for further assessment.

Table 5-23: Seabirds and relevant European sites excluded from further assessment at Stage 2 (not recorded at all during site-specific surveys).

Relevant qualifying feature	Special Protection Area
Great skua (*Catharacta skua*)	• St Kilda SPA
Storm Petrel (*Hydrobates pelagicus*)	• Duvillaun Islands SPA • Skomer, Skokholm and the Seas off Pembrokeshire SPA • Inishglora and Inishkeeragh SPA
Shag (*Phalacrocorax aristotelis*)	• Skerries Islands SPA • Lambay Island SPA • North-west Irish Sea SPA
Little Tern (*Sterna albifrons*) [A195]	• North-west Irish Sea SPA
Roseate Tern (*Sterna dougallii*)	• North-west Irish Sea SPA

The seabirds, and their relevant SPA, detailed in Table 5-24 were recorded in very low numbers (see appendix H: Offshore Ornithology – Supporting Information, for further detail i.e. very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) during site-specific surveys and have therefore been excluded from further assessment.

Table 5-24: Seabirds and relevant European sites excluded from further assessment at Stage 2 (very low numbers).

Relevant qualifying feature	Special Protection Area
Sandwich tern (*Sterna sandvicensis*)	• Carlingford Lough SPA • Strangford Lough SPA
Common tern (*Sterna hirundo*)	• Carlingford Lough SPA • Rockabill SPA • North-west Irish Sea SPA
Black-headed gull (*Chroicocephalus ridibundus)*	• Dundalk Bay SPA • Wexford Harbour and Slobs SPA • Lough Swilly SPA • Greers Isle SPA • Ballymacoda Bay SPA • Lady's Island Lake SPA • Dalkey Islands SPA • The Murrough SPA • Lough Foyle SPA • North-west Irish Sea SPA • Seas off Wexford SPA
Arctic tern *(Sterna paradisaea)*	• Rockabill SPA • North-west Irish Sea SPA
Lesser black-backed gull (*Larus fuscus)*	• Ailsa Craig SPA • Lambay Island SPA • Ribble and Alt Estuaries SPA • Morecambe Bay and Duddon Estuary SPA • North-west Irish Sea SPA • Seas off Wexford SPA • Saltee Islands SPA
Puffin *(Fratercula arctica)*	• Skomer, Skokholm and the Seas off Pembrokeshire SPA • Lambay Island SPA • Saltee Islands SPA

Relevant qualifying feature	Special Protection Area
	• North-west Irish Sea SPA • Seas off Wexford SPA
Little Gull (*Larus minutus)*	• Liverpool Bay SPA • Mersey Narrows and North Wirral Foreshore SPA • North-west Irish Sea SPA
Cormorant (*Phalacrocorax carbo*)	• Skerries Islands SPA • North-west Irish Sea SPA
Fulmar (*Fulmarus glacialis*)	• Lambay Island SPA • Saltee Islands SPA • Horn Head to Fanad Head SPA • Tory Island SPA • West Donegal Coast SPA • Beara Peninsula SPA • Duvillaun Islands SPA • Deenish Island and Scariff Island SPA • Mingulay and Berneray SPA • Shiant Isles SPA • St Kilda SPA • North-west Irish Sea SPA • Seas off Wexford SPA

Table 5-25: Importance to the site for species recorded in low numbers during the site-specific surveys Seabirds and if taken through to assessment at Stage 2.

Species	Peak count during one survey	SPA	SPA population (at destination)	Peak count as a % of the SPA population	Taken through to further assessment
Common tern	21	North-west Irish Sea[11]	See Carlingford Lough SPA and Rockabill SPA		
		Carlingford Lough	339 pairs	3.1	No
		Rockabill	1,940 pairs	0.5	No
		Total SPA population	2,279 pairs	0.5	No
Cormorant	18	North-west Irish Sea	N/A	N/A	No
		Skerries Island	558 pairs	1.6	No
Fulmar	21	North-west Irish Sea	See Lambay Island SPA		
		Lambay Island	635 pairs	1.7	No
		Seas off Wexford[11]	See Saltee Islands SPA		
		Saltee Islands	525 pairs	2.0	No
		Horn Head to Fanad	1,974 pairs	0.5	No
		Tory Island	641 pairs	1.6	No
		West Donegal Coast	1,879 pairs	0.6	No
		Mingulay and Berneray	12,500 pairs	0.1	No
		Beara Peninsula	575 pairs	1.8	No
		Shiant Isles	6,820 pairs	0.2	No
		St Kilda	62,820 pairs	<0.1	No

[11] Marine SPAs (specifically North-west Irish Sea SPA, Seas off Wexford SPA and the Irish Sea Front SPA) provide protection for foraging birds during the breeding season or aggregations of wintering individuals during the non-breeding period. It should therefore be noted that for marine SPAs reference populations for the qualifying interests of breeding colony SPAs have not been defined.

Species	Peak count during one survey	SPA	SPA population (at destination)	Peak count as a % of the SPA population	Taken through to further assessment
		Duvilllaun Islands	1,150 pairs	0.9	No
		Deenish Island and Scariff Island	325 pairs	3.2	No
		Total SPA population	89,844 pairs	<0.1	No
Lesser black-backed gull	20	North-west Irish Sea	See Lambay Island SPA		
		Lambay Island	309 pairs	3.2	No
		Ailsa Craig	1,800 pairs	0.6	No
		Morecambe Bay and Duddon Estuary	4,860 pairs	0.2	No
		Ribble and Alt Estuaries	1,800 pairs	0.6	No
		Seas off Wexford	See Saltee Islands SPA		
		Saltee Islands	175 pairs	5.7	No
		Total SPA population	9,119 pairs	0.1	
Puffin	24	North-west Irish Sea	See Lambay Island SPA		
		Lambay Island	265 individuals	9.1	No
		Seas off Wexford	See Saltee Islands SPA		
		Saltee Islands	1,822 individuals	1.3	No
		Skomer, Skokholm and the Seas off Pembrokeshire	9,500 pairs	0.1	No
		Total SPA population	21,087 individuals	0.1	No

Therefore, the remaining seabirds and their relevant SPA that have been brought forward for Stage 2 assessment and are listed in Table 5-26.

Table 5-26: Seabirds and relevant European sites considered for further assessment at Stage 2.

Relevant qualifying feature	Special Protection Area
Common gull *(Larus canus)*	• Dundalk Bay SPA • North-west Irish Sea SPA
Gannet *(Morus bassanus)*	• Ailsa Craig SPA • Grassholm SPA • Saltee Islands SPA
Great black-backed gull (*Larus marinus*)	• North-west Irish Sea SPA
Guillemot (*Uria aalge)*	• Ireland's Eye SPA • Lambay Island SPA • Rathlin Island SPA • North-west Irish Sea SPA
Herring gull *(Larus argentatus)*	• Dundalk Bay SPA • Ireland's Eye SPA • Lambay Island SPA • River Nanny Estuary and Shore SPA • Skerries Islands SPA • North-west Irish Sea SPA

Relevant qualifying feature	Special Protection Area
Kittiwake *(Rissa tridactyla)*	• Ailsa Craig SPA • Helvick Head to Ballyquin SPA • Horn Head to Fanad Head SPA • Howth Head Coast SPA • Ireland's Eye SPA • Lambay Island SPA • North Colonsay and Western Cliffs SPA • Rathlin Island SPA • Saltee Islands SPA • Wicklow Head SPA • North-west Irish Sea SPA • Seas off Wexford SPA
Manx shearwater *(Puffinus puffinus)*	• Copeland Islands SPA • Glannau Aberdaron ac Ynys Enlli SPA • Irish Sea Front SPA • Rum SPA • Skomer, Skokholm and the Seas off Pembrokeshire SPA • Deenish Island and Scariff Island SPA • Skelligs SPA • St Kilda SPA • North-west Irish Sea SPA • Seas off Wexford SPA
Razorbill *(Alca torda)*	• Ireland's Eye SPA • Lambay Island SPA • Rathlin Island SPA • North-west Irish Sea SPA • Seas off Wexford SPA

5.7.1.2 Shorebirds

All shorebirds screened in during the Stage 1 appraisal to inform screening for Appropriate Assessment (see section 4) have been brought forward for Stage 2 assessment and are listed in Table 5-27.

Table 5-27: Shorebirds and relevant European sites included for further assessment at Stage 2.

Relevant qualifying feature	Relevant European Site(s) (code)
Bar-tailed Godwit *(Limosa lapponica)*	• Dundalk Bay SPA
Black-tailed Godwit *(Limosa limosa)*	• Dundalk Bay SPA • Boyne Estuary SPA
Common Scoter *(Melanitta nigra)*	• Dundalk Bay SPA • North-west Irish Sea SPA
Curlew *(Numenius arquata)*	• Dundalk Bay SPA
Dunlin *(Calidris alpina)*	• Dundalk Bay SPA
Golden Plover *(Pluvialis apricaria)*	• Dundalk Bay SPA • Boyne Estuary SPA
Great Crested Grebe *(Podiceps cristatus)*	• Dundalk Bay SPA
Great Northern Diver (*Gavia immer*)	• North-west Irish Sea SPA
Grey Plover *(Pluvialis squatarola)*	• Dundalk Bay SPA • Boyne Estuary SPA

Relevant qualifying feature	Relevant European Site(s) (code)
Greylag Goose *(Anser anser)*	• Dundalk Bay SPA • Stabannan-Braganstown SPA
Knot *(Calidris canutus)*	• Dundalk Bay SPA • Boyne Estuary SPA
Lapwing *(Vanellus vanellus)*	• Dundalk Bay SPA • Boyne Estuary SPA
Light-bellied Brent Goose *(Branta bernicla hrota)*	• Dundalk Bay SPA • Carlingford Lough SPA (UK) • Carlingford Lough SPA (IE) • Skerries Islands SPA • South Dublin Bay and Tolka Estuary SPA • Strangford Lough SPA • Outer Ards SPA
Mallard *(Anas platyrhynchos)*	• Dundalk Bay SPA
Oystercatcher *(Haematopus ostralegus)*	• Dundalk Bay SPA
Pintail *(Anas acuta)*	• Dundalk Bay SPA
Red-breasted Merganser *(Mergus serrator)*	• Dundalk Bay SPA
Red-throated Diver (*Gavia stellata*)	• North-west Irish Sea SPA
Redshank *(Tringa aritim)*	• Dundalk Bay SPA
Ringed Plover *(Charadrius hiaticula)*	• Dundalk Bay SPA
Ruddy Turnstone *(Arenaria interpres)*	• Boyne Estuary SPA
Sanderling *(Calidris alba)*	• Boyne Estuary SPA
Shelduck *(Tadorna tadorna)*	• Dundalk Bay SPA • Boyne Estuary SPA
Teal *(Anas crecca)*	• Dundalk Bay SPA

5.7.2 European Sites within the ZoI

5.7.2.1 Brief description of relevant European sites

Ailsa Craig SPA (UK9003091)

Ailsa Craig is an SPA with an area of 2759.53 ha, 96.8% of which is in the marine area (JNCC, 2015c). Ailsa Craig SPA is located approximately 153.8 km from the Project. This SPA is an island situated in the outer part of the Firth of Clyde, on the west coast of Scotland. The island rises to 338 metres with cliffs up to 100 metres providing nesting sites for a wide variety of seabird species. Qualifying interests at Ailsa Craig SPA include populations of European importance of migratory bird species, including lesser black-backed gull *Larus fuscus* and one of the largest Northern gannet *Morus bassanus* colonies in the world (SNH, 2009). The seaward extension of Ailsa Craig SPA extends approximately 2 km including the marine environment and includes the seabed, water column and surface.

Boyne Estuary SPA (IE004080)

Boyne Estuary SPA is a 593.4 ha coastal site. It is located west of Drogheda on the border of Co. Louth and Co. Meath, approximately 10.2 km southwest of the Project. This SPA comprises most of the estuary of the Boyne River, which drains a large catchment and has a navigable, dredged channel. Intertidal flats are present along the sides of the channelled river, parts of which are fringed by salt marshes. The sediments vary throughout the river, with innermost sheltered areas comprised of fine muds, and sandy muds or sands present towards the mouth of the river. The Boyne Estuary SPA is a highly important site for its wetland habitat and wintering waterfowl. Species which have populations of national importance here include Sanderling *Calidris canutus* (supports 7% of the national total) and Golden plover *Pluvialis apricaria*

(supports 4% of the national total). Breeding populations of Little tern *Sterna albifrons* have been recorded at Boyne Estuary since at least 1984 and are also a qualifying interest for this site (NPWS, 2015d).

Carlingford Lough SPA (IE004078)

Carlingford Lough SPA (IE) is a relatively small site approximately 595 ha in area, located c. 5.7 km from the Project. This site comprises the southern side of Carlingford Lough in Co. Louth, extending from Ballagan Point to Carlingford Harbour. Carlingford Lough SPA is of significant international importance for its population of Light-bellied Brent Goose *Branta bernicla hrota*. The predominant habitats in this SPA are intertidal sand and mud flats up to the low tide mark, which provide feeding areas for wintering birds. The site also has some wetland habitat which is also a qualifying interest, with a range of associated waterbirds of special conservation interest. Much of the shoreline has been artificially embanked (NPWS, 2011g).

Carlingford Lough SPA (UK9020161)

Carlingford Lough SPA (UK) is an 826.91 ha site in Co. Down, 94.5% of which is in the marine area (JNCC, 2015d). This SPA is located approximately 7.4 km north of the Project. The site extends from Soldiers Point to Killowen Point on the northern shores of Carlingford Lough and includes a number of offshore islands at Blockhouse, Green Island and off Greencastle Point. Carlingford Lough SPA is comprised of almost exclusively intertidal habitat, with the exception of the islands mentioned, coastal saltmarsh and wet grasslands in Mill Bay. The extent of this SPA is limited to those areas regularly used by the population of Light-bellied Brent Goose *Branta bernicla hrota,* alongside past, present and potential tern nesting sites (DAERA, 2015).

Copeland Islands SPA (UK9020291)

Copeland Islands SPA is a small site of 200.19 ha (JNCC, 2015l), located off the north-east coast of Co. Down and close to the entrance to Belfast Lough. It is situated c. 86.8 km from the Project. This SPA comprises a group of three islands, Big Copeland, Light House Island and Mew Island, alongside associated islets. It encompasses the islands down to the low water mark, excluding buildings and associated structures. The habitats within this site include rocky shores, saltmarsh, freshwater marsh, maritime grassland, limited extent of inland cliff and semi-improved agricultural grassland (DoENI, 2015c). This site is of conservation importance because of its breeding and wintering populations of seabirds and waterfowl. This includes breeding colonies of Manx shearwater and Arctic tern, which are both qualifying interests for this site.

Deenish Island and Scariff Island SPA (IE004175)

Deenish Island and Scariff Island SPA is an 845.35 ha site located off the coast of Co. Kerry, 76.3% of which is in the marine area. Deenish Island and Scariff Island are small to medium-sized islands situated between 5 and 7 km west of Lamb's Head. This SPA includes the two islands and the surrounding seas to a distance of 500m and is located approximately 342.6 km from the Project. The larger island, Scariff, is entirely steep-sided and rises to a peak of 252 metres. In the north-east sector of Scariff Island, there are ruins of a monastic settlement and a cottage, which are known to be used by breeding seabirds. The vegetation on these islands is a mix of maritime grassland, areas dominated by Bracken (*Pteridium aquilinum*) and heathy areas with Ling Heather (*Calluna vulgaris*). Deenish Island and Scariff Island support an internationally important population of Storm Petrel (*Hydrobates pelagicus*) and nationally important populations of four other breeding seabirds, all of which qualifying interests for this SPA (NPWS, 2015f).

Dundalk Bay SPA (IE004026)

Dundalk Bay SPA is a large open shallow sea bay SPA of 13,237.9 ha, located 0.7 km west of the Project. The site comprises extensive saltmarshes and intertidal sand/mudflats, which extend some 16 km from Castletown River on the Cooley Peninsula in the north, to Annagassan/Salterstown in the south. The site is of international ornithological importance, supporting an assemblage of more than 20,000 wintering waterbirds. The primary qualifying interests for this SPA are 23 wintering bird species, including Light-bellied Brent Goose, Knot, Black-tailed Godwit, Golden Plover and Redshank. The wetland habitat and its associated waterbirds are also of special conservation interest here. The extensive sand and mud flat habitats have a rich fauna of marine invertebrates, while the outer bay provides shallow-water habitat. These provide excellent food resources for the wintering waterfowl (NPWS, 2014g).

Glannau Aberdaron ac Ynys Enlli SPA (UK9013121)

Glannau Aberdaron ac Ynys Enlli SPA is a very large site of c. 33,942.42 ha (JNCC, 2015m), situated 139.6 km from the Project. This SPA is located at the very southwestern tip of the Lleyn Peninsula, in northwest Wales. The site includes three islands, Ynys Enlli and two small islands known as Ynysoedd y Gwylanod. The coast is geologically diverse and supports a wide range of habitats, including maritime and coastal heath and grasslands, which support important vascular and non-vascular plants. The site is designated as an SPA due to its high ornithological importance (CCW, 2008). The qualifying interests for this site are Manx shearwater and Chough. Bardsey (Enlli) island is home to an internationally important breeding population of Manx shearwater.

Grassholm SPA (UK9014041)

Grassholm SPA is a relatively large site with an area of 1,774.42 ha, located approximately 237.9 km from the Project. The SPA includes the entire island of Grassholm as well as a number of small islets and rocks, down to the mean low water mark (NRW, 2013). The underlying geology consists of basalt and igneous rock, with nutrient rich soils. The only qualifying interest for this SPA is the regularly occurring breeding population of migratory Northern Gannet *Morus bassanus.* In 1994/95, there were 33,000 pairs during breeding season, representing 12.5% of the breeding North Atlantic population (JNCC, 2015e).

Helvick Head to Ballyquin SPA (IE004192)

Helvick Head to Ballyquin SPA is a 784.32 ha site which is located approximately 211.7 km from the Project. It is a linear site, situated along the south-west coast of Co. Waterford, which includes the sea cliffs and land adjacent to the cliff edge between Helvick Head in the east and the townland of Ballyquin in the south-west. The seaward boundary of the site is primarily formed by the high water mark. However, around Helvick Head the surrounding sea area to a distance of 500 m is included in the SPA. The cliff tops comprise of low heath and agricultural farmland, which provide foraging habitat for seabirds. There are five bird species listed as qualifying interests for this site. The SPA supports a range of breeding seabirds, including nationally important populations of Cormorant, Herring Gull and Kittiwake. It is also an important site for Chough and Peregrine, which are both listed on Annex I of the EU Birds Directive (NPWS, 2015g).

Horn Head to Fanad Head SPA (IE004194)

Horn Head to Fanad Head SPA is a relatively large site with an area of 2,385.34 ha, situated approximately 161.9 km from the Project. This site comprises a number of separate sections of the north Co. Donegal coastline stretching some 70 km eastwards from Dooros Point, south-west of Horn Head to just south of Saldanha Head, south of Fanad Head. Included within the site are the high coastal areas and sea cliffs, the land adjacent to the cliff edge and the sand dunes and lake at Dunfanaghy/Rinclevan. The seaward boundary of the site is primarily formed by the high water mark. However, around Horn Head the surrounding sea area to a distance of 500 m from the cliff base is included in the SPA. Sea cliffs, which are almost all greater than 10 m in height and rise to over 200 m in places, are present along virtually all the site. The site is of special conservation interest for holding an assemblage of over 20,000 breeding seabirds, with ten species designated as qualifying interests for this site. The site supports nationally important populations of Greenland White-fronted Goose and Barnacle Goose and is also of high importance for Annex I species Chough and Peregrine (NPWS, 2014h).

Howth Head Coast SPA (IE004113)

Howth Head Coast SPA is a relatively small site of 207.73 ha, comprising a rocky headland of sea cliffs on the northern side of Dublin Bay. The site extends from just east of the Nose of Howth to the tip of the Bailey Lighthouse peninsula and is located approximately 51.6 km from the Project. Also included within the site is the surrounding marine area to a distance of 500 m from the base of the cliffs. The cliffs vary between 60-90 m in height with fairly sheer, exposed rock face in some areas. The peninsula is composed primarily of Cambrian rock of the Bray Group, with quartzite being the most conspicuous. The cliffs host a number of plant species such as Rock Sea-spurrey *Spergularia rupicola* and Biting Stonecrop *Sedum acre*, as well as a diversity of lichens. The only qualifying interest for Howth Head Coast SPA is Kittiwake *Rissa tridactyla.* The site has nationally important populations of breeding Kittiwake, alongside regionally important colonies of other seabirds (NPWS, 2011h).

Ireland's Eye SPA (IE004117)

Ireland's Eye SPA, which has an area of 214.43 ha, comprises a relatively small uninhabited island situated 1.5 km north of Howth in Co. Dublin. It is located 48.9 km south of the Project. Alongside Ireland's Eye, the SPA encompasses Rowan Rocks, Thulla, Thulla Rocks, Carrageen Bay and a marine extension of 200m in the west and 500m to the north and east. Along the northern and eastern sides of the island, Cambrian greywackes and quartzites form impressive near-vertical cliffs reaching 69 m in height. There are also scattered exposures elsewhere on the island, particularly in the high northern half. Habitats on the main island include shingle/sandy beaches and an extensive area of bedrock shore, which is heavily dominated by brown seaweeds and is exposed at low tide between Thulla islet and the main island. Glacial drift covers some areas of the island and there are no watercourses or springs present. Five seabird species are qualifying interests for this SPA; Cormorant *Phalacrocorax carbo*, Herring Gull *Larus argentatus*, Kittiwake *Rissa tridactyla,* Guillemot *Uria aalge* and Razorbill *Alca torda.* The island is of high ornithological importance on a national level (NPWS, 2011i).

Irish Sea Front SPA (UK9020328)

Irish Sea Front SPA is a large site with an area of 18,000 ha (JNCC, 2017b), situated approximately 56.9 km from the Project. This entirely marine site comprises a highly productive shallow sea tidal mixing front that forms seasonally from May to September (JNCC, 2016a). The only qualifying feature of the Irish Sea Front SPA is Manx shearwater. This migratory species uses this site for foraging during the breeding season, when the area regularly supports over 12,000 individuals of Manx shearwater.

Lambay Island SPA (IE004069)

Lambay Island, which rises to 127 m, is situated approximately 4 km off the north coast of Co. Dublin and is separated from the mainland by a channel of 10-13 m in depth. The water deepens rapidly into the Irish Sea basin to the east of the island. The SPA is c. 599 ha in area and is located 40.4 km south of the Project. The underlying geology of the island is dominated by volcanic igneous rocks (of andesitic type) and ash and the soils are typically shallow and derived from glacial tills originating from the Irish Sea. There are more peaty soils present on high exposed ground and above the cliffs. Various habitat types exist on the island, including a bedrock shoreline, cobble storm beaches and sandflats exposed at low tide. There are steep cliffs on most shorelines of the island, which vary in height from 15-50 m and are backed by vegetated slopes with typical maritime species. This SPA is of high conservation interest as it holds an assemblage of over 20,000 breeding seabirds. The qualifying interests for this site are ten bird species in particular, including Fulmar *Fulmarus glacialis,* Guillemot *Uria aalge* and Puffin *Fratercula arctica.* The island also supports wintering populations of Greylag Goose *Anser anser* and Herring Gull *Larus argentatus*, which are of national importance. In addition, Lambay Island supports a long-established colony of Grey Seal (Annex II species on the Habitats Directive) as well as non-native Fallow Deer and Red-necked Wallaby (NPWS, 2011e).

North Colonsay and Western Cliffs SPA (UK9003171)

North Colonsay and Western Cliffs SPA is a large site with an area of 3,297.3 ha, 74.1% of which is marine (JNCC, 2015n). It is situated c. 236.8 km from the Project. This SPA covers an area of rocky coast, cliffs, and maritime heath on the island of Colonsay in Argyll, Scotland. The seaward extension of the site extends c. 1km into the marine environment to include the seabed, water column and surface. The qualifying interests of this SPA are three breeding bird species and a seabird assemblage of over 30,000 individuals. The site regularly supports populations of European importance of Chough, which is an Annex I species of the EU Birds Directive. It also supports nationally important populations of black-legged kittiwake (represents 0.9% of the GB population) and common guillemot (represents 0.9% of the GB population) (SNH, 2009h).

North-west Irish Sea SPA (IE004236)

The North-west Irish Sea SPA constitutes an important resource for marine birds. The estuaries and bays that open into it along with connecting coastal stretches of intertidal and shallow subtidal habitats, provide safe feeding and roosting habitats for waterbirds throughout the winter and migration periods. These areas, along with more pelagic marine waters further offshore, provide additional supporting habitats (for foraging and other maintenance behaviours) for those seabirds that breed at colonies on the north-west Irish Sea's islands and coastal headlands. These marine areas are also important for seabirds outside the breeding

period. This SPA extends offshore along the coasts of counties Louth, Meath and Dublin, and is approximately 2,333 km^2 in area. This SPA is ecologically connected to several existing SPAs in this area (NPWS, 2023b).

Outer Ards SPA (UK9020271)

Outer Ards SPA is a large coastal site with an area of 4753.82 ha, located off Co. Down. The SPA extends from near Grey Point, Belfast Lough to the north of Ballyquintin Point at the southern end of the Ards Peninsula (DoENI, 2015i). The site is located approximately 56.1 km from the Project. A variety of shoreline types exist in this SPA, including rock platforms, sand and mud dominated shores, cobble and boulder beaches together with rocky shores, but no significant cliffs are present. Off-shore islands are also included in the SPA. The open shore is utilised by various species of wintering waterfowl. Outer Ards SPA includes a marine area adjoining Cockle Island, Groomsport to include breeding terns and their nest sites. On the landward side, the SPA is generally limited to the head of beaches and rock platforms but extends inland in places where habitat quality justifies it. The qualifying interests for this SPA are the breeding colony of Arctic Tern, together with wintering populations of Light-bellied Brent Goose, Golden Plover, Turnstone and Ringed Plover.

Rathlin Island SPA (UK9020011)

Rathlin Island is a large inhabited marine island, which is situated c. 4 km off the north coast of Antrim in Northern Ireland. The SPA has a large area of approximately 3,344.62 ha and is located 145.4 km north of the Project. The site comprises the major sea-cliffs, which are up to 100 m in height and made from basalt and limestone, and numerous sea stacks on the north and west shores of the island. The shores on the south and east of the island are gently sloping with areas of grassy maritime vegetation and rocky shore. The sea-cliffs and surrounding marine areas are of high importance for seabird colonies; for their courtship, preening and loafing behaviours, and to a lesser extent, feeding (DoENI, 2015j). The qualifying interests for this site are nine breeding bird species, including internationally important numbers of migratory species, Razorbill, Guillemot and Kittiwake, and nationally important numbers of Annex I species Peregrine Falcon.

River Nanny Estuary and Shore SPA (IE004158)

River Nanny Estuary and Shore SPA is a relatively small site of 229.68 ha in Co. Meath, located approximately 16.6 km from the Project. It comprises the estuary of the River Nanny and sections of the shoreline to the north and south of the estuary (c. 3 km in length). The channel is narrow and well sheltered and extends inland for almost 2 km. The sediments are typically muddy and are edged by saltmarsh and freshwater marsh/wet grassland habitats. The shoreline is well-exposed, c. 500 m in width to the low tide mark and comprises beach and intertidal habitats, with coarse sand sediments. The beaches of the estuary, which are well-developed and backed in places by clay cliffs, provide suitable high tide roosts for various bird species. This site is of high ornithological importance as it supports five wintering waterbird species and one gull species of national importance, which are qualifying interests for this site. In addition, wetland habitat forms part of the SPA and is also a qualifying interest alongside its associated waterbirds (NPWS, 2015h).

