Environmental Impact Assessment Report

Volume 3

Chapter 10 Ornithology

codling wind park

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Abbreviations

Abbreviation	Term in Full
AAM	Alternative Alignment for the Purposes of Modelling
BDMPS	Biologically Defined Minimum Population Scales
BoCCI	Bird of Conservation Concern Ireland
BTO	British Trust for Ornithology
CDL	Coal Distribution Limited
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CLV	Cable Laying Vessel
CRM	Collision Risk Modelling
CWP	Codling Wind Park
CWPL	Codling Wind Park Limited
DAERA	Department of Agriculture, Environment and Rural Affairs
DP	Decommissioning Plan
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESAS	European Seabirds at Sea
ESB	Electricity Supply Board
EU	European Union
ha	Hectare
HDD	Horizontal Directional Drilling
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Assessment
IAC	Inter Array Cable
IAM	Impact Assessment Matrix
IEFs	Important Ecological Features
INNS	Invasive Non-native Species
IUCN	International Union for Conservation of Nature

Abbreviation	Term in Full
ISMP	Invasive Species Management Plan
I-WeBS	Irish Wetland Birds Survey
IWT	Irish Wildlife Trust
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
MI	Marine Institute
MSP	Mid Support Pontoon
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organization
MS	Marine Scotland
MSL	Mean Sea Level
NBDC	National Biodiversity Data Centre
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Services
NRA	National Road Authority
OECC	Offshore Export Cable Corridor
OWF	Offshore Wind Farm
O&M	Operations and Maintenance
OSS	Offshore Substation Structure
OTI	Onshore Transmission Infrastructure
pNHA	Proposed Natural Heritage Area
SAC	Special Area of Conservation
sCRM	Stochastic Collision Risk Modelling
SCI	Special Conservation Interest
SD	Standard Deviation
SMP	Seabird Monitoring Programme
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SDZ	Strategic Development Zone
TJB	Transition Joint Bay

Abbreviation	Term in Full
VP	Vantage Point
WTG	Wind Turbine Generator
ZoI	Zone of Influence

Definitions

Glossary	Meaning
the Applicant	The developer, Codling Wind Park Limited (CWPL).
array site	The red line boundary area within which the wind turbine generators (WTGs), inter array cables (IACs) and the Offshore Substation Structures (OSSs) are proposed.
Auks	Bird species such as guillemot, razorbill, puffin and black guillemot.
Biologically Defined Minimum Population Scales (BDMPS)	Species-specific seabird estimated regional populations outside of the breeding season from Furness et al. (2015).
Coal Distribution Ltd (CDL) Dolphin	A rectangular concrete mooring structure owned by Dublin Port Company. It is used by nesting Arctic and common tern During their breeding season.
Codling Wind Park (CWP) Project	The proposed development as a whole is referred to as the Codling Wind Park (CWP) Project, comprising of the offshore infrastructure, the onshore infrastructure and any associated temporary works.
Codling Wind Park Limited (CWPL)	A joint venture between Fred. Olsen Seawind (FOS) and Électricité de France (EDF) Renewables, established to develop the CWP Project.
Collision Risk Modelling (CRM)	A method of estimating the risk (which can be either deterministic or stochastic) to seabirds of collision (and estimated mortality) with operational turbines.
Environmental Impact Assessment (EIA)	A systematic means of assessing the likely significant effects of a proposed project, undertaken in accordance with the EIA Directive and the relevant Irish legislation.
Environmental Impact Assessment Report (EIAR)	The report prepared by the Applicant to describe the findings of the EIA for the CWP Project.
ESB Dolphin	A rectangular structure, previously used for mooring ships, is now managed by ESB as a common tern nesting platform.
ESBN network cables *(previously the ESB grid connection)*	Three onshore export cable circuits connecting the onshore substation to the proposed ESBN Poolbeg substation, which will then transfer the electricity onwards to the national grid.
export cables	The cables, both onshore and offshore, that connect the offshore substations with the onshore substation.
landfall	The point at which the offshore export cables are brought onshore and connected to the onshore export cables via the transition joint bays (TJB). For the CWP Project The landfall works include the installation of the offshore export cables within Dublin Bay out to approximately 4 km offshore, where water depths that are too shallow for conventional cable lay vessels to operate.
mean high water springs	The mean height of high water during spring tides in a year. As per the MAP definition, this is high water of ordinary or medium tides is the same as the HWM (high water mark).

Glossary	Meaning
mean low water springs	The mean height of low water during spring tides in a year.
mean-max foraging range	A foraging range calculated as the maximum reported range that a species for each colony is known to have foraged, based on the literature review undertaken by Woodward et al. (2019)
offshore export cables	The cables which transport electricity generated by the WTGs from the offshore substation structure (OSSs) to the TJBs at the landfall.
offshore export cable corridor (OECC)	The area between the Array Site and the landfall, within which the offshore export cables cable will be installed along with cable protection and other temporary works for construction.
offshore infrastructure	The permanent offshore infrastructure, comprising of the WTGs, IACs, OSSs, Interconnector cables, offshore export cables and other associated infrastructure such as cable and scour protection.
onshore transmission infrastructure (OTI)	The onshore transmission assets comprising the TJBs, onshore export cables and the onshore substation. The EIAR considers both permanent and temporary works associated with the OTI.
operations and maintenance (O&M) activities	Activities (e.g., monitoring, inspections, reactive repairs, planned maintenance) undertaken during the O&M phase of the CWP Project.
O&M phase	This is the period of time during which the CWP project will be operated and maintained.
parameters	Set of parameters by which the CWP Project is defined and which are used to form the basis of assessments.
Phase 1 Project	Under the special transition provisions in the Maritime Area Planning Act 2021, as amended (the MAP Act), the Minister for the Department of Environment, Climate and Communications (DECC) has responsibility for assessing and granting a Maritime Area Consent (MAC) for a first phase of offshore wind projects in Ireland. The Phase 1 Projects include Oriel Wind Park, Arklow Bank II, Dublin Array, North Irish Sea Array, Codling Wind Park and Skerd Rocks. A MAC has since been granted by DECC for each of the Phase 1 Projects.
Stochastic Collision Risk Modelling (sCRM)	A method to estimate the risk of collision to seabirds from operational turbines. This varies from deterministic CRM as it incorporates uncertainty in input parameters through defining a distribution, and subsequently iterates through model estimates to present a range of collision estimates - commonly reported with a median and confidence intervals.
transition joint bay (TJB)	This is required as part of the OTI and is located at the landfall. It is an underground bay housing a joint which connects the offshore and onshore export cables.
zone of Influence (ZoI)	Spatial extent of potential impacts resulting from the project.

10 ORNITHOLOGY

10.1 Introduction

1. Codling Wind Park Limited (hereafter 'the Applicant') is proposing to develop the Codling Wind Park (CWP) Project, which is located in the Irish Sea approximately 13–22 km off the east coast of Ireland, at County Wicklow.

2. This chapter forms part of the Environmental Impact Assessment Report (EIAR) for the CWP Project. The purpose of the EIAR is to provide the decision-maker, stakeholders and all interested parties with the environmental information required to develop an informed view of any likely significant effects resulting from the CWP Project, as required by the European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) (the Environmental Impact Assessment (EIA) Directive).

3. This EIAR chapter describes the potential impacts of the CWP Project's offshore and onshore infrastructure on ornithological receptors during the construction, operation and maintenance and decommissioning phases.

4. In summary this EIAR chapter:
   - Details the EIA scoping and consultation process undertaken, setting out the scope of the impact assessment for ornithological receptors;
   - Identifies the key legislation and guidance relevant to ornithological receptors, with reference to the latest updates in guidance and approaches;
   - Confirms the study area for the assessment and presents the impact assessment methodology for ornithological receptors;
   - Describes and characterises the baseline environment for ornithological receptors established from desk studies, project survey data and consultation;
   - Defines the project design parameters for the impact assessment and describes any primary mitigation measures relevant to the ornithological assessment;
   - Presents the assessment of potential impacts on ornithological receptors and identifies any assumptions and limitations encountered in compiling the impact assessment; and
   - Details any additional mitigation and / or monitoring necessary to prevent, minimise, reduce or offset potentially significant effects identified in the impact assessment.

5. The assessment should be read in conjunction with **Appendix 10.1 Cumulative Effects Assessment (CEA)**, which considers other plans, projects and activities that may act cumulatively with the CWP Project and provides an assessment of the potential cumulative impacts on ornithological receptors.

6. A summary of the CEA for ornithological receptors is presented in **Section 10.11**.

7. Additional information to support the assessment includes:
   - **Appendix 10.1 Cumulative Effects Assessment;**
   - **Appendix 10.2 Representative Scenario and Limits of Deviation Assessment;**
   - **Appendix 10.3 Collision Risk Modelling;**
   - **Appendix 10.4 Offshore Ornithology Displacement;**
   - **Appendix 10.5 Offshore Ornithology Baseline Characterisation Report;**
   - **Appendix 10.6 Ornithology figures showing acoustic and visual disturbance areas to intertidal waterbirds considered during the construction phase of the intertidal OECC and landfall;**
   - **Appendix 10.7 Collision Risk Modelling of Kittiwake;**
   - **Appendix 10.8 Onshore Ornithology Baseline Characterisation Report;**

- **Appendix 10.9 Investigation of disturbance tolerance of terns breeding near to the onshore substation site;**
- **Appendix 10.10 Black guillemot Survey 2023;**
- **Appendix 10.11 Intertidal disturbance and displacement - magnitude of impact and residual effects;**
- **Appendix 10.12 Ornithological receptor tolerance – offshore construction phase prey effects;** and
- **Appendix 10.13 Onshore substation shadow study.**

10.2 Consultation

8. Consultation with statutory and non-statutory organisations is a key part of the EIA process. Consultation with regard to offshore and onshore ornithology has been undertaken to inform the approach to and scope of the assessment.

9. The key elements of this consultation to date have included EIA scoping, consultation events and ongoing topic-specific meetings with key stakeholders. The feedback received throughout this process has been considered in preparing the EIAR. EIA consultation is described further in **Chapter 5 EIA Methodology,** the **Planning Documents** and in the **Public and Stakeholder Consultation Report**, which has been submitted as part of the development consent application.

10. **Table 10-1** provides a summary of the key issues raised during the consultation process relevant to ornithology and details how these issues have been considered in the production of this EIAR chapter.

Table 10-1 Consultation responses relevant to ornithology

Consultee	Comment	How issues have been addressed
Scoping responses		
Marine Management Organisation (MMO) 10 December 2020	It is not considered by the MMO that there is any transboundary issue to comment on here. We have much closer European windfarms in the North Sea and we don't usually comment as long as they are within their own boundaries.	Noted, no further action required.
Department of Agriculture, Environment and Rural Affairs (DAERA) 25 January 2021	Natural Environment Division have no comments to make.	Noted, no further action required.
National Parks and Wildlife Service (NPWS) 26 January 2021	No comments to make on scoping report.	Noted, no further action required.
Marine Scotland (MS) 28 January 2021	Marine Scotland-Licensing Operations Team has no comments on the scoping report.	Noted, no further action required.
Marine Institute (MI) 03 February 2021	Establishing a baseline is critical to assessing likely impact of the	Baseline conditions have been assessed by means of a suite of at sea

Consultee	Comment	How issues have been addressed
	activities as well as any future monitoring. It is important to assist in identifying the likely impacts of the proposed development on the environment. It is the advice of the Marine Institute that the scale of effects of the proposed development be considered beyond the footprint of the turbines and the licenced area. Comment on concerns over sufficient inclusivity of relevant species and Special Protection Area (SPA) colonies and how any species can be screened out given importance of north Irish Sea for seabirds. Common scoter (Actitis hypoleucos) not included in Table 11.7 [of submitted document], despite being SPA species in Dundalk region and occurring around Meath. MI is also a source of seabird data in the Irish Sea.	and intertidal surveys, spanning a number of years. A comprehensive review of baseline conditions, along with details of the screening process, is provided in **Appendix 10.5 Baseline Characterisation Report**. Baseline conditions have been assessed beyond the footprint of the turbines and licenced area by means of inclusion of survey buffers. In response to consultation responses and the designation of North-west Irish Sea SPA (2023), the southern edge of which lies less than 2 km from the northern extent of the OECC, and for which Common scoter in a non-breeding Special Conservation Interest (SCI), assessment of impacts to Common scoter of works within the OECC has been incorporated into this impact assessment.
Department of Agriculture, Environment and Rural Affairs (DAERA) 23 February 2021	Retention of some concerns regarding collision risk mortality during non-breeding season, particularly during migration periods, which could also contribute to a wider cumulative risk in-combination with other Irish Sea projects. Chief concerns relate to terns, Kittiwake (*Rissa tridactyla*) and Lesser black-backed gull (*Larus fuscus*). Comment that component species of breeding seabird assemblage features of SPAs should be treated similarly to qualifying features. Consideration of Fulmar (*Fulmarus glacialis*) from Rathlin Island SPA would therefore require consideration by the impact assessment.	Collision Risk Modelling (CRM) has been carried out, with collision mortality being estimated during all months of the year. Further information on CRM carried out can be found in **Appendix 10.3 Collision Risk Modelling**. A cumulative effect assessment (CEA) has been undertaken with other Irish Sea projects (**Section 10.11**). Fulmar has been included in the assessment due to there being internationally designated sites (breeding) within mean maximum foraging range +1 Standard Deviation (SD) of the CWP array site, which includes Rathlin Island SPA. **Section 10.6** provides a list of SPAs and relevant SCI features designated therein. More distant conservation sites considered for ornithological connectivity with the CWP array site are detailed in **Appendix 10.1 Ornithology Cumulative Effects Assessment**.
Irish Wildlife Trust (IWT)	No response provided.	Noted, no further action required.