Rockabill SPA (IE 004014)

Rockabill SPA is a large marine site of 5,227.09 ha, situated c. 7 km off the coast of Co. Dublin. The site comprises two small, low-lying, granitic islets separated by a narrow channel, though are connected at low spring tides. The surrounding sea waters to a distance of 3.5 km from the islands are also included in the site. This SPA is located approximately 26.9 km south of the Project. The main ‘Lighthouse Island’ is vegetated by a scrubby sward of Tree Mallow (*Lavatera arborea*), alongside a range of other maritime species such as Sea Mayweed (*Matricaria maritima*), Sorrel (*Rumex spp.*) and Rock Sea-spurrey (*Spergularia rupicola*). The smaller ‘Bill Island’ is very exposed and sparsely vegetated. The qualifying interests for this site are Purple Sandpiper, Roseate Tern, Common Tern and Arctic Tern. Nationally important numbers of Purple Sandpiper winter at Rockabill SPA, while the site hosts breeding populations of the three tern species.

Rum SPA (UK9001341)

Rum SPA is a very large site of 46,724.16 ha, located off the west coast of Scotland (NatureScot, 2020). It is situated approximately 328.6 km from the Project. Included within Rum SPA are the Inner Hebridean Island of Rum and adjacent coastal waters to approximately 4 km. The island has a largely rocky coast, with cliffs rising to 210 metres, a few exposed beaches and a more sheltered shingle and boulder beach with intertidal mudflats in the inlet of Loch Scresort. Other habitats of this SPA include submaritime grasslands and heaths, mountain and moorland with numerous streams and small lochs, vestigial saltmarsh and a small sand-dune system backed by machair grading into alluvial marsh on the flood plain of the Kilmory River. While there are some areas of planted woodland, the island is largely treeless with fragments of natural woodland and scrub only in a few rocky gullies (NatureScot, 2020). This regularly supports populations of European importance of red-throated diver, an Annex I species, and Manx shearwater. It also supports nationally important populations of golden eagle, black-legged kittiwake and common guillemot, all of which are qualifying interests for this site.

Saltee Islands SPA (IE004002)

Saltee Islands SPA is an 870.62 ha site, situated some 4-5 km off the south coast of Co. Wexford. It is located approximately 188.9 km from the Project. The site comprises the Great Saltee and Little Saltee islands, the surrounding seas between them and to a distance of 500 m from them, where seabirds feed, bathe and socialise. The bedrock of the islands is composed of Precambrian gneiss and granite. The islands have exposed rocky cliffs on their south and east, which are c. 30 m high on the great Saltee and c. 15 m high on Little Saltee. Shingle and boulder shores fringe the northern and western sides of the islands, with small areas of intertidal flats. The Great Saltee has sea caves at the base of its cliffs. This SPA is of special conservation interest for holding an assemblage of over 20,000 breeding seabirds and the most important colony on the south-east for populations and species diversity. The qualifying interests for the site are seven breeding seabird species, including Shag *Phalacrocorax aristotelis*, Razorbill *Alca torda* and Puffin *Fratercula arctica* (MPWS, 2012f).

Skelligs SPA (IE004007)

Skelligs SPA is a 624.08 ha site, 95.1% of which is in the marine area. It comprises the Great Skellig and Little Skellig islands, which are separated by a distance of 3 km and are situated in the Atlantic some 14 km and 11 km (respectively) off the mainland of Co. Kerry. This SPA is located approximately 354.1 km from the Project. Great Skellig and Little Skellig, which rise to 218 m and 134 m, respectively, are both precipitous rocky sea stacks. On Great Skellig there are shallow soils and a sparse maritime flora, with common species such as Thrift (Armeria maritima), Sea Campion (Silene maritima) and Rock Sea-spurrey (Spergularia rupicola). This island is notable for its rare lichen flora. The smaller island, Little Skellig, is largely unvegetated, due to the low soil cover and the effect that the nesting birds have on the vegetation. The site supports internationally important populations of Storm Petrel and Gannet, as well as nationally important populations of a further five breeding seabird species, all of which are qualifying interests for this site. Skelligs SPA is also of conservation interest for its assemblage of over 20,000 breeding seabirds.

Skerries Islands SPA (IE004122)

Skerries Islands SPA is a small site with an area of 217.12 ha, located approximately 30.1 km south of the Project. The site comprises a group of three small uninhabited islands, Shenick's Island, St Patrick's Island and Colt Island, situated 0.5-1.5 km off the north coast of Co. Dublin, and the surrounding seas to a distance of 200 m from the shoreline. All three islands are low-lying, with maximum heights between 8-13 m above sea level. Shenick's Island has extensive areas of intertidal rocky shore and sandflats, while the other two islands have low cliffs. There is also a shingle bar which connects the mainland to Shenick's Island at low tides. Skerries Islands SPA is of high importance for breeding seabirds and wintering waterfowl, with populations of international and national importance. The qualifying interests for this site are six bird species in particular, including breeding Cormorant, Shag and Herring Gull. The islands also support an internationally important population of Light-bellied Brent Goose during winter (NPWS, 2009).

Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)

This is a very large marine SPA with an area of 166,800.74 ha, situated off the extreme south-west tip of Pembrokeshire in south-west Wales. The SPA comprises the islands of Skomer and Skokholm and extends beyond the 12 nautical mile boundary, lying partly in Welsh territorial waters and partly in UK offshore waters. It is located 236.9 km from the Project. This SPA is classified for the protection of a number of breeding seabird species in England and Wales. The qualifying interests for this site are breeding Manx Shearwater *Puffinus puffinus*, Puffin *Fratercula arctica*, Storm Petrel *Hydrobates pelagicus* and Lesser Black-backed Gull *Larus fuscus.* The site regularly supports globally and nationally important breeding colonies of these species (JNCC, 2015f).

South Dublin Bay and Tolka Estuary SPA (IE004024)

South Dublin Bay and Tolka Estuary SPA is a marine site comprising a substantial part of Dublin Bay, covering an area of 2,193.17 ha. It includes almost all of the intertidal area in the south of the bay between the River Liffey and Dun Laoghaire, as well as a large portion of the Tolka Estuary to the north of the River Liffey. It also includes Booterstown Marsh, an area of grassland at Poolbeg, north of Irishtown Nature Park and a small area of shallow marine waters in the bay. The site is located approximately 52.8 km south of the project. In the south bay, the intertidal flats extend for almost 3 km at their widest point and the sediments are mainly well-aerated sands. There is a diversity of species here including green algae and a well-developed macro-invertebrate fauna. The Tolka Estuary has varying sediments, from soft thixotrophic muds with a high organic content in the inner estuary to exposed, well-aerated sands off the Bull Wall. Booterstown Marsh is an enclosed area of saltmarsh and muds which is cut off from the sea by the railway line, except where it is linked by the Nutley stream. This SPA supports an internationally important population of wintering Light-bellied Brent Goose *Branta bernicla hrota,* which is one of the qualifying interests for this site. It is also autumn roosting ground for significant populations of Common Tern, Roseate Tern and Arctic Tern (NPWS, 2015e).

Stabannan-Braganstown SPA (IE004091)

Stabannan-Braganstown SPA is a relatively small site of 251.89 ha in Co. Louth and is located approximately 1.8 km from the Project. It is a small, flat alluvial plain adjacent to the River Glyde, situated c. 4 km inland from Dundalk Bay. The site is bounded by low, rolling hills to the north and south. Much of this site was formerly marshland or wet grassland but is now drained and has been agriculturally improved. The land is farmed intensively for grass, cereals and root crops. The only qualifying interest for Stabannan-Braganstown SPA is Greylag Goose *Anser anser.* The site supports an internationally important wintering population of this species, accounting for 35% of the national total (NPWS, 2010).

St Kilda SPA (UK9001031)

St Kilda SPA is a large marine site with an area of 29,014.62 ha, located approximately 448.6 km from the Project. This SPA comprises a group of remote Scottish islands lying in the North Atlantic about 70 km west of North Uist in the Outer Hebrides. The seaward boundary of the site extends to c. 4 km into the marine environment, encompassing the seabed, water column and surface. The steep, precipitous cliffs reach 430 m on Hirta and 380 m on Soay and Boreray. The vegetation on the islands is strongly influenced by sea spray and the presence of seabirds and livestock. Species-poor acidic grassland and sub-maritime heaths occupy extensive areas inland on Hirta island. These islands provide important nesting sites for seabirds that feed in the waters to the west of Scotland (SNH, 2009i). St Kilda SPA hosts a seabird population of more than 600,000 individuals, making this one of the largest concentrations in the North Atlantic and the largest in the UK. The qualifying interests of this SPA are ten breeding seabirds, including Leach's storm-petrel and European storm-petrel, of which the site supports populations of European importance.

Strangford Lough SPA (UK9020111)

Strangford Lough SPA is a large site with an area of 15,580 ha, situated on the east coast of Co. Down. It is located 49.4 km from the Project. The marine inlet is connected to the open sea by an 8 km long channel with a minimum width of 0.5 km, called Strangford Narrows. The Lough itself is 30 km in length from head to mouth and up to 8 km wide, with extensive tidal flats along the northern and north-eastern shorelines. There are also extensive areas of mud/sand flats, saltmarsh and rocky coastline present in other areas. Strangford

Lough supports a diversity of marine habitats and communities, with over 20,000 recorded species. It is an important site for a range of marine invertebrates, algae and saltmarsh plants, wintering and breeding waterbirds and marine mammals (JNCC, 2015g). The qualifying interests for this site are internationally important breeding populations of Common Tern *Sterna hirundo* and Sandwich Tern *Sterna sandvicensis* and nationally important breeding populations of Arctic Tern *Sterna paradisaea.*

Wicklow Head SPA (IE004127)

Wicklow Head SPA comprises a rocky headland with extensive exposures of mica-schist and has an area of 195 ha. The site is situated c. 3 km south of Wicklow town and is a distance of approximately 97.0 km from the Project. Wicklow Head has a lighthouse near the base of its cliffs, which rise to a maximum of c. 60 m immediately south of the lighthouse and host populations of various breeding seabirds. The SPA includes the cliffs, cliff-top vegetation and some heath vegetation. Also included within the site is the surrounding sea water to a distance of 500 m from the base of the cliffs. The qualifying interest for this SPA is Kittiwake *Rissa tridactyla*, as the Wicklow Head is utilised by a nationally important population of this species (NPWS, 2012g).

5.7.2.2 Conservation objectives

Site specific COs for the relevant SPAs were reviewed. Table 5-28 identifies the CO attributes which could potentially be adversely affected by the Project, for relevant SCIs scoped into the Stage 2 assessment (i.e., SCIs in relation to which it could not be excluded, based on objective information following screening, that the Project would have likely significant effects).

Table 5-28: Conservation Objective Attributes for relevant Birds Directive SCI species.

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Ailsa Craig SPA (UK9003091) (NatureScot, 2009)		
Gannet (*Morus bassanus*) [A016]	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained	Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species
Kittiwake (*Rissa tridactyla*) [A188]		
Boyne Estuary SPA (IE004080) (NPWS, 2013e; Version 1; 26/02/2013)		
Black-tailed Godwit (*Limosa limosa*) [A156]	To maintain the favourable conservation condition	Population trend Distribution
Golden Plover (*Pluvialis apricaria*) [A140]		
Grey Plover (*Pluvialis squatarola*) [A141]		
Lapwing (*Vanellus vanellus*) [A142]		
Knot (*Calidris canutus*) [A143]		
Sanderling (*Calidris alba*) [A144]		
Shelduck (*Tadorna tadorna*) [A048]		
Turnstone (*Arenaria interpres*) [A169]		
Carlingford Lough SPA (IE004078) (NPWS, 2013c; Version 1; 22/08/2013)		

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	To maintain the favourable conservation condition	Population trend Distribution
Carlingford Lough SPA (UK9020161) (DAERA, 2015; Version 3; 01/04/2015)		
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	To maintain each feature in favourable condition	Wintering population
Copeland Islands SPA (UK9020291) (DoENI, 2015c; Version 2; 01/04/2015)		
Manx Shearwater (*Puffinus puffinus*) [A013]	To maintain each feature in favourable condition	Occupied nests Fledging success
Deenish Island and Scariff Island SPA (IE004175) (NPWS, 2022a; Version 1; 12/10/2022)		
Manx Shearwater (*Puffinus puffinus*) [A013]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Dundalk Bay SPA (IE004026) (NPWS, 2011a; Version 1; 19/07/2011)		
Bar-tailed Godwit (*Limosa lapponica*) [A157]	To maintain the favourable conservation condition	Population trend Distribution
Black-tailed Godwit (*Limosa limosa)* [A156]		
Common Gull (*Larus canus*) [A182]		
Common Scoter (*Melanitta nigra*) [A065]		
Curlew (*Numenius arquata*) [A160]		
Dunlin (*Calidris ariti*) [A149]		
Golden Plover (*Pluvialis apricaria*) [A140]		
Great Crested Grebe (*Podiceps cristatus*) [A005]		
Grey Plover (*Pluvialis squatarola*) [A141]		
Greylag Goose (*Anser anser*) [A043]		
Herring Gull (*Larus argentatus*) [A184]		
Knot (*Calidris canutus*) [A143]		
Lapwing (*Vanellus vanellus*) [A142]		
Light-bellied Brent Goose (*Branta bernicla hrota)* [A046]		
Mallard (*Anas platyrhynchos*) [A053]		
Oystercatcher (*Haematopus ostralegus*) [A130]		
Pintail (*Anas acuta*) [A054]		
Red-breasted Merganser (*Mergus serrator*) [A069]		
Redshank (*Tringa aritim*) [A162]		
Ringed Plover (Charadrius hiaticula) [A137]		

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Shelduck (*Tadorna tadorna*) [A048]		
Teal (*Anas crecca*) [A052]		
Wetlands and Waterbirds [A999]		Habitat area
Glannau Aberdaron ac Ynys Enlli SPA (UK9013121) (JNCC, 2018)		
Manx Shearwater (*Puffinus puffinus*) [A013]	To be in a favourable conservation status	Breeding population size Productivity /breeding success
Grassholm SPA (UK9014041) (CCW, 2008; Version 2; 08/04/2008)		
Gannet (*Morus bassanus*) [A016]	To be in a favourable conservation status	Number of pairs Measurable change
Helvick Head to Ballyquin SPA (IE004192) (NPWS, 2022b; Version 1; 12/10/2022)		
Kittiwake (*Rissa tridactyla*) [A188]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Horn Head to Fanad Head SPA (IE004194) (NPWS, 2022c; Version 1; 12/10/2022)		
Kittiwake (*Rissa tridactyla*) [A188]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Howth Head Coast SPA (IE 004113) (NPWS, 2022d; Version 1; 12/10/2022)		
Kittiwake (*Rissa tridactyla*) [A188]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Ireland's Eye SPA (IE 004117) (NPWS, 2022e; Version 1; 12/10/2022)		
Guillemot (*Uria aalge*) [A199]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Herring Gull (*Larus argentatus*) [A184]		
Kittiwake (*Rissa tridactyla*) [A188]		
Razorbill (*Alca torda*) [A200]		
Irish Sea Front SPA (UK9020328) (JNCC, 2023; March 2023)		
Manx Shearwater (*Puffinus puffinus*) [A013]	To avoid significant deterioration of the habitats used by the qualifying species, or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long term and makes an appropriate contribution to achieving the aims of the Conservation of Habitats and Species Regulations 2017.	Avoid significant disturbance Maintain the habitats, processes and food resources Ensure connectivity between the site and its supporting habitats and Manx shearwater breeding colonies
Lambay Island SPA (IE004069) (NPWS, 2022f; Version 1; 12/10/2022)		
Guillemot (*Uria aalge*) [A199]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Razorbill (*Alca torda)* [A200]		
Herring Gull (*Larus argentatus*) [A184]		
Kittiwake (*Rissa tridactyla*) [A188]		
Shag (*Phalacrocorax aristotelis*) [A018]		

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
North Colonsay and Western Cliffs SPA (UK9003171) (NatureScot, 2006)		
Kittiwake (*Rissa tridactyla*) [A188]	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained	Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species
North-west Irish Sea SPA (IE004236) (NPWS, 2023a; Version 1; 19/09/2023)		
Common Gull (*Larus canus*) [A182]	To maintain the favourable conservation condition	Non-breeding population size Spatial distribution Forage spatial distribution, extent and abundance Disturbance across the site Barriers to connectivity and site use
Common Scoter (*Melanitta nigra*) [A065]	To maintain the favourable conservation condition	
Great Black-backed Gull (*Larus marinus*) [A187]	To maintain the favourable conservation condition	
Great Northern Diver (*Gavia immer*) [A003]	To maintain the favourable conservation condition	
Red-throated Diver (*Gavia stellata*) [A001]	To maintain the favourable conservation condition	
Guillemot (*Uria aalge*) [A199]	To maintain the favourable conservation condition	Population size Spatial distribution Forage spatial distribution, extent, abundance and availability Disturbance across the site Barriers to connectivity
Herring Gull (*Larus argentatus*) [A184]	To restore the favourable conservation condition	
Kittiwake (*Rissa tridactyla*) [A188]	To restore the favourable conservation condition	
Razorbill (*Alca torda*) [A200]	To maintain the favourable conservation condition	
Manx Shearwater (*Puffinus puffinus*) [A013]	To maintain the favourable conservation condition	Breeding population size Spatial distribution Forage spatial distribution, extent, abundance and availability Disturbance across the site Barriers to connectivity
Outer Ards SPA (UK9020271) (DAERA, 2015; Version 2; 01/04/2015)		
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	To maintain each feature in favourable condition	Wintering population
Rathlin Island SPA (UK9020011) (DAERA, 2015; Version 3; 01/04/2015)		
Kittiwake (*Rissa tridactyla*) [A188]	To maintain each feature in favourable condition	Breeding population
Razorbill (*Alca torda*) [A200]		
River Nanny Estuary and Shore SPA (IE004158) (NPWS, 2012c; Version 1; 21/09/2012)		
Herring Gull (*Larus argentatus*) [A184]	To maintain the favourable conservation condition	Population trend Distribution
Rum SPA (UK9001341) (SNH, 2021; 11/202021)		
Manx Shearwater (*Puffinus puffinus)* [A013]	1. To ensure that the qualifying features of Rum SPA are in favourable condition and	Population Distribution

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
	make an appropriate contribution to achieving Favourable Conservation Status. 2. To ensure that the integrity of Rum SPA is restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature: 2a. The populations of the qualifying features are viable components of Rum SPA. 2b. The distributions of the qualifying features throughout the site are maintained by avoiding significant disturbance of the species. 2c. The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained, or where appropriate, restored at Rum SPA.	Supporting habitat
Saltee Islands SPA (IE004002) (NPWS, 2011; Version 1; 21/10/2011)		
Gannet (*Morus bassanus*) [A016]	To maintain the favourable conservation condition	Breeding population abundance: apparently occupied nests (AONs) Productivity rate Distribution: breeding colonies Prey biomass available Barriers to connectivity Disturbance at breeding site Disturbance at marine areas
Kittiwake (*Rissa tridactyla*) [A188]		Breeding population abundance: apparently occupied nests (AONs) Productivity rate Distribution: breeding colonies Prey biomass available Barriers to connectivity Disturbance at breeding site
Skelligs SPA (IE004007) (NPWS, 2022g; Version 1; 12/10/2022)		
Manx Shearwater (*Puffinus puffinus*) [A013]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Skerries Islands SPA (IE004122) (NPWS, 2022h; Version 1; 12/10/2022)		
Cormorant (*Phalacrocorax carbo*) [A017]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat
Herring Gull (*Larus argentatus*) [A184]		
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]		
Shag (*Phalacrocorax aristotelis*) [A018]		
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051) (JNCC, 2015f)		
Manx Shearwater (*Puffinus puffinus)* [A013]	To be in a favourable conservation status	Breeding population size Distribution Sufficient habitat Factors affecting the population or its habitat should be under appropriate control
South Dublin Bay and Tolka Estuary SPA (IE004024) (NPWS, 2015a; Version 1; 09/03/2015)		

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes Potentially Affected by the Project
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	To maintain the favourable conservation condition	Population trend Distribution
Stabannan-Braganstown SPA (IE004091) (NPWS, 2022i; Version 1; 15/11/2022)		
Greylag Goose (*Anser anser*) [A043]	To restore the favourable conservation condition	Winter population trend Winter spatial distribution Disturbance at wintering site Barriers to connectivity and site use Forage spatial distribution, extent and abundance Roost spatial distribution and extent Supporting habitat: area and quality
Strangford Lough SPA (UK9020111) (DAERA, 2015; Version 4; 01/04/2015)		
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	To maintain each feature in favourable condition	Wintering population
St Kilda SPA (UK9001031) (JNCC, 2021)		
Manx Shearwater (*Puffinus puffinus*) [A013]	1.To ensure that the qualifying features of St Kilda SPA and the Seas off St Kilda SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2. To ensure that the integrity of St Kilda SPA and the Seas off St Kilda SPA is restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature: 2a. The populations of qualifying features are viable components of St Kilda SPA and Seas off St Kilda SPA. 2b. The distributions of the qualifying features throughout St Kilda SPA and Seas off St Kilda SPA are maintained by avoiding significant disturbance of the species. 2c. The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained, or where appropriate restored, at St Kilda SPA and/or Seas off St Kilda SPA.	Population Distribution Supporting Habitat
Wicklow Head SPA (IE004127) (NPWS, 2022j; Version 1; 12/10/2022)		
Kittiwake (*Rissa tridactyla*) [A188]	To maintain or restore the favourable conservation condition	Population dynamics Natural range Sufficiently large habitat

5.7.3 Baseline environment

The baseline environment of Birds Directive SCI species has been fully characterised in appendix H: Offshore Ornithology – Supporting Information and appendix I: Onshore Biodiversity – Supporting Information.

5.7.3.1 Data validity and limitations

5.7.3.1.1 Seabirds

As with any seabird surveys, there are a number of limitations in data collection and subsequent analyses, which have been taken into account. The baseline site characterisation is based on over two years' of data collection (May 2018 to September 2020) within the Offshore Ornithology Study Area. In line with NatureScot

(2023) guidance (i.e. that data has been collected up to 5 years prior to the submission date) the data is therefore considered to be sufficiently robust to undertake this assessment.

During the site-specific boat-based transect surveys the November 2018, October 2019 and May 2020 surveys were only partially completed due to weather or other logistical constraints, with a single survey visit undertaken in each of those months. In November 2018, alternate transects were covered to achieve representative sampling coverage across the Offshore Ornithology Study Area. In October 2019, coverage was only achieved of transects 6-11 in the northern half of the Offshore Ornithology Study Area and in May 2020 transects 3-10 were covered. Surveys were not completed in May 2019, September 2019, November 2019, February 2020 and March 2020 due to adverse weather constraints during planned survey windows. The use of the MRSea model to estimate spatial abundance of birds takes into account incomplete survey coverage. In line with NatureScot (2023) guidance (i.e. that data has been collected up to 5 years prior to the submission date) the data is therefore considered to be sufficiently robust to undertake this assessment.

As described above, the baseline site characterisation is based on over two years' of data collection and is therefore considered to be sufficiently robust to undertake an impact assessment in line with NatureScot (2023) guidance, Natural England (2022a, 2022b, 2022c) and DCCAE (2018). Additionally, in line with NatureScot (2023) guidance (i.e. that data has been collected up to 5 years prior to the submission date) the data is therefore considered to be sufficiently robust to undertake this assessment.

5.7.3.1.2 Shorebirds

Data validity depends on the sensitivity of the baseline environment and the nature and type of potential impacts that arise as a result of the Project. Table 5-29 provides details on the validity of the survey data used to inform the assessment of shorebirds, and has been reviewed in line with the CIEEM Advice Note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019). CIEEM (2019) provides guidance on the age of survey data that can be used to inform the assessment. Where CIEEM does not provide guidance on a particular survey type, professional judgement has been provided.

Table 5-29: Baseline environment - data validity.

Survey Title	Period of survey	Recommended lifespan for the data	Is data valid? Yes /No Notes
Birds – onshore/ breeding	October 2018 to December 2019; April to July 2023.	12 months (CIEEM, 2019)	Yes. As birds are mobiles species within a dynamic environment (i.e. may utilise new areas for roosting/nesting) these data are considered valid for one year, and meets the CIEEM recommended advice note of 12 months for mobile-species.
Birds - intertidal	December 2017 to March 2019; April to August 2023.	12 months (CIEEM, 2019)	Yes. As birds are mobiles species within a dynamic environment (i.e. changes to land management of intertidal habitat or changes in breeding populations) these data are considered valid for one year, and meets the CIEEM recommended advice note of 12 months for mobile-species.

Data limitations in relation to both desktop and field studies are described under section 5.2.2.1.

5.7.4 Project design parameters

5.7.4.1 Onshore/Intertidal ornithology

The project design parameters for onshore and intertidal SCI birds has been fully described in section 5.2.3 under onshore biodiversity and benthic subtidal and intertidal ecology.

5.7.4.2 Offshore ornithology

Table 5-30 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on offshore ornithology.

The final height of the wind turbine will be confirmed following detailed geotechnical investigations and analysis of ground conditions (see design flexibility details in section 2 - Project Description). The assessment (section 5.7.6) considers the lowest blade tip height of 27 m above LAT (Table 5-30) as this would result in the maximum potential for impacts arising from collision risk. Should the final height of the wind turbine result in a blade tip height greater than 27 m, this would also result in a lesser impact from collision. The assessment is based on the greatest impact and therefore the most precautionary numbers are presented in section Table 5-30.

Additionally, due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore cable and offshore inter-array cables will be confirmed during construction (see design flexibility details in section 2 - Project Description). For the purposes of the assessment presented in section Table 5-30 the maximum length of cables has been considered (Table 5-30) to ensure the potential for maximum impact is assessed. Should the final lengths of cables be less than those specified, then the potential for effects will be the same or less than what is outlined in section 5.7.6. An alternative route within the offshore wind farm area of offshore cable corridor won't change the assessment presented in section Table 5-30.

Table 5-30: Project design parameters considered for the assessment of potential impacts on offshore SCI birds.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
Disturbance and displacement	✓	✓	✓	**Construction phase:** Disturbance and displacement from construction activity including: • Installation of 25 wind turbine generators (WTGs) and one offshore substation (OSS); • 26 monopile foundations; • Maximum of 5 hours piling per pile with one pile expected to be installed within each 24-hour period; • Maximum days piling = 26 days Maximum duration of piling: 8 hours per pile; total number of days of piling: 26; • Installation of 41 km of inter-array cables and 16 km offshore cable; • 50% of inter-array cables and 50% of offshore cable may require cable protection; and • Maximum 475 vessel round trips during the construction phase (including jack-up barges, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels and crew transfer vessels (CTVs)). Offshore construction may take place over a period of 15 months. **Operational and maintenance phase** • Presence and operation of 25 x WTGs and 1 x OSS; and • 352 vessel round trips per year.	Represents the maximum number of vessel movements that would cause greatest disturbance and displacement to birds from offshore wind farm area and offshore cable corridor. Accounts for the number of turbines and structures across the offshore wind farm area. Represents maximum extent and installation duration of cables that would cause greatest disturbance and displacement to birds.

Potential impact	Phase[1] C O D	Project design parameters	Justification
		Operational and maintenance phase is 40 years **Decommissioning phase** Disturbance and displacement from decommissioning activity including: • Removal of 25 x WTGs and 1 x OSS; • Maximum 475 vessel round trips during the decommissioning phase. Decommissioning duration assumed to be similar to that for construction but of a lower magnitude than construction	
Indirect displacement resulting from changes to prey and habitats	✓ ✓ ✓	Project design parameters as described in appendix E: Fish and Shellfish Ecology and appendix D: Benthic, Subtidal and Intertidal Ecology.	Project design parameters as described in appendix E: Fish and Shellfish Ecology for the following impacts: • Temporary subtidal habitat loss/disturbance during construction; • Long-term subtidal habitat loss during operation and maintenance phase; • Increased suspended sediment concentrations and associated sediment deposition; and • Injury and/or disturbance to fish and shellfish from underwater noise and vibration.
Collision risk	× ✓ ×	**Operational and maintenance phase** Presence of 25 x WTGs within the offshore wind farm area: • Hub height 145 - 152 m above Lowest Astronomical Tide (LAT); • Lower blade tip height of 27 m above LAT; • Upper blade tip height of 270 m above LAT; and • Maximum rotor diameter of 236 m.	The wind turbine parameters assessed for collision impact risk.
Barrier effect	× ✓ ×	**Operational and maintenance phase** Presence of 25 x WTGs within wind farm array area with minimum spacing of 944 m between turbines; and Presence of one OSS.	Maximum density of turbines and structures across the offshore wind farm area, which represents the greatest potential barrier of birds moving between colonies and foraging grounds, and those migrating through the offshore wind farm area.

1 C= Construction, O = Operation, D = Decommissioning

5.7.5 Measures included in the Project

5.7.5.1 Onshore/Intertidal SCI birds

The measures for onshore and intertidal SCI birds have been fully described in section 5.2.4.

5.7.5.2 Offshore SCI birds

As part of the project design process (see section 2), a number of measures have been proposed to reduce the potential for impacts on offshore ornithology (see Table 5-31). These measures were not taken into account in the Stage 1 Report to Inform Screening for Appropriate Assessment (see appendix A) in accordance with guidance and prevailing case law but can lawfully be taken into account for the Stage 2 appraisal.

These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 5.7.6 below (i.e. the assessment of the project against site COs). These measures are considered standard industry practice for this type of development. This approach has taken regard of the mitigation hierarchy as described by CIEEM (2018), where a sequential process is adopted to avoid, mitigate and compensate negative ecological impacts and effects.

Measures relevant to offshore SCI birds are presented in Table 5-31.

Table 5-31: Measures included in the Project – SCI seabirds.

Measures included in the Project	Justification
An EMP will be implemented during the construction, operational and maintenance, and decommissioning phases of the Project (see appendix K: Management Plans). The EMP includes a plan for minimising disturbance to rafting seabirds from construction vessels. Measures include: • Use of existing navigation approaches to port; avoid over-revving engines to minimise noise; and • Avoidance of rafting seabirds and seaducks enroute between work areas and port, or within the offshore wind farm area and offshore cable corridor, achieved through briefing (e.g. toolbox talks) of vessel crew about the purpose and implications of the vessel management practices.	Rafting seabirds and seaducks may occur within the navigation routes of construction vessels. Due to the infrequency of movements of additional vessel traffic, there is low potential for significant disturbance effects; however, it is best practice to minimise disturbance to birds.
The EMP (see appendix K: Management Plans) includes a Marine Pollution Contingency Plan (MPCP) which will include key emergency contact details (e.g. Environmental Protection Agency (EPA)). Measures for the MPCP include: • Designated areas for refuelling where spillages can be easily contained; • Storage of chemicals in secure designated areas in line with appropriate regulations and guidelines; and • Double skinning of pipes and tanks containing hazardous substances, and storage of these substances in impenetrable bunds.	To ensure that the potential for release of pollutants from construction, operational and maintenance, and decommissioning plant is minimised. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project.

5.7.6 Assessment of Project against conservation objectives

The prediction of adverse effects on site integrity during construction, operational and maintenance, and decommissioning phases of the Project on SCI birds is outlined in Table 5-32.

Table 5-32: **Prediction of adverse effects on site integrity during the construction, operational and maintenance, and decommissioning phases of the project on birds directive SCI birds.**

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Ailsa Craig SPA (UK9003091) (NatureScot, 2009)				
Gannet (*Morus bassanus*) [A016]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Population of the species as a viable component of the site** -Predicted impacts from the presence of the Project causing disturbance, displacement, collision risk, barrier effect and changes to prey availability as these species may be actively foraging in the area. **Distribution of the species within site** -Predicted impacts from the presence of the Project causing disturbance, displacement, collision risk and barrier effect as these species may be actively foraging in the area. **Distribution and extent of habitats supporting the species** -None predicted as no habitat loss or alteration is required which supports this seabird. Impacts are limited to displacement from habitat rather than loss in the distribution or extent of habitat. **Structure, function and supporting processes of habitats supporting the species** -None predicted as the project will not interfere with habitats that support this species. Impacts are limited to displacement from habitat rather than loss of structure, function etc. **No significant disturbance of the species** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk and barrier effect as these species may be actively foraging in the area.	Sea
Kittiwake (*Rissa tridactyla*) [A188]				Sea
Boyne Estuary SPA (IE004080) (NPWS, 2013e; Version 1; 26/02/2013)				
Black-tailed Godwit (*Limosa limosa*) [A156]	Disturbance from noise, vibration, lighting and human presence.	Siltation rate changes, dumping, depositing of dredged deposits [J02.11].	**Population trend** -Predicted impacts from disturbance causing behavioural changes, possible increased mortality and/or changes in foraging/roosting locations. **Distribution** -Predicted impacts from disturbance causing changes in range or occurrence and use of the area.	Shore
Golden Plover (*Pluvialis apricaria*) [A140]				Shore
Grey Plover (*Pluvialis squatarola*) [A141]				Shore
Lapwing (*Vanellus vanellus*) [A142]				Shore

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Knot (*Calidris canutus*) [A143]				Shore
Sanderling (*Calidris alba*) [A144]				Shore
Shelduck (*Tadorna tadorna*) [A048]				Shore
Turnstone (*Arenaria interpres*) [A169]				Shore
Carlingford Lough SPA (IE004078) (NPWS, 2013c; Version 1; 22/08/2013)				
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Disturbance from noise, vibration, lighting and human presence.	None relevant.	**Population trend** -Predicted impacts from disturbance causing behavioural changes, possible increased mortality and/or changes in foraging/roosting locations. **Distribution** -Predicted impacts from disturbance causing changes in range or occurrence and use of the area.	Shore
Carlingford Lough SPA (UK9020161) (DAERA, 2015; Version 3; 01/04/2015)				
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Disturbance from noise, vibration, lighting and human presence.	Pollution to surface waters (limnic, terrestrial and marine & brackish) [H01], marine water pollution [H03]	**Wintering population** -Predicted effects from disturbance causing a decline in the population.	Shore
Copeland Islands SPA (UK9020291) (DoENI, 2015c; Version 2; 01/04/2015)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Habitat quality – open water	**Occupied nests** -None predicted as the proposed Project does not interfere with nesting sites for Manx Shearwater (i.e. islands and coastal cliffs) **Fledging success** -None predicted as the proposed project doesn't interfere with any breeding locations on offshore islands that would impact on fledgling success. -However, predicted impacts could occur where adult mortality impacts fledgling production.	Sea
Deenish Island and Scariff Island SPA (IE004175) (NPWS, 2022a; Version 1; 12/10/2022)				

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **Natural range** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Dundalk Bay SPA (IE004026) (NPWS, 2011a; Version 1; 19/07/2011)				
Bar-tailed Godwit (*Limosa lapponica*) [A157]	Disturbance from noise, vibration, lighting and human presence.	Siltation rate changes, dumping, depositing of dredged deposits [J02.11] and discharges [E03].	**Population trend:** -Predicted impacts from disturbance causing behavioural changes, possible increased mortality and/or changes in foraging/roosting locations. **Distribution:** -Predicted impacts from disturbance causing changes in range or occurrence and use of the area.	Shore
Black-tailed Godwit (*Limosa limosa)* [A156]				Shore
Common Scoter (*Melanitta nigra*) [A065]				Shore
Curlew (*Numenius arquata*) [A160]				Shore
Dunlin (*Calidris ariti*) [A149]				Shore
Golden Plover (*Pluvialis apricaria*) [A140]				Shore
Great Crested Grebe (*Podiceps cristatus*) [A005]				Shore
Grey Plover (*Pluvialis squatarola*) [A141]				Shore
Greylag Goose (*Anser anser*) [A043]				Shore
Knot (*Calidris canutus*) [A143]				Shore

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Lapwing (*Vanellus vanellus*) [A142]				Shore
Light-bellied Brent Goose (*Branta bernicla hrota)* [A046]				Shore
Mallard (*Anas platyrhynchos*) [A053]				Shore
Oystercatcher (*Haematopus ostralegus*) [A130]				Shore
Pintail (*Anas acuta*) [A054]				Shore
Red-breasted Merganser (*Mergus serrator*) [A069]				Shore
Redshank (*Tringa aritim*) [A162]				Shore
Ringed Plover (*Charadrius hiaticula*) [A137]				Shore
Teal (*Anas crecca*) [A052]				Shore
Herring Gull (*Larus argentatus*) [A184]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Siltation rate changes, dumping, depositing of dredged deposits [J02.11] and discharges [E03].	**Population trend** **-**Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey/habitat which may cause a decline in the population in the area. **Distribution** -Predicted impacts as a result of disturbance and displacement which may cause a decline in the population in the area.	Sea
Common Gull (*Larus canus*) [A182]				Sea
Wetlands and Waterbirds [A999]	Surface water pollution.		**Habitat area** -None predicted as Project avoids activity within and/or removal of this habitat.	-
Glannau Aberdaron ac Ynys Enlli SPA (UK9013121) (JNCC, 2018)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Breeding population size** **-**Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may cause a decline in the breeding population in the area. **Productivity /breeding success**	Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
			-None predicted as the proposed project doesn't interfere with any breeding locations on offshore islands that would impact on fledgling success. -However, predicted impacts could occur where adult mortality impacts production of young and therefore breeding success.	
Grassholm SPA (UK9014041) (CCW, 2008; Version 2; 08/04/2008)				
Gannet (*Morus bassanus*) [A016]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Number of pairs** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may cause a decline in the population and therefore the number of breeding pairs. **Measurable change (i.e. decline of 25% on previous years)** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which could cause a decline in the population and therefore a measurable change of the population in the area.	Sea
Helvick Head to Ballyquin SPA (IE004192) (NPWS, 2022b; Version 1; 12/10/2022)				
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Motorised vehicles [G01.03]; and Erosion [K01.01].	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **-Natural range** Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Horn Head to Fanad Head SPA (IE004194) (NPWS, 2022c; Version 1; 12/10/2022)				
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Motorised vehicles [G01.03]; Removal of beach materials [C01.01.02]; and Erosion [K01.01].	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances.	Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
			-Natural range Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	
Howth Head Coast SPA (IE 004113) (NPWS, 2022d; Version 1; 12/10/2022)				
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **-Natural range** Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Ireland's Eye SPA (IE 004117) (NPWS, 2022e; Version 1; 12/10/2022)				
Guillemot (*Uria aalge*) [A199]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **-Natural range** Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Razorbill (*Alca torda*) [A200]				Sea
Herring Gull (*Larus argentatus*) [A184]				Sea
Kittiwake (*Rissa tridactyla*) [A188]				Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Irish Sea Front SPA (UK9020328) (JNCC, 2023)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Renewable energy developments: wind, wave and tidal.	**Avoid significant disturbance** -Predicted impacts on foraging or migrating birds in the area. The project could cause disturbance, displacement or collision. **Maintain the habitats and food resources** **-**Predicted impacts where water pollution could impact on fish assemblages causing an indirect effect on food resources. **Ensure connectivity between the site and supporting habitat and Manx shearwater breeding colonies** **-**Predicted impacts as the proposed project introduces a new barrier to the offshore environment. This could impact linkage between breeding colonies.	Sea
Lambay Island SPA (IE004069) (NPWS, 2022f; Version 1; 12/10/2022)				
Guillemot (*Uria aalge*) [A199]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **Natural range** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Razorbill (*Alca torda)* [A200]				Sea
Herring Gull (*Larus argentatus*) [A184]				Sea
Kittiwake (*Rissa tridactyla*) [A188]				Sea
Outer Ards SPA (UK9020271) (DAERA, 2015; Version 2; 01/04/2015)				
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Disturbance from noise, vibration, lighting and human presence.	Marine water pollution [H03].	**Wintering population:** -Predicted effects from disturbance causing a decline in the population.	Shore
North Colonsay and Western Cliffs SPA (UK9003171) (NatureScot, 2006)				
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect;	None relevant.	**Population of the species as a viable component of the site**	Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
	and changes to prey/habitat.		-Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area. **Distribution of the species within site** **-**Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area. **Distribution and extent of habitats supporting the species** -None predicted as no habitat loss or alteration is required which supports this seabird. Impacts are limited to displacement from habitat rather than loss in the distribution or extent of habitat. **Structure, function and supporting processes of habitats supporting the species** -None predicted as the project will not interfere with habitats that support this species. Impacts are limited to displacement from habitat rather than loss of structure, function etc. **No significant disturbance of the species** **-**Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area.	
North-west Irish Sea SPA (IE004236) (NPWS, 2023a; Version 1; 19/09/2023)				
Common Gull (*Larus canus*) [A182]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Natura 2000 Data Form not yet published. Therefore, in the absence of the Natura 2000 Data Form, relevant site-level threats have been obtained from a review of the ARCs[12], and include the following: • Removing or disturbing rock,	**Non-breeding population size** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could lower the abundance of individuals **Spatial distribution** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively using suitable habitat in the area.	Sea
Common Scoter (*Melanitta nigra*) [A065]				Shore
Great Black-backed Gull (*Larus marinus*) [A187]				Sea

[12] North-west Irish Sea cSPA – Activities Requiring Consent (ARCs): https://www.npws.ie/sites/default/files/protected-sites/minsterial_direction/MD004236.pdf

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Great Northern Diver (*Gavia immer*) [A003]		minerals, mud, sand, gravel or other sediment; • Any activity intended to disturb birds, including by mechanical, air, gas, wind powered or audible means; and • Introduction of plants or animals not found in the area.	**Forage spatial distribution, extent and abundance** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area. **Disturbance across the site** -Predicted impacts from the presence of the project causing disturbance and displacement, and change to prey as this site overlaps with project offshore cable corridor. **Barriers to connectivity and site use** **-**Predicted impacts as the proposed project introduces a new barrier to the offshore environment. This could impact birds which forage or migrate in the area.	Shore
Red-throated Diver (*Gavia stellata*) [A001]				Shore
Guillemot (*Uria aalge*) [A199]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Natura 2000 Data Form not yet published. Therefore, in the absence of the Natura 2000 Data Form, relevant site-level threats have been obtained from a review of the ARCs [13], and include the following: • Removing or disturbing rock, minerals, mud, sand, gravel or other sediment; • Any activity intended to disturb birds, including by mechanical, air, gas, wind powered or audible means; and	**Population size** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could lower the abundance of individuals **Spatial distribution** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively using suitable habitat in the area. **Forage spatial distribution, extent, abundance and availability** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area. **Disturbance across the site** -Predicted impacts from the presence of the project causing disturbance and displacement, and change to prey as this site overlaps with project offshore cable corridor. **Barriers to connectivity** **-**Predicted impacts as the proposed project introduces a new barrier to the offshore environment. This could impact birds which forage or migrate in the area.	Sea
Herring Gull (*Larus argentatus*) [A184]				Sea
Kittiwake (*Rissa tridactyla*) [A188]				Sea
Razorbill (*Alca torda*) [A200]				Sea

[13] North-west Irish Sea cSPA – Activities Requiring Consent (ARCs): https://www.npws.ie/sites/default/files/protected-sites/minsterial_direction/MD004236.pdf

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
		• Introduction of plants or animals not found in the area.		
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Natura 2000 Data Form not yet published. Therefore, in the absence of the Natura 2000 Data Form, site-level threats have been derived from a review of the ARCs (activities requiring consent)[14], and include the following: • Removing or disturbing rock, minerals, mud, sand, gravel or other sediment; • Any activity intended to disturb birds, including by mechanical, air, gas, wind powered or audible means; and • Introduction of plants or animals not found in the area.	**Breeding population size** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could lower the abundance of individuals available for breeding. **Spatial distribution** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively using suitable habitat in the area. **Forage spatial distribution, extent, abundance and availability** -Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area. **Disturbance across the site** -Predicted impacts from the presence of the project causing disturbance and displacement, and change to prey as this site overlaps with project offshore cable corridor. **Barriers to connectivity** **-**Predicted impacts as the proposed project introduces a new barrier to the offshore environment. This could impact birds which forage or migrate in the area.	Sea
Cormorant (*Phalacrocorax carbo*) [A017]				Shore
Rathlin Island SPA (UK9020011) (DAERA, 2015; Version 3; 01/04/2015)				
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Mixed source air pollution, air-borne pollutants (J03)	**Breeding population** **-**Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could lower the abundance of individuals available for breeding.	Sea
Razorbill (*Alca torda*) [A200]				Sea
River Nanny Estuary and Shore SPA (IE004158) (NPWS, 2012c; Version 1; 21/09/2012)				

[14] North-west Irish Sea cSPA – Activities Requiring Consent (ARCs): https://www.npws.ie/sites/default/files/protected-sites/minsterial_direction/MD004236.pdf

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Herring Gull (*Larus argentatus*) [A184]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Population trend** **-**Predicted impacts as a result of disturbance, displacement, collision risk, barrier effect and change to prey which may cause a decline in the population in the area, altering trends. **Distribution** **-**Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as this species may be actively foraging in the area.	Sea
Rum SPA (UK9001341) (SNH, 2021; 11/202021)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Renewable energy generation (wind, wave and tidal power), including infrastructure.	**Population** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could affect population numbers. **Distribution** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could affect birds foraging in the area. **Supporting habitat** -None predicted as the project will not interfere with habitats that support this species. Impacts are limited to displacement from habitat rather than loss of structure, function etc.	Sea
Saltee Islands SPA (IE004002) (NPWS, 2011c; Version 1; 21/10/2011)				
Gannet (*Morus bassanus*) [A016]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Breeding population abundance** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could cause mortality and lower the abundance of individuals available for breeding. **Productivity rate** **-**Predicted impacts where disturbance displacement, collision risk, barrier effect and change to prey could cause mortality and lower population rates**.** **Distribution: breeding colonies** **-**Predicted impacts from the presence of the project causing disturbance, displacement, collision risk, barrier effect and change to prey as these species may be actively foraging in the area. **Prey biomass available**	Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
			-Predicted impacts where changes to prey could impact on fish assemblages causing an indirect effect on prey availability. **Barriers to connectivity** -Predicted impacts as the proposed project introduces a new barrier to the offshore environment. This could impact birds which forage or migrate in the area. **Disturbance at breeding site** -None predicted. The proposed Project does not interfere with breeding sites. **Disturbance at marine areas** -Predicted impacts as the proposed project will be located in marine waters and may cause disturbance to non-site-specific behaviours.	
Kittiwake (*Rissa tridactyla*) [A188]			**Breeding population abundance: apparently occupied nests (AONs)** -None predicted. The proposed project does not interfere with nesting sites (i.e. cliffs). **Productivity rate** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could cause adult mortality and lower population rates. **Distribution: breeding colonies** -None predicted. The proposed project does not interfere with breeding colony locations (i.e. vertical rocky sea cliffs). **Prey biomass available** -Predicted impacts where changes to prey could impact on fish assemblages causing an indirect effect on prey availability. **Barriers to connectivity** -Predicted impacts as the proposed Project introduce a new barrier to the offshore environment. This could impact birds which forage or migrate in the area. **Disturbance at breeding site** -None predicted as the proposed project does not interfere with breeding sites associated with this bird (i.e. cliffs).	Sea
Skelligs SPA (IE004007) (NPWS, 2022g; Version 1; 12/10/2022)				

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collison, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **-Natural range** Predicted impacts as a result of disturbance, displacement, collison, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea
Skerries Islands SPA (IE004122) (NPWS, 2022h; Version 1; 12/10/2022)				
Cormorant (*Phalacrocorax carbo*) [A017]	Disturbance from noise, vibration, lighting and human presence	None relevant	**Population dynamics** -Predicted impacts as a result of disturbance which may result in changes to population dynamic such as breeding population and abundances. **Natural range** -Predicted impacts as a result of disturbance which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Shore
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]				Shore
Herring Gull (*Larus argentatus*) [A184]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.		**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **Natural range** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat**	Sea

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
			-Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051) (NRW & JNCC, 2015f)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant	**Breeding population size** -Predicted impacts as a result of disturbance, displacement and collison which may cause a decline in the breeding population size in the area (i.e. mortality or movement to a different area). **Distribution** -Predicted impacts from the presence of the project on species that may be actively foraging in the area. **Sufficient habitat** -Predicted impacts where the presence of the project may reduce the habitat available for foraging or other uses. Factors affecting the population or its habitat should be under appropriate control -Predicted impacts where boat use and human presence may cause disturbance.	Sea
South Dublin Bay and Tolka Estuary SPA (IE004024) (NPWS, 2015a; Version 1; 09/03/2015)				
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Disturbance from noise, vibration, lighting and human presence.	Discharges [E03]	**Population trend:** -Predicted impacts from disturbance causing behavioural changes, possible increased mortality and/or changes in foraging/roosting locations. **Distribution:** -Predicted impacts from disturbance causing changes in range or occurrence and use of the area.	Shore
Stabannan-Braganstown SPA (IE004091) (NPWS, 2022i; Version 1; 15/11/2022)				
Greylag Goose (*Anser anser*) [A043]	Disturbance from noise, vibration, lighting and human presence.	None relevant	**Winter population trend** -Predicted impacts from disturbance causing behavioural changes, possible increased mortality and/or changes in foraging/roosting locations. **Winter spatial distribution** -Predicted impacts from disturbance causing changes in range or occurrence and use of the area. **Disturbance at wintering site**	Shore

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
			-None predicted as the Project does not interfere with wintering site locations. **Barriers to connectivity and site use** -Predicted impacts as the proposed Project introduces a new barrier to the offshore environment. This could impact birds which forage or migrate in the area, and therefore effect site use. **Forage spatial distribution, extent and abundance** -Predicted impacts as the Project may interfere with key foraging habitats such as marshes, grassland and cereal stubble. **Roost spatial distribution and extent** -None predicted as the Project does not interfere with day or night time roosting locations (i.e. lakes and estuaries) **Supporting habitat: area and quality** -Predicted impacts as the Project may interfere with key supporting habitats such as marshes, grassland and cereal stubble.	
Strangford Lough SPA (UK9020111) (DAERA, 2015; Version 4 01/04/2015)				
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	Disturbance from noise, vibration, lighting and human presence.	Habitat extent – inter-tidal; Habitat extent and quality-breeding	**Wintering population:** -Predicted effects from disturbance causing a decline in the population.	Shore
St Kilda SPA (UK9001031) (JNCC, 2021)				
Manx Shearwater (*Puffinus puffinus*) [A013]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	Mixed source air pollution, air-borne pollutants (J03).	**Population** -Predicted impacts where disturbance, displacement, collision risk, barrier effect and change to prey could cause mortality and lower the abundance of individuals available for breeding. **Distribution** -Predicted impacts from the presence of the Project causing disturbance, displacement, collision risk, barrier effect and change to prey as these species may be actively foraging in the area. **Supporting Habitat** -None predicted as the Project will not interfere with habitats that support this species. Impacts are limited to displacement from habitat rather than loss of structure and function.	Sea
Wicklow Head SPA (IE004127) (NPWS, 2022j; Version 1; 12/10/2022)				

Relevant Qualifying Interest	Effect pathway(s)	Relevant Site-level Threat	Potential Adverse Effect(s) to relevant SCI	Seabird (Sea) / Shorebird (Shore)
Kittiwake (*Rissa tridactyla*) [A188]	Disturbance; displacement; collision risk; barrier effect; and changes to prey/habitat.	None relevant.	**Population dynamics** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may result in changes to population dynamic such as breeding population and abundances. **Natural range** -Predicted impacts as a result of disturbance, displacement, collision, barrier effect and changes to prey which may affect population distribution and abundance. **Sufficiently large habitat** -Predicted impacts from the presence of the Project causing changes to prey and habitat as this species may be actively foraging in the area.	Sea

5.7.6.1 Construction/decommissioning phase

5.7.6.1.1 Shorebirds

All relevant shorebirds are discussed below in this section. It should be noted that all shorebirds discussed, either have the potential to occur within the area of the Project works at the landfall or were noted to occur during intertidal bird surveys.

Population trend

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'population trend' as part of four SPA's, namely the Boyne Estuary SPA (IE004080), Carlingford Lough SPA (IE004078), Dundalk Bay SPA (IE004026) and South Dublin Bay and Tolka Estuary SPA (IE004024).

The following shorebirds (wintering populations) have been assessed: black-tailed godwit, bar-tailed godwit, common scoter, curlew, dunlin, golden plover, great crested grebe, greylag goose, grey plover, lapwing, knot, sanderling, shelduck, turnstone, light-bellied brent goose, mallard, oystercatcher, pintail, red-breasted merganser, redshank, ringed plover and teal.

In terms of 'population trend' the focus of this CO is that the long-term population trend of shorebirds should be stable or increasing. The population trend of shorebirds are considered to be unfavourable when they have declined by 25% or more. Disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location within the intertidal area is predicted to produce only temporary and short-lived increases at Dunany Bay beach shoreline within 300 m of the landfall location.

Where disturbance could occur at the landfall and within the intertidal area, and noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), disturbances will not contribute to a decline in population as the receptor (i.e. intertidal shorebirds) is absent. Potential effects during the construction and decommissioning phases of the Project are therefore not deemed to generate adverse effects on the population trend of shorebirds.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Population dynamic; Natural range

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'population dynamic' as part of one SPA, Skerries Islands SPA (IE004122). The following shorebirds have been assessed: cormorant (breeding population) and light-bellied brent goose (wintering population).

In terms of 'population dynamic' and 'natural range' the focus of these COs is that the species is maintaining itself on a long-term basis as a viable component of its natural habitats and is neither being reduced nor is likely to be reduced for the foreseeable future. As detailed above under 'Population trend', disturbance will not contribute to a change in population dynamic to intertidal shorebirds such as light-bellied brent goose noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds).

In relation to breeding populations of cormorant, there is no overlap between breeding colonies and Dunany Bay beach shoreline as cormorant breed on cliffs along the coast and in trees when inland. The localised, temporary and short lived increases in disturbance at Dunany Bay beach are not considered to contribute to any other adverse effect on population dynamic or the natural range of cormorant given their tendency to forage close to their nesting location (Siegel-Causey, 1997) and the c. 30km distance between Skerries Islands SPA and Dunany Bay beach.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Wintering population

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'wintering population' as part of three SPAs, namely Carlingford Lough SPA (UK9020161), the Outer Ards SPA (UK9020271) and Strangford Lough SPA (UK9020111). Light-bellied brent goose has been assessed.