Consultee	Comment	How issues have been addressed
30 April 2021		
BirdWatch Ireland (onshore ornithology)	No comment in relation to onshore ornithology	The Applicant has continued to seek engagement with BirdWatch Ireland across onshore and offshore matters, and applied best practice to the EIA.
An Taisce (onshore ornithology)	No comment in relation to onshore ornithology	The Applicant has continued to seek engagement with An Taisce across onshore and offshore matters, and applied best practice to the EIA.
Topic-specific meetings (summary of discussions)		
National Parks and Wildlife Service (NPWS) 27 February 2020	Queried what analysis was being undertaken to show bird feeding usage of areas known for sandeels.	The DAS data have been used to determine densities of birds, in order to predict the potential impacts arising across the study area (**Section 10.6**).
	There should be a high-level consideration / knowledge of the impacted prey base from pile driving and the consequences of the OWF on future prey resource.	The benthic conditions, effects on physical processes and underwater noise modelling etc are used to determine sandeel distribution and the possible effects on prey resource and indirect effects on ornithological features.
	Queried how CWP contextualise bird prey base within the CWP Project footprint and outside compared to other areas around the project area.	A wide variety of baseline data are collated as part of the EIA process, including the use of reference sites from outside the zone of Influence (ZoI) in order to draw comparisons.
	Queried whether in literature there were details of the impacts of noise on diving birds.	There is no evidence of underwater noise impact affecting bird species. This is addressed as part of impacts during construction (**Section 10.10**).
	Queried whether CWP had considered the regional context of species importance and advised to look into datasets that are non-site specific, in particular the Department paper on the Seasonal distribution and abundance of seabirds in the western Irish Sea (2016) [Jessopp et al., 2018] which shows the type of analysis needed by CWP to put CWP into context and assist with the CEA.	This reference has been used as part of the desk-based study which is presented in the baseline characterisation in **Section 10.6**. The CEA, which draws on the baseline information, is summarised in **Section 10.11**.
	For CEA, advised using min / max scenarios, where min includes only consented	The methods used for the CEA are presented in **Appendix 10.1**

Consultee	Comment	How issues have been addressed
	projects, and max also includes projects that could be consented between assessment and works commencing.	**Ornithology Cumulative Effects Assessment**.
	Queried whether significant diurnal migration was noticed, and queried whether other than marine birds, there are any other flags for other migratory birds e.g., passerines (Passeriformes).	Nocturnal surveys were not undertaken, but an estimate of nocturnal movements of relevant species is taken into account in the migratory collision risk analysis (**Appendix 10.3 Collision Risk Modelling**).
	Queried the estimation of flight height from aerial surveys, and whether previous boat-based surveys used a laser range finder.	Flight-height data used for the assessment come from both collated data (Johnston et al., 2014) and the site-specific boat-based surveys where appropriate (**Appendix 10.5 Baseline Characterisation Report**). A laser range-finder was used for training and calibration purposes.
	Advised that there is a breeding common tern (*Sterna hirundo*) colony in the River Tolka Estuary & South Dublin Bay SPA that should be considered when determining whether spring / summer landfall surveys are needed as part of landfall surveys.	Staging tern-specific surveys have been carried out in the vicinity of the River Tolka Estuary and South Dublin Bay SPA (**Section 10.4**). Further details can be found in **Appendix 10.5 Baseline Characterisation Report**.
	Advised that BirdWatch Ireland and Marine Institute are consulted for relevant tern data for South Dublin Bay, and there is a paper to be published in Irish Birds.	Information relating to terns in South Dublin Bay was sought from Birdwatch Ireland via the South Dublin Bay Birds Project. See **Section 10.4 Impact assessment**.
Marine Institute (MI) 6 May 2021	Meeting on Offshore Scoping – Ornithology. No further key comments raised beyond those from 3 February 2021 (above).	
National Parks and Wildlife Service (NPWS) 5 October 2022	Meeting to discuss approach to assessment within EIAR including CRM modelling.	No major comments on approach.
NPWS: onshore ornithology: 26 October 2022	Discussion regarding onshore ornithology including breeding tern disturbance survey. Recommended the consideration of: - Screening requirements at perimeter of the onshore	Construction mitigation relative to the breeding tern colonies including screening proposals are addressed in **Section 10.11.2** (Onshore and Estuarine / Liffey - Construction: Impact 2 - Disturbance and displacement).

Consultee	Comment	How issues have been addressed
	substation for the construction phase - The potential for shading impacts on the breeding tern colonies as a result of the onshore substation buildings - The onshore substation buildings increasing the potential for perching predators during the operational phase	A shade assessment relative to the breeding tern colonies along with mitigation relating to screening during the construction stage is addressed in **Section 10.10** Mitigation relating to perch potential at the onshore substation is addressed in **Section 10.9**.
Review of Method Statement Offshore Wind Ornithology Assessment for East Coast Phase 1 Projects – National Parks and Wildlife Service (NPWS) November 2023	NPWS Published the summary review of the Method Statement - Offshore Wind Ornithology Assessment for East Coast Phase 1 Projects.	The response was received and the feedback has informed the assessment where applicable, notably the running of CRM with revised flight speeds for Kittiwake (**Appendix 10.7 Kittiwake Collision Risk Modelling**). The approaches used in this chapter agree with this by: - Using sCRM to inform collision impacts, and specifically using site-specific flight height data to inform these CRMs. - Using a matrix approach to inform disturbance and displacement impacts in the absence of individual-based models being developed for use in Ireland.
BirdWatch Ireland (June 2024)	Meeting to discuss approach to assessment within the EIAR and NIS, key mitigations and initial conclusions, and proposed monitoring.	Meeting was to provide overview and update, limited updates required following discussion.

10.3 Legislation, policy and guidance

10.3.1 Legislation

11. The main legislation that is applicable to the assessment of offshore and onshore ornithology is summarised below. Further detail is provided in **Chapter 2 Policy and Legislative Context**.

- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations;
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, hereafter referred to as the Birds Directive;
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive;

- The Conservation (Natural Habitats and c.) Regulations 1994 (as amended);
- The Conservation of Offshore Marine Habitats and Species Regulations 2017; and
- Ramsar Convention on Wetlands of International Importance 1971.

10.3.2 Policy

12. The overarching planning policy relevant to the CWP Project is described in EIAR **Chapter 2 Policy and Legislative Context**.

13. The assessment of the CWP Project against relevant planning policy is provided in the **Planning Report**.

10.3.3 Guidance

14. The principal guidance and best practice documents used to inform the assessment of potential impacts on offshore and onshore ornithology is summarised below.

15. Guidance relevant to all project infrastructure:

- Environmental Protection Agency (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available at: https://www.epa.ie/news-releases/news-releases-2022/epa-publishes-guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment-reports.php [Accessed: May 2023].
- Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2019/02/Combined-EcIA-guidelines-2018-compressed.pdf [Accessed: May 2023].
- Department of Environment, Community and Local Government (2018). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).
- Department of Communications, Climate Action and Environment & Sustainable Energy Authority of Ireland (2017). Guidance on EIS and NIS Preparation for Offshore Renewable Projects.
- European Commission (2017). Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report.
- Environmental Protection Agency (2003). Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

16. Guidance relevant to onshore infrastructure:

- Gilbert, G., Stanbury, A., & Lewis, L. (2021). Birds of Conservation Concern in Ireland 4: 2020–2026. *Irish Birds*, *43*, 1-22.
- McGuinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S., & Crowe, O. (2015). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland. *BirdWatch Ireland, Kilcoole, Wicklow*.
- NatureScot (2016). Assessing Connectivity with Special Protection Areas (SPAs). (SNH, 2016) Available from: https://www.nature.scot/doc/assessing-connectivity-special-protection-areas [Accessed: May 2023].
- NatureScot (2017). Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms Available from: https://www.nature.scot/doc/recommended-bird-survey-methods-inform-impact-assessment-onshore-windfarms [Accessed: May 2023].

17. Guidance relevant to offshore infrastructure:

- ABPmer, (2023). Review of Method Statement, Offshore Wind Ornithology Assessment for East Coast Phase 1 Projects, ABPmer, Report No. R.4394. A report produced by ABPmer for An tSeirbhis Páirceanna Náisiúnta agus Fiadhúlra (National Parks and Wildlife Service), November 2023.
- Band, W. (2012). Using a collision risk model to assess bird collision risks for offshore wind farms. Report to The Crown Estate Strategic Ornithological Support Services (SOSS), SOSS-02.
- Chartered Institute of Ecology and Environmental Management (2019). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Coastal and Marine. Available at: https://infrastructure.planninginspectorate.gov.uk/ [Accessed: May 2023].
- Department of Communications, Climate Action & Environment (2017). Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects. Available at: https://www.gov.ie/en/publication/3d6efb-guidance-documents-for-offshore-renewable-energy-developers/ [Accessed: May 2023].
- Department of the Environment, Climate and Communications (2018). Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects Parts 1 & 2 Available at: https://www.gov.ie/en/publication/3d6efb-guidance-documents-for-offshore-renewable-energy-developers/ [Accessed: May 2023].
- Furness, R. W. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, (164).
- Joint UK Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments. (UK SNCBs, 2017).
- McGregor, R. M., King, S., Donovan, C. R., Caneco, B. and Webb, A. (2018). A Stochastic Collision Risk Model for Seabirds in Flight. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/factsheet/2021/02/stochastic-collision-risk-model-for-seabirds-in-flight/documents/full-report/full-report/govscot%3Adocument/full%2Breport.pdf [Accessed: May 2023].
- Natural England interim advice on updated Collision Risk Modelling parameters (Natural England, 2022).
- NatureScot (2017). Interim guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs. Available at: https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations. [Accessed: May 2023].
- Searle, K., Mobbs, D., Daunt, F., & Butler, A. (2019). A population viability analysis modelling tool for seabird species. Natural England Commissioned Reports, Number 274.
- Woodward, I., Thaxter, C. B., Owen, E., & Cook, A. S. C. P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report, (724).

10.4 Impact assessment

18. **Chapter 5 EIA Methodology** provides a summary of the general impact assessment methodology applied to the CWP Project, which includes the approach to the assessment of transboundary and inter-related effects. The approach to the assessment of cumulative effects is provided in **Chapter 5, Appendix 5.1 CEA Methodology**.

19. The following sections confirm the methodology used to assess the potential impacts on offshore and onshore ornithology.

10.4.1 Study areas

20. As an overarching principle the chapter is split into four receptor groups, which correspond with four study areas. It is acknowledged that certain species may utilise multiple study areas, occur across the terrestrial and marine environments, and as such may be exposed to impacts across the CWP Project. Where this occurs, the chapter identifies clearly where the assessment presented has been consolidated for ease of review.

21. The receptor groups and study areas are as follows:

- Offshore: comprises the array site and the OECC up to Mean Low Water Springs (MLWS);
- Intertidal: comprises the OECC between MLWS and Mean High Water Springs (MHWS);
- Onshore: comprises infrastructure above MHWS; and
- Estuarine / Liffey: comprises the Liffey River up to MHWS and the river Liffey.

22. MHWS and MLWS are adopted in the definition of the study areas for ornithology to align with the intertidal definition presented within some of the relevant documentation used to inform the assessment, including the conservation objectives supporting document for the South Dublin Bay and River Tolka SPA.