In terms of 'wintering population' the focus of this CO is that there should be no significant decrease in population against national trends. A decline to a level below the Common Standards Monitoring baseline (JNCC, 2004) over a five year period indicates unfavourable condition. Disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location within the intertidal area is predicted to produce only temporary and short-lived increases in disturbance. Where disturbance could occur, and noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), disturbances are considered not to contribute to a decline in population as the receptor is absent. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the wintering population of light-bellied brent geese associated with Carlingford Lough SPA, the Outer Ards SPA and Strangford Lough SPA.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Winter population trend

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'wintering population trend' as part of one SPA, Stabannan-Braganstown SPA (IE004091). Greylag goose has been assessed.

In terms of 'winter population trend' the focus of this CO is to ensure that the long-term population trend within the SPA is stable or increasing. Impacts are predicted to be the same as those described above under 'population trend'. Noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), disturbances will not contribute to a decline in population as the receptor (i.e. intertidal shorebirds) is absent. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the population trend of greylag goose.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Non-breeding population size

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'non-breeding population size' as part of one SPA, the North-west Irish Sea SPA (IE004236). Common scoter, great northern diver and red-throated diver have been assessed.

In terms of 'non-breeding population size', the focus of this CO is to ensure that there is no significant decline in the size of the non-breeding population. According to the NPWS (2023a), common scoter, great northern diver and red-throated diver tend to concentrate in the shallower coastal area of the western Irish Sea during the non-breeding period (i.e. outside the months of spring and summer). Disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location and within the intertidal area is predicted to produce only temporary and short-lived increases in disturbance. Noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), and where disturbance could occur within the non-breeding period, disturbances are not considered to contribute to any significant decline in the non-breeding population size. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the non-breeding population size of common scoter, great northern diver and red-throated diver associated with the North-west Irish Sea SPA.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Breeding population size

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'breeding population size' as part of one SPA, the North-west Irish Sea SPA (IE004236). Cormorant has been assessed.

In terms of 'breeding population size' the focus of this CO is to ensure the long term population trend within the SPA is stable or increasing. According to the NPWS (2023a), breeding populations occurring within the North-west Irish Sea SPA exploit the area as a foraging resource to varying degrees. There is potential for disturbance at the landfall, and within the intertidal area to effect cormorant. Disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location and within the intertidal area is predicted to produce only temporary and short-lived increases in disturbance. Furthermore, no birds were confirmed breeding at the landfall location. Mindful of the temporary duration of works at the landfall and within the intertidal area no significant decline in the breeding population size is expected to occur. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the breeding population size of cormorant associated with the North-west Irish Sea SPA.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Winter spatial distribution

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'wintering population trend' as part of one SPA, Stabannan-Braganstown SPA (IE004091). Greylag goose has been assessed.

In terms of 'winter spatial distribution' the focus of this CO is to ensure that there is sufficient area and availability (in terms of timing and intensity of use) of suitable habitat to support the population target. Impacts are predicted to be the same as those described above under 'population trend' whereby construction works to facilitate cable laying at the landfall location and within the intertidal area, and construction within the substation site may reduce the availability of habitat to greylag goose (i.e. grassland, intertidal habitat and arable field). Greylag geese were not noted at the substation site during site-specific surveys but if they were to occur, their temporary displacement would be to suitable adjoining habitat. Furthermore, taking account of the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the winter spatial distribution (i.e. habitat available) of greylag goose.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Forage spatial distribution, extent and abundance; Supporting habitat: area and quality

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'forage spatial distribution, extent and abundance' as part of two SPAs, Stabannan-Braganstown SPA (IE004091) and the North-west Irish Sea SPA (IE004236). Common scoter, great northern diver, red-throated diver, cormorant and greylag goose have been assessed.

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'supporting habitat: area and quality' as part of one SPA, Stabannan-Braganstown SPA (IE004091). Greylag goose has been assessed.

In terms of 'forage spatial distribution, extent and abundance' the focus of this CO is to ensure there are sufficient number of locations, area of suitable habitat and available forage biomass to support the population target. In terms of 'supporting habitat: area and quality', the focus of the CO is to ensure there is sufficient area of utilisable habitat available in ecologically important sites outside the SPA.

In relation to greylag goose (wintering population), and as detailed above under 'winter spatial distribution', noting the extensive availability of alternative habitat within the wider environment at both of these locations (i.e. substation, and landfall location), and taking account of the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on suitable habitat and foraging resources available to greylag goose.

In relation to common scoter, great northern diver and red-throated diver (non-breeding populations), and as detailed above under 'non-breeding population size' disturbance will be short lived and temporary. Where disturbance does occur, these birds have extensive additional habitat and foraging resources available within the wider environment of the landfall and intertidal area. Taking account of the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds) potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on suitable habitat and available forage biomass available to common scoter, great northern diver and red-throated diver associated with the North-west Irish Sea SPA.

In relation to cormorant (breeding population), disturbance will be short lived and temporary. Where disturbance does occur, these birds have extensive additional habitat and foraging resources available within the wider environment of the landfall and intertidal area. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on suitable habitat and available forage biomass available to cormorant associated with the North-west Irish Sea SPA.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Distribution; Spatial distribution

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'distribution' as part of four SPA's, namely the Boyne Estuary SPA (IE004080), Carlingford Lough SPA (IE004078), Dundalk Bay SPA (IE004026) and South Dublin Bay and Tolka Estuary SPA (IE004024). The following shorebirds (wintering populations) have been assessed: black-tailed godwit, bar-tailed godwit, common scoter, curlew, dunlin, golden plover, great crested grebe, greylag goose, grey plover, lapwing, knot, sanderling, shelduck, turnstone, light-bellied brent goose, mallard, oystercatcher, pintail, red-breasted merganser, redshank, ringed plover and teal.

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'spatial distribution' as part of one SPA, the North-west Irish Sea SPA (IE004236). Common scoter, great northern diver, red-throated diver (non-breeding populations) and cormorant (breeding) have been assessed.

In terms of 'distribution' the focus of this CO is that there should be no significant decrease in the range, timing or intensity of use of the area by SCI birds. A decline in distribution can occur where patterns of shorebirds across the low and high tide change or do not support the critical shorebird functions such as foraging or roosting availability.

In terms of 'spatial distribution' the focus of this CO is that there should be sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population.

In relation to wintering and non-breeding populations of the aforementioned SPAs, potential effects on shorebird distribution include disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location within the intertidal area. These activities are predicted to produce only temporary and short-lived increases at Dunany Bay beach shoreline within 300 m of the landfall location. However, potential effects are likely to cause disturbances which may impact shorebird patterns and occurrence within the intertidal area where they may forage or roost. This may undermine the favourable condition of shorebird species within the aforementioned SPAs. However, where disturbance could occur and noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), disturbances will not contribute to a decrease in the range, timing or intensity of use of the area as the receptor (i.e. wintering populations) and will not alter sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population (i.e. non-breeding populations).

In relation to cormorant (breeding) of the North-west Irish Sea SPA, potential effects on their spatial distribution include disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location within the intertidal area. These activities are predicted to produce only temporary and short-lived increases at Dunany Bay beach shoreline within 300 m of the landfall location. However, temporary disturbances will not contribute to a decrease in a sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population.

Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on the distribution of shorebirds. On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Sufficiently large habitat

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'sufficiently large habitat' as part of one SPA, Skerries Islands SPA (IE004122). The following shorebirds have been assessed: cormorant (breeding population) and light-bellied brent goose (wintering population).

In terms of 'sufficiently large habitat' the focus of this CO is to ensure supporting habitat is available to these species that will maintain its population on a long -term basis. As detailed under 'Population dynamic' and 'natural range, the Project will not contribute to a change in the habitat available to intertidal shorebirds such as light-bellied brent goose noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds). Furthermore, in relation to breeding populations of cormorant, there is no overlap between the Project and supporting habitat for cormorant as cormorant breed on cliffs along the coast and in trees when inland. The localised, temporary and short lived increases in disturbance at Dunany Bay beach are not considered to contribute to any other adverse effect on habitat available to cormorant.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance across the site

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'disturbance across the site' as part of one SPA, the North-west Irish Sea SPA (IE004236). Common scoter, great northern diver, red-throated diver and cormorant have been assessed.

In terms of 'disturbance across the site' the focus of this CO is to ensure the intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population size and spatial distribution.

As described under 'non-breeding population size', disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location and within the intertidal area is predicted to produce only temporary and short-lived increases in disturbance. Noting the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), and where disturbance could occur it is not considered to contribute to any significant impact on the achievement of targets for population size and spatial distribution. Potential effects during the construction and decommissioning phases of the Project are not deemed to generate adverse impacts on common scoter, great northern diver and red-throated diver associated with the North-west Irish Sea SPA.

In relation to cormorant (breeding) of the North-west Irish Sea SPA, potential effects on their spatial distribution include disturbance from noise, vibration, lighting and human presence as a result of cable laying at the landfall location and within the intertidal area. These activities are predicted to produce only temporary and short-lived increases at Dunany Bay beach shoreline within 300 m of the landfall location. These temporary disturbances will do not significantly impact the achievement of targets for population size and spatial distribution

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Barriers to connectivity and site use

Shorebirds listed in Table 5-32 have been included for assessment under the conservation attribute 'barriers to connectivity and site use' as part of two SPAs, Stabannan-Braganstown SPA (IE004091) and the North-west Irish Sea SPA (IE004236). Common scoter, great northern diver, red-throated diver, cormorant and greylag goose have been assessed.

In terms of 'barriers to connectivity and site use' the focus of this CO is to ensure number, location, shape and area of barriers do not significantly impact the site population's access to the SPA or other ecologically important sites outside the SPA.

In relation to greylag goose, the Project will not introduce any physical barrier to limit the access of this species to the SPA or supporting habitat. However, a barrier in the form of disturbance may cause temporary and localised effects. Greylag geese were not noted at the substation site during site-specific surveys but if they were to occur, their temporary displacement would be to suitable adjoining habitat. Furthermore, taking account of the measures described in Table 5-5 (i.e. timing of landfall works will avoid peak season for intertidal birds), potential effects during the construction and decommissioning phases of the Project are not deemed to limit this species access to the SPA or supporting habitat outside the SPA.

In relation to common scoter, great northern diver, red-throated diver and cormorant, the Project offshore cable corridor overlaps with the North-west Irish Sea SPA over an area of approx. 215 ha (which accounts for approx. 0.09 % of the SPA). Cable laying within this corridor may introduce a barrier to connectivity in the form of vessels required to complete cable installation. However, noting that offshore cable installation within the intertidal area will be short lived and temporary, and the small area in which it interferes with (i.e. <1% of the total area of the SPA), site use and access to the SPA will not be affected by the Project. Furthermore, taking account of the measures described in Table 5-5 (i.e. timing of landfall and offshore cable works (within the intertidal area) will avoid peak season for intertidal birds), potential effects during the construction and decommissioning phases of the Project are not deemed to limit this species access to the SPA or supporting habitat outside the SPA.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.7.6.1.2 Seabirds

All relevant seabirds are discussed in this section. It should be noted that all seabirds discussed either have the potential to occur within the offshore wind farm area or were noted to occur during dedicated aerial and boat surveys. The reference populations for the SCIs of breeding colony SPAs have been derived from the latest updates to the Natura 2000 Standard Data Forms and are provided in appendix H: Offshore Ornithology – Supporting Information. Marine SPAs (specifically the North-west Irish Sea SPA and Irish Sea Front SPA) have not had the population defined. Both of the marine SPAs provide protection for foraging birds during the breeding season or aggregations of wintering individuals during the non-breeding period. Therefore, the total population of each of the marine SPAs is defined by the combined breeding population, for which it protects, and the entire winter Biologically Defined Minimum Population Scales (BDMPS) due to increase mobility of birds during the wintering period (Furness, 2015).

Population; Measurable Change

Disturbance and displacement

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'population' (i.e. species as a viable component of the site, population dynamics, breeding population/population size, breeding population abundance, population trend and measurable change, and non-breeding population size) as part of 22 SPA's, namely: the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Deenish Island and Scariff Island SPA (IE 004175), Dundalk Bay SPA (IE004026),

Glannau Aberdaron ac Ynys Enlli SPA (UK9013121), Grassholm SPA (UK9014041), Helvick Head to Ballyquin SPA (IE004192), Horn Head to Fanad Head SPA (IE004194), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069), Rathlin Island SPA (UK9020011), River Nanny Estuary and Shore SPA (IE004158), Rum SPA (UK9001341), Saltee Islands SPA (IE004002), Skelligs SPA (IE004007), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), St Kilda SPA (UK9001031), Horn Head to Fanad Head SPA (IE004194), North Colonsay and Western Cliffs SPA (UK9003171) and Wicklow Head SPA (IE004127).

In terms of 'population' the overall focus of this CO is that the long-term population trends and population abundances of seabirds and breeding seabirds should be stable or increasing with no significant declines seen. In terms of 'measurable change', this is the measured decline in a population, whereby a population should not and will not drop by more than 25% of the previous year's figures in any one year (CCW, 2008). Disturbance and displacement (i.e. installing foundations, wind turbines, inter-array cabling and associated vessel movements) and changes to prey/habitat (i.e. temporary habitat loss, underwater noise and suspended sediment) as a result of construction activities within the offshore environment have the potential to effect the population of the following seabirds (Table 5-32): gannet, guillemot, razorbill, herring gull, manx shearwater, kittiwake, common gull and common scoter, and great black-backed gull.

A screening assessment (see appendix H: Offshore Ornithology – Supporting Information) for construction disturbance and displacement has been carried out for each of the above species with consideration of the species' sensitivity rating and abundance in the Offshore Ornithology Study Area (see section 3.2.1). Only species that were recorded in abundances within the offshore wind farm area of moderate, or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000), and with a sensitivity of moderate or above will be assessed in this section (see appendix H: Offshore Ornithology – Supporting Information for abundances). Therefore, guillemot and razorbill are discussed further below.

Disturbance and displacement – Guillemot (all seasons)

During the breeding season, based on a mean-peak densities of 10.3 to 21.4 birds/km^2 within an area of 12.56 km^2, there would be approximately 129 to 269 birds at risk of temporary disturbance and displacement during one or two breeding seasons during which construction would occur.

During the non-breeding season, based on a mean-peak density of 30.5 to 61.9 birds/km^2 within an area of 12.56 km^2, there would be approximately 383 to 777 birds birds at risk of temporary disturbance and displacement during one or two non-breeding seasons during which construction would occur.

Following the guidance presented by the SNCB (2022), the recommended displacement rate for auk species is between 30 % and 70 %, while advice provided by NatureScot recommends a displacement rate of 60 % and a mortality rate of 1 % (from Marine Scotland Scoping opinion for Seagreen development in the Firth of Forth). For the purposes of this report and considering the temporary and intermittent nature of the construction disturbance, the impact is assessed in the context of 50 % displacement rate and 1 % mortality rate.

Based on these rates, the construction of the offshore wind farm and offshore cable would result in additional mortality of:

- Breeding season: 6.5 to 13.4 birds; and
- Non-breeding season: 19.2 to 38.9.

Due to the lesser estimate of potential mortality during construction than during operational and maintenance, it was not deemed necessary to apportion the impact on the SPAs for which guillemot is a qualifying feature. As the increase in baseline mortality during the operational and maintenance phase is <1 %, the impact during the construction phase is not considered to have an adverse effect on the site's integrity for all SPAs assessed from the Project alone.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance and displacement – Razorbill (all seasons)

During the breeding period, based on a mean-peak densities of 0.25 to 5.6 birds/km^2 within an area of 12.56 km^2, there would be approximately 3 to 70 birds at risk of temporary disturbance and displacement during one or two breeding seasons during which construction would occur.

During the non-breeding period, based on a mean-peak density of 9.6 to 10.5 birds/km^2 within an area of 12.56 km^2, there would be approximately 121 to 132 birds at risk of temporary disturbance and displacement during one or two non-breeding seasons during which construction would occur.

Following the guidance presented by the SNCB (2022), the recommended displacement rate for auk species is between 30% and 70% and mortality between 1 and 10%, while advice provided by NatureScot recommends a displacement rate of 60% and a mortality rate of 1% (from Marine Scotland Scoping opinion for Seagreen development in the Firth of Forth). For the purposes of this assessment and considering the temporary and intermittent nature of the construction disturbance, the impact is assessed in the context of 50% displacement rate and 1% mortality rate.

Based on these rates, the construction of the offshore wind farm and offshore cable would result in additional mortality of:

- Breeding season: 0.2 to 3.5 birds; and
- Non-breeding season: 6.0 to 6.6 birds.

Due to the lesser estimate of potential mortality during construction than during operational and maintenance, it was not deemed necessary to apportion the impact on the SPAs for which razorbill is a qualifying feature. As the increase in baseline mortality during the operational and maintenance phase is <1 %, the impact during the construction phase is not considered to have an adverse effect on the site's integrity for all SPAs assessed from the Project alone.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Indirect disturbance and displacement resulting from changes to prey and habitats

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'population' (i.e. species as a viable component of the site, population dynamics, breeding population/population size, breeding population abundance, population trend and measurable change and non-breeding population size) as part of 22 SPA's, namely: the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Deenish Island and Scariff Island SPA (IE 004175), Dundalk Bay SPA (IE004026), Glannau Aberdaron ac Ynys Enlli SPA (UK9013121), Grassholm SPA (UK9014041), Helvick Head to Ballyquin SPA (IE004192), Horn Head to Fanad Head SPA (IE004194), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069), Rathlin Island SPA (UK9020011), River Nanny Estuary and Shore SPA (IE004158), Rum SPA (UK9001341), Saltee Islands SPA (IE004002), Skelligs SPA (IE004007), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), St Kilda SPA (UK9001031), Horn Head to Fanad Head SPA (IE004194), North Colonsay and Western Cliffs SPA (UK9003171) and Wicklow Head SPA (IE004127).

Potential effects on the fish assemblages during the construction and decommissioning phases of the Project, are discussed under section 5.5.5.1. Seabirds may be indirectly disturbed and displaced during the construction phase as a result of direct impacts on prey species or habitat (i.e. temporary habitat loss, underwater noise and suspended sediment), which may result in the loss of a food resource to birds in the offshore wind farm area and offshore cable corridor.

Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. However, the assessment concluded that temporary loss of habitat was considered unlikely to diminish ecosystem functions for fish and shellfish species, and therefore would have an undetectable indirect impact on seabird species.

In relation to the influence of underwater noise affecting fish and shellfish populations, proposed piling activities will unlikely result in mortality, but some recoverable injury is possible within approximately 1 km of the piling works, particularly for salmonids, scombridae, gadoids and eels, herring, sprat and shads. The assessment concluded that the effect was both short-term and reversible, and therefore would have an undetectable indirect impact on seabird species.

With regards to an increase in suspended sediment concentration (SSC), this may lead to a short-term avoidance of affected areas by sensitive fish and shellfish species, although many species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea. The assessment concluded that based on the low levels of increased SSC, the localised nature of the impact, and the tolerance of fish and shellfish receptors, the effect would have an undetectable indirect impact on seabird species.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Number of pairs

Gannet listed in Table 5-32 has been included for assessment under the conservation attribute 'number of pairs' as part of one SPA, namely Grassholm SPA (UK9014041). The focus of this CO is that the population will not fall below 30,000 pairs (lower limit) in three consecutive years and will not drop by more than 25% of the previous year's figures in any one year.

For the Project, although there will be no interaction or adverse effects on breeding colonies or breeding locations of gannet, adult mortality may cause a decline in the number of pairs available ensuring a stable population turnover. During the construction phase, there is potential for disturbance and displacement, and changes to prey/habitat to cause an increase in stress hormones, a reduction in the use of a site by birds, a reduction in food resources available and alteration of foraging behaviour (i.e. increased energy expenditures), to effect the number of gannet pairs.

As described under 'Productivity rate; Breeding success; Fledgling success', gannet have a very low sensitivity to disturbance and displacement during construction and therefore no adverse effects are *predicted on gannet pairs. In relation to changes to prey/habitat, as detailed above under '*Population; Measurable Change'*,* the assessment concluded that effects of fish assemblages would have an undetectable indirect impact on seabird species. Therefore, changes to prey/habitat will not cause an adverse effect on the number of gannet pairs.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Productivity rate; Breeding success; Fledgling success

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'productivity rate', 'breeding success' and 'fledgling success' as part of three SPA's, namely: Saltee Islands SPA (IE004002), Copeland Islands SPA (UK9020291) and Glannau Aberdaron ac Ynys Enlli SPA (UK9013121).

The focus of these CO's is to ensure stable reproductive rates, no significant decline in productivity, and that there is an appropriate level of fledgling survival. Productivity rate is directly linked with breeding and fledgling success in a population. For the Project, although there will be no interaction or adverse effects on breeding colonies or breeding locations, adult mortality may cause a decline population turnover and the number of fledglings produced in a given breeding season.

During the construction phase, there is potential for disturbance and displacement, and changes to prey/habitat to cause an increase in stress hormones, a reduction in the use of a site by birds, a reduction in food resources available and alteration of foraging behaviour (i.e. increased energy expenditures). As a result of construction activities within the offshore environment, there is potential for effects on the productivity of the following seabirds (Table 5-32): manx shearwater, kittiwake and gannet.

As described above under 'Population; Measurable Change', only species that were recorded in abundances within the offshore wind farm area of moderate, or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) and with a sensitivity of moderate or above will be assessed in this section. Manx shearwater, kittiwake and gannet all have a very low sensitivity to disturbance and displacement during construction and therefore do not require further assessment.

In relation to changes to prey/habitat, as detailed above, the assessment concluded that effects of fish assemblages would have an undetectable indirect impact on seabird species. Therefore, changes to prey/habitat will not cause an adverse effect on the productivity of manx shearwater, kittiwake or gannet.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Distribution; natural range; Spatial distribution; Forage spatial distribution, extent, abundance and availability

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'distribution' (i.e., distribution of the species within site, distribution-breeding colonies);'natural range'; 'spatial distribution'; and 'forage spatial distribution, extent, abundance and availability' as part of 17 SPAs, namely: the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Deenish Island and Scariff Island SPA (IE 004175), Dundalk Bay SPA (IE004026), Helvick Head to Ballyquin SPA (IE004192), Horn Head to Fanad Head SPA (IE004194), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069*),* River Nanny Estuary and Shore SPA (IE004158), Rum SPA (UK9001341), Saltee Islands SPA (IE004002), Skelligs SPA (IE004007), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), St Kilda SPA (UK9001031), North Colonsay and Western Cliffs SPA (UK9003171).

In terms of distribution the focus of this CO is to ensure no significant decrease in the numbers or range of areas used by seabirds (including the distribution of breeding colonies). In terms of 'spatial distribution' the focus of this CO is to ensure sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population, and in terms of 'forage spatial distribution, extent, abundance and availability' the focus of this CO is to ensure sufficient number of locations, area of suitable habitat and available forage biomass to support the population target.

During the construction phase, changes in the distribution of seabirds in an area are reflective of disturbance and displacement, and changes to prey/habitat. As a result of construction activities within the offshore environment, there is potential for effects on the distribution , natural range and forage spatial distribution, extent, abundance and availability of the following seabirds (Table 5-32): gannet, guillemot, razorbill, herring gull, manx shearwater, kittiwake, common gull, common scoter and great black-backed gull.

The potential for effects as a result of disturbance and displacement and changes to prey/habitat are described above under 'Population; Measurable Change' and the impacts are considered the same or similar to these in relation to: distribution; natural range; and forage spatial distribution, extent, abundance and availability. As described above, only species that were recorded in abundances within the offshore wind farm area of moderate, or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) and with a sensitivity of moderate or above will be assessed in this section. Therefore, only guillemot and razorbill are assessed.

As these three factors are not considered to have an adverse effect on site integrity (see assessment above under 'Population; Measurable Change'), the distribution, natural range and forage spatial distribution, extent, abundance and availability of seabirds associated with these European sites shall not be altered (i.e. there is no predicted significant change in the numbers of seabirds or their range).

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'disturbance' (i.e. no significant disturbance of the species, and disturbance at marine areas); 'avoid significant disturbance'; and 'disturbance across the site' as part of five SPAs, namely the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Saltee Islands SPA (IE004002), North Colonsay and Western Cliffs SPA (UK9003171) and the Irish Sea Front SPA (UK9020328).

The focus of this CO is to ensure no significant increase in the form of disturbance as a result of human activity at marine areas adjacent to breeding colonies, to ensure significant mortalities of seabirds do not occur, and to ensure disturbance does not occur at levels that will significantly impact the achievement of targets for population size and spatial distribution. As a result of construction activities within the offshore environment, there is potential for disturbance effects on the following seabirds (Table 5-32): gannet, kittiwake, manx shearwater, common gull, common scoter, guillemot, herring gull and razorbill.

Only species that were recorded in abundances within the offshore wind farm area of moderate, or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) and with a sensitivity of moderate or above will be assessed in relation disturbance and displacement. Gannet, kittiwake, manx shearwater, great black-backed gull and herring gull have a very low sensitivity to disturbance and displacement during construction and therefore do not require further assessment. Common gull has a low sensitivity to disturbance and displacement during construction and therefore does not require further assessment. Common scoter has a high sensitivity to disturbance and displacement during construction, however it has a low abundance recorded during site-specific surveys and therefore does not require further assessment. Guillemot and razorbill both have a moderate sensitivity to disturbance and displacement during construction (and were recorded in very high numbers during site-specific surveys), and as detailed above under "disturbance and displacement" for these species, due to the *de minimis* estimate of potential mortality during construction, it was not deemed necessary to apportion the impact on the relevant SPAs.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Prey biomass; Maintain the habitats and food resources; Sufficiently large habitat.

Seabirds listed in Table 5-32 have been included for discussion under the conservation attributes 'prey biomass' and 'habitats and food resources' and 'sufficiently large habitat' as part of 12 SPAs, namely: Deenish Island and Scariff Island SPA (IE004175), Helvick Head to Ballyquin SPA (IE004192), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069), Saltee Islands SPA (IE004002), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), Wicklow Head SPA (IE004127), the Irish Sea Front SPA (UK9020328), Horn Head to Fanad Head SPA (IE004194) and Skelligs SPA (IE004007). There is potential for effects on the following seabirds (Table 5-32): manx shearwater, kittiwake, guillemot, razorbill, herring gull and gannet.

The focus of these COs are to ensure the availability of both habitat and prey in order to support the seabird populations associated with that site. Seabirds rely on fish assemblages as a food resource and therefore any marine water pollution has the potential to have detrimental effect on prey availability and on population abundance and distribution (i.e. contamination and sedimentation). However, as detailed under 'Indirect disturbance and displacement resulting from changes to prey and habitats', no adverse effects on fish assemblages are predicted, therefore there shall be no adverse effect on the availability of prey as a food resource, the seabirds of which depend on them, or on site integrity.

In terms of maintaining and ensuring sufficient habitat available, some seabirds have particular habitat requirements to ensure prey species can be maintained in the long term. The project will be introducing new infrastructure to open water habitat, however the project will not be causing any significant loss of open water habitat nor will it cause any long term negative effects on fish using this habitat.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Factors affecting the population or its habitat should be under appropriate control

Manx shearwater listed in Table 5-32 has been included for assessment under the conservation attribute 'factors affecting the population or its habitat should be under appropriate control' as part of one SPA, namely Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051).