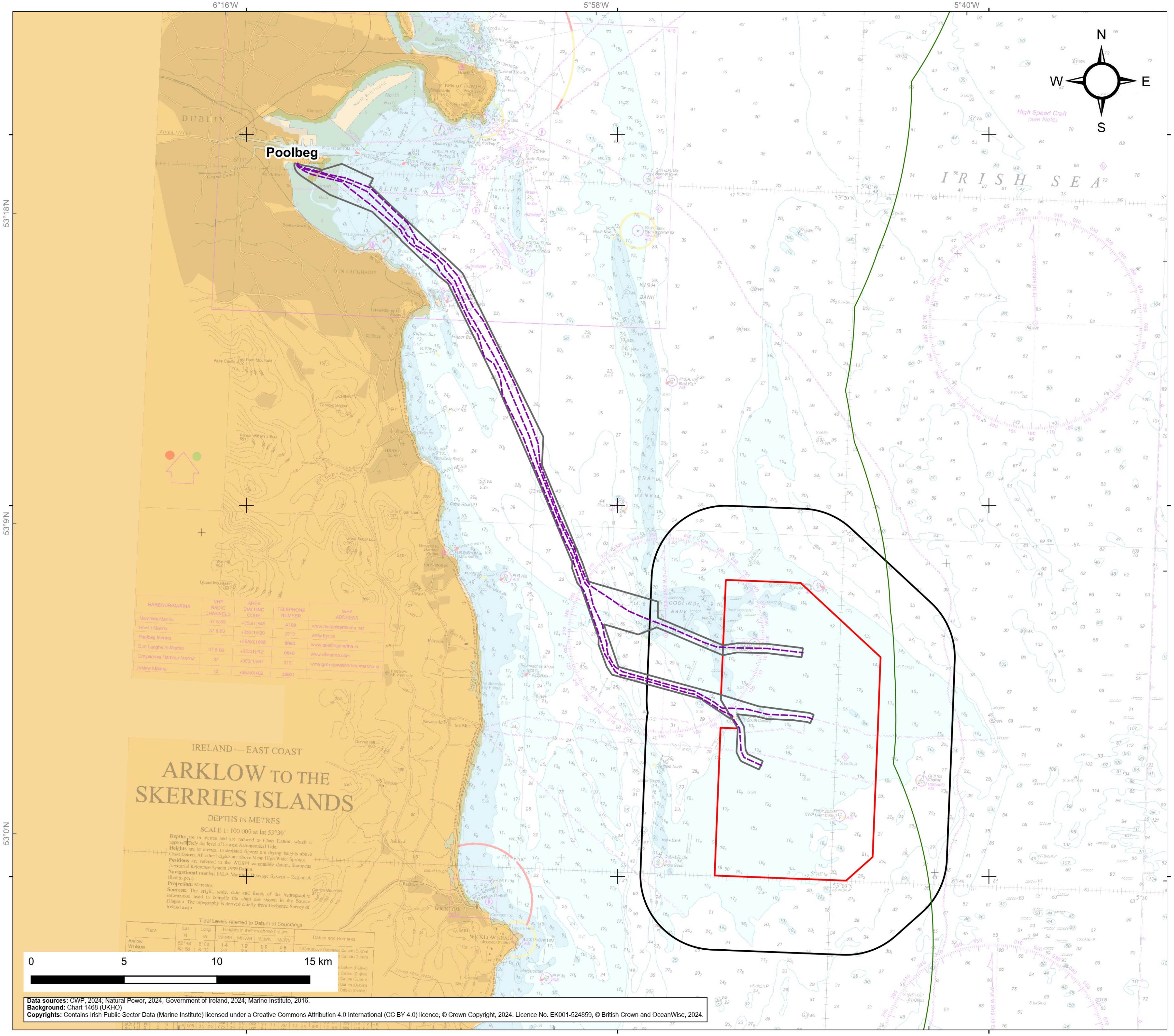
Offshore – array site and OECC

23. Offshore study areas for the ornithological assessment have been determined in relation to impacts associated with proposed works within the array site and the OECC up to MLWS. The following sections provide the study areas associated with each component of the proposed development.

24. The study area for offshore ornithology is defined as the offshore elements of the offshore development area plus the ZoI for offshore ornithology receptors. The study area has been defined through reference to the offshore development area, as this represents the area in which construction and operation of the development will take place, with the Marine Safety Demarcation Area being used only for short term navigation safety activities such as deployment of buoyage.

25. In accordance with Irish guidance relating to offshore ornithological baseline dataset collection survey design (Department of Communications, Climate Action & Environment, 2018), this has been defined as a 4 km buffer and this is considered to represent a general realistic maximum spatial extent of potential impacts on offshore ornithological receptors. It is, however, acknowledged that, for Red-throated diver, distribution responses to OWF infrastructure may occur over larger distances (i.e., Garthe et al., 2023) and this is duly considered in impact assessments for this species. The study area for the offshore ornithology assessment includes the array site with a 4 km buffer, and the OECC up to MLWS at the landfall site at Poolbeg.

26. Digital aerial and boat-based surveys were focussed on the array site plus a 4 km buffer. The OECC beyond the 4 km buffer of the array site (**Figure 10-1**) was not included in the area covered by site-specific digital aerial and boat-based surveys. Based on the predicted level of impact arising from cable laying on seabirds, the use of existing data sources is considered sufficient to characterise ornithological baseline conditions for the OECC for the purposes of the EIA Report, as per recent precedent from UK wind farms such as Berwick Bank (Pelagica and Cork Ecology, 2022) and Hornsea Project 4 (APEM, 2019).



Data sources: CWP, 2024; Natural Power, 2024; Government of Ireland, 2024; Marine Institute, 2016.
Background: Chart 1468 (UKHO)
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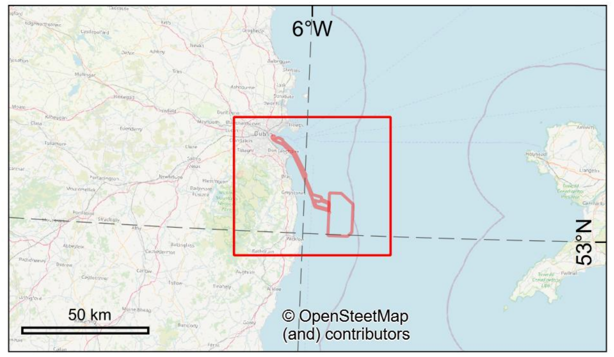


Legend

- Array site
- 4 km buffer from array site
- Offshore export cable
- Offshore export cable corridor
- 12 nautical mile limit

Project: Codling Wind Park
Contractor: www.naturalpower.com

Figure 10.1
Offshore ornithology study area

CWP doc. number: CWP-NPC-ENG-08-01-MAP-1172

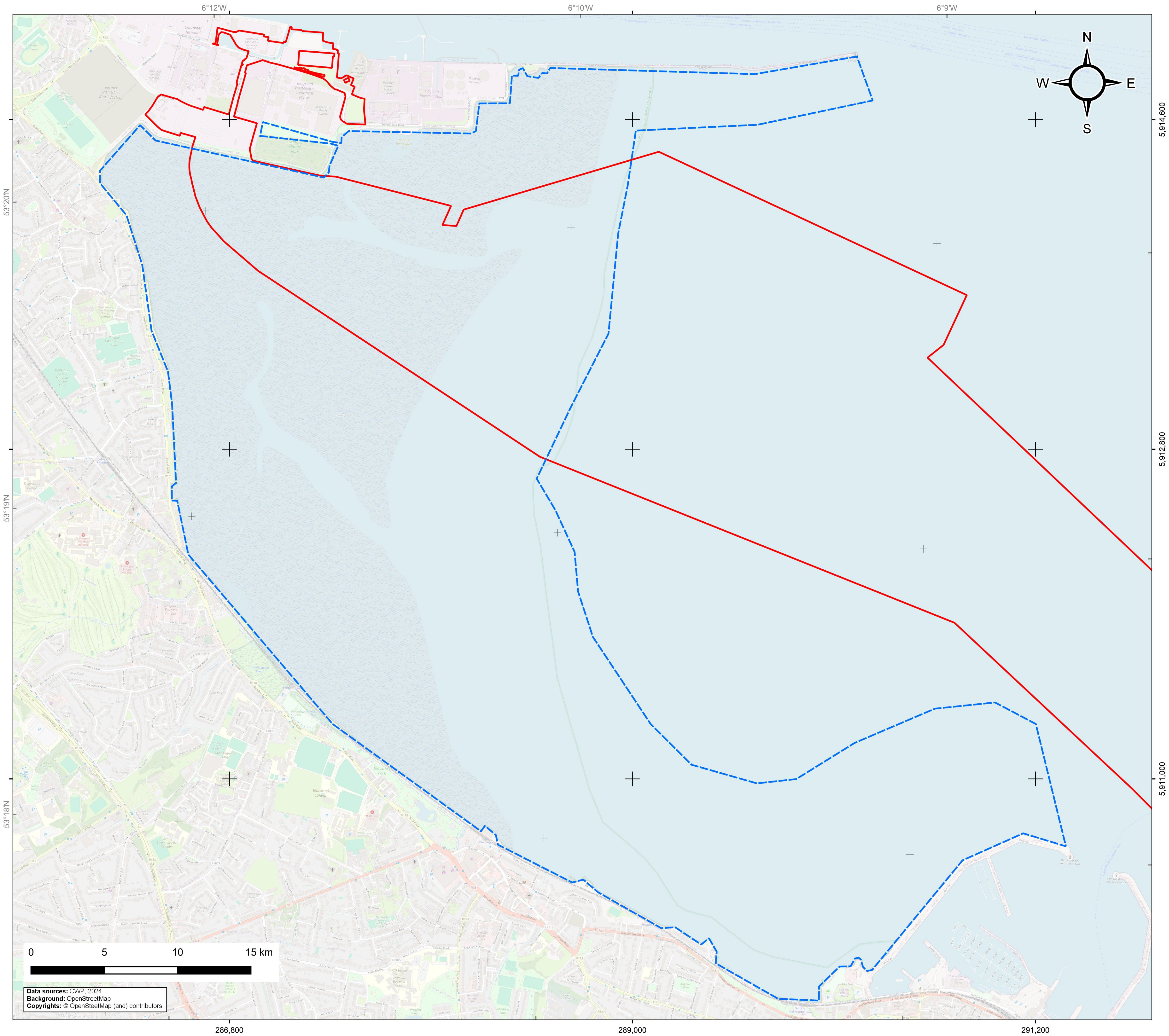
Internal descriptive code: WE - WF.RLB. BUFF.4km..OECC.PB.RLB..OECs.3PB. Opt8 - SEA.LIMs - (EIAR.Vol.03.Ch.10.FIG.01)
Size: A3
Scale: 1:200,000
CRS: EPSG 25830

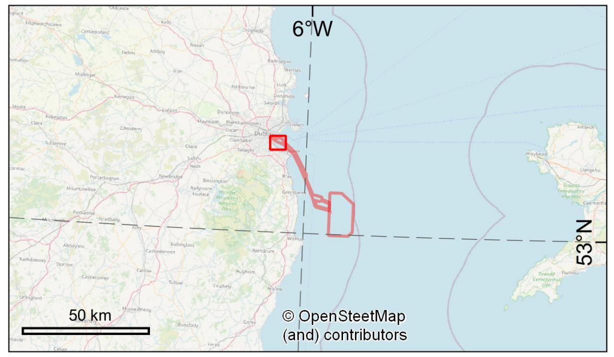
Rev.	Updates	Date	By	Chk'd	App'd
A	First issue	2024/07/18	AC	FM/EA	CP
B	Final version	2024/08/13	AC	FM/EA	CP

Intertidal (<MHWS)

27. The intertidal study area for the Ornithological assessment comprises the landfall area between MLWS and MHWS within South Dublin Bay as shown in **Figure 10-2**. This is considered to cover the range of assessed impacts, and is in line with the ZoI of the project for the intertidal area, which is defined as the outer reaches of the low acoustic and visual disturbance thresholds (Cutts et al., 2013; see **Section 10.11.2** Construction impact 2 – Disturbance and displacement).

28. The intertidal ornithology study area is congruous with the Irish Wetlands Birds Survey (I-WeBS) 'Dublin Bay' site, and encompasses the intertidal area between the Great South Wall at its northernmost extent, adjacent to the Liffey, and the northern harbour wall of Dun Laoghaire, at the south end of the site. The rationale for selecting this study area is such that baseline data collected using the adapted I-WeBS methodology could be complimented by existing I-WeBS data. Furthermore, at the time ornithology baseline surveys were commencing (autumn 2019), the exact landfall location within South Dublin Bay was still unknown. The ornithology study area selected ensured comprehensive baseline coverage of South Dublin Bay, so that data would be available against which to assess impacts from activities at most locations within the study area. Finally, given the spatial extents over which acoustic and visual impacts have the potential to impact bird populations, impacts to intertidal waterbirds have the potential to extend beyond the OECC as it passes through the intertidal landfall area. Inclusion of baseline observations from the entirety of the intertidal ornithological study area within South Dublin Bay allows for comprehensive assessment of impacts to SPA features beyond the delineation of the intertidal OECC.