The focus of this CO is that rafting birds should remain unaffected by boat use and other anthropogenic factors; appropriate codes of conduct must be followed by all visitors and craft surrounding the islands (NRW & JNCC, 2015). This breeding population of manx shearwater are known to regularly form aggregations at sea (called rafts), up to 10 km from the colony shore in the evening, prior to coming ashore to feed the chick after night-fall (JNCC, 2008a).

Given that there is no spatial overlap between the Project and rafting locations of manx shearwater associated with Skomer, Skokholm and the Seas off Pembrokeshire SPA, and given that there will be no interaction between construction activity vessels and these rafting locations, no adverse effect will occur.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Barriers to connectivity; Ensure connectivity between the site, supporting habitat and breeding colonies; Barriers to connectivity and site use

Seabirds listed in Table 5-32 have been included for discussion under the conservation attribute 'barriers to connectivity'; 'ensure connectivity between the site, supporting habitat and breeding colonies'; and 'barriers to connectivity and site use' as part of 3 SPA's, namely: the North-west Irish Sea SPA (IE004236), the Irish Sea Front SPA (UK9020328) and Saltee Islands SPA (IE004002).

The focus of this CO is to ensure that there is no significant increase of barriers within the SPA, and there is access to the site from supporting habitat have access to the site for foraging within the breeding season. The greatest potential barrier to birds is largely associated with the operational and maintenance phase (see section 5.7.6.2). During construction, the Project is not considered to introduce any barrier within either the Irish Sea Front SPA or Saltee Islands SPA, and will not cause any significant barriers to manx shearwater, gannet, kittiwake, common gull, common scoter, great black-backed gull, guillemot, herring gull or razorbill associated with the site or adjacent waters. Construction vessel movements will be of limited duration at any one location, because it is a transient impact as marine vessels move through an area relatively quickly. Vessel movements for the construction of the offshore infrastructure will also be infrequent.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.7.6.1.3 Wetlands and Waterbirds

Wetlands and waterbirds have been scoped out for further appraisal under the conservation attribute 'habitat area', as set out in section 4.4.7.4 of the Report to Inform Screening for Appropriate Assessment (see appendix A). The Project avoids activity within and/or removal of this habitat. As described in section 5.2, there is no spatial overlap between the Project and any of the relevant Annex I habitats. Additionally, based on computational modelling of sediment associated with the Project, it shall not jeopardise the conservation targets for habitat area as it will not make any significant changes to the existing sediment transport regime.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.7.6.2 Operational and maintenance phase

5.7.6.2.1 Shorebirds

In relation to onshore and intertidal maintenance activities, the operational and maintenance phase of the Project will involve limited maintenance requirements of the onshore cable route, offshore cable route and onshore substation. It is not expected that the transition joint bay will need to be accessed and inspections of the onshore cable route will be monitored remotely (see section 2, Project Description). Cable repairs within the intertidal area will also be required, however impacts are similar to those described under the construction and decommissioning phase. Operations at the substation will involve six to eight visits per month by ESB personnel. A quarterly inspection site visit to the communications link chambers of joint bays along the onshore cable and maintenance visits when required. These visits will be undertaken by a technicians in one vehicle (van) via the established permanent access to the Transition Joint Bay.

No impacts are predicted on shorebirds as maintenance activities will be localised and infrequent. Therefore, no European sites or SCIs require consideration and no adverse effects on shorebirds or site integrity will occur.

5.7.6.2.2 Seabirds

In relation to offshore maintenance activities, the operational and maintenance phase of the Project will involve the following: routine operational activities (i.e. up to 30 maintenance personnel and Crew Transfer Vessels (CTVs) for routine transfer of personnel, tools and equipment to and from the port to the wind farm site), routine inspections and seabed surveys (i.e. foundations, WTGs, OSS and export cable), repairs and replacement of navigational equipment, painting, major component replacement, cable repair and reburial activities and vessel movements (i.e. movement of CTVs).

Seabirds have the potential to be impacted by these activities in the form of the operational turbines (i.e. turning rotor blades) resulting in disturbance and displacement, changes to prey/habitats, collision risk, barrier effects and therefore mortality. Further detail is provided below. The assessment of effects as a result of collision risk is provided under section '*distribution; natural range; Spatial distribution; Forage spatial distribution, extent, abundance and availability'*.

Population; Measurable Change

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'population' (i.e. species as a viable component of the site, population dynamics, breeding population/population size, breeding population abundance, population trend and measurable change, and non-breeding population size) as part of 22 SPA's, namely:

North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Deenish Island and Scariff Island SPA (IE 004175), Dundalk Bay SPA (IE004026), Glannau Aberdaron ac Ynys Enlli SPA (UK9013121), Grassholm SPA (UK9014041), Helvick Head to Ballyquin SPA (IE004192), Horn Head to Fanad Head SPA (IE004194), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069), Rathlin Island SPA (UK9020011), River Nanny Estuary and Shore SPA (IE004158), Rum SPA (UK9001341), Saltee Islands SPA (IE004002), Skelligs SPA (IE004007), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), St Kilda SPA (UK9001031), Horn Head to Fanad Head SPA (IE004194), North Colonsay and Western Cliffs SPA (UK9003171) and Wicklow Head SPA (IE004127).

In terms of 'population' the overall focus of this CO is that the long-term population trends and population abundances of seabirds and breeding seabirds should be stable or increasing with no significant declines seen. In terms of measurable change, this is the measured decline in a population, whereby a population should not and will not drop by more than 25% of the previous year's figures in any one year (CCW, 2008). Disturbance and displacement (i.e. installing foundations, wind turbines, inter-array cabling and associated vessel movements) and changes to prey/habitat (i.e. temporary habitat loss, underwater noise and suspended sediment) as a result of operational and maintenance activities within the offshore environment have the potential to effect the population of the following seabirds (Table 5-32): gannet, guillemot, razorbill, herring gull, manx shearwater, kittiwake, common gull, common scoter, and great black-backed gull.

A screening assessment for disturbance and displacement (see appendix H: Offshore Ornithology – Supporting Information) associated with the operational and maintenance phase has been carried out for each of the above species with consideration of the species' sensitivity rating and abundance in the Offshore Ornithology Study Area (see section 3.2.1). Only species that were recorded in abundances within the offshore wind farm area of moderate or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) AND with a sensitivity of moderate or above will be assessed in this section (see appendix H: Offshore Ornithology – Supporting Information). Therefore, gannet, guillemot and razorbill are discussed further below.

Disturbance and displacement – Gannet

Gannet are unique in that they are sensitive to both displacement (up to 2 km from the wind farm) and collisions for birds that do not avoid the area. Following recommended guidance, a displacement rate of 60 – 80 % and a mortality rate of up to 1 % are applicable (SNCB, 2022). It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement would not be subject to potential collision risk as they are already assumed to have not entered the array area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As such a 70 % macro-avoidance rate has been applied for gannet.

A mortality rate of 1 % has been used for the assessment as gannet are able to utilise a wide range of habitat types and food sources and can range over a large area away from breeding colonies and during migration periods.

Displacement matrices for gannet have been calculated for the breeding season and for the non-breeding season.

Breeding season

Using the NatureScot apportioning tool, 45.5 % of the birds recorded in the Project in the breeding season would be predicted to originate from the Ailsa Craig SPA. The Grassholm SPA which is the largest colony within the species' foraging range of the Project is predicted to contribute to 23.6 % of the birds within the offshore wind farm area. The proportional weight column will not equal one as multiple non-SPA colonies make up the regional breeding population.

By apportioning impacts (NatureScot apportioning tool) for gannet to the relevant SPAs listed in Table 5-32[15], the estimated mortality range is from 0.10 to 2.86 adult birds, depending on the colony (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between 0.01 and 0.5 % in adult birds. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Non-breeding season

By apportioning impacts (NatureScot apportioning tool) for gannet to the relevant SPAs listed in Table 5-32, **the** estimated number of collisions range from <0.01 to 1.48, depending on the SPA (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between < 0.01 and 0.03 %, depending on colony. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

[15] Note: When apportioning impacts, additional SPA's and species included for potential impacts in appendix H: Offshore Ornithology – Supporting Information, but not considered for assessment in the NIS were included in the apportioning tool. The inclusion of such sites and species are not considered to affect the outcome of adverse effects on SPA's considered in this NIS.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

All seasons

Combining the impacts from both the breeding and non-breeding seasons above provides the annual impact on each SPA that is designated for gannet. Apportioned annual mortality for gannet is presented in appendix H: Offshore Ornithology – Supporting Information. The estimated number of mortalities from collision and disturbance and displacement range from 0.64 to 4.36 birds, depending on the SPA. This increased baseline mortality between 0.02 and 0.224 %, which is considered undetectable in each individual SPA population. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

SPAs which have more than a >0.05 % increase in baseline population and an estimated mortality of >0.1 bird from the project alone are therefore presented within the in-combination assessment (see section 5.8).

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance and displacement - Guillemot

The worst-case scenario is that displacement will occur at a constant level within 2 km of the offshore wind farm area, of which between 30 and 70 % of birds will be displaced, leading to a mortality rate of between 1 and 5 % (JNCC, 2022). More recent evidence (MacArthur Green, 2023) has indicated that a 70 % displacement rate is not realistic and 50 % is a more realistic scenario from empirical data.

Breeding season

Using the NatureScot apportioning tool, 71.6 % of the birds recorded in the Project in the breeding season would be predicted to originate from the Lambay Island SPA. The Rathlin Island SPA which is the largest colony within the species foraging range of the Project is predicted to contribute to 16.2 % of the birds within the offshore wind farm area. The proportional weight column will not equal one as multiple non-SPA colonies make up the regional breeding population.

By apportioning impacts (NatureScot apportioning tool) for guillemot to the relevant SPAs listed in Table 5-32, the estimated mortality range is from <0.1 to 2.7 adult birds, depending on the SPA (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between < 0.01 and 0.406 % in adult birds. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Non-breeding season

By apportioning impacts (NatureScot apportioning tool) for guillemot to the relevant SPAs listed in Table 5-32, the estimated number of mortalities from displacement range from <0.1 to 22.1 birds, depending on the colony (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between 0.01 and 0.03 %. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

On this basis, offshore wind turbines associated with the Project during the operational and maintenance phase of the Project shall not jeopardise the COs and attribute targets of any European sites. This is in the absence of mitigation measures.

All seasons

Combining the impacts from both the breeding and non-breeding seasons above provides the annual impact on each SPA that is designated for guillemot. Apportioned annual mortality for guillemot is presented

appendix H: Offshore Ornithology – Supporting Information. The estimated number of mortalities from displacement range from 0.01 to 4.27 birds, depending on the SPA. This increased baseline mortality between 0.02 and 0.09 % is considered undetectable in each individual SPA population.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance and displacement – Razorbill

The worst-case scenario is that displacement will occur at a constant level within 2km of the offshore wind farm area, of which between 30 and 70 % of birds will be displaced, leading to a mortality rate of between 1 and 5 % (JNCC, 2022). More recent evidence (MacArthur Green, 2023) has indicated that a 70 % displacement rate is not realistic and 50 % is a more realistic scenario from empirical data.

Breeding season

Using the NatureScot apportioning tool, 60.5 % of the birds recorded in the Project in the breeding season would be predicted to originate from the Lambay Island SPA. Rathlin Island SPA which is the largest colony within the species' foraging range of the Project is predicted to contribute to 17.7 % of the birds within the offshore wind farm area. The proportional weight column will not equal one as multiple non-SPA colonies make up the regional breeding population.

By apportioning impacts (NatureScot apportioning tool) for razorbill to the relevant SPAs listed in Table 5-32, the estimated number of mortalities from displacement range from 0 to 0.6 adult birds, depending on the SPA (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between 0 and 0.06 % in adult birds.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Non-breeding season

By apportioning impacts (NatureScot apportioning tool) for razorbill to the relevant SPAs listed in Table 5-32, the estimated number of mortalities from displacement range from <0.1 to 10.3 birds, depending on the colony (see appendix H: Offshore Ornithology – Supporting Information). This increased baseline mortality between <0.01 and 0.01 %. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

All seasons

Combining the impacts from both the breeding and non-breeding seasons above provides the annual impact on each SPA that is designated for razorbill. Apportioned annual mortality for razorbill is presented in appendix H: Offshore Ornithology – Supporting Information. The estimated number of mortalities from displacement range from < 0.1 to 0.84 birds, depending on the SPA. This increased baseline mortality between 0.02 and 0.08 % is considered undetectable in each individual SPA population. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

SPAs which have > 0.05 % increase in baseline population and an estimated mortality of >0.1 bird from the Project alone are therefore presented within the in-combination assessment (see section 5.8).

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Indirect disturbance and displacement resulting from changes to prey and habitats

Potential effects on the fish assemblages during the operational and maintenance phase of the Project are discussed under section 5.5. Seabirds may be indirectly disturbed and displaced as a result of long-term subtidal habitat loss, increased suspended sediment concentrations and associated sediment deposition and Electromagnetic Fields (EMF) from subsea electrical cabling.

Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. However, the assessment concluded that temporary loss of habitat was considered unlikely to diminish ecosystem functions for fish and shellfish species, and therefore would have an undetectable indirect impact on seabird species.

With regards to an increase in SSC, this may lead to a short-term avoidance of affected areas by sensitive fish and shellfish species, although many species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea. This effect would have an undetectable indirect impact on seabird species.

Localised EMF may result from the presence and operation of inter-array cables and offshore cable which could potentially affect the sensory mechanisms of some species of fish and shellfish. Based on the localised nature of the impact (centimetres from the cables), the rapid decay of EMF and the ability of receptors to detect and therefore avoid EMF, the effect would have an undetectable indirect impact on seabird species.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Number of pairs

Gannet listed in Table 5-32 has been included for assessment under the conservation attribute ‘number of pairs’ as part of one SPA, namely Grassholm SPA (UK9014041). The focus of this CO is that the population will not fall below 30,000 pairs (lower limit) in three consecutive years and will not drop by more than 25% of the previous year’s figures in any one year.

For the Project, although there will be no interaction or adverse effects on breeding colonies or breeding locations of gannet, adult mortality during the operational and maintenance phase due to the presence of offshore wind turbines and maintenance activities may cause a decline in the number of pairs available ensuring a stable population turnover. There is potential for disturbance and displacement, changes to prey/habitat, collision risk and barrier effect, to have an effect on the number of gannet pairs.

As detailed above under *‘*Population; Measurable Change’*,* the assessment concluded that disturbance and displacement effects on populations of gannet are negligible and effects of fish assemblages would have an undetectable indirect impact on seabird species. Therefore, any decline in the population of gannet and therefore number of pairs will not have an adverse effect.

In relation to collision risk, impacts are discussed above under *‘*distribution; natural range; Spatial distribution; Forage spatial distribution, extent, abundance and availability,’ whereby the assessment concluded that the increase in baseline mortality for gannet population of relevant SPAs was negligible.

In relation to the barrier effect, gannet have a low sensitivity to barrier effects and a low score for habitat flexibility (Maclean *et al.,* 2009 and Furness *et al*., 2012), therefore the Project is unlikely to provide a significant barrier to foraging gannets given the species has an extensive foraging range and efficient flying capability.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Distribution; natural range; Spatial distribution; Forage spatial distribution, extent, abundance and availability

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute 'distribution' (i.e. distribution of the species within site, distribution-breeding colonies); 'natural range'; 'spatial distribution'; and 'forage spatial distribution, extent, abundance and availability'. as part of 17 SPA's, namely: the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Deenish Island and Scariff Island SPA (IE 004175), Dundalk Bay SPA (IE004026), Helvick Head to Ballyquin SPA (IE004192), Horn Head to Fanad Head SPA (IE004194), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE004117), Lambay Island SPA (IE004069*),* River Nanny Estuary and Shore SPA (IE004158), Rum SPA (UK9001341), Saltee Islands SPA (IE004002), Skelligs SPA (IE004007), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), St Kilda SPA (UK9001031), North Colonsay and Western Cliffs SPA (UK9003171).

In terms of distribution the focus of this CO is to ensure no significant decrease in the numbers or range of areas used by seabirds (including the distribution of breeding colonies). In terms of 'spatial distribution' the focus of this CO is to ensure sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population, and in terms of 'forage spatial distribution, extent, abundance and availability' the focus of this CO is to ensure sufficient number of locations, area of suitable habitat and available forage biomass to support the population target.

Mortality during the operational and maintenance phase due to the presence of offshore wind turbines and maintenance activities may cause a decline in the distribution, natural range and forage spatial distribution, extent, abundance and availability of: gannet, guillemot, razorbill, herring gull, manx shearwater, kittiwake, common gull, common scoter and great black-backed gull. There is potential for disturbance and displacement, changes to prey/habitat, collision risk and barrier effect to effect these species.

As described above under 'Population; Measurable Change', only species that were recorded in abundances within the offshore wind farm area of moderate or above (i.e. level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1000 to 4,999 and very high: > 5,000) AND with a sensitivity of moderate or above will be assessed in this section.

In relation to disturbance and displacement, impacts are discussed under 'Population; Measurable Change' and which concluded (for gannet, guillemot and razorbill), in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

In relation to changes to prey/habitat and as detailed above under *'*Indirect disturbance and displacement resulting from changes to prey and habitats*,'* effects on fish assemblages would have an undetectable indirect impact on seabird species. Therefore, any decline in the distribution, natural range and forage spatial distribution, extent, abundance and availability of these species will not have an adverse effect.

In relation to collision risk, manx shearwater, guillemot and razorbill all have a very low sensitivity to disturbance and displacement during the operational and maintenance phase and therefore do not require further assessment. Common scoter has a low sensitivity (and very low abundance) to disturbance and displacement during the operational and maintenance phase and therefore does not require further assessment. Common gull, gannet, herring gull, great black-backed gull and kittiwake have a high sensitivity to disturbance and displacement during the operational and maintenance phase and therefore has been included for further assessment. In relation to collision risk, gannet, common gull, herring gull, great black-backed gull and kittiwake have been assessed.

For collision risk and gannet, impacts are discussed above under 'disturbance and displacement', whereby the assessment concluded that the Project is unlikely to provide a significant barrier to foraging gannets given the species has an extensive foraging range and efficient flying capability.

For collision risk and common gull during the non-breeding season – the estimated number of mortalities from collisions range from 0.79 to 2.72 birds, depending on the SPA. This increased baseline mortality between 0.20 and 0.67 %. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

For collision risk and herring gull during the breeding season – the estimated number of mortalities from collision range from 0.04 to 1.90 adult birds, depending on the colony and AR used. This increased baseline mortality between 0.31 and 1.07 % in adult birds. This increase in baseline mortality is <1 % of the population for all SPAs assessed, excluding Skerries Islands SPA. However, as there is a minute population and 0.06 birds does not represent a true risk to the population (i.e. one bird killed every ~ 16.6 years) it is not deemed proportionate, to result in adverse effect on site integrity. During the non-breeding season, the estimated number of mortalities from collision range from 0.01 to 2.01 adult birds, depending on the colony. This increased baseline mortality between 0.11 and 0.18 % in adult birds. This increase in baseline mortality is <1 % of the population for all SPAs assessed. Across all seasons (i.e. combining the breeding and non-breeding seasons), the annual impact on SPAs range from 0.01 to 2.37 birds, depending on the SPA. This increased baseline mortality between 0.12 and 1.23 %, which is considered undetectable in each individual SPA population.

For collision risk and great black-backed gull during the non-breeding season – the estimated number of mortalities from collision range from from 0.74 to 0.92 birds when using the Natural England AR and 0.11 to 0.14 birds when using the JNCC AR. This increased baseline mortality between 0.80 and 1.00 %, or 0.12 to 0.15 %, which have more than a >0.05 % increase in baseline population and an estimated mortality of >0.1 bird. This increase in baseline mortality is <1 % of the population for all SPAs assessed.

For collision risk and kittiwake during the breeding season – the estimated number of mortalities from collision range from <0.01 to 0.96 adult birds, depending on the colony. This increased baseline mortality between 0.01 and 0.10 % in adult birds. This increase in baseline mortality is <1 % of the population for all SPAs assessed. During the non-breeding season, the apportioned mortality for kittiwake ranges from <0.01 to 0.02 % increase in baseline mortality. This increase in baseline mortality is <1 % of the population for all SPAs assessed. Across all seasons (i.e. combining the breeding and non-breeding seasons), the estimated number of mortalities from collisions range from <0.01 to 1.904 birds, depending on the SPA. This increased baseline mortality between 0.01 and 0.14 %, which is considered undetectable in each individual SPA population.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Disturbance

Seabirds listed in Table 5-32 have been included for assessment under the conservation attribute ‘disturbance’ (i.e. no significant disturbance of the species, and disturbance at marine areas); ‘avoid significant disturbance’; and ‘disturbance across the site’ as part of five SPA’s, namely the North-west Irish Sea SPA (IE004236), Ailsa Craig SPA (UK9003091), Saltee Islands SPA (IE004002), North Colonsay and Western Cliffs SPA (UK9003171) and the Irish Sea Front SPA (UK9020328).

The focus of this CO is to ensure no significant increase in the form of disturbance as a result of human activity at marine areas adjacent to breeding colonies, to ensure significant mortalities of seabirds do not occur, and to ensure disturbance does not occur at levels that will significantly impact the achievement of targets for population size and spatial distribution. Mortality during the operational and maintenance phase due to the presence of offshore wind turbines and maintenance activities may cause a decline in the distribution of: gannet. kittiwake, manx shearwater, common gull, common scoter, great black-backed gull, guillemot, herring gull and razorbill. There is potential for disturbance and displacement, changes to prey/habitat, collision risk and barrier effect to affect those species.

These impacts are described under ‘distribution; natural range; Spatial distribution; Forage spatial distribution, extent, abundance and availability’, which concluded no adverse effects on site integrity.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Prey biomass; Maintain the habitats and food resources; Sufficiently large habitat.

Seabirds listed in Table 5-32 have been included for discussion under the conservation attributes 'prey biomass' and 'habitats and food resources' and 'sufficiently large habitat' as part of 12 SPAs, namely:

Deenish Island and Scariff Island SPA (IE004175), Helvick Head to Ballyquin SPA (IE004192), Howth Head Coast SPA (IE 004113), Ireland's Eye SPA (IE 004117), Lambay Island SPA (IE004069), Saltee Islands SPA (IE004002), Skerries Islands SPA (IE004122), Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051), Wicklow Head SPA (IE004127), the Irish Sea Front SPA (UK9020328), Horn Head to Fanad Head SPA (IE004194) and Skelligs SPA (IE004007). There is potential for effects on the following seabirds (Table 5-32): manx shearwater, kittiwake, guillemot, razorbill, herring gull and gannet.

The focus of these COs are to ensure the availability of both habitat and prey in order to support the seabird populations associated with that site. Seabirds rely on fish assemblages as a food resource and therefore any marine water pollution has the potential to have detrimental effect on prey availability and on population abundance and distribution (i.e. contamination and sedimentation). However, as detailed under 'Indirect disturbance and displacement resulting from changes to prey and habitats' during the operational and maintenance phase, no adverse effects on fish assemblages are predicted, therefore there shall be no adverse effect on the availability of prey as a food resource, the seabirds of which depend on them, or on site integrity.

In terms of maintaining and ensuring sufficient habitat available, some seabirds have particular habitat requirements to ensure prey species can be maintained in the long term. The Project will be introducing new infrastructure to open water habitat, however the project will not be causing any significant loss of open water habitat nor will it cause any long term negative effects on fish using this habitat.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Factors affecting the population or its habitat should be under appropriate control

Manx shearwater listed in Table 5-32 has been included for assessment under the conservation attribute 'factors affecting the population or its habitat should be under appropriate control' as part of one SPA, namely Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051).

The focus of this CO is that rafting birds should remain unaffected by boat use and other anthropogenic factors; appropriate codes of conduct must be followed by all visitors and craft surrounding the islands (NRW & JNCC, 2015). This breeding population of manx shearwater are known to regularly form aggregations at sea (called rafts), up to 10 km from the colony shore in the evening, prior to coming ashore to feed the chick after night-fall (JNCC, 2008a).

Given that there is no spatial overlap between the Project during the operational and maintenance phase and rafting locations of manx shearwater associated with Skomer, Skokholm and the Seas off Pembrokeshire SPA, and given that there will be no interaction between operational vessel movements and these rafting locations, no adverse effect will occur.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

Barriers to connectivity; Ensure connectivity between the site, supporting habitat and breeding colonies; Barriers to connectivity and site use

Seabirds listed in Table 5-32 have been included for discussion under the conservation attribute 'barriers to connectivity'; 'Ensure connectivity between the site, supporting habitat and breeding colonies'; and 'barriers to connectivity and site use' as part of three SPA's, namely: the North-west Irish Sea SPA (IE004236); the Irish Sea Front SPA (UK9020328) and Saltee Islands SPA (IE004002).

The focus of this CO is to ensure that there is no significant increase of barriers within the SPA, and there is access to the site from supporting habitat for foraging within the breeding season. During the operational and maintenance phase, there could be adverse impacts arising from barrier effects if the presence of offshore wind farm structures (i.e. turbines) prevented access to foraging grounds or forced the individual to circumnavigate the wind farm to/from foraging grounds, as this would lead to higher energy expenditure. Barrier effect has the potential to impact manx shearwater, gannet or kittiwake associated with the aforementioned SPAs. Based on species sensitivity, barrier effect is not considered for manx shearwater owing to low sensitivity to disturbance, displacement and collision risk.

Gannet and kittiwake have large mean maximum foraging ranges from breeding colonies and generally forage widely. In addition, both gannet and kittiwake have low sensitivity to barrier effects and a low score for habitat flexibility (Maclean *et al*., 2009 and Furness *et al*., 2012), therefore the Project is unlikely to provide a significant barrier to foraging gannets and kittiwakes from these colonies given the species' extensive foraging range and efficient flying capabilities.

For species with a higher sensitivity to barrier effects and that score medium for habitat flexibility, such as guillemot and razorbill (Maclean *et al*., 2009), the Project area is unlikely to form a significant part of these species' foraging grounds because the offshore wind farm area is relatively small in the context of their overall ranges. A medium score of '3' means that these species have some flexibility in their habitat ranges and so would be able to move elsewhere. The magnitude for guillemot and razorbill is therefore considered to be low.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.7.6.2.3 Wetlands and Waterbirds

The operational and maintenance phase of the Project will involve limited maintenance requirements of the onshore cable route (c. every 3 years) and onshore substation. Infrequent on-site inspections of the onshore cable route will be monitored remotely (see section 2, Project Description). Operations at the substation will involve six to eight visits per month by authorised personnel, a quarterly inspection site visit to the communications link chambers of joint bays along the onshore cable and maintenance visits when required. These visits will be undertaken by a technician in one vehicle (van) via the established permanent access.

On this basis, in light of site COs and with the implementation of measures included in the Project, there will be no adverse effect on the integrity of any European site(s) due to the Project alone, and no reasonable scientific doubt remains as to the absence of such effects.

5.8 In-Combination Effects

5.8.1 Assessment of In-combination plans and projects

It is a requirement of AA that the in-combination (i.e. cumulatively with any other plans or projects) effects be assessed. The in-combination assessment (ICA) takes into account the impact associated with the Project together with other projects and plans, and has particular regard for developments potentially affecting relevant European sites, given their connectivity to the Project. The projects and plans selected as relevant to the ICA presented within this section are based upon the results of a screening exercise (see appendix J: Screening – In-combination Effects). Each project has been considered on a case-by-case basis for screening in or out of this NIS based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved (see also section 3.2.6 for further details on the methodology to screening projects and plans).

The approach to in-combination examines the effects of the Project alongside the following projects if they fall within the Zone of Influence (ZoI):

- Other projects with consent but not yet constructed/construction not completed;
- Other projects in a consent application process but not yet determined (including planning applications, foreshore lease/licence applications, Dumping at Sea Permit applications);

- Other projects currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact; and

- Projects, which satisfy the definition of 'relevant maritime usage' under the Maritime Area Planning Act (2021) (i.e. wind farm projects designated as 'Relevant Projects' or 'Phase 1 Projects') including Arklow Bank II, Bray Bank and Kish Bank; North Irish Sea Array, Codling Wind Park (I and II).

A list of projects with potential for impact are presented in section 5.8.3 to section 5.8.8 of this report. Plans are discussed in section 5.8.2.

5.8.2 Plans

The plans considered for in-combination assessment, which are discussed in appendix J: Screening – In-combination Effects, are:

- Third Cycle Draft River Basin Management Plan 2022-2027 (DoHLGH, 2022);

- National Development Plan 2018-2027 (Government of Ireland, 2021);

- Climate Action Plan 2023 (and Draft Climate Action Plan 2024) (DECC, 2022; DECC, 2023a);

- National Energy and Climate Plan 2021-2030 (DECC, 2020);

- Offshore Renewable Energy Development Plan (OREDP) I (and draft OREDP II) (Government of Ireland 2018);

- Designated Maritime Area Plan (DMAP) Proposal for Offshore Renewable Energy (and Draft DMAP) (DECC, 2023b);

- Marine Plan for Northern Ireland (DAERA, 2018a);

- Project Ireland 2040 – National Planning Framework (DoHLGH, 2019);

- National Marine Planning Framework (NMPF) 2021 (DoHLGH, 2021a);

- Ireland's 4th National Biodiversity Action Plan 2023-2030 (DoHLGH, 2024); and

- Louth County Development Plan 2021-2027 (LCC, 2021).

The Climate Action Plan 2023 (and Draft Climate Action Plan 2024) has been brought forward for assessment below.

5.8.2.1 Climate Action Plan 2023 (and Draft Climate Action Plan 2024)

The Climate Action Plan (CAP) 2023 was the first Climate Action Plan delivered under the Climate Action and Low Carbon Development (Amendment) Act 2021 and, following the introduction in July 2022, of economy-wide carbon budgets and sectoral emissions ceilings (SECs). The government agreed these SECs to achieve the 2030 emissions reductions targets. The SECs include specific limits for the electricity, transport, buildings, industry and agriculture sectors of the economy. In addition to the introduction of the ceilings, the Government increased its 2030 offshore wind energy target from 5 gigawatts (GW) to 7 GW, and doubled its solar target to reach 5.5 GW by 2030. There is also a new agri-forestry and anaerobic digestion target to produce up to 5.7 terawatt hours (TWh) of biomethane. The CAP therefore implements the carbon budgets and SECs and sets a roadmap of actions to comply with these and reach the 2030 and 2050 climate action goals as committed to in the Programme for Government.

The CAP23 aims to achieve the ambition of a 51% reduction in Ireland's emissions from 2021 to 2030, and to achieving climate neutrality no later than 2050. As such, the plan deals with various sectors including transport, electricity, industry, the built environment, agriculture, marine, forestry and energy, all of which may give rise to development in order to meet climate action commitments e.g. infrastructure developments.

However, in relation to these potential developments, given that CAP23 does not clearly determine (in most instances) the precise location of any development at lower planning tiers, the usual planning development controls will apply. All developments must take into account the application of AA processes and any proposals as part of this plan will be subject to their own AA requirements.

Thus, the in-combination impacts from the CAP23 with the Project are not predicted.

The draft CAP 2024 was published in December 2023, and is subject to SEA and AA processes and public consultation. The draft plan builds on the actions set out in CAP23 by refining and updating the measures and actions. It provides a roadmap of actions, and outlines actions required to 2035 and beyond to achieve climate neutrality by 2050. Similar to CAP 2023, the draft 2024 Plan is positive. CAP 2024 includes several precise actions related to offshore wind renewable energy such as recognising Ireland's enormous potential for offshore wind, and progressing the development and delivery of offshore wind proposals, all while ensuring the conservation, protection and recovery of marine biodiversity. In this regard, Oriel Wind Farm aligns directly with CAP 2024 on decarbonising the Irish electricity systems.

Much the same as the in-combination for CAP 2023, the draft CAP 2024, may give rise to many other infrastructural developments. However, as described above, the usual planning development controls will apply and all developments must take into account the application of AA processes and any proposals as part of this plan will be subject to their own AA requirements.

Thus, the in-combination impacts from the CAP24 with the Project are not predicted.

5.8.3 Annex I Habitats

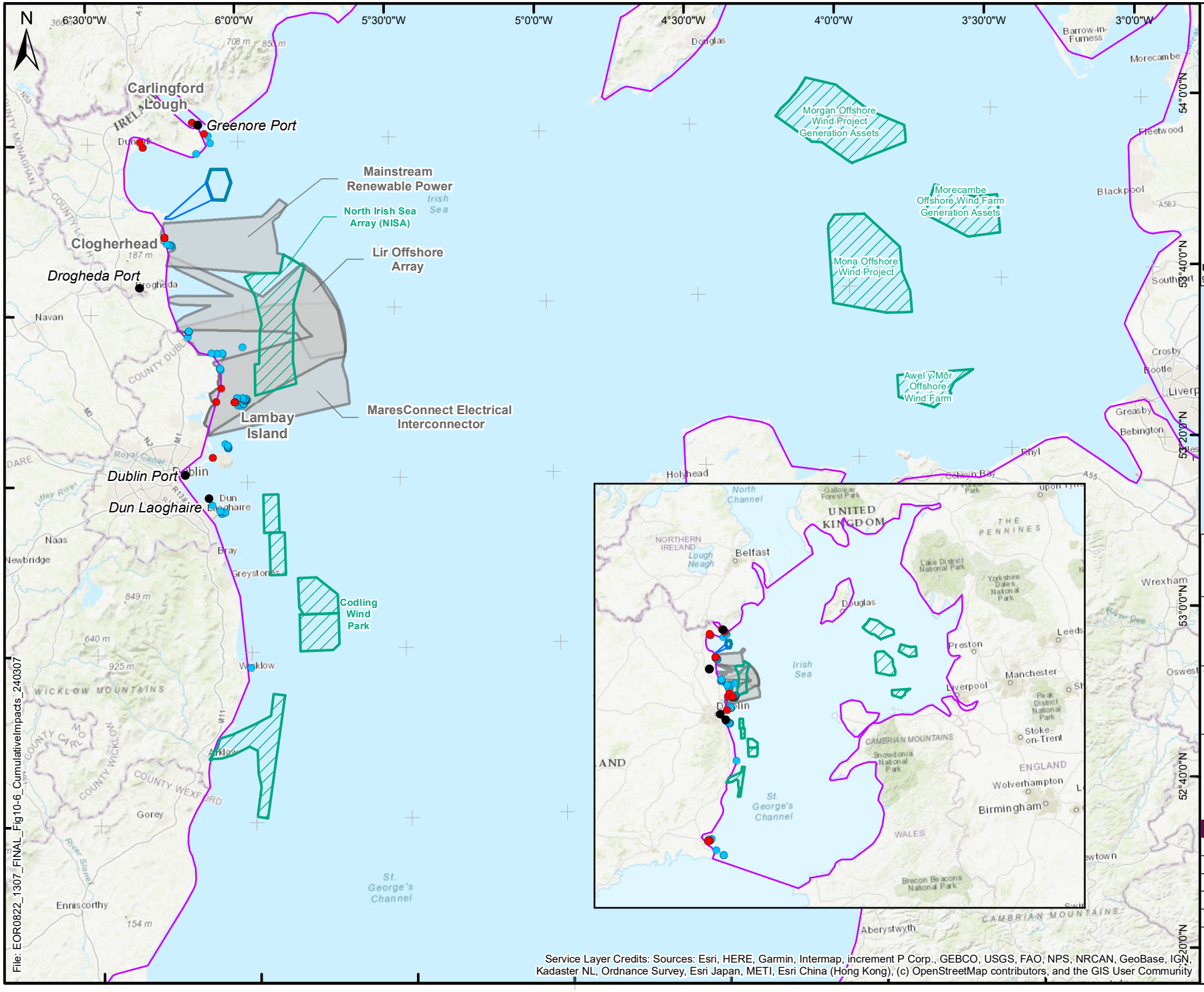
No plans or projects were screened in for the ICA for Annex I habitats (see appendix I: Onshore Biodiversity – Supporting Information).

5.8.4 Annex II Marine Mammals

The specific projects screened into the ICA for Annex II marine mammals are outlined in appendix F: Marine Mammals and Megafauna – Supporting Information, which consists of offshore wind projects, site investigations and a single communications infrastructure project. No plans were screened in for the ICA for Annex II marine mammals.

For the list of other projects considered in relation to Annex II marine mammals for the in-combination assessment, refer to Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information, and Figure 5-1 below.

Collaboration with the other Phase 1 projects has informed the in-combination assessment. Also the projects commit to implementing phased piling alongside other adjacent offshore wind farms in the western Irish Sea as part of a Piling Strategy should construction programmes overlap.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6°0'0"W
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4°30'0"W
4°0'0"W
3°30'0"W
3°0'0"W
54°0'0"N
53°40'0"N
53°20'0"N
53°0'0"N
52°40'0"N
52°20'0"N
Carlingford Lough
Greenore Port
Mainstream Renewable Power
North Irish Sea Array (NISA)
Lir Offshore Array
Clogherhead
Drogheda Port
MaresConnect Electrical Interconnector
Lambay Island
Dublin Port
Dun Laoghaire
Codling Wind Park
Morgan Offshore Wind Project Generation Assets
Morecambe Offshore Wind Farm Generation Assets
Mona Offshore Wind Project
Awel y Môr Offshore Wind Farm
Irish Sea
St. George's Channel
North Channel
Douglas
Barrow-in-Furness
Morecambe
Fleetwood
Blackpool
Holyhead
Llandudno
Colwyn Bay
Rhyl
Crosby
Bootle
Liverpool
Greasby
Bebington
Wrexham
Navan
Drogheda
Dublin
Dun Laoghaire
Bray
Greystones
Naas
Newbridge
Wicklow
Arklow
Gorey
Enniscorthy
WICKLOW MOUNTAINS
COUNTY WEXFORD
COUNTY WICKLOW
COUNTY CARLOW
COUNTY DUBLIN
COUNTY LOUTH
COUNTY MONAGHAN
Aberystwyth
CAMBRIAN MOUNTAINS
Brecon Beacons National Park
Snowdonia National Park
Peak District National Park
Lake District National Park
Yorkshire Dales National Park
THE PENNINES
UNITED KINGDOM
NORTHERN IRELAND
Belfast
Lough Neagh
ENGLAND
WALES
Manchester
Liverpool
Leeds
Preston
Stoke-on-Trent
Wolverhampton
Birmingham
Oswestry
Newtown
Galloway Forest Park
Douglas
Legend
Offshore Wind Farm Area
Offshore Cable Corridor
Cumulative Marine Mammal and Megafauna Study Area
Wind Farm Application Area
Harbour Seal haul-out
Grey Seal haul-out
Site Investigation Surveys
Data Sources: Client, ICES, SNH
gov.ie (Dept of Housing, Local Government and Heritage)
Client
ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY
Project
Oriel Wind Farm Project
Title
Figure 5-1
Other projects screened into the in-combination assessment - marine mammals
West Pier Business Campus,
Dun Laoghaire,
Co Dublin,
Ireland.
Tel: +353 (0) 1 4882900
Email: ireland@rpsgroup.com
Web Page: rpsgroup.com/ireland
Issue Details
Drawn By: NG
Checked By: NG
Approved By: AOS
Scale: 1:1,100,000@A4
Date: 07/03/2024
Project No. EOR0822 (MDR1520B)
File Ref: EOR0822_MAM_E_1307_FINAL
Projection: ITM (IRENET95)
Geographic Co-ordinates: ETRS89
NOTE: 1. This drawing is the property of RPS Group Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels are referred to Ordnance Datum, Malin Head.
3. Ordnance Survey Ireland Licence EN 0005019
©Copyright Government of Ireland.
File: EOR0822_1307_FINAL_Fig10-6_CumulativeImpacts_240307
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Table 5-33 presents the relevant project design parameters which are used to assess the potential in-combination effects of the Project with the other projects identified in Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information.

Impacts have been carried forward for assessment where there is potential for an effect to occur from the Project alone over a scale that could impact in-combination with other plans or projects within the Regional Marine Megafauna Study Area.

Therefore, three impacts are assessed here: 1) injury/ disturbance to marine megafauna from underwater noise during pile-driving; 2) injury/ disturbance to marine megafauna from elevated noise during routine geophysical surveys; and 3) injury/disturbance to marine megafauna from vessel activities. Effects on marine mammals arising from the impact of changes in the fish and shellfish community and EMF from subsea electrical cabling are considered to be localised to within the offshore wind farm area and offshore cable corridor and unlikely to lead to in-combination effects with other plans or projects.

Table 5-33: Project design parameters considered for potential in-combination impacts on Annex II Marine Mammals.

Potential impact	Phase[1]			Project Design Parameters	Justification
	C	O	D		
Injury and/or disturbance to marine mammal species from underwater noise during pile-driving.	✓	✗	✗	Design parameters as described for the Project assessed in-combination with the following other projects: **Offshore wind farms** • Dublin Array – piling of up to 61 foundations; • NISA - piling of up to 36 foundations. • Arklow Bank Wind Park (Phase 2) – piling of up to 62 foundations; • Codling Wind Park – piling of up to 140 foundations; • Awel y Môr Offshore Wind Farm – piling of up to 50 foundations; • Mona Offshore Wind Project – piling of up to 115 foundations; • Morgan Offshore Wind Project Generation Assets: – piling of up to 115 foundations; and • Morecambe Offshore Windfarm Generation Assets – piling of up to 42 foundations.	Maximum potential for in-combination effects from underwater noise from construction operations within the Regional Marine Mammal and Megafauna Study Area.
Injury and/or disturbance to marine mammals from elevated underwater noise during routine geophysical surveys	✗	✓	✗	Design parameters as described for the Project assessed in-combination with the following other projects: **Site investigation surveys** • Mainstream Renewable Power Ltd. – site investigation surveys; • Lir Offshore Array Ltd. – site investigation surveys; and • MaresConnect Electrical Interconnector – site investigation surveys.	Maximum potential for in-combination effects of underwater noise from routine survey operations within the Regional Marine Mammal and Megafauna Study Area. Site investigation surveys more than 45 km from the Project have been screened out as having no potential for in-combination effects.
Injury and/or disturbance to marine mammal species from vessel activities.	✓	✓	✓	Design parameters as described for the Project assessed in-combination with the following other projects: **Offshore wind farms**	Maximum potential for in-combination effects from vessel activity associated with construction and

Potential impact	Phase[1] C O D	Project Design Parameters	Justification
		• Dublin Array – vessel traffic during all phases; • NISA - vessel traffic during all phases; • Arklow Bank Wind Park (Phase 2) – vessel traffic during all phases; • Codling Wind Park – vessel traffic during all phases; and • Awel y Môr Offshore Wind Farm – vessel traffic during all phases. • Mona Offshore Wind Project – vessel traffic during all phases; • Morgan Offshore Wind Project Generation Assets: – vessel traffic during all phases; and • Morecambe Offshore Windfarm – vessel traffic during all phases. **Site investigation surveys** • Mainstream Renewable Power Ltd. – site investigation surveys; • Lir Offshore Array Ltd. – site investigation surveys; and • MaresConnect Electrical Interconnector – site investigation surveys. • Up to 26 additional site investigation surveys ranging from 45.3 km and 287 km from the Project that have the potential to overlap temporally.	maintenance works within the Regional Marine Mammal and Megafauna Study Area.

1 C= Construction, O = Operation, D = Decommissioning

5.8.4.1 Construction phase

Possibility of injury and/or disturbance to marine mammal species from underwater noise during piling-driving / drilling

The installation of foundations within the offshore wind farm area, together with the projects identified in Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information, may lead to either spatial effects (where piling phases overlap) and/or temporal effects (a longer duration of piling compared to the Project alone). Other projects screened into the assessment within the Regional Marine Megafauna Study Area include the following offshore wind farms: Dublin Array, Arklow Bank Wind Park (Phase 2), NISA, Codling Wind Park, Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets and Morecambe Offshore Windfarm Generation Assets. The species likely to be affected include harbour porpoise, bottlenose dolphin, grey seal, and harbour seal.

The maximum predicted injury ranges for the Project are presented in Table 7-3 of appendix F: Marine Mammals and Megafauna – Supporting Information, along with project parameters and predicted injury ranges for those projects where quantitative information is available.

For projects where quantitative information is available (Morgan Offshore Wind Project Generation Assets, Mona Offshore Wind Project, Awel y Môr Offshore Wind Farm and Morecambe Offshore Windfarm Generation Assets) ranges presented for PTS are up to 0.99 km for the SPL_{pk} metric and up to 5.47 km for the SEL_{cum} metric. TTS ranges presented are up to 1.6 km for the SPL_{pk} metric and up to 30 km for the SEL_{cum} metric. Assuming that projects adopt standard industry measures to mitigate the risk of PTS there is no potential for an in-combination effect of PTS. TTS to some extent will also be mitigated through the adoption of standard industry measures, but even with the possibility of a residual effect, TTS is reversible. In addition, projects in the eastern Irish Sea are located more than 119 km from the Project and therefore there is considered to be no potential for overlap of injury ranges.

For projects in the western Irish Sea (Dublin Array, Arklow Bank Wind Park (Phase 2), NISA and Codling Wind Park), no quantitative information on PTS or TTS ranges is available. It is considered that PTS ranges and TTS ranges would be in the same order of magnitude, or less than those presented in Table 7-3 of appendix F: Marine Mammals and Megafauna – Supporting Information. Whilst there is greater potential for overlap of injury ranges with projects located in the western Irish Sea, the closest project is located 16 km away (NISA). Therefore, assuming that all projects screened in to the in-combination assessment adopt standard industry measures to mitigate the risk of PTS it is considered that there is no potential for in-combination effects for injury from elevated underwater noise during piling. The focus of in-combination effects is therefore on the potential for disturbance of marine mammals. The modelled disturbance contours for piling at the east and west of the Project are set out in Figure 6-3 and Figure 6-4 of appendix F and the numbers of animals potentially affected by disturbance as a result of piling at the Project are set out in Table 6-9 of appendix F.

Injury to marine mammal species is considered unlikely to lead to in-combination effects as the effect ranges are considered to be very localised and, with mitigation in place, are unlikely to lead to potential effects.

There is the potential for an in-combination effect of disturbance from piling at the Project with other projects in the Regional Marine Megafauna Study Area (see Figure 5-1) including Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets, Morecambe Offshore Wind Project Generation Assets, Dublin Array, Arklow Bank Wind Park (Phase 2), NISA and Codling Wind Park.

For in-combination projects where detailed information is available, piling is expected to take place for up to 201 days for piling of monopiles at Awel y Môr Offshore Wind Farm (over the 1-year piling phase in 2028); 35 days for piling of monopiles at both Mona Offshore Wind Project and Morgan Offshore Wind Project Generation Assets (over the respective 2-year construction phases in 2027 and 2028); and 42 days for piling of monopiles at Morecambe Offshore Wind Project Generation Assets (over the 2-year piling phase in 2027 and 2028). These timelines are, however, indicative and may be subject to change. Piling at each of these projects will occur as a discrete stage within the overall construction phase and therefore the periods of piling may not coincide.

It has been assumed that construction phases for both offshore wind farm projects could overlap temporally with the construction phase of the Project, with potential for piling operations to coincide.

The maximum predicted disturbance ranges for the Project are presented in Table 7-4 of appendix F, along with disturbance ranges for those projects where quantitative information is available. The Awel y Môr Offshore Wind Farm did not consider effects on harbour seal, as this species was scoped out. Given that the in-combination assessment for piling is provided on species-by-species basis, harbour seal will not be considered further for this project. There were no estimates available for the number of animals likely to be affected during piling for Dublin Array, Arklow Bank Wind Park (Phase 2), NISA or Codling Wind Park, and therefore a quantitative in-combination assessment was not possible for these projects.

For those projects where quantitative information is available (projects in the eastern Irish Sea), the numbers of animals predicted to be affected by individual projects represent relatively small proportions of respective MUs (see Table 7-4 of appendix F). If piling were to coincide at these projects there is potential for a larger area of available habitat within the wider Irish Sea to be affected at any one time. However, these projects are located more than 119 km from the Project (see Table 7-4 of appendix F). Strong and mild disturbance contours (160 dB re 1µ Pa (rms) and 140 dB re 1µ Pa (rms), respectively) modelled for the Project are predicted to extend to ~3.2 km and ~17 km from the Project, respectively (see Figure 6-3, Figure 6-4 and Figure 6-5 of appendix F). Therefore, the likelihood for overlap of either strong or mild disturbance contours of the Project with those from projects where noise modelling has been undertaken (projects in the eastern Irish Sea) is negligible.

The remaining projects considered are located between 16 and 107 km from the Project, in the western Irish Sea. Whilst quantitative information is not available for these projects, the proximity to the Project of the closer projects means there is potential for a larger number of marine mammals to be at any one time.. Assuming similar disturbance ranges for those modelled for the Project, there is potential for overlap of mild disturbance contours with proximal projects (e.g. NISA at 16 km distance). At the lower end of the behavioural response spectrum (Southall *et al.,* 2021) animals are unlikely to be displaced from their habitat; behavioural responses are expected to be less severe (such as changes in swimming speed or direction) and are unlikely to result in population-level effects. Temporally, the duration of disturbance within the

western Irish Sea would be greatest where piling occurs sequentially at these wind farms. As described previously, piling represents only a fraction of the overall construction phase of the Project with a total of 208 hours over 26 days of piling over the 15-month offshore construction period (i.e. piling occurs for ~7.5% of the total construction period). In addition, for the Project alone and shown in Figure 6-5 of appendix F, the modelled Project disturbance contours of 135 dB re 1µPa SEL_{ss} (= 140 dB re 1µPa SPL_{rms}, mild disturbance) and 150 dB re 1µPa SEL_{ss} (= 160 dB re 1µPa SPL (rms); strong disturbance) do not overlap with any European site with marine mammals listed as a qualifying feature (see Figure 6-5 of appendix F). Therefore, there is considered to be limited potential for the Project to contribute to an in-combination effect on SACs.

The impact of piling at four offshore wind farms in the western Irish Sea (in addition to the Project) and four offshore wind farms in the eastern Irish Sea may lead to potential in-combination behavioural effects on sensitive marine mammal species. The maximum adverse spatial scenario would be where piling occurs concurrently at all nine project sites (recognising the unlikelihood of this occurring), whilst the maximum adverse temporal scenario would be where piling occurs sequentially. All project sites are, however, located beyond the distances within which there would likely be overlap of strong disturbance contours during piling at these project sites (i.e. closest offshore wind farm is approximately 16 km from the Project). Whilst the in-combination effect is predicted to be of regional spatial extent and medium term, and the impact will affect the receptor directly, the effect of behavioural disturbance is of high reversibility (with animals returning to baseline levels within hours/days after piling have ceased). Disturbance would occur as a series of short-term, intermittent events and there is evidence from the published literature to suggest that recoverability would be rapid following cessation of piling. The impact could result in some measurable changes to individuals that are disturbed (i.e. interruption of feeding or breeding and/or displacement to alternative area) but there are no long-term population-level consequences of disturbance anticipated.

As previously highlighted, if piling were to coincide at these wind farms there is potential for a greater number of individuals to be affected at any one time leading to a greater maximum spatial scenario. Whilst the Project is expected to contribute low levels of disturbance to any in-combination effect, in order to minimise the level of disturbance in the Irish Sea, a Piling Strategy will be implemented, alongside an MMMP which sets out a final project design prior to construction as well as options for potential management measures that may be implemented to ensure any effects are reduced to an acceptable level, such as phased piling.

As discussed in appendix F, population modelling was carried out for the Project alone for harbour porpoise, bottlenose dolphin, grey seal and harbour seal. Modelling results for all species demonstrated that there may be negligible reductions in population sizes for the impacted populations. Such small changes would not be enough to significantly affect population trajectories over a generational scale and would fall within the expected range of natural variation. A collaboration of Phase 1 projects in the Irish Sea has led to the completion of in-combination population modelling, to provide support to the understanding of whether piling at phase 1 projects will result in long term population level effects on marine mammal species (for which population modelling is possible within the interim Population Consequences of Disturbance (iPCoD) framework. The modelling confirmed that no significant impacts to any marine mammals from disturbance from piling at the five projects is predicted. This information will be used to inform the piling strategy.

For further information (i.e. supporting data tables and figures) on the ICA in relation to injury and/or disturbance to marine mammal species from underwater noise during piling-driving / drilling, refer to appendix F: Marine Mammals and Megafauna – Supporting Information.

Injury and/or disturbance to marine mammal species from vessel activities

Vessel traffic associated with the construction of the Project, together with vessel traffic associated with the projects identified in Table 7-1 of appendix F Marine Mammals and Megafauna – Supporting Information, may increase the potential for injury (vessel noise or collision risk) and/or disturbance (vessel noise) to marine mammals. Other projects screened into the assessment within the Regional Marine Megafauna Study Area include the Dublin Array, Arklow Bank Wind Park (Phase 2), NISA, Codling Wind Park, Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets and Morecambe Offshore Windfarm Generation Assets. Other projects screened in include the Setanta Wind Park, North East Wind, Lir Offshore Array, Banba, and MaresConnect site investigations (see Table 7-1 of appendix F). The species likely to be affected are those identified as key sensitive receptors for the Project and at least one other wind farm, and include: harbour porpoise, bottlenose dolphin, grey seal, and harbour seal.

The types of vessels involved in construction activities at the Dublin Array, Arklow Bank Wind Park (Phase 2), NISA, Codling Wind Park, Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets and Morecambe Offshore Windfarm Generation Assets are anticipated to be similar to those identified for construction of the Project, such as jack-up vessels, tug/anchor handers, cable installation vessels, scour/cable protection installation vessel, guard vessels, survey vessels and CTVs. The number of return trips for vessels involved in construction activities at the Project are provided in Table 5-9. Vessels travelling to/from the Project would originate from an offshore operations and maintenance (O&M) base located at an existing harbour in County Louth or County Down and would follow existing shipping routes when in transit. Three harbours (Kilkeel, Warrenpoint and Greenore) have suitable facilities and are approximately 1 hour sailing time from the offshore wind farm area.

This assessment considered injury resulting from both vessel noise and collision risk due to the uplift in traffic associated with projects screened in to the in-combination assessment. In the assessment for the Project alone (see section 5.3.5) both PTS and TTS were not exceeded for high frequency cetaceans, or for seals. For harbour porpoise the PTS range was very small (< 15 m for all vessel types and sound sources). For TTS the maximum range was 1,670 m (for survey and support vessels, CTV's, and scour/cable protection/seabed preparation/installation vessels (see Table 6-14 of appendix F).