Legend

- Planning Application Boundary (PAB)
- Intertidal landfall survey area

Project: Codling Wind Park	Contractor: www.naturalpower.com

Figure 10.2
Site specific survey area

CWP doc. number: CWP-NPC-ENG-08-01-MAP-1173

Internal descriptive code:	*Size:* A3	*CRS:*
PB..DLH - PAB - SAFITS - EIAR.FIG.10.02	*Scale:* 1:20,000	EPSG 25830

Rev.	*Updates*	*Date*	*By*	*Chk'd*	*App'd*
A	Final version	2024/07/18	AC	FM/EA	CP

Onshore (>MHW (South Dublin Bay) – MHW(Liffey))

29. The study area for onshore ornithology addresses the onshore transmission infrastructure (OTI) and landfall situated within the Poolbeg Peninsula. This includes the transition joint bays (TJBs), onshore export cables, the onshore substation and the Electricity Supply Board Networks (ESBN) network cables to connect the onshore substation to the Poolbeg 220 kV substation. This onshore study area will also describe the potential impacts of the works at the landfall (landward of the MHW), where the offshore export cables are brought onshore and connected to the onshore export cables at the TJBs.

30. The study area also considers sensitive receptor sites within and around the Poolbeg Peninsula including the Electricity Supply Board (ESB) Poolbeg Generation Station (used by breeding Peregrine falcon *[Falco peregrinus*]) the grassland immediately south of the Ringsend WWTP (known as ‘Goose Green’), which forms part of the South Dublin Bay and River Tolka Estuary SPA and amenity areas such as Irishtown Nature Park and Sean Moore Park. The study area for onshore ornithology is shown on **Figure 10-3.**

Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- Onshore ornithology study area
- Peregrine Falcon survey vantage points

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.3
Terrestrial ornithology study area

CWP doc. number: CWP-TOB-ENG-08-01-MAP-1174

Internal descriptive code: PB - PAB..SS.PP.PL - HWM..ORNTH.ONSH..PER.FALC. S.VANTAGE.POINTS - (EIAR.Vol.03.Ch.10.FIG.03)

Size: A3

Scale: 1:10,000

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES

Estuarine / Liffey – (<MWHS – river)

31. The study area for the Estuarine / Liffey is focused near the onshore substation including the adjacent rock armour and quay walls and extends into the River Liffey located on the north side Poolbeg Peninsula in County Dublin. The study area also considers sensitive receptor sites within the River Liffey including the Coal Distribution Limited (CDL) and ESB mooring dolphins (used by breeding Common and Arctic tern (*Sterna paradisaea*)). The mooring dolphins form the Dolphins, Dublin Docks pNHA, with the ESB mooring dolphin also forming part of the South Dublin Bay and River Tolka Estuary SPA. The study area also considers other jetties and piers extending into the river. The estuarine / Liffey study area is shown on **Figure 10-4**.

Legend

- Planning application boundary
- Onshore substation boundary (operational)
- High water mark
- Estuarine/Liffey ornithology study area

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.4

Estuarine/Liffey ornithology study area

CWP doc. number: CWP-TOB-ENG-08-02-MAP-1517

Internal descriptive code:	Size: A3	CRS:
PB - PAB_SS.PP.PL - HWM_ORNTH.ONSH.ESTU.LIFFEY - (EIAR.FIG.10.04)	Scale: 1:10,000	EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES

10.4.2 Data and information sources

32. The following sections describe the data and information sources used to inform the assessment of impacts associated with the offshore components, the intertidal components, the onshore components and the estuarine / Liffey components of the CWP Project. A summary of target species for each survey – these are the types of species on which data were collected during the survey; i.e., included species that were not scoped into this assessment if they were not recorded to a level that met this criteria.

Offshore

Target species

33. For site-specific surveys in relation to the offshore elements of the CWP Project, target species were considered to be all seabird species which utilise the array site or surrounding buffer areas during breeding or wintering periods, or during pre and post breeding migrations.

34. Incidental records of migratory non-seabird species recorded on passage over the array site or surrounding buffer areas were also collected.

Site specific surveys

35. To provide a site-specific and up to date baseline characterisation upon which to base the impact assessment, data from the following contemporary site characterisation surveys were utilised:

- Array site (plus 4 km buffer):
    - 24 digital aerial surveys, undertaken approximately monthly between May 2020 and April 2022; and
    - 15 boat-based European Seabirds at Sea (ESAS) surveys, undertaken approximately monthly between October 2018 and August 2020.
    - This provides a total of 43 consecutive months survey across two platforms, which is considered a comprehensive dataset against which to assess the potential impacts of the proposed project array.
- Export cable route intertidal landfall area:
    - 81 intertidal diurnal landfall surveys, undertaken approximately twice per month (excluding April 2020 and early May 2020) between October 2019 and March 2023; and
    - Eight intertidal crepuscular landfall surveys (to characterise site use by roosting tern aggregations), four each year between mid-July and mid-September in 2020 and 2021.

36. Survey methodologies followed industry best-practice and were provided to consultees for comment, as noted in **Table 10-1**. Detailed information on site-specific survey methodologies is provided in **Appendix 10.5 Baseline Characterisation Report.**

Desk study

37. In addition to site-specific surveys, a comprehensive desk-based review was undertaken to inform the baseline for offshore and intertidal ornithology. Key data sources used to inform the assessment are set out in **Table 10-2**. Further information relating to the desk-based review for offshore ornithology is provided in **Appendix 10.5 Baseline Characterisation Report**.

Table 10-2 Key data sources

Data	Source	Date
SPAs	NPWS website	2023
Seabird Count national colony census data	Seabird Monitoring Programme website	2015–2021
I-WeBS data	BWI website and data requests to BWI	2016/17–2020/21
South Dublin Bay roosting tern survey data	Dublin Bay Birds Project and BWI website	2008–2018
Urban gull survey	NPWS website	2021
Breeding seabirds	NPWS website	2013–2018

Intertidal (between MLWS and MHWS)

Target species

38. For site-specific surveys in relation to the intertidal elements of the CWP Project, target species were considered to be bird species listed under at least one of the following:

- Annex I of the Birds Directive;
- Red and amber Listed Birds of Conservation Concern Ireland (BoCCI; Gilbert et al., 2021); or
- SCIs of SPAs within the ZoI of the project for the intertidal area.

39. Species which do not meet the above criteria were not included for further assessment. These include terrestrial species such as passerines and birds of prey. It is considered that these species within South Dublin Bay and adjacent connected habitats are not at risk of direct habitat loss at significance levels above imperceptible, and / or neither are they considered likely to utilise South Dublin Bay and its connected habitats any more than minimally. Target species recorded during site-specific intertidal surveys were categorised into the following species groups:

- Waders;
- Gulls and terns;
- Seabirds, divers and grebes;
- Wildfowl; and
- Other waterbirds.

40. ‘Red-listed’ species are those of highest conservation priority, being globally threatened, declining rapidly in abundance or range, or having undergone historic declines from which they have not recently recovered (Gilbert et al., 2021). ‘Amber-listed’ species have an unfavourable status in Europe, have moderately declined in abundance or range, a very small population size, a localised distribution, or occur in internationally important numbers (Gilbert et al., 2021).

Intertidal ornithological surveys: adapted I-WeBS

41. Point counts of intertidal habitats and inshore waters were undertaken in line with standard I-WeBS methodology, altered to account for spatial distributions and behaviours as per the Low Tide Waterbird Survey Method developed by BirdWatch Ireland and the NPWS (Lewis & Tierney, 2014). Counts were timed to provide approximately equal survey effort coverage during all tidal states.

42. Surveys were undertaken on a twice-monthly basis throughout the year (as opposed to once-monthly counts taking place during the winter months only, as per standard I-WeBS methodology), commencing in October 2019 and continuing until September 2021.

43. Count locations were visited twice per month, with coverage alternating between high / low tide one month and rising / falling tide the next in order to provide approximately equal survey effort coverage during all tidal states.

44. Counts were conducted from suitable vantage points (VPs) in supra-tidal areas by two surveyors, with both surveyors coordinating survey coverage to ensure complete coverage of the survey, while minimising the potential for double counting. In most diurnal surveys and all post-breeding tern aggregation surveys surveyors worked concurrently for the duration of the survey.

45. The species, numbers and behaviours of birds within the survey area was noted, and the locations of flocks and individuals mapped onto high resolution field maps.

46. In addition, surveyors collected information relating to any disturbance events observed during adapted I-WeBS counts and weather the conditions during surveys. Surveys were not conducted where conditions were considered to prevent proper counts being undertaken, specifically during high wind speeds (>Beaufort 5) or periods of low visibility.

Post-breeding tern aggregation surveys

47. During the periods in which staging terns were present within South Dublin Bay (mid-July to mid-September 2020 and 2021), additional surveys timed to coincide with dusk were undertaken; four in each year.

48. Surveys aimed to capture the numbers, distributions and species compositions of post-breeding tern aggregations present within the Poolbeg survey area. The survey methodology was adapted from that used for post-breeding aggregations of roosting terns counts carried out by BirdWatch Ireland between 2013 and 2016.

49. Visits were timed to begin two hours before sunset and continued until approximately civil twilight or approximately 15 minutes after sunset. Visits were timed to take place on a high or rising tide, if possible, (with high water occurring within one to two hours of sunset) so that the birds were more concentrated. The surveyor recorded all terns within the survey area and included as much additional information as possible with details such as numbers, species composition of flocks, behaviour etc.

50. As with the adapted I-WeBS surveys, surveyors collected information relating to any disturbance events and weather the conditions during surveys. Surveys were not conducted where conditions were considered to prevent proper counts being undertaken, using the same criteria as outlined under the adapted I-WeBS methodology, above.

Desk study

51. A desk-based review was carried out in relation to intertidal ornithology. **Table 10-3** below shows the literature data sources used to determine baseline characterisation of the landfall survey area.

Table 10-3 Data sources used to determine baseline characterisation of the intertidal study area

Source	Date	Summary	Coverage of study area
Contemporary site-specific baseline characterisation surveys			
Diurnal tidal landfall bird survey data	2019 – 2023	81 diurnal surveys using an adapted I-WeBS methodology conducted approximately twice monthly (excluding April 2020 and early May 2020) between October 2019 and September 2021.	Within the CWP Project export cable route intertidal landfall area and a wider area within South Dublin Bay between the Great South Wall of Dublin Port and the north-west wall of Dun Laoghaire Harbour.
Post-breeding tern aggregation survey data	2020 and 2021	8 dusk surveys during mid-July to mid-September (4 surveys each year) to record the distribution and number of terns using post-breeding roost sites.	
Additional data sources			
I-WeBS	2016/17–2020/21	Seasonal peak abundances of species within intertidal habitats in Dublin Bay site from monthly I-WeBS coverage between September and March each year. Mean monthly abundances (September to March) of species in intertidal habitats within Dublin Bay I-WeBS sub-sites collectively covering area congruous to the contemporary diurnal tidal landfall and post-breeding tern aggregation survey area [2017/18 to 2020/21 non-breeding seasons only].	The wider Dublin Bay I-WeBS site covers all intertidal habitats surrounding Dublin Bay. Several Dublin Bay I-WeBS sub-sites collectively cover an area which is the same as the area covered during contemporary diurnal tidal landfall and post-breeding tern aggregation surveys.
Post-breeding tern survey data	2013–2018	Roosting tern numbers, site use timings, distributions and sources of disturbance from summaries of survey data collected during each post-breeding	Focus upon intertidal habitat within South Dublin Bay between the Great South Wall of Dublin Port and the north-west wall of Dun Laoghaire Harbour.

Source	Date	Summary	Coverage of study area
		period (mid-July to mid-September) within South Dublin Bay each year.	

Onshore (>MHWS)

Target species

52. Target species are generally those which are afforded a higher level of legislative protection, and also include species which are more likely to be subject to impact from construction or disturbance as a result of the OTI. The target species include those listed under the following:

- Annex I of the Birds Directive;
- Red and amber Listed BoCCI; and
- SCI of SPAs within the ZoI of the project.

53. 'Red-listed' species are those of highest conservation priority, being globally threatened, declining rapidly in abundance or range, or having undergone historic declines from which they have not recently recovered. 'Amber-listed' species have an unfavourable status in Europe, have moderately declined in abundance or range, a very small population size, a localised distribution, or occur in internationally important numbers (Gilbert et al., 2021).

54. Species which do not meet the above criteria were not included for further assessment. These include terrestrial species such as passerines and birds of prey that were listed green according to BoCCI.

Transect and point count surveys

55. Transect and point count surveys were undertaken during both the breeding and winter seasons following best practice. These surveys were undertaken to establish a baseline for breeding and wintering bird activity within the onshore study area. The objectives of the surveys were to detect the presence and density of breeding and wintering birds within the study area, to determine their habitat associations, and to identify any key species or bird habitats of conservation significance within the study area. Breeding bird surveys were carried out over one day in May 2021, three days between April and July 2022 (by Flynn Furney Environmental Consultants) and six days between April and June 2023 (by TOBIN). Winter bird surveys were carried out over two days between December 2021 and January 2022 (by Flynn Furney Environmental Consultants) and four days between December 2022 and March 2023 (by TOBIN).

56. Transect methodology was broadly based on those published by BirdWatch Ireland (2012) and Bibby et al., (2000), whereby the study areas were surveyed during daylight hours, to within 25 m of the project and closest defined boundary (e.g., a road or neighbouring property), or within 50 m of all other areas (e.g., open tidal habitat areas). Habitats used by bird species were classified according to Fossitt (2000).

57. All sites where access was granted or open to the public within the study area were surveyed once per visit. These surveys, during both the breeding and winter season, recorded presence and abundances of all bird species within the study area with emphasis on target species (i.e., BoCCI amber and red-listed bird species, all raptor, waders, gulls and other wetland associated birds). Other signs of bird usage were also noted including faeces / whitewash, prey remains and feathers. Additionally, during the breeding bird season, bird species observed were given British Trust for

Ornithology (BTO) breeding status codes (**Table 10-4**), detailing the highest level of breeding evidence detected for each species.

58. Surveys were conducted during daylight hours, in optimal weather conditions, i.e., dry weather, with winds of less than Beaufort scale 3. Birds in flight, that were apparently interacting with the study area (as determined by the surveyor), were also recorded and birds flying over but not directly interacting with the study area were recorded separately, as 'overflying' birds (as per BirdWatch Ireland, 2012).

59. Point counts were also carried out at regular intervals in several locations along the transects following the method published by Bibby et al. (1992). Surveyors stood and recorded presence and abundances of all bird species with emphasis on target species and noted any breeding behaviour (if any).

Table 10-4 BTO Breeding Status Codes

Breeding Status	Breeding Code	Breeding Code Description
Non-breeding	**F**	**F**lying over
	M	Species observed but suspected to be still on **M**igration
	U	Species observed but suspected to be s**U**mmering non-breeder
Possible Breeding	**H**	Species observed in breeding season in suitable nesting **H**abitat
	S	**S**inging male present (or breeding calls heard) in breeding season in suitable breeding habitat
Probable Breeding	**P**	**P**air observed in suitable nesting habitat in breeding season
	T	Permanent **T**erritory presumed through registration of territorial behaviour (song etc) on at least two different days a week or more part at the same place or many individuals on one day
	D	Courtship and **D**isplay (judged to be in or near potential breeding habitat; be cautious with wildfowl)
	N	Visiting probable **N**est site
	A	**A**gitated behaviour or anxiety calls from adults, suggesting probable presence of nest or young nearby
	I	Brood patch on adult examined in the hand, suggesting **I**ncubation
	B	Nest **B**uilding or excavating nest-hole
Confirmed Breeding	**DD**	**D**istraction-**D**isplay or injury feigning
	UN	**U**sed **N**est or eggshells found (occupied or laid within period of survey)
	FL	Recently **FL**edged young (nidicolous species) or downy young (nidifugous species). Careful consideration should be given to the likely provenance of any fledged juvenile capable of significant geographical movement. Evidence of dependency on adults (e.g., feeding) is helpful. Be cautious, even if the record comes from suitable habitat.
	ON	Adults entering or leaving nest-site in circumstances indicating **O**ccupied **N**est (including high nests or nest holes, the contents of which cannot be seem) or adults seen incubating
	FF	Adult carrying **F**aecal sac or **F**ood for young
	NE	**N**est containing **E**ggs
	NY	**N**est with **Y**oung seen or heard

Raptor surveys – breeding Peregrine falcon

60. Following a review of information obtained during the desk study, Peregrine falcon was found to nest and occur regularly on the Poolbeg Peninsula, largely around the now disused Poolbeg chimney stacks. A raptor survey was subsequently undertaken to collect baseline data on the breeding behaviour and flight activity of Peregrine falcon, to determine how they utilise the onshore and estuarine / Liffey study areas, and to assess the potential for impacts upon this species. Incidental sightings of other raptor species were also recorded.

61. Surveys occurred over eight days between March and September 2022 (by Flynn Furney Environmental Consultants) and nine days between April and September 2023 (by TOBIN). The survey methodology, to determine signs of occupancy and evidence of breeding, followed that of Hardey et al. (2013). Two VPs were selected to give clear views over the study area and the Peregrine falcon nest site at the Poolbeg chimney stacks (See **Figure 10-3**). VPs were conducted according to Scottish Natural Heritage (SNH) (now NatureScot) (2017) guidance and occurred over a 3 to 4 hour period, as recommend by Hardey et al., (2013). Raptor species observed during VP surveys were recorded, noting species, abundance, activity and a brief comment. Flightlines or locations were then mapped. Surveys were conducted during daylight hours, in optimal weather conditions, i.e., dry weather, with winds of less than Beaufort scale 3.

Desk study

62. In addition to site-specific surveys, a comprehensive desk-based review was undertaken to inform the baseline for onshore ornithology. Key data sources used to inform the assessment are set out in **Table 10-5** below. Further information relating to the desk-based review for onshore ornithology is provided in **Chapter 21 Onshore Biodiversity Section 21.6**.

Table 10-5 Data sources used to determine baseline characterisation of the onshore study area

Source	Date	Summary	Coverage of study area
Contemporary site-specific baseline characterisation surveys			
Transect and Point count surveys	2021–2023	16 surveys (10 during breeding and 6 during the winter seasons) using an adapted bird walkover methodology.	Within the onshore study area.
Raptor surveys	2022 and 2023	17 surveys during the 2022 and 2023 breeding seasons to collect baseline data on the breeding behaviour and flight activity of Peregrine falcon and other raptor species.	
Additional data sources			
National Biodiversity Data Centre (NBDC)	2007–2023	Review of all bird records held by the NBDC, which includes records from the most	The two hectads (10 km squares) of O13 and O23, which overlap the onshore study area.

Source	Date	Summary	Coverage of study area
		recent national bird atlas survey (Bird atlas 2007 – 2011 [Balmar et al., 2013]).	
Special Protection Areas (various) From the NPWS website and the protected site map viewer	2023	Conservation objectives and site synopsis of SPAs for nearby sites.	South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA.
Diurnal tidal landfall bird survey data (CWP project / Natural Power)	2019–2021	45 diurnal surveys using an adapted I-WeBS methodology conducted approximately twice monthly (excluding April 2020 and early May 2020) between October 2019 and September 2021. Data regarding onshore usage by Light-bellied Brent Goose (*Brenta bernicla hrota*) was examined from the CWP intertidal surveys).	Records of Light-bellied Brent Goose usage within the onshore study area.

Estuarine / Liffey

Target species

63. Target species are generally those which are afforded a higher level of legislative protection, and also include species which are more likely to be subject to impact from construction or disturbance as a result of the OTI. The target species include those listed under the following:

- Annex I of the Birds Directive;
- Red and amber Listed BoCCI; and
- SCI of SPAs within the ZoI of the project.

64. 'Red-listed' species are those of highest conservation priority, being globally threatened, declining rapidly in abundance or range, or having undergone historic declines from which they have not recently recovered. 'Amber-listed' species have an unfavourable status in Europe, have moderately declined in abundance or range, a very small population size, a localised distribution, or occur in internationally important numbers (Gilbert et al., 2021).

65. Species which do not meet the above criteria were not included for further assessment. These include terrestrial species such as passerines and birds of prey that were listed green according to BoCCI.

Transect and point count surveys

66. This survey followed the same methodology as set out above in **Section 10.4.2 (Onshore (>MHWS) - Transect and point count surveys).** Target species which were observed using the estuarine / Liffey area were recorded and their location and activity noted. The species most often recorded were gulls roosting on piers and jetties.

tern surveys

67. A study to examine the level of existing and potential disturbance on terns breeding at the Poolbeg colonies was carried out in summer 2022 and spring 2023 by ALCnature. Field surveys were carried out on 18 dates between 31 May and 13 July 2022 and five dates in May 2023, to investigate existing levels of disturbance of terns at the sites (background disturbance). This utilised VP watches by experienced personnel to examine and score disturbance response of terns to disturbance stimuli. Totals of 121.5 h and 118.5 h of VP survey time were completed at the CDL Dolphin and ESB Dolphin respectively. This included three hours of nocturnal surveys at each site (between 2200h and 0100h on 16 June 2022 at the CDL Dolphin and 20 June 2022 at the ESB Dolphin).

68. A second period (three dates in July 2022 and two dates in May 2023) assessed the level of response of breeding terns to the application of simulated construction disturbance on the site (experimental disturbance) under NPWS licence.

69. These approaches provided site-specific assessment of disturbance response in order to inform assessment of potential impacts arising during the construction phase.

Black guillemot survey

70. Black guillemots (*Cepphus grylle*) occurring close to the onshore substation site were surveyed in April 2023, by ALCnature, for population size and nest site locations using two methods.

Population size

71. Population size was determined by applying standard methods, laid out by in the Seabird Monitoring Handbook (Walsh et al., 1995), which involved using the total number of observations over the survey period to calculate the population size of the specific area. This entailed visiting the full extent of the survey area in early spring and counting all adult birds seen on water and on shore and structures, within the extent of the study area, on two visits in April 2023 at least one week apart and in fine weather.

Nest site distribution

72. Locations of crevices and holes suitable for nesting Black guillemots were recorded using a walkover nest site search during the population surveys in April 2023, with an additional visit, in June 2023. Activity at potential nest sites were determined by a 3-hour watch of all likely sites from a key VP. Nest sites were recorded as occupied if visited and entered by adults and a probable or confirmed breeding status assigned. Timing and duration of this survey visited was planned to ensure likely visiting of all occupied nest sites by adults during the observation period, as fish delivery is known to be highest during the morning and evening (Shoji et al., 2015), to avoid under recording of sites where foraging adults were absent (e.g., in early morning).

Desk study

73. In addition to site-specific surveys, a comprehensive desk-based review was undertaken to inform the baseline for onshore ornithology. Key data sources used to inform the assessment are set out below. Further information relating to the desk-based review for estuarine / Liffey ornithology is provided in **Table 10-6**.

Table 10-6 Data sources used to determine baseline characterisation of the estuarine / Liffey study area

Source	Date	Summary	Coverage of study area
Contemporary site-specific baseline characterisation surveys			
tern Surveys	2022 and 2023	Examined the level of existing and potential disturbance on terns breeding at the Poolbeg colonies and was carried out in summer 2022 and spring 2023.	Within the estuary / Liffey study area.
Black guillemot Surveys	2022 and 2023	Surveys carried out during the 2022 and 2023 breeding season, to identify numbers of breeding Black guillemot and mapping their location.	
Additional data sources			
National Biodiversity Data Centre (NBDC)	2007–2023	Review of all bird records held by the NBDC, which includes records from the most recent national bird atlas survey (Bird atlas 2007–2011; Balmar et al., 2013).	The two hectads (10 km squares) of O13 and O23, which overlap the onshore study area.
Dublin Bay Birds Project (BirdWatch Ireland)	2013–2022	Dublin Port tern Conservation Project Report from 2022. Contains results of 2022 breeding season, but also includes productivity results from previous years, up to 2013.	Four tern colonies within Dublin port, including the CDL and SPA platform colonies which are closest in proximity to the proposed development.
	2016/2017–2020/2021	Waterbird data request of peak counts for species located within the River Liffey channel subsite.	Within the Rivier Liffey channel from the East Link Bridge to the outflow of the River Liffey along the great south wall.

Source	Date	Summary	Coverage of study area
Special Protection Areas (various) From the NPWS website and the protected site map viewer	2023	Conservation objectives and site synopsis of SPAs for nearby sites.	South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA.

10.4.3 Impact assessment

General approach to assessment

74. The significance of potential effects has been evaluated using a systematic approach, based upon identification of the receptor sensitivity to potential impacts resultant from the project activity, together with the predicted magnitude of the impact.