For offshore wind projects in the western Irish Sea, no publicly available information on which to base quantitative assessment was identified for Arklow Bank Wind Park (Phase 2), NISA, or Codling Wind Park and Dublin Array. The Awel y Môr assessment summarised that in the context of 57 vessels per day recorded within the study area, at the busiest time of year, the introduction of vessels during the construction of the wind farm would not be a novel impact for marine mammals present in the area. Whilst quantitative information is not available for other projects screened into the cumulative assessment it is expected that predicted ranges would be similar to those reported for the Project.

Quantitative information was available for offshore wind projects in the eastern Irish Sea. The Awel y Môr assessment summarised that in the context of 57 vessels per day recorded within the study area, at the busiest time of year, the introduction of vessels during the construction of the wind farm would not be a novel impact for marine mammals present in the area. The Mona Offshore Wind Project identified a maximum of 80 vessels on site at any one time, a maximum of 2,004 return trips per year and maximum disturbance ranges of 22 km. The Morgan Offshore Wind Project Generation Assets identified a maximum of 63 vessels on site at any one time, and a maximum of 1,878 return trips per year, and maximum disturbance ranges of 22 km. Both projects concluded that a slight increase from the existing levels of traffic in the vicinity of the respective project areas may not result in high levels of disturbance. The Morecambe Offshore Windfarm Generation Assets anticipated up to 30 vessels on site at any one time, with 150 return trips for delivery of main components and installation over the construction phase, and 2,778 return trips per year for support vessels. Disturbance ranges were not modelled, but assessment for all species was based on a disturbance impact range of 2 km (based upon studies by Brandt *et al*. 2018 and Benhemma-Le Gall *et al*. (2021).

The number of vessels associated with geotechnical and geophysical site investigation surveys in the Irish Sea is anticipated to be small (one or two per project) and typically the duration of surveys will be relatively short (weeks to a few months). There are up to 26 site investigation surveys identified in the screening area for marine mammals. Surveys typically occur over short durations (typically up to 2 months) and therefore as a conservative approach it is assumed as a worst-case scenario that up to two surveys (in addition) could overlap with the Project geophysical surveys (associated with routine inspection of the Project offshore assets) at any one point. There are limitations on the number of survey vessels that could carry out such surveys at one time and therefore it is highly unlikely that all would overlap temporally.

As such, the magnitude for auditory injury to all marine mammals as a result of in-combination vessel activity is deemed to be localised, of medium term duration, intermittent and reversible. The magnitude is therefore, considered to be low.

As described above, injury to marine mammals is more likely to arise from vessels travelling in excess of 7 m/s (Wilson *et al.,* 2007) or 14 knots (Laist *et al.,* 2001), however, vessels involved in the construction or survey of each project are likely to be travelling considerably slower than this, and therefore collision risk is expected to be lower than that posed by commercial shipping activity. Vessel traffic associated with offshore wind farm construction and site investigation surveys will be localised to within the project areas and will likely follow existing shipping lanes to/from port. Therefore, even with an in-combination increase in vessel traffic, the type of vessels involved and transit routes is unlikely to impose a greater risk to marine mammals.

As such the magnitude for collision risk as a result of vessels involved in the construction phase for all qualifying marine mammal species is deemed to be of localised, of medium term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.

Disturbance from vessel noise may result in an in-combination effect on sensitive marine mammal species. As described for the Project alone, there is potential for a fleeing response (based on the TTS threshold) to occur over very localised ranges depending on the vessel (up to maximum of 1,670 m across all vessel types and species groups). Behavioural effects could occur over greater ranges as a result of vessel noise, and the use of the conservative NMFS threshold of 120 dB re 1 µPa (rms) led to predicted ranges of disturbance from construction vessels at the Project between 755 m and 8.5 km depending on vessel type. The increase in number of vessels associated with the other projects screened into this assessment is anticipated to be relatively small in context of the existing levels of vessel activity in the area (from shipping, fishing and recreational traffic) and the magnitude of the impact would be largely localised to within project sites.

Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets, Morecambe Offshore Windfarm Generation Assets, Dublin Array, Arklow Bank Wind Park (Phase 2), Statkraft, NISA, Codling Wind Park are located considerable distances from the Project and therefore there is unlikely to be any spatial overlap in the vessel activity at these project sites. Site investigation surveys at Mainstream Renewable Power and Lir Offshore Array would be carried out in close proximity to the offshore wind farm area, however, these surveys would only lead to a very small uplift in vessel numbers (e.g. up to two vessels per survey).

In terms of disturbance, the impact could result in a small but measurable alteration to the distribution of marine mammals but, due to the localised nature of the impact in each of the in-combination project areas, reduction in reproductive success of affected animals is considered unlikely. The impact is predicted to localised, of medium term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Injury (collision risk and auditory injury) and disturbance would occur as a series of short-term, intermittent events. Implementation of a Code of Conduct for vessel operators, particularly in proximity to seal haul-outs, would reduce the risk of injury from collision with construction vessels. A suite of different marine mammal species are common to all project areas considered in this assessment, and therefore may be sensitive to in-combination behavioural effects from vessels. However, given the existing baseline levels of vessel activity in the area, it is anticipated that animals would be tolerant to small increases and would recover rapidly following cessation of the activity.

The qualifying marine mammal features are likely to tolerate the effect without any impact on reproduction and survival rates and are able to return to previous behavioural states/activities once the impact has ceased.

For further information (i.e. supporting data tables and figures) on the ICA in relation to injury and/or disturbance to marine mammal species from vessel activities, refer to appendix F: Marine Mammals and Megafauna – Supporting Information.

5.8.4.2 Operational and maintenance phase

Injury and/or disturbance to marine mammals from elevated underwater noise during geophysical surveys

Geophysical surveys associated with routine inspection of the Project offshore assets, together with geophysical site investigation surveys associated with projects identified identified in Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information, may increase the potential for auditory injury or disturbance to marine mammals. Surveying operations will commence in year five and have a five-year periodicity. Projects screened into the assessment within the Regional Marine Megafauna Study Area include Mainstream Renewable Power site investigation surveys, Lir Offshore Array site investigation surveys MaresConnect site investigation surveys and routine geophysical surveys at NISA.

The potential for marine mammal receptors to experience auditory injury as a result of underwater noise due to geophysical surveys associated with the Project would be expected to occur only within the vicinity of operational geophysical survey equipment: up to 227 m for PTS and 449 m for TTS for harbour porpoise. The risk of both PTS and TTS is expected to be reduced further by the implementation of measures included in the Project (see section 5.3.4). The potential for marine mammal receptors to experience disturbance as a result of underwater noise due to geophysical surveys associated with the Project would be expected to occur at greater distances (out to 1,410 m) than for injury.

Quantitative information on injury and disturbance ranges for site investigation surveys at Mainstream Renewable Power, Lir Offshore Array and MaresConnect is available in respective Foreshore Licence applications. Although the equipment to be employed for geophysical site investigation surveys of the Project assets is expected to be restricted to MBES methods only, a range of geophysical survey equipment for other in-combination projects has been assessed, employing multiple equipment types with a range of operational parameters. For Mainstream Renewable Power, injury and disturbance ranges are predicted to be similar to those for the Project (up to 200 m for harbour porpoise for PTS, and up to 2,000 m for harbour porpoise for both TTS and disturbance). For MaresConnect, the results of noise modelling demonstrated that for harbour porpoise in particular, the onset of PTS is predicted to arise from between 17 m and 23 m from the source and potential behavioural effects are predicted to occur within 2.4 km and 2.5 km. The same level of information is not available for the Lir project but ranges are expected to be similar to those presented for the other two projects. Quantitative information is not available for NISA but it is expected that injury and disturbance ranges would be of a similar magnitude to the Project. It is expected that injury ranges for all in-combination projects would be further reduced by the implementation of measures, and therefore the potential for in-combination impacts would be further reduced.

Routine geophysical surveying of the offshore assets of the Project are planned to occur every five years, commencing in year five, and survey campaigns are expected to be a maximum total duration of 42 days (assuming three consecutive 14-day surveys, see section 5.3.3). There is therefore potential for temporal overlap with geophysical site-investigation surveys included in Table 7-1 of appendix F. However, there is expected to be a low probability that these would coincide temporally given the low frequency and short duration of survey campaigns for the Project.

As a conservative approach, it is assumed as a worst-case that up to two geophysical site investigation surveys could overlap with the Project geophysical surveys at any one point. There are limitations on the number of survey vessels that could carry out such surveys at any one time and therefore it is highly unlikely that all surveys associated with projects set out in Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information would overlap temporally. No adverse effects are predicted.

Sonar-like geophysical survey systems have very strong directivity which effectively means that there is only potential for injury when a marine mammal is directly underneath the sound source or directly within the swathe. Once the animal moves outside of the main beam, there is significantly reduced potential for injury. The closest site investigation survey to the Project is Mainstream Renewable Power (0.8 km to the south of the Project) and the closest wind farm project with the potential for geophysical surveys to be undertaken during its operational and maintenance phase is NISA (16.2 km to the south of the Project). In the unlikely event that surveys were to overlap temporally between the Project and NISA, the distance between these projects is significantly greater than the maximum spatial range over which injury or disturbance associated with geophysical survey methods is likely to occur.

For further information (i.e. data tables and figures) on the ICA in relation to injury and/or disturbance to marine mammals from elevated underwater noise during geophysical surveys, refer to appendix F: Marine Mammals and Megafauna – Supporting Information.

Injury and/or disturbance to marine mammal species from vessel activities

Vessel traffic associated with the operational and maintenance phase of the Project, together with vessel traffic associated with the projects identified in Table 7-1 of appendix F: Marine Mammals and Megafauna – Supporting Information, may increase the potential for injury and/or disturbance to marine mammal species. Other projects screened into the assessment within the Regional Marine Mammal and Megafauna Study Area include the Dublin Array, Arklow Bank Wind Park (Phase 2), NISA, Codling Wind Park, Awel y Môr Offshore Wind Farm, Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets,

Morecambe Offshore Windfarm Generation Assets, the Setanta Wind Park, North East Wind, Lir Offshore Array, Banba and MaresConnect site investigations.

The impact is not expected to differ from that presented for the construction phase.

5.8.5 Annex II Terrestrial and Freshwater Mammals

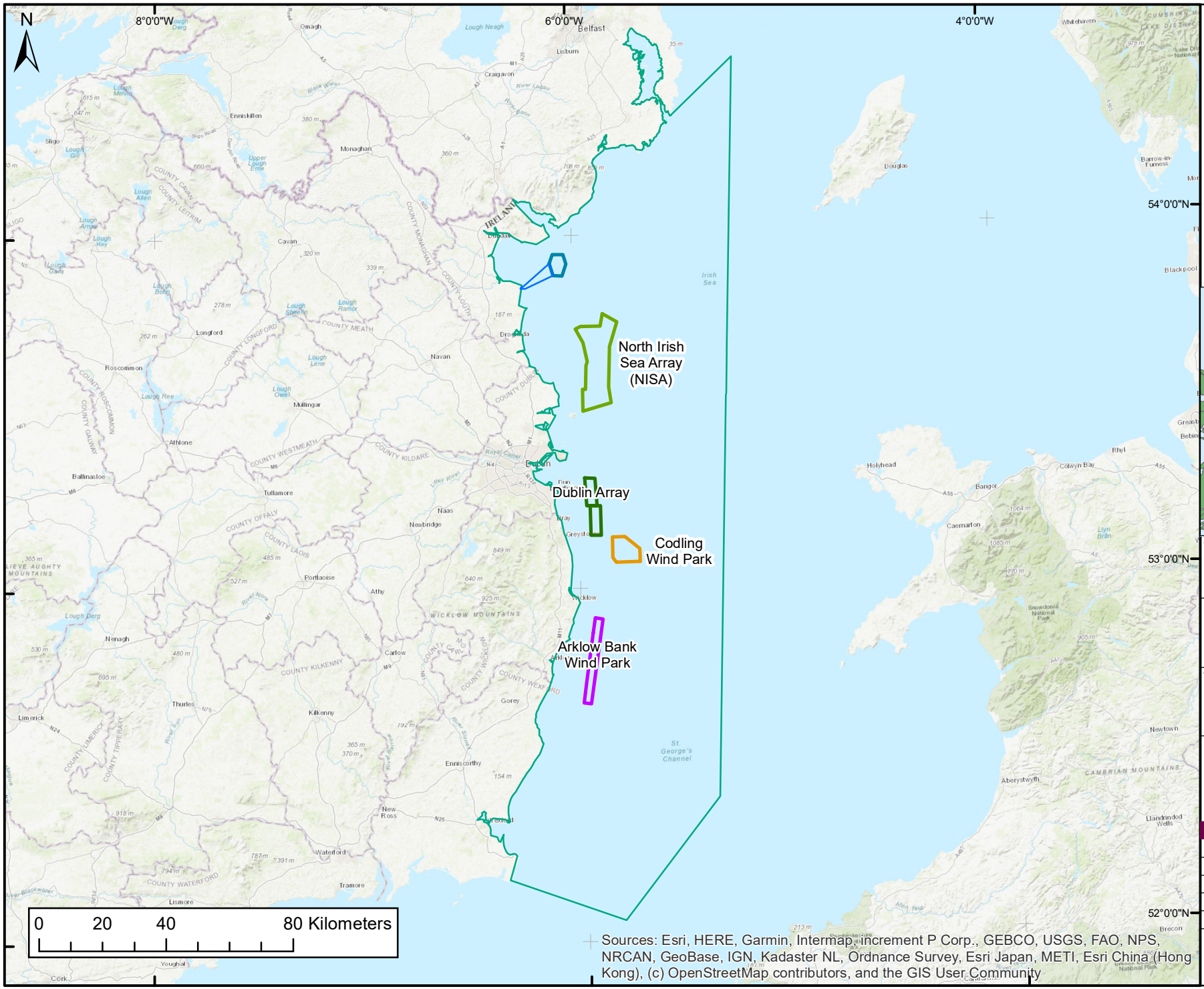
No plans or projects were screened in for the ICA for Annex I habitats (see appendix I: Onshore Biodiversity – Supporting Information).

5.8.6 Annex II Fish

The specific projects screened into the ICA for Annex II fish are outlined in appendix E: Fish and Shellfish Ecology Marine Mammals and Megafauna – Supporting Information, which consists of offshore wind projects. No plans were screened in for the ICA for Annex II fish.

For the list of other projects considered in relation to Annex II fish for the in-combination assessment, refer to Table 7-1 of appendix E: Fish and Shellfish Ecology – Supporting Information (NISA, Dublin Array, Codling Wind Park, Arklow Bank Wind Park) and Figure 5-2.

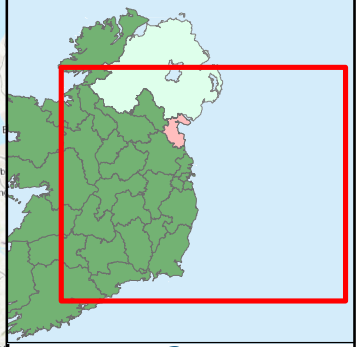
Collaboration with the other Phase 1 projects has informed the in-combination assessment.



Legend

- Offshore Wind Farm Area
- Offshore Cable Corridor
- Dublin Array
- Arklow Bank Wind Park
- Codling Offshore Wind Farm
- North Irish Sea Array (NISA)
- Western Irish Sea Fish and Shellfish Ecology Study Area

Data Sources: Client



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title **Figure 5-2**
Offshore projects screened into the in-combination assessment - fish

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Issue Details

Drawn By: NG	**Project No.** EOR0822 (MDR1520B)
Checked By: NG	**File Ref:** EOR0822_FAS_E_1203_FINAL
Approved By: AOS	
Scale: 1:1,592,230@A4	**Projection:** ITM (IRENET95)
Date: 07/03/2024	Geographic Co-ordinates: ETRS89

Table 5-34 presents the relevant project design parameters, which are used to assess the potential in-combination effects of the Project with the other projects identified in Table 7-1 of appendix E: Fish and Shellfish Ecology – Supporting Information.

For the purposes of this assessment, in-combination underwater noise emissions have been assessed within the Project study area. In-combination impacts associated with the generation of electrical magnetic fields have not been assessed, given the localised impacts associated with the electrical magnetic fields generated by operational subsea cables respectively (particularly given the large distances between the Project and other projects).

Table 5-34: Assessment of potential in-combination impacts on Annex II fish.

Potential impact	Phase			Project design parameters	Justification
	C	O	D		
Injury and/or disturbance to fish from underwater noise during pile-driving	✓	×	×	Project design parameter as described for the Project assessed in-combination with the following other projects: • NISA; • Codling Wind Park; • Dublin Array (Bray Bank and Kish Banks); and • Arklow Bank Wind Park.	Maximum potential for in-combination effects from underwater noise from construction operations within the Western Irish Sea Fish and Shellfish Ecology Study Area.

5.8.6.1 Construction phase

Injury and/or disturbance to fish from underwater noise during pile-driving

The installation of foundations within the offshore wind farm area, together with the projects identified in Table 7-1 and Figure 7-1 of appendix E: Fish and Shellfish Ecology – Supporting Information, may lead to injury and/or disturbance to fish from underwater noise during pile driving. Other projects screened into the assessment within the western Irish Sea Fish and Shellfish Ecology Study Area include the NISA, Codling Wind Park, Dublin Array and Arklow Bank Wind Park offshore wind farms.

Injury or mortality of fish from piling noise would not be expected to occur in-combination, due to the small range within which potential injury effects would be expected (i.e. predicted to occur within tens to hundreds of metres of piling activity within each of the identified projects) and the large distances between identified projects. In-combination effects of underwater noise are therefore discussed in the context of behavioural effects, particularly on spawning or nursery habitats.

Piling operations will represent intermittent occurrences at these offshore wind farm sites, with each individual piling event likely to be similar in duration to those proposed for the Project. The project design parameter (temporal) for piling duration for the Project is for monopile foundations with on average five hours piling per pile (up to a maximum of eight hours per pile) (see Table 5-34).

For other offshore wind farm projects monopile foundations have been assumed to represent the maximum design parameter. Given the intermittent nature of identified piling events the potential for temporal overlap is therefore minimised even when construction phases overlap which, as outlined in Table 7-1 of appendix E: Fish and Shellfish Ecology – Supporting Information, are indicative and subject to change as construction phases are indicative.

No publicly available information was available to determine the level of impact associated with underwater noise emissions on fish for these four offshore wind farm projects. However, it is assumed that a similar level of impact to the Project is likely based on the project locations and geographic area. Also, due to a lack of data or information regarding piling timescales for these projects for the purposes of this assessment it is assumed that construction periods could overlap.

Each of the impact assessments considers the project design parameters for hammer energy and/or the largest pile diameter and therefore results in the greatest propagation ranges. It should be noted, however,

that the project specific assessments may have used behavioural response criteria which differ from the approach used for this Project and from the other projects. The project specific assessments were undertaken using the best scientific evidence available at the time that the assessments were drafted. As such, it is not appropriate to make direct comparisons between the behavioural response ranges across projects, however the following paragraphs do give an indication of the extents of behavioural responses from fish and shellfish to support this in-combination assessment.

The NISA Offshore Wind Farm, Codling Wind Park, Dublin Array and Arklow Bank Wind Park are assumed to contribute to the cumulative disturbance resulting underwater noise as a result of piling activities from the installation of wind turbines (NISA – 46 WTGs, Dublin Array – 61, Codling – 140 WTGs and Arklow Bank Wind Park – between 36 and 60 WTGs). Currently these projects have only published EIA scoping reports or information on their project websites, which have limited information on the impact of underwater noise expected from the projects. Given the importance of this impact, the projects have committed to providing an assessment of noise effects. The scoping information, however, is not sufficient enough to undertake a detailed assessment however the contribution of these four wind farms to underwater noise is likely to be similar to other offshore wind farms in the Fish and Shellfish Ecology Study Area.

Based on the distance to the other offshore wind farm projects (16 km to the closet offshore wind farm) and disturbance ranges predicted for the Project (approximately 300 m) and assuming similar levels of effects from the other projects for fish receptors, it is not expected that there will be a spatial overlap of underwater noise emissions associated with each project in the event that construction timeframes coincide.

Fish injury as a result of piling noise would only be expected in the immediate vicinity of piling operations, and the area within which effects on fish larvae would be expected is similarly small, though it is unclear whether effects on fish larvae would include injury or mortality.

Behavioural effects on fish species as a result of piling noise are predicted to be dependent on the nature of the fish. The spread of behavioural impact ranges (see section 5.5.5.1 for examples of such behavioural effects) predicted for the identified projects reflects some of the uncertainty associated with behavioural effects criteria, with any behavioural effects also dependent on factors such as type of fish, its sex, age and condition, stressors to which the fish is or has been exposed or the reasons and drivers for the fish being in the area.

Effects on migratory species are likely to be limited to behavioural effects within the ranges discussed for the projects listed above. Lamprey species and Atlantic salmon are likely to be affected to relatively smaller ranges. Due to the distance between the offshore wind projects (at least 60 km) and the distance of these projects from the coast (approximately 5 km), there is minimal potential for in-combination effects from piling noise to represent a barrier to migratory Annex II fish species for the projects identified, particularly taking into account the intermittency of piling activities.

Overall, the impact is considered to be of local/regional spatial extent, short term duration, intermittent and high reversibility. Although the level of sensitivity of fish receptors is considered to be low to medium (see Table 6-4 of appendix E: Fish and Shellfish Ecology – Supporting Information), given the limited spatial extent and short term duration for which impacts could occur - no onshore projects that spatially or temporally overlap with the Project were considered to have in-combination adverse effects on Annex II fish.

For further information on the ICA in relation to injury and/or disturbance to fish from underwater noise during pile-driving, refer to appendix E: Fish and Shellfish Ecology – Supporting Information.

5.8.7 Annex II Invertebrates

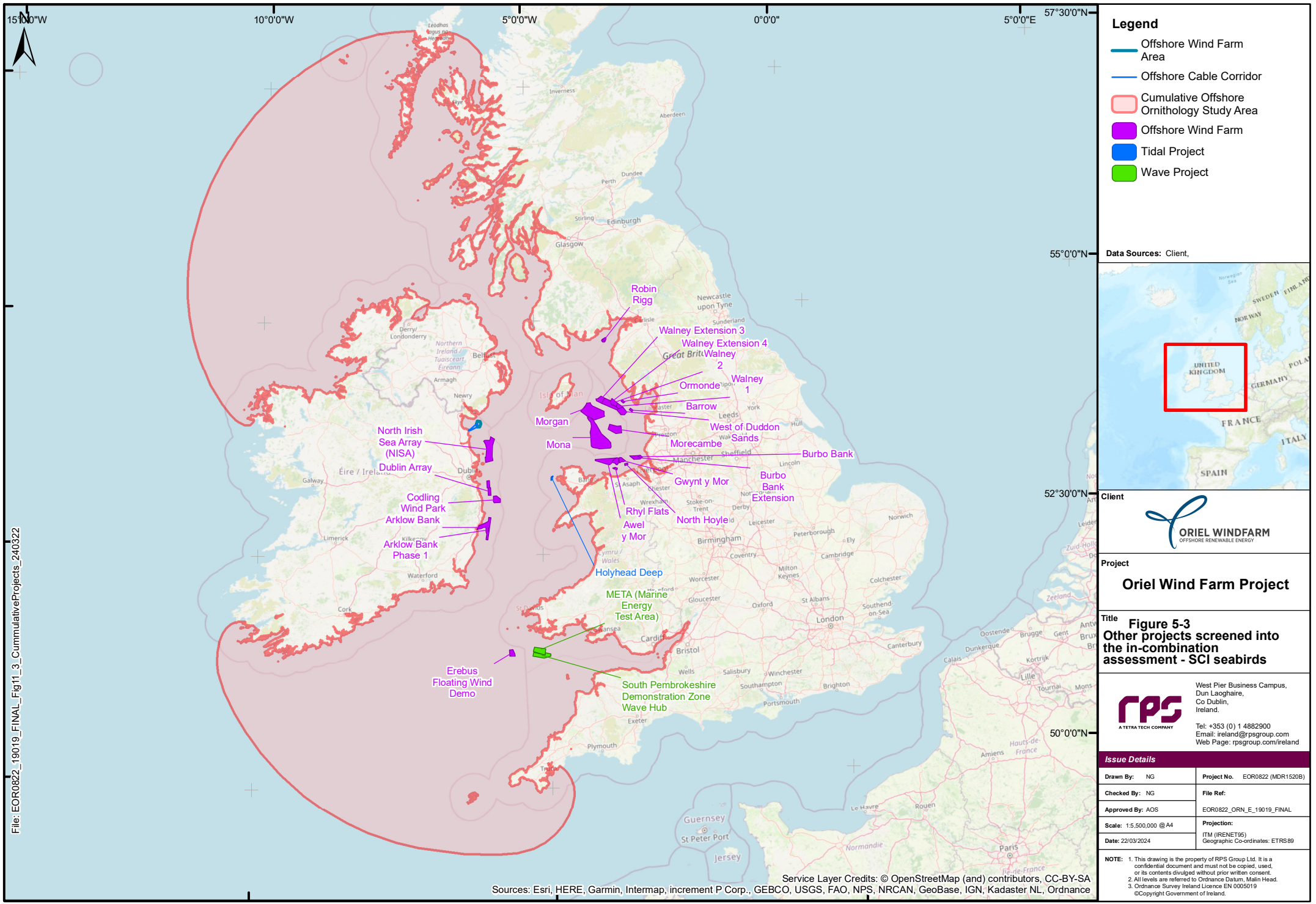
See section 5.8.2 and section 5.8.5. No onshore projects or plans that spatially or temporally overlap with the Project were considered to have in-combination adverse effects on Annex II invertebrates.

5.8.8 Birds Directive SCI Species

The specific projects scoped into the ICA for Birds Directive SCI species are outlined in appendix H: Offshore Ornithology – Supporting Information and appendix I: Onshore Biodiversity – Supporting Information.

For the list of other projects considered in relation to SCI seabirds for the in-combination assessment, refer to Table 6-1 of appendix H: Offshore Ornithology – Supporting Information, and Figure 5-3 below. No projects were screened in for the ICA for SCI shorebirds (see appendix I: Onshore Biodiversity – Supporting Information).

The Applicant has engaged with the other four Phase 1 offshore wind farm developers on the east coast of Ireland (who hold a Maritime Area Consent) to inform the ICA. A single output for these projects is presented below (see appendix H: Offshore Ornithology – Supporting Information). These projects shared data and outputs from collisions risk modelling and displacement to inform the assessment of potential in-combination impacts on offshore ornithology.



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Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title: **Figure 5-3 Other projects screened into the in-combination assessment - SCI seabirds**

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Issue Details			
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Approved By:	AOS		
Scale:	1:5,500,000 @A4	Projection:	ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date:	22/03/2024		

5.8.8.1 Operational and maintenance phase

Disturbance and displacement during operational and maintenance phase

There is potential for cumulative displacement as a result of operational activities associated with the Project along with other developments.

The level of data available and the ease with which disturbance and displacement impacts can be combined across the wind farms is quite variable, reflecting the availability of relevant data for other projects and the approach to assessment taken. During the operational and maintenance phase, the presence of offshore turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale.