75. The terms used to define receptor sensitivity and magnitude of impact are based on the Environmental Protection Agency (EPA), 2022 guidance. These criteria have been adapted in order to implement a specific methodology for Ornithology.

Impact screening

76. For each potential impact the assessment includes high level consideration as to whether ornithological receptors are sensitive to that impact and whether receptors occur within / utilise areas in which they may experience potential impacts. This uses the conceptual source-pathway-receptor model to determine whether there is a meaningful pathway for an impact source to affect a receptor.

77. This model identifies likely environmental impacts resulting from the proposed construction, operation and decommissioning of the offshore infrastructure. This process provides an easy to follow assessment route between impact sources and potentially sensitive receptors, ensuring a transparent impact assessment. The parameters of this model are defined as follows:

- **Source** – the origin of a potential impact (noting that one source may have several pathways and receptors) e.g., an activity such as cable installation and a resultant effect such as re-suspension of sediments.
- **Pathway** – the means by which the effect of the activity could impact a receptor e.g., for the example above, re-suspended sediment could settle and smother the seabed.
- **Receptor** – the element of the receiving environment that is impacted e.g., for the above example, seabird prey species living on or in the seabed are unavailable to foraging individuals.

78. Where receptors are sensitive to an impact and occur within areas where they may experience that impact they are screened in for further consideration in assessment (i.e., sensitivity of receptor, magnitude of impact and significance of effect determined).

79. Where it is established within the scientific literature that receptors are insensitive to an impact and / or do not occur within areas where they may experience that impact they are screened out for further consideration on the basis to there being no pathway to impact.

Sensitivity of receptor

80. Receptor sensitivity is defined in EPA guidance as 'the potential of a receptor to be significantly affected' (EPA, 2022). For the purpose of this assessment, and to align as closely as possible with impact assessment approaches implemented by other Irish Phase 1 projects, criteria to define receptor sensitivity relate to the importance of populations potentially impacted and the tolerance of those populations to that impact.

81. The importance of a population is determined by consideration of the connectivity of impacted receptors to internationally, nationally or regionally designated sites and the conservation status of impacted receptors (making reference to BoCCI, International Union for Conservation of Nature (IUCN) and Birds Directive Annex 1 lists).

82. The tolerance of a population is considered as the potential for an impact to affect survival and / or reproductive rates, with consideration given to:

- The persistence of such effects while the impact is ongoing (i.e., habituation) or after the impact ceases (i.e., recoverability); and
- The ability of the receptor to adapt behaviours to avoid effects to survival and / or reproductive rates.

83. Criteria considered in the determination of importance for ornithological receptors are described in **Table 10-7**.

84. Note that determinations of importance often satisfy criteria drawn from different levels. For example, a receptor may be identified as not having connectivity with nationally or internationally designated populations, but be classed as having a high level conservation status. It is therefore necessary to consider the contribution from each definition when reaching an overall assessment of importance.

Table 10-7 Criteria for determination of receptor importance

Receptor Importance	Criteria
Very high	Receptors considered to have a very high level of potential connectivity with internationally designated populations (i.e., overlap with or foraging range connectivity with SPA or Ramsar Sites) and high level conservation designation classifications (BoCCI Red List, IUCN Red List categories of Vulnerable and above, Annex I of the Birds Directive).
High	Receptors considered to have a high level of potential connectivity with internationally designated populations (i.e., foraging range connectivity SPA and Ramsar Sites) or overlap with nationally important population concentrations, and / or high or medium conservation designation classifications (BoCCI Amber or Red List, IUCN Red List categories of Near Threatened and above, Annex I of the Birds Directive).
Medium	Receptors considered to have potential connectivity with internationally designated populations (i.e., distant foraging range connectivity SPA and Ramsar Sites), proximity to nationally important population concentrations, or overlap with regionally important population concentrations, and / or medium conservation designation classifications (BoCCI Amber List).
Low	Receptors with limited potential connectivity with internationally designated populations (SPAs and Ramsar sites), proximity to regionally important population concentrations, or overlap with locally important population concentrations, and / or low conservation designation classifications (BoCCI Green List, IUCN Red List Least Concern category).

Very Low	Receptors with no apparent connectivity with designated populations or important population concentrations, and / or low conservation designation classifications (BoCCI Green List, IUCN Red List Least Concern category).

85. Criteria considered in the determination of tolerance for ornithological receptors are described in **Table 10-8**.

86. Note that determinations of tolerance often satisfy criteria drawn from different levels. For example, a receptor may be identified as being intolerant to an impact (i.e., reproductive or survival rates initially adversely affected), but able to habituate to that impact. It is therefore necessary to consider the contribution from each definition when reaching an overall assessment of tolerance.

87. Note also that a relationship exists between receptor tolerance and impact magnitude (see **Table 10-10**, below), insofar that generally speaking 'bigger' impacts are more difficult to tolerate than 'smaller' impacts. In particular, and to relate this to the criteria used in **Table 10-8** to define tolerance, if an impact affects all of the areas used by a receptor at all times then the receptor cannot avoid that impact and, dependant on the nature of the impact, the probability of demographic consequences to the receptor population increases. Conversely, the more spatially or temporally localised an impact, the probability of that impact becoming avoidable increases, and likelihood of demographic consequences decreases.

88. Similarly, there is a usually a relationship between where (or when) an impact occurs and the tolerance of a receptor to that impact. Again, to relate this to the criteria used in **Table 10-8** to define tolerance, if an impact affects an area or areas that are important for a receptor (for example, the receptor uses that area in large relative numbers, or to undertake key sensitive behaviours), then the receptor may be less able to avoid that impact and, dependant on the nature of the impact, the probability of demographic consequences to the receptor population increases. Conversely, for impacts affecting areas which are 'unimportant' to the receptor, the probability of that impact becoming avoidable increases, and likelihood of demographic consequences decreases.

89. Assessment of receptor tolerance therefore may incorporate consideration of relevant benchmarks from literature and / or baseline characterisation datasets when relating impacts to the tolerance criteria outlined in **Table 10-8**.

Table 10-8 Criteria for determination of receptor tolerance

Receptor Tolerance	Criteria
Very Low	Receptor is considered to have no tolerance to impact such that reproductive and survival rates may be severely affected. Receptor is considered not to habituate to ongoing impacts and has low maximal productivity values (i.e., limited ability for populations to rapidly recover following cessation of an impact). Receptor is considered unable to adapt behaviours to avoid effects on survival and reproductive rates.
Low	Receptor is considered to have very limited tolerance to impact such that reproductive and survival rates may be affected. Receptor is considered to have limited ability to habituate to ongoing impacts and has low / medium maximal productivity values (i.e., limited ability for populations to rapidly recover following cessation of an impact). Receptor is considered to have very limited ability to adapt behaviours to ever avoid effects on survival and reproductive rates.

Medium	Receptor is considered to have limited tolerance to impact such that reproductive rates may be affected but survival rates not likely to be affected. Receptor is considered to have medium ability to habituate to ongoing impacts and has moderate maximal productivity values (i.e., moderate ability for populations to rapidly recover following cessation of an impact). Receptor is considered to have some ability to adapt behaviours to infrequently avoid effects on survival and reproductive rates.
High	Receptor is considered able to tolerate impact such that potential effect on reproduction and survival rates are limited. Receptor readily habituates to ongoing impacts and has moderate maximal productivity values (i.e., moderate ability for populations to rapidly recover following cessation of an impact). Receptor is considered to have ability to adapt behaviours to frequently avoid effects on survival and reproductive rates.
Very High	Receptor is considered able to tolerate impact without any noticeable effect on reproduction and survival rates. Receptor readily habituates to ongoing impacts and has high maximal productivity values (i.e., high ability for populations to rapidly recover following cessation of an impact). Receptor is considered to have ability to adapt behaviours to usually avoid effects on survival and reproductive rates.

90. Derivation of receptor sensitivity through integration of importance and tolerance rankings is described in **Table 10-9**.

Table 10-9 Criteria for determining overall receptor sensitivity

Importance	Tolerance				
	Very Low	Low	Medium	High	Very High
Very High	Very High	Very High	High	Medium	Low
High	Very High	High	High	Medium	Low
Medium	High	High	Medium	Low	Very Low
Low	Medium	Medium	Low	Low	Very Low
Very Low	Low	Low	Very Low	Very Low	Very Low

Magnitude of impact

91. The scale or magnitude of potential impacts (both beneficial and adverse) depends on the degree and extent to which the CWP Project activities may change the environment, which usually varies according to project phase (i.e., construction, operation and maintenance and decommissioning).

92. Magnitude of impact refers to the scale of an impact to a receptor population and is determined on a quantitative basis where possible. Impact magnitude is primarily defined in relation to the consequence of the impact upon affected populations.

93. Consequence is considered as the potential for an impact to affect a population in terms of what risk this presents to altering the functionality of that population or the probability of persistence of that population. In considering consequence, where appropriate, reference is made to the following:

- The extent of an impact in terms of spatial range and / or proportion of a population which is impacted;
- The duration of an impact in terms of how long an impact and its effects will persist; from momentary to permanent;
- The frequency of an impact; from one off to continuous; and
- The probability that a potential impact will result in an effect.

94. Criteria considered in the determination of magnitude of impact for ornithological receptors are described in **Table 10-10**.

Table 10-10 Criteria for determining magnitude of impact

Magnitude	Criteria	Supporting considerations
Very High	**Impact predicted to be of very high consequence to affected population.** Guide: >10% increase to baseline mortality rate.	**Extent:** Impact experienced over very large spatial range and / or by very large proportion of population. **Duration:** Impact durations long term or permanent (more than 15 years). **Frequency:** Impacts very frequently or constantly occurring. **Probability:** Impacts likely to occur (i.e., can reasonably be expected to occur because of the planned project).
High	**Impact predicted to be of high consequence to affected population.** Guide: 5-10% increase to baseline mortality rate.	
Medium	**Impact predicted to be of moderate consequence to affected population.** Guide: 1-5% increase to baseline mortality rate.	
Low	**Impact predicted to be of low consequence to affected population.** Guide: 0.1-1% increase to baseline mortality rate.	**Extent:** Impact experienced over very limited spatial range and / or by very small proportion of population. **Duration:** Impact durations brief or momentary (less than a day). **Frequency:** Impacts one off or very rarely occurring. **Probability:** Impacts unlikely to occur (i.e., can reasonably be expected not to occur because of the planned project).
Negligible	**Impact predicted to be of very low consequence to affected population.** Guide: <0.1% increase to baseline mortality rate.	

Significance of effect

95. As set out in **Chapter 5 EIA Methodology**, an Impact Assessment Matrix (IAM) is used to determine the significance of an effect. In basic terms, the potential significance of an effect is a function of the sensitivity of the receptor and the magnitude of the impact, as shown in **Table 10-11**.

96. The matrix provides a framework for the consistent and transparent assessment of predicted effects across all technical chapters; however, it is important to note that individual assessments are based on relevant guidance and the application of expert judgement.

97. The matrix provides levels of effect significance ranging from Imperceptible to Profound, as defined in the EPA (2022) EIAR Guidelines. For the purposes of this assessment, effects rated as being 'Significant – Moderate' or above are considered to be significant in EIA terms. Effects rated as being 'Moderate' are effectively significant / not significant subject to professional judgement, with a rationale provided for this in the main assessment. Effects identified as less than moderate significance are not considered to be significant in EIA terms.

Table 10-11 Impact assessment matrix for determination of significance of effect

Sensitivity of Receptor	Magnitude of Impact				
	Very High	High	Medium	Low	Negligible
Very High	Profound	Very Significant	Significant	Moderate*	Slight
High	Very Significant	Significant	Significant	Slight	Not Significant
Medium	Significant	Significant	Moderate*	Slight	Imperceptible
Low	Moderate*	Slight	Slight	Not Significant	Imperceptible
Very Low	Slight	Not Significant	Imperceptible	Imperceptible	Imperceptible

**Moderate will either be treated as significant or non-significant, with this determined using expert opinion and supported by appropriate evidence.*

10.5 Assumptions and limitations

98. The data sources used in this chapter are detailed in **Table 10-5** and **Table 10-6**, with additional relevant information from **Appendix 10.5 Baseline Characterisation Report**. The desktop data used are the most up to date publicly available information which can be obtained from the applicable data sources as cited.

10.5.1 Offshore

99. There is a high degree of variability in the marine environment, both spatially and temporally. However, as the offshore baseline site characterisation for this EIAR has been based on two years of digital aerial survey data, informed by further data from fifteen boat-based ESAS surveys over a 22-month period, it is considered to be representative of the array site and surrounding 4 km buffer area for the purpose of impact assessment.