The species assessed for cumulative displacement impacts were great northern diver, guillemot and razorbill. With regards to this ICA of displacement effects, suitable information was obtained from each relevant project publicly available documentation. It should be noted that the amount of data available and the practicality of combining impacts across projects is variable. Wherever possible, the cumulative assessment is quantitative, however where no data is available, the cumulative assessment is qualitative.

Guillemot

Due to variation in methods used to assess annual disturbance and displacement impacts the mid-point of the alone assessment was used, and therefore the estimated number of mortalities is using a 50 % displacement and a 1 % mortality estimate. The number presented for the Project is the higher of either the DAS or boat-based surveys for precaution. Within Table 5-35 N/A indicates that the project did not consider the SPA, mainly due to the SPA being out with the foraging range of the guillemot from the project in question. No other project considered Howth Head Coast SPA or Rathlin Island SPA for guillemot and therefore those sites are not included within this Table 5-35. The project alone concluded that the impact on Wicklow head was <0.05 % increase in baseline mortality and an estimated mortality of <0.1 bird therefore has not been included within this in-combination assessment.

Table 5-35: Estimated annual mortality of guillemot (all ages) from disturbance and displacement apportioned to the relevant SPAs from the in-combination projects.

Project	SPA	
	Ireland's Eye	Lambay Island
Awel y Môr Mona Offshore Wind Project	0.04	0.6
Project Erebus	N/A	N/A
Minesto Tidal Kite (collisions with tidal kite)	0.2	6.4
In-combination total (consented)	**0.24**	**7**
Mona Offshore Wind Project	0.21	3.17
Morgan Offshore Wind Project Generation Assets	0.15	2.33
Morecambe Offshore Windfarm	No assessment of guillemot was undertaken in the PEIR	
Other Phase 1 projects	8.24	76.94
Oriel Wind Farm Project	0.13	2.36
In-combination total (all Projects)	**9.21**	**98.8**
Baseline mortality of SPA	1,313	17,864
In-combination total as a % increase on baseline mortality	**0.70**	**0.55**

The impact of disturbance and displacement caused by operational and maintenance activities annually when all projects are considered in-combination is predicted to be of local spatial extent, long term duration,

continuous and medium reversibility. As the increase in baseline mortality is <1 %, the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed from the Project alone.

Razorbill

Due to variation in methods used to assess annual disturbance and displacement impacts the mid-point of the alone assessment was used, and therefore the estimated number of mortalities is using a 50 % displacement and a 1 % mortality estimate. The number presented for the Project is the higher of either the DAS or boat-based surveys for precaution. Within Table 5-36 "N/A" indicates that the project did not consider the SPA, mainly due to the SPA being out with the foraging range of the razorbill from the project in question. No other Project considered Howth Head Coast SPA, Wicklow Head SPA or Rathlin Island SPA for razorbill as these SPAs have no connectivity with thew other projects and therefore those sites are not included within Table 5-36.

Table 5-36: Estimated annual mortality of razorbill (all ages) from disturbance and displacement apportioned to the relevant SPAs from the in-combination projects.

Project	SPA	
	Ireland's Eye	Lambay Island
Awel y Môr Mona Offshore Wind Project	0.02	0.09
Project Erebus	N/A	N/A
Minesto Tidal Kite (collisions with tidal kite)	0.04	0.37
In-combination total (consented)	**0.06**	**0.46**
Mona Offshore Wind Project	No assessment of razorbill was undertaken in the PEIR	
Morgan Offshore Wind Project Generation Assets		
Morecambe Offshore Windfarm		
Other Phase 1 projects	1.44	5.64
Oriel Wind Farm Project	0.14	0.83
In-combination total (all Projects)	**1.7**	**7.39**
Baseline mortality of SPA	473	2,175
In-combination total as a % increase on baseline mortality	**0.36**	**0.34**

The impact of disturbance and displacement caused by operational and maintenance activities annually when all projects are considered in-combination is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. As the increase in baseline mortality is <1 %, the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed from the Project alone.

Collision risk during operational and maintenance phase

The offshore wind farm area, together with that of other projects may contribute to in-combination collision risk during the operational and maintenance phase. Other projects screened into the assessment within the Cumulative Offshore Ornithology Study Area are presented in appendix H: Offshore Ornithology – Supporting Information, and these are also considered alongside the species' mean maximum foraging range plus one standard deviation (Woodward *et al*., 2019). The four species identified as potentially impacted by the Project alone during operational and maintenance phase were common gull, gannet, herring gull and kittiwake. Assessment of gannet is considered in section 5.7.6 combined with displacement as the species is susceptible to both.

Common gull

Within the Project alone assessment, the Dundalk Bay SPA and the North-west Irish Sea SPA were considered during the winter period only. All birds present within the Dundalk Bay SPA and North-west Irish Sea SPA are part of the larger international population which winters in both the UK and Republic of Ireland. The total population which could be present during the winter period is 756,002 birds (713,129 birds from the

UK, Channel Isles and Isle of Man (Banks *et al.*, 2007) and an additional 21,438 from Ireland (Burke *et al.*, 2018)). Both Dundalk Bay SPA and North-west Irish Sea SPA represent a small proportion of this winter population, 1,594 and 2,866 birds respectively, which proportionally is 0.0021 and 0.0038 of the whole non-breeding population. As the increase in baseline mortality was <1 % (Table 5-37), the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed in-combination.

Table 5-37: Estimated annual morality of common gull from collisions apportioned to the relevant SPAs from the in-combination Projects.

Project	Site	
	North-west Irish Sea SPA	Dundalk Bay SPA
Awel y Môr Mona Offshore Wind Project	0	0
Project Erebus	0	0
Minesto Tidal Kite (collisions with tidal kite)	0	0
Mona Offshore Wind Project	0.08	0.04
Morgan Offshore Wind Project Generation Assets	0	0
Morecambe Offshore Windfarm	0.01	0.01
Other Phase 1 projects	0.60	0.33
Oriel Wind Farm Project	0	0
In-combination total (all Projects)	**0.69**	**0.38**
Baseline mortality of SPA	725	403
In-combination total as a % increase on baseline mortality	**0.10**	**0.09**

Great black-backed gull

Within the Project alone assessment, the North-west Irish Sea SPA was considered during the winter period only. All birds present within the North-west Irish Sea SPA are part of the larger international population which winters in both the UK and Republic of Ireland. The total population which could be present during the winter period is 53,181 (Furness, 2015). The North-west Irish Sea SPA represent a small proportion of this winter population, with an estimated 982 birds, or a proportion of 0.0185. As it was not always clear which avoidance rates have been used to calculate the impacts, the numbers presented for the older projects are considered an overestimation and have not used the latest evidence on avoidance. When the avoidance rate was known (e.g. Walney Extension and Awel y Môr), the figure presented is has used the latest avoidance rate. As the increase in baseline mortality was <1 %, the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed in-combination.

Table 5-38: Estimated annual morality of great black-backed gull from collisions apportioned to the relevant SPAs from the in-combination Projects.

Project	SPA
	North-west Irish Sea
Awel y Môr Mona Offshore Wind Project	0.09
Project Erebus	0.02
Minesto Tidal Kite (collisions with tidal kite)	0
Mona Offshore Wind Project	0.14
Morgan Offshore Wind Project Generation Assets	0.05
Morecambe Offshore Windfarm	0.02
Walney Extension	0.04
Walney 1 + 2	0.23
Burbo Bank	0.01

Other Phase 1 projects	0.06
Oriel Wind Farm Project	0.14
In-combination total (all Projects)	**0.80**
Baseline mortality of SPA	93
In-combination total as a % increase on baseline mortality	**0.86**

Herring gull

As stated above, only sites for which the Project has a measurable impact (concluded as >0.1 increase in baseline mortality and >0.1 birds) from the Project alone, would be included within an in-combination assessment. Therefore, the Ireland's Eye SPA and the Lambay Island SPA are presented within the in-combination assessment. It was predicted that up to 6.99 birds would be killed from collisions that originated from the Lambay Island SPA, with a smaller number of birds from the Ireland's Eye SPA (2.86 birds) (Table 5-39).

When considering all of the projects within the Cumulative Offshore Ornithology Study Area the increase in baseline mortality for both sites is >1 % (appendix H: Offshore Ornithology – Supporting Information) and therefore additional analysis was undertaken, in the form of a PVA. Full details are provided within annex 8: Population Viability Analysis for impacted SPAs.

Following the PVA, it was concluded that the counterfactual growth rate was ≥0.995 for Lambay Island SPA, with Ireland's Eye SPA indicating a 0.994 counterfactual growth rate. A counterfactual growth rate of ≥0.995 is considered to be within natural fluctuations of the population and no significant impact is predicted from the increase in mortality of 6.97. A counterfactual growth rate of 0.994 is of low significance, with the impacted population having a 0.5 % change on the growth rate of non-impacted population. The population of herring gull at Ireland's Eye SPA undertook a 29% increase between the Seabird 2000 and Seabird Count national census (Burnell *et al*., 2023). Therefore with an increasing population a counterfactual growth rate of 0.994 is considered insignificant. In addition, the impact from the Project, included within the in-combination assessment is the Natural England AR, if the JNCC AR was presented the impact would be less, and highly likely to result in >0.995 counterfactual of growth rate.

Full calculations and methods are presented in annex 8: Offshore Ornithology Population Viability Analysis, for impacted SPAs. As the counterfactual growth rate was ≥0.995, the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed in-combination.

Table 5-39: Estimated annual morality of adult herring gull from collisions apportioned to the relevant SPAs from the in-combination Projects.

Project	SPA	
	Ireland's Eye	Lambay Island
Awel y Môr Mona Offshore Wind Project	No potential for the SPAs to be impacted as outside connectivity range	
Project Erebus		
Minesto Tidal Kite (collisions with tidal kite)		
Mona Offshore Wind Project		
Morgan Offshore Wind Project Generation Assets		
Morecambe Offshore Windfarm		
Other Phase 1 projects	2.19	4.60
Oriel Wind Farm Project (Natural England AR)	0.65	2.37
In-combination total (all Projects)	**2.84**	**6.97**
Baseline mortality of SPA	106	301
In-combination total as a % increase on baseline mortality	**2.68**	**2.32**

Kittiwake

As stated above, only sites for which the Project has a measurable impact (concluded as >0.1 increase in baseline mortality and >0.1 birds) from the project alone, would be included within an in-combination assessment. Therefore, the Ireland's Eye SPA, the Lambay Island SPA, the Howth Head Coast SPA and Rathlin Island SPA are presented within the in-combination assessment for kittiwake. The SPA with the greatest number of predicted mortalities was Rathlin island SPA with up to 13.09 annual mortalities. However it was the Ireland's Eye SPA which the increased annual mortalities had the greatest increase in baseline mortality (1.87 %).

When considering all of the projects within the Cumulative Offshore Ornithology Study Area the increase in baseline mortality for three of the SPAs is >1 % (Table 5-40) and therefore additional analysis was undertaken, in the form of a PVA. Full details are provided within annex 8: Offshore Ornithology Population Viability Analysis, for impacted SPAs. No further analysis was undertaken for Rathlin Island SPA as the increase in baseline mortality of 0.33 the impact is not considered to have an adverse effect on the site's integrity.

Following the PVA, it was concluded that the counterfactual growth rate was ≥0.995 for all three SPAs assessed. A counterfactual growth rate of ≥0.995 is considered to be within natural fluctuations and no impact is predicted from the increase in mortality in-combination. Full calculations and methods are presented in annex 8: Population Viability Analysis for impacted SPAs. As the counterfactual growth rate was ≥0.995, the impact is not considered to have an adverse effect on the site's integrity for all SPAs assessed in-combination.

Table 5-40: Estimated annual mortality of adult kittiwake from collisions and displacement apportioned to the relevant SPAs from the in-combination projects.

Project	SPA			
	Ireland's Eye	Lambay Island	Howth Head Coast	Rathlin Island
Awel y Môr Mona Offshore Wind Project	0.07	0.15	0.1	N/A
Project Erebus	<0.01	0.01	0.01	N/A
Minesto Tidal Kite (collisions with tidal kite)	No impact predicted from this technology			
Mona Offshore Wind Project	0.6	1.4	1.2	3.29
Morgan Offshore Wind Project Generation Assets	0.6	1.5	1.2	7.39
Morecambe Offshore Windfarm	No data presented within the PIER			
Other Phase 1 projects	1.06	7.29	5.54	0.51
Oriel Wind Farm Project (Natural England AR)	0.15	1.35	0.50	1.90
In-combination total	**2.49**	**11.70**	**8.55**	**13.09**
Baseline adult mortality of SPA	133	1,001	518	4,002
In-combination total as a % increase on baseline mortality	**1.87**	**1.17**	**1.65**	**0.33**

Combined disturbance and displacement and collision risk during the operational and maintenance phase on gannet

As stated previously, only sites for which the Project has a measurable impact (concluded as >0.1 increase in baseline mortality and >0.1 birds) from the Project alone, are included within an in-combination assessment. Therefore, the Alisa Craig SPA and Saltee Islands SPA are presented within the in-combination assessment for kittiwake (Table 5-41). The SPA with the greatest number of predicted mortalities was Ailsa Craig SPA with up to 46 annual mortalities.

When considering all of the projects within the Cumulative Offshore Ornithology Study Area the increase in baseline mortality for the SPAs is <1 % (Table 5-41) and therefore no additional analysis was undertaken and the impact is not considered to have an adverse effect on the site's integrity.

Table 5-41: Estimated annual mortality of gannet (adults) from disturbance and displacement and collisions apportioned to the relevant SPAs from the in-combination projects.

Project	SPA	
	Alisa Craig	Saltee Islands
Minesto Tidal Kite (underwater collisions with tidal kite)	N/A	N/A
Awel y Môr Mona Offshore Wind Project	7.4	N/A
Walney Extension (3 + 4) (collisions only)	25	N/A
Project Erebus	N/A	N/A
Mona Offshore Wind Project	0.7	N/A
Morgan Offshore Wind Project Generation Assets	0.5	N/A
Morecambe Offshore Windfarm	5.11	N/A
Other Phase 1 projects	1.55	0.98
Oriel Wind Farm Project (Natural England AR)	5.5	0.54
In-combination total	**45.76**	**1.52**
Baseline adult mortality of SPA	5,383	765
In-combination total as a % increase on baseline mortality	**0.85**	**0.20**

5.8.9 In-combination conclusion

Having regard for the above, other projects and plans are not predicted to have adverse effects on the integrity of any European sites, either alone or in-combination. No significant in-combination effects are predicted, having regard for the legal protection for these European sites (through legislation at national level, and policy initiatives at national, county and local levels).

6 MITIGATION AND MONITORING MEASURES

6.1 Measures included in the Project

For the purposes of this assessment the term “mitigation measures” are considered to be “measures proposed by the plan or project developer or required by the competent national authorities in order to remove, pre-empt or reduce the impacts identified in the appropriate assessment to a level where they will no longer affect the integrity of the site” (EC, 2021).

Based on the Stage 2 Appraisal for Appropriate Assessment carried out in section 5, the NIS has concluded that there will be no adverse effects on any European site(s) (see section 7) and therefore it is considered that no further measures over those included in the Project (sections 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, and 5.7.5) are required. However, some additional measures to further reduce the risk of injury to marine mammals have been provided in section 6.2.

The Project, and any contractor appointed by the Project, shall be required to comply with, and implement, the measures included in the project, as set out in the assessment. It is required that these measures be fully incorporated into construction, operational and maintenance, and decommissioning phases.

6.2 Additional mitigation measures

6.2.1 Annex II Marine Mammals

6.2.1.1 Mitigation for injury as a result of piling

A number of measures have been included in the Project and are described in Table 5-10, including a soft start to piling and the implementation of an MMMP. Mitigation will be applied to reduce the risk of injury to marine mammals by use of an ADD. Originally developed for use in aquaculture, ADDs have been commonly used in marine mammal mitigation at UK offshore wind farms to deter animals from injury zones prior to the start of piling and the JNCC (2010) draft guidance for piling mitigation recommends their use, particularly in respect of periods of low visibility or at night to allow 24 hour working. With a number of research projects on ADDs commissioned via the Offshore Renewables Joint Industry Programme (ORJIP), the use of ADDs for mitigation at offshore wind farms has gained momentum. Indeed, for the Beatrice Offshore Wind Farm, the use of ADDs was accepted by the regulators (Marine Scotland) as the only mitigation tool to be applied pre-piling as it was thought to be more effective at reducing the potential for injury to marine mammals compared to standard mitigation (MMOs and PAM) which have limitations with respect to effective detection over distance (Parsons *et al*., 2009; Wright and Cosentino, 2015).

There are a number of different ADDs on the market with different sound source characteristics (see McGarry *et al*., 2020) and a suitable device will be selected based on the key species requiring mitigation for the Project. The selected device will typically be deployed from the piling vessel and activated for a pre-determined duration to allow animals sufficient time to move away from the sound source whilst also minimising the additional noise introduced into the marine environment. The type of ADD and approach to mitigation (including activation time and procedure) will be discussed and agreed with relevant stakeholders.

6.2.1.2 Noise modelling assessment

Noise modelling was carried out for the SEL_{cum} metric to determine the potential efficacy of using this device to deter marine mammals from the injury zone (see appendix C: Subsea Noise Technical Report). The modelled parameters included the activation of an ADD for a period of 15 minutes prior to initiation of piling and was compared to the parameter including measures adopted as part of the Project only (i.e. initiation + soft start + ramp up) to determine whether deployment of an ADD was of potential benefit to reducing the risk of injury to marine mammals (Table 6-1).

Table 6-1: Project design parameters modelled for a single monopile.

Pile type	Locations	Threshold	Parameter modelled	
			Parameter	Description
Monopile	East and west of the offshore wind farm area	Weighted SEL_{cum} Ramp up during single pile installation (maximum 5 hours duration)	Initiation	1 min @ 525 kJ
			Soft start	20 min @ 525 kJ
			Ramp up	9 min @ 525 to 2,500 kJ
			Standard operation	150 min @ 2,500 kJ
			Full power	120 min @ 3,500 kJ
		Unweighted SPL_{pk} Ramp up during single pile installation (maximum 5 hours duration)	Initiation	1 min @ 525 kJ
			Soft start	20 min @ 525 kJ
			Ramp up	9 min @ 525 to 2,500 kJ
			Standard operation	150 min @ 2,500 kJ
			Full power	120 min @ 3,500 kJ

The results suggest that the use of an ADD would further reduce the risk of injury occurring in marine mammal receptors. For example, based on the SEL_{cum} metric, with an ADD deployed and activated the thresholds for PTS are not exceeded in any species as animals would flee beyond the injury zones prior to the start of piling (Table 6-2 and Table 6-3). Over a duration of 15 minutes activation and based on a conservative swim speed of 1.5 m/s (Otani *et al.,* 2000) a marine mammal would be able to move a distance of 1,350 m. Several studies provide empirical evidence for deterrence over these distances particularly for harbour porpoise (e.g. Dahne *et al.,* 2017; Geelhoed *et al.* 2017; Brandt *et al.,* 2012) and seal species (e.g. Gordon *et al.,* 2019; Gordon *et al.* 2015; ABPmer 2014). It is therefore anticipated that animals would be beyond the maximum injury zone predicted using the SPL_{pk} metric at soft start initiation (i.e. up to 236 m). Several studies provide evidence that ADDs deter different marine mammals over several hundreds of metres or indeed up to several kilometres from the source in a small number of cases (reviewed in McGarry *et al*., 2020).

The use of an ADD would also reduce the risk of TTS occurring in marine mammals. With an ADD deployed the range at which the SEL_{cum} threshold for TTS would be reduced to 4,620 m for harbour porpoise and for high frequency cetaceans and pinnipeds the TTS thresholds would not be exceeded. As discussed previously, for TTS these ranges are likely to be unrealistic overestimates, however, the subsea noise modelling does illustrate that the use of an ADD can be used to reduce the risk of a temporary auditory impairment.

Table 6-2: Summary of the SEL_{cum} injury ranges for marine mammals due to piling of single monopile at the east of the offshore wind farm area with measures included in the Project and mitigation (ADD) (N/E = threshold not exceeded).

Species / Group	Threshold (Weighted SEL_{cum})	Range (m)	
		Measures included in the Project	Measures included in the Project + mitigation (ADD)
LF	PTS – 183 dB re 1 μPa^2s	394	N/E
	TTS – 168 dB re 1 μPa^2s	8,060	5,980
HF	PTS – 185 dB re 1 μPa^2s	N/E	N/E
	TTS – 170 dB re 1 μPa^2s	12	N/E
VHF	PTS – 155 dB re 1 μPa^2s	168	N/E
	TTS – 140 dB re 1 μPa^2s	5,980	4,620
PW	PTS – 185 dB re 1 μPa^2s	19	N/E
	TTS – 170 dB re 1 μPa^2s	1,330	N/E

Since deployment of an ADD would mean that the PTS threshold would not be exceeded there would be no animals potentially exposed to noise levels that could cause PTS. Similarly, TTS would not be experienced in bottlenose dolphin (as high frequency cetaceans), nor in the pinnipeds harbour seal and grey seal. The number of animals affected by TTS would be reduced for harbour porpoise with the use of an ADD. With an ADD activated between 19 to 90 harbour porpoise may be exposed to noise levels that induce TTS compared to 32 to 149 without the use of an ADD (Table 6-2). The magnitude of the impact of TTS for high frequency cetaceans and pinnipeds would be negligible, whilst for very high frequency cetaceans and low frequency cetaceans the residual magnitude is, conservatively, assessed as medium.

6.2.1.3 Sensitivity of the qualifying species

The sensitivity of marine mammal species to both PTS and TTS remains as described previously (section 5.3).

6.2.1.4 Potential effect of ADD on marine mammals

It is also important to highlight the potential effect and sensitivity of marine mammals to the ADD itself. Whilst ADDs deployed for such short durations are unlikely to lead to injury there may be some trade-off with an increase in disturbance during the period of activation. Depending on the device employed, ADDs may elicit a strong behavioural response and lead to displacement over potentially large ranges (up to a kilometre or more) for periods of time longer than the activation of the device itself. For example, a Lofitech ADD deployed for 15 minutes pre-piling led to a minimum return time of 2 hours within 1 km of the deployment location (Thompson *et al*., 2020). Whilst this is useful for reducing the risk of injury to marine mammals (because animals may stay out of the injury zone for sufficient lengths of time) there needs to be a balance to ensure that ADD do not lead to significant additional disturbance themselves. This can be achieved by optimising both ADD source signals and deployment schedules (Thompson *et al.*, 2020). The effect of ADDs on marine mammals is likely to be a short-term disturbance response over a relatively localised area (within a maximum of few kilometres) and animals are likely to quickly recover to baseline levels (within a few hours).

Table 6-3: Number of animals potentially affected by PTS (auditory injury) and TTS arising from impact piling at a single monopile location at the east of the offshore wind farm area based on SEL injury ranges (soft start and soft start + ADD) (N/E = threshold not exceeded).

Species	Threshold (Weighted) SEL_{cum}	Measures applied	Density estimate (animals/km²)	MU population	Range (m)	Area of sea within zone of injury (km²)	Number animals within zone of injury	Proportion of MU population (%)
Harbour porpoise	PTS – 155 dB re 1 μPa²s	Soft start	0.280 – 1.330	62,517	168	0.09	< 1	3.97×10^{-5} – 0.0002
	TTS – 140 dB re 1 μPa²s				5,980	112.29	32 – 150	0.050 – 0.239
	PTS – 155 dB re 1 μPa²s	Soft start + ADD			N/E	N/A	N/A	N/A
	TTS – 140 dB re 1 μPa²s				4,620	67.02	19 – 90	0.030 – 0.143
Bottlenose dolphin	PTS – 185 dB re 1 μPa²s	Soft start	0.046 0.235*	293 8,326*	*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				12	0.0005	< 1	7.10×10^{-6} 1.28×10^{-6}
	PTS – 185 dB re 1 μPa²s	Soft start + ADD			*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				*N/E*	N/A	N/A	N/A
Common dolphin	PTS – 185 dB re 1 μPa²s	Soft start	0.027	102,656	*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				12	0.0005	< 1	1.199×10^{-8}
	PTS – 185 dB re 1 μPa²s	Soft start + ADD			*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				*N/E*	N/A	N/A	N/A
Minke whale	PTS – 183 dB re 1 μPa²s	Soft start	0.014 – 0.26	20,118	394	0.49	< 1	3.39×10^{-5} – 0.0006
	TTS – 168 dB re 1 μPa²s				8,060	203.99	3– 54	0.014 – 0.264
	PTS – 183 dB re 1 μPa²s	Soft start + ADD			*N/E*	N/A	N/A	N/A
	TTS – 168 dB re 1 μPa²s				5,980	112.34	2 – 30	0.008 – 0.145
Grey seal	PTS – 185 dB re 1 μPa²s	Soft start	0.327	5,882	19	0.001	< 1	6.30×10^{-6}
	TTS – 170 dB re 1 μPa²s				1,330	5.55	2	0.031
	PTS – 185 dB re 1 μPa²s	Soft start + ADD			*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				*N/E*	N/A	N/A	N/A
Harbour seal	PTS – 185 dB re 1 μPa²s	Soft start	0.280	1,635	19	0.001	< 1	1.24×10^{-5}
	TTS – 170 dB re 1 μPa²s				1,330	5.55	2	0.095
	PTS – 185 dB re 1 μPa²s	Soft start + ADD			*N/E*	N/A	N/A	N/A
	TTS – 170 dB re 1 μPa²s				*N/E*	N/A	N/A	N/A

* Density generated using SCANS-IV data has been compared against a reference population estimated by summing the abundance within the Irish Sea SCANS-IV blocks

6.3 Monitoring

The Project proposes to continue monitoring the population distribution and abundance of the Offshore Ornithology Study Area. This monitoring is proposed to consist of DAS before construction (Year 0) and Years 1, 3, 5 and 15 following construction, following the same scope, methods and analysis of the baseline surveys.

This monitoring requirement is set out in DCCAE's guidance to inform ecological monitoring (DCCAE, 2018). As the assessments concluded no adverse effects on site integrity for all SPAs and species assessed there is no requirement for additional monitoring, above what is set out by DCCAE. The level of monitoring proposed will help provide scientific evidence of how birds within the Irish Sea respond to Offshore Wind Farm developments.

7 CONCLUSION OF NATURA IMPACT STATEMENT

This NIS has been prepared following applicable guidance (see section 3.1). As stated in the Department of the Environment, Heritage and Local Government guidance 'Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities' (DoEHLG, 2010a), the requirement of the AA is to establish beyond reasonable scientific doubt that adverse effects on site integrity will not result.

RPS has prepared this NIS to document scientific analysis and evaluation seeking to establish whether or not, in view of best scientific knowledge and applying the precautionary principle, and in light of the COs of relevant European sites, the Project, either individually or in combination with other plans or projects, will adversity affect the integrity of any European site(s).

Provided the measures included in the Project (sections 5.2.4, 5.3.4, 5.4.4, 5.5.5, 5.6.4, and 5.7.5) are implemented in full, it is concluded that there will be no adverse effects on the integrity of any European sites, and no reasonable scientific doubt remains as to the absence of such effects. Furthermore, it is also concluded that no residual effects remain.

In conclusion, it is the opinion of RPS that in view of best scientific knowledge and applying the precautionary principle, and in light of the COs of the relevant European sites, the Project, either individually or in combination with other plans or projects, will not have adverse effect on the integrity of any European site(s), given the implementation of the measures included in the Project.

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