100. It was not always possible to complete digital aerial surveys every month, due to poor weather conditions, for example in January 2021 the survey was missed and in February 2021 only one survey was undertaken due to a period of continued unsettled weather. To ensure a robust dataset, two surveys were undertaken in March 2021. Further details of survey coverage are presented in **Appendix 10.5 Baseline Characterisation Report**.

101. Given the limited scale of works required for the OECC (i.e., a relatively small number of vessel movements over a relatively small area for a short period of time), no specific surveys were commissioned for the area between the offshore ornithology study area and the intertidal ornithology study area. Instead, the assessment for this section of the OECC makes use of published data (Jessop et al., 2018) on the presence of birds from the desk study.

10.5.2 Intertidal

102. Surveys of the intertidal area in the vicinity of the export cable landfall were carried out to provide data in relation to potential impacts on estuarine birds in the vicinity. Surveys were timed to ensure approximately equal effort through all tidal states throughout the year and designed to capture the numbers and distribution of birds across all intertidal habitat within South Dublin Bay. Surveys were carried out in suitable weather conditions (avoiding times of low visibility).

103. Due to Covid-19 restrictions throughout April and early May 2020, no surveys were undertaken during this period; a total of three surveys missed. Surveys were, however, undertaken during this period in 2021. No interannual variation is therefore accounted for in April count data and the extent to which interannual variation is incorporated into May counts is somewhat reduced relative to other months. Despite this limitation, given the large number of surveys undertaken (45) across the remainder of the two-year period, the resultant dataset describing the distribution and abundance of ornithological receptors throughout the year is considered suitably robust to inform impact assessment, with the absence of data from April and early May 2020 considered unlikely to have impacted assessment conclusions or resultant mitigation design decisions.

10.5.3 Onshore

104. The transect and point count surveys were undertaken over four days during the 2021 and 2022 breeding seasons, and over two days during the 2021 / 2022 winter season. These surveys only provide a snapshot in time of bird activity in the study area. As a result, additional surveys were carried out over six days in 2023 during the breeding season and four days over the 2022 / 2023 winter season to increase the results on bird activity in the study area.

105. The environment within the study area consists of highly modified man-made structures or habitats and other areas with no active management / containing dense vegetation. When combined with the fact some bird species are more cryptic than others, this can lead to some birds being underrepresented in the survey results (especially during the breeding season, when species can be more secretive around nest sites).

106. However, when these limitations are considered with the desk study results and in conjunction with expected bird usage within identified habitats onsite, it is considered that these surveys provide sufficient data to establish the ornithological baseline within the study area.

10.5.4 Estuarine / Liffey

107. No assumptions or limitations were noted during surveys within the estuarine / Liffey study area.

10.6 Existing environment

108. The following sections describe the receiving environment across the four study areas identified. Namely, offshore (array and OECC), intertidal (MLWS to MHWS), onshore (>MHWS) and estuarine / Liffey (<MHWS).

10.6.1 Offshore – array site and OECC

109. A summary of the baseline environment for offshore ornithology for the array site and OECC is provided below. Further details are provided in the **Appendix 10.5 Baseline Characterisation Report**, which includes information relating to survey design, methodology data treatment techniques and summaries of survey results.

110. Species assessed for impacts are those which were recorded during the 2020-2022 digital aerial surveys or 2019-2020 boat-based surveys, and which are considered to be at potential risk, either due to their abundance, potential sensitivity to wind farm impacts, or due to behavioural characteristics (e.g., commonly fly at within rotor swept altitudes). Species for which fewer than 10 individuals were observed during the 2020-2022 digital aerial surveys, or for which fewer than 10 individuals were observed during the 2019-2020 boat-based surveys, were not scoped into assessment as they were concluded to use the study area rarely and infrequently and as such had no potential to be significantly adversely affected in relation to development impacts.

111. One exception to this was little tern (*Sternula albifrons*) which, although only recorded once (two individuals) during baseline surveys, has been reported within the array site and OECC during visual aerial surveys of the wider western Irish Sea Region during the summer of 2016 (Jessopp et al., 2018), and occurs as a designated breeding feature of one SPA in the vicinity of the array site and OECC. Another exception to this was Common scoter which, although recorded only twice during baseline surveys of the array site (one record of one individual on the sea within the buffer area during digital aerial surveys and one record of three individuals in flight over the buffer area during boat-based ESAS), has been reported within the array site and OECC during visual aerial surveys of the wider western Irish Sea Region during 2016 (Jessopp et al., 2018), and occurs as a designated non-breeding feature of one SPA in the vicinity of the OECC.

112. Abundances of all species observed during site-specific digital aerial and boat-based surveys are presented in **Appendix 10.5 Baseline Characterisation Report**. The following species were scoped in:

- Common scoter;
- Kittiwake;
- Black-headed gull (*Chroicocephalus ridibundus*);
- Little gull (*Hydrocoleus minutus*);
- Common gull (*Larus canus*);
- Great black-backed gull (*Larus marinus*);
- Herring gull (*Larus argentatus*);
- Lesser black-backed gull;
- Sandwich tern (*Thalasseus sandvicensis*);
- Roseate tern (*Sterna dougallii*);
- Common tern;
- Arctic tern;
- Little tern;
- Guillemot (*Uria aalge*);
- Razorbill (*Alca torda*);

- Black guillemot;
- Puffin (*Fratercula arctica*);
- Red-throated diver (*Gavia stellata*);
- Great northern diver (*Gavia immer*);
- Fulmar;
- Manx shearwater (*Puffinus puffinus*);
- Gannet (*Morus bassanus*);
- Cormorant (*Phalacrocorax carbo*); and
- Shag (*Gulosus aristotelis*).

113. Bird behaviour and abundance is recognised to differ across a calendar year dependent upon the biological seasons (bio-seasons) that may be applicable to different seabird species. Separate bio-seasons are recognised in this chapter in order to establish the level of importance any seabird species has within the offshore ornithology study area during any particular period of time.

114. Impacts have been assessed in relation to relevant bio-seasons, as defined by Furness et al., 2015 (or as otherwise stated where species are not included within Furness et al., 2015), amended where:

- Region specific definitions are considered more appropriate (specifically in relation to tern species) where, due to the presence of internationally important post-breeding aggregations from July onwards, July is considered within the post-breeding migration period; and
- Month-splitting bio-season definitions are presented in Furness et al., 2015, in which case we have chosen to elongate the breeding season.

115. A summary for these seasons for seabird species is presented in **Table 10-12**. Bio-seasons are defined in this chapter as: return migration, migration-free breeding, post-breeding migration, migration-free winter, breeding and nonbreeding. These six bio-seasons can be applied to different periods within the annual cycle for most seabird species, though not all are applicable for all seabird species, with different combinations used depending on the biology and life history of a species:

- Return migration: when birds are migrating to breeding grounds;
- Migration-free breeding: when birds are attending colonies, nesting and provisioning young;
- Post-breeding migration: when birds are either migrating to wintering areas or dispersing from colonies;
- Migration-free winter: when non-breeding birds are over-wintering in an area; and
- Breeding and Non-breeding: for some species, there is significant overlap between migratory, breeding and wintering periods between colonies and individuals, and so the above bio-seasons cannot be appropriately applied. Therefore, two bio-seasons are defined:
  - Breeding: from modal arrival to the colony at the beginning of breeding to modal departure from the colony; and
  - Non-breeding: from modal departure from the colony at the end of breeding to modal return to the colony the following year.

Table 10-12 Seasonal definitions for seabird species considered at potential risk of impacts

Species	Return migration (RM)	Migration-free breeding (MFB)	Post-breeding migration (PBM)	Migration-free winter (MFW)	Breeding (B)	Non-breeding (NB)
Kittiwake	Jan – Apr	May – Jul	Aug – Dec			
Black-headed gull*[3]	Jan – Apr	May – Jul	Aug – Dec			
Little gull*[2]	Mar – Apr	May – Sep	Oct – Dec	Jan – Feb		
Great black-backed gull					Apr – Aug	Sep – Mar

Species	Return migration (RM)	Migration-free breeding (MFB)	Post-breeding migration (PBM)	Migration-free winter (MFW)	Breeding (B)	Non-breeding (NB)
Common gull*3	Jan – Apr	May – Jul	Aug – Dec			
Herring gull					Apr – Aug	Sep – Mar
Lesser black-backed gull	Mar – Apr	May – Jul	Aug – Oct	Nov – Feb		
Sandwich tern	Mar – May	Jun	Jul – Sep			
Roseate tern*4	Apr – May	Jun	Jul – Sep			
Common tern*4	Apr – May	Jun	Jul – Sep			
Arctic tern*4	Apr – May	Jun	Jul – Sep			
Little tern	Apr – May	Jun – Jul	Aug - Sep			
Guillemot					Mar – Jul	Aug – Feb
Razorbill	Jan – Mar	Apr – Jul	Aug – Oct	Nov – Dec		
Black guillemot					Apr – Aug	Sep – Mar
Puffin*5	Mar – Apr	May – Jul	Aug	Sep – Feb		
Red-throated diver	Feb – Apr	May – Aug	Sep – Nov	Dec – Jan		
Great northern diver	Mar – May		Sep – Nov	Dec – Feb		
Fulmar	Dec – Mar	Apr – Aug	Sep – Oct	Nov		
Manx shearwater	Mar – May	Jun – Jul	Aug – Oct	Nov – Feb		
Gannet	Dec – Mar	Apr – Aug	Sep – Nov			
Cormorant*6					Apr – Aug	Sep – Mar
Shag	Dec – Feb	Mar – Jul	Aug – Oct	Nov		

Table notes: *1 from Cramp & Simmons (1977); *2 from Robinson (2005); *3 Common gull and black-headed gull are not included in Furness (2015) – based on Kittiwake; *4 tern species bio-seasons adjusted from Furness (2015) to correspond with whole months and reflect that post-breeding aggregations in the region begin to be used from mid-July onwards; *5 Puffin bio-seasons adjusted from Furness (2015) to correspond with whole months; *6 from Royal Haskoning DHV (2019).

116. Furness, 2015, also provides non-breeding season population estimates for seabird species in species-specific biologically appropriate regions surrounding Great Britain. These regions, termed Biologically Defined Minimum Population Scale (BDMPS) regions, have been adapted to arrive at regional population estimates which include the western side of the Irish Sea surrounding the CWP Project.

117. A full description of how non-breeding season BDMPS regional populations from Furness, 2015, were altered in order to incorporate western Irish Sea areas is provided in **Section 2.5.1**, of **Appendix 10.5 Baseline Characterisation Report**. The general approach is summarised as follows:

- For each species, BDMPS (Furness et al., 2015) regional populations incorporate a proportion of the estimated Irish breeding population. This component was removed from the BDMPS population and replaced with the proportion of the Irish breeding population breeding on the Irish and Celtic Sea coasts multiplied by the Irish breeding population as defined from the Seabird Count (2015-21) UK and Irish census dataset (Burnell et al., 2023). This additional Irish component of the wider regional population was corrected to include non-adults based upon immature to adult ratios of stable age structure populations derived from demographic parameters taken from Horswill and Robinson (2015).

- For Red-throated diver there is no Irish population estimate available in Burnell et al., 2019 and there is known to be a western Irish Sea non-breeding population not incorporated into Furness et al., 2015 BDMPS region population estimates. Western Irish Sea abundance estimates were therefore derived from 2016 ObSERVE datasets (Jessop et al., 2018), incorporated into adopted BDMPS regional populations. As ObSERVE surveys were not undertaken during the spring period (roughly corresponding with the return migration bio-season), autumn (roughly corresponding with the post-breeding migration bio-season) abundance estimates were used as a proxy for spring abundance within the western Irish Sea region.
- Where no bio-season BDMPS population was defined in Furness et al., 2015 the following approaches were taken.
    - Black-headed and Common gull: all-Ireland non-breeding population figures from Stroud et al., 2016, were used.
    - Little gull: estimated winter abundance within western Irish Sea region covered by ObSERVE surveys (Jessop et al., 2018) was used to define the regional population during all non-breeding bio-seasons. This estimate does not include unidentified small gull records, a proportion of which would be Little gull. As such it is considered a precautionary underestimate for the western Irish Sea area and suitably conservative as a basis for impact assessment.
    - Black guillemot: since this species is highly sedentary / non-migratory the regional non-breeding population for this typically non-migratory species was assumed to be the same as regional breeding population, where the regional breeding population was taken as the sum of all colony counts from Dublin and Wicklow Counties from the Seabird Count dataset (Burnell et al., 2023), plus an estimated number of immatures associated with this number of adults (**Table 10-14**).

118. The general approach followed to determine regional reference populations for seabird species in the breeding season has been to firstly determine the number of breeding adults within mean-maximum foraging range plus one standard deviation (Woodward et al., 2019: **Table 10-13**) of the array site using data from the Seabird Monitoring Programme (SMP) online database (JNCC, 2023); or the Seabird Count dataset (Burnell et al., 2023) where these sources do not align. For breeding Herring gull and Lesser black-backed gull regional populations, in the absence of robust population estimates for urban nesting birds within the SMP database, Irish urban gull breeding population estimates from the NPWS 2021 National Urban gull Survey (Keogh and Lauder, 2021) were included within regional breeding season population estimates.

119. A full description of how breeding season regional populations were determined from Furness, 2015, is provided in **Section 2.5.2**, of **Appendix 10.5 Baseline Characterisation Report**.

120. During the breeding season, in addition to birds associated with breeding colonies, there will also be immature (non-breeding) birds present within the region. Therefore, secondly, to incorporate immature birds into regional breeding season population estimates, two methods have been used:

- **Method 1: Carry over of immature proportion from previous bio-season**. If it is assumed that immature birds may spend the summer in their wintering areas, then the regional breeding season population is calculated as:
    - *The number of breeding adults within foraging range plus the number of immature individuals present in the regional population of the previous bio-season.*
- **Method 2: Number of immatures derived from number of breeding adults.** If it is assumed that the number of immature birds within a regional breeding population is associated with the number of adults breeding within that region, then the regional breeding season population is calculated as:

- *The number of breeding adults within foraging range plus the number of immatures associated with that number of adults within a stable population structure (i.e., regional population = breeding adults + (breeding adults * immature to adult ratio)).*

121. Exceptions to this generic approach to determining regional breeding season population estimates include:

- For Black guillemot the regional breeding population was taken as the sum of all most recent colony counts from Dublin and Wicklow Counties from the Seabird Count dataset Burnell et al., 2023), plus an estimated number of immatures associated with this number of adults (**Table 10-14**).
- For Fulmar, due to the very large foraging range of this receptor, and the habit of Fulmar often to breed within small colonies, there is a very large number of colonies within this range included within the SMP database (the entire Irish and majority of UK populations). Extraction of this information from SMP database for presentation as per other receptors was considered unfeasible. As such, the 'all Ireland' breeding total from the Seabird Count (2015-2021) (Burnell et al., 2023), has been used.

122. Regional bio-seasonal reference populations for each seabird species are presented in **Table 10-14**.

123. The method to assess the potential impact from additional mortality to populations due to the CWP Project is assessed in terms of any change in relation to the baseline mortality rate for any given species within each of the recognised bio-seasons. The average mortality across all age classes for each species is presented in **Table 10-15**. This method to determine average mortality assumes all age classes are equally at risk to the possible impacts of the proposed development and, as such, the baseline mortality rate is a weighted average based on all age classes. Demographic rates for each species were those provided in Horswill and Robinson (2015). These data were used to calculate the expected stable proportions in each age class for each species. Each age class survival rate was then multiplied by its stable age proportion and the total for all ages summed to give the weighted average survival rate converted to an average mortality rate.

Table 10-13 Mean-maximum foraging range + 1 SD for seabird species

Species	Mean-max foraging range (km)	SD (km)	Mean-max foraging range + 1 SD (km)
Kittiwake	156.1	144.5	300.6
Black-headed gull	18.5	-	18.5
Little gull	NA – Not a breeding species in Ireland or UK – Any individuals observed during MFBS (May-Sep) considered non-breeders.		
Common gull	50	-	50
Great black-backed gull	73	-	73
Herring gull	58.8	26.8	85.6
Lesser black-backed gull	127	109	236
Sandwich tern	34.3	23.2	57.5
Roseate tern	12.6	10.6	23.2
Common tern	18.0	8.9	26.9
Arctic tern	25.7	14.8	40.5
Little tern	5	-	5

Species	Mean-max foraging range (km)	SD (km)	Mean-max foraging range + 1 SD (km)
Guillemot	73.2	80.5	153.7
Razorbill	88.7	75.9	164.6
Black guillemot	4.8	4.3	9.1
Puffin	137.1	128.3	265.4
Red-throated diver	9	-	9
Great northern diver	NA – Not a breeding species in Ireland or UK – absent during MFBS (Jun–Aug)		
Fulmar	542.3	657.9	1,200.2
Manx shearwater	1,346.8	1,018.7	2,365.5
Gannet	315.2	194.2	509.4
Cormorant	25.6	8.3	33.9
Shag	13.2	10.5	23.7

Table 10-14 Species-specific bio-seasonal population estimates used for impact assessment

Species	Estimated population within region in each bio-season (Adults + immatures)							
	RM	MFB		PBM	MFW	B		NB
		Method 1	Method 2			Method 1	Method 2	
Kittiwake	713,112	404,582	127,666	933,172				
Little gull	1,539			1,539	1,539			
Black-headed gull	100,000	32,000		100,000				
Great black-backed gull						33,346	2,492	53,405
Common gull	67,500	21,012		67,500				
Herring gull						117,240	21,569	187,090
Lesser black-backed gull	171,513	115,041	65,563	171,513	51,663			
Sandwich tern	14,535	5,087		14,535				
Roseate tern	6,374	2,626		6,374				
Common tern	73,998	31,505	1,731	73,998				
Arctic tern	72,227	24,435	33	72,227				
Little tern	1,649	474	0	1,649				
Guillemot						812,085	335,387	1,332,663
Razorbill	632,448	318,987	44,341	632,448	366,956			
Puffin	300,433	188,907	95,044	300,433	300,433			
Black guillemot							1,043	1,043

Species	Estimated population within region in each bio-season (Adults + immatures)							
	RM	MFB		PBM	MFW	B		NB
		Method 1	Method 2			Method 1	Method 2	
Red-throated diver	12,717	4,472		12,717	4,148			
Great northern diver	872			872	751			
Fulmar	843,724	508,130	144,571	843,724	571,897			
Manx shearwater	1,585,474	2,125,206	2,736,288	1,585,474				
Gannet	643,713	516,802	420,278	534,979				
Cormorant						11,020	304	18,406
Shag	17,104	7,688	229	17,104	17,104			

Table 10-15 Demographic rates (from Horswill and Robinson, 2015) used to calculate stable age population age class proportions, immature to adult ratios and average mortality rates

Species	Parameter	Survival (Age class)										Productivity (chicks per pair)	Immature to adult ratio	Average mortality
		0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	Adult			
Kittiwake	Demographic Rate	0.790	0.854	0.854	0.854						0.854	0.69	0.898	0.156
	Population Age Ratio	0.155	0.123	0.105	0.090						0.527			

Species	Parameter	Survival (Age class)										Productivity (chicks per pair)	Immature to adult ratio	Average mortality
		0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	Adult			
Black-headed gull	Demographic Rate	0.825	0.825								0.825	0.625	0.471	0.175
	Population Age Ratio	0.175	0.145								0.680			
Little gull	Demographic Rate	0.800	0.800								0.800	0.625	0.471	0.200
	Population Age Ratio	0.175	0.145								0.680			
Great black-backed gull	Demographic Rate	0.798	0.930	0.930	0.930	0.930					0.930	1.139	1.538	0.095
	Population Age Ratio	0.188	0.134	0.112	0.094	0.078					0.394			
Common gull	Demographic Rate	0.410	0.710	0.828							0.828	0.543	0.452	0.253
	Population Age Ratio	0.172	0.078	0.061							0.689			
Herring gull	Demographic Rate	0.798	0.834	0.834	0.834	0.834					0.834	0.92	1.37	0.172
	Population Age Ratio	0.163	0.132	0.111	0.094	0.079					0.422			
Lesser black-backed gull	Demographic Rate	0.820	0.885	0.885	0.885	0.885					0.885	0.53	0.876	0.123
	Population Age Ratio	0.125	0.102	0.090	0.080	0.070					0.533			
Sandwich tern	Demographic Rate	0.358	0.741	0.741							0.898	0.702	0.538	0.238

Species	Parameter	Survival (Age class)										Productivity (chicks per pair)	Immature to adult ratio	Average mortality
		0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	Adult			
	Population Age Ratio	0.212	0.078	0.060							0.650			
Roseate tern	Demographic Rate	0.664	0.664	0.850							0.883	0.764	0.701	0.191
	Population Age Ratio	0.197	0.130	0.086							0.588			
Common tern	Demographic Rate	0.664	0.664	0.850							0.883	0.764	0.701	0.191
	Population Age Ratio	0.197	0.130	0.086							0.588			
Arctic tern	Demographic Rate	0.664	0.837	0.837	0.837						0.837	0.38	0.511	0.183
	Population Age Ratio	0.114	0.082	0.074	0.068						0.662			
Little tern	Demographic Rate	0.800	0.800								0.800	0.518	0.403	0.200
	Population Age Ratio	0.156	0.131								0.713			
Guillemot	Demographic Rate	0.560	0.792	0.917	0.939	0.939	0.939				0.939	0.672	0.916	0.136
	Population Age Ratio	0.160	0.087	0.067	0.060	0.055	0.050				0.522			
Razorbill	Demographic Rate	0.794	0.794	0.895	0.895	0.895					0.895	0.57	0.876	0.129

Species	Parameter	Survival (Age class)										Productivity (chicks per pair)	Immature to adult ratio	Average mortality
		0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	Adult			
	Population Age Ratio	0.135	0.107	0.084	0.075	0.066					0.533			
Black guillemot	Demographic Rate	0.731	0.870	0.870	0.870	0.870					0.870	1.298	1.681	0.158
	Population Age Ratio	0.200	0.139	0.115	0.095	0.078					0.373			
Puffin	Demographic Rate	0.709	0.709	0.709	0.760	0.805					0.906	0.617	0.842	0.177
	Population Age Ratio	0.156	0.113	0.082	0.060	0.047					0.543			
Red-throated diver	Demographic Rate	0.600	0.620	0.840							0.840	0.571	0.534	0.224
	Population Age Ratio	0.168	0.108	0.072							0.652			
Great northern diver	Demographic Rate	0.770	0.770	0.770	0.870	0.870	0.870				0.870	0.543	0.947	0.161
	Population Age Ratio	0.126	0.101	0.081	0.065	0.059	0.053				0.514			
Fulmar	Demographic Rate	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.936	0.419	1.083	0.103
	Population Age Ratio	0.095	0.083	0.072	0.062	0.054	0.047	0.041	0.035	0.031	0.480			
Manx shearwater	Demographic Rate	0.870	0.870	0.870	0.870	0.870					0.870	0.697	1.132	0.130

Species	Parameter	Survival (Age class)										Productivity (chicks per pair)	Immature to adult ratio	Average mortality
		0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	Adult			
	Population Age Ratio	0.141	0.121	0.104	0.089	0.077					0.469			
Gannet	Demographic Rate	0.424	0.829	0.891	0.895	0.919					0.919	0.7	0.761	0.181
	Population Age Ratio	0.183	0.077	0.064	0.057	0.051					0.568			
Cormorant	Demographic Rate	0.540	0.540	0.868							0.868	1.985	1.451	0.297
	Population Age Ratio	0.334	0.171	0.088							0.408			
Shag	Demographic Rate	0.513	0.737								0.858	1.303	0.792	0.262
	Population Age Ratio	0.297	0.145								0.558			

124. Non-seabird migratory species assessed for impacts in relation to collision mortality (if migrating through the operational array site) and additional energetic costs (if altering migration routes to pass around the array site) are those which are features of designated sites within Ireland. The following species are included in the assessment:

- Light-bellied Brent Goose;
- Greenland white-fronted Goose (*Anser albifrons*);
- Bewick's Swan (*Cygnus columbianus bewicki*);
- Whooper Swan (*Cygnus cygnus*);
- Shelduck (*Tadorna tadorna*);
- Shoveler (*Spatula clypeata*);
- Wigeon (*Mareca Penelope*);
- Mallard (*Anas platyrhynchos*);
- Pintail (*Anas acuta*);
- Teal (*Anas crecca*);
- Pochard (*Aythya farina*);
- Tufted Duck (*Aythya fuligula*);
- Scaup (*Aythya marila*);
- Eider (*Somateria mollissima*);
- Common scoter;
- Goldeneye (*Bucephala clangula*);
- Red-breasted merganser (*Mergus serrator*);
- Corncrake (*Crex crex*);
- Great crested grebe (*Podiceps cristatus*);
- Oystercatcher (*Haematopus ostralegus*);
- Lapwing (*Vanellus vanellus*);
- Golden plover (*Pluvialis apricaria*);
- Grey plover (*Pluvialis squatarola*);
- Ringed plover (*Charadrius hiaticula*);
- Curlew (*Numenius arquata*);
- Bar-tailed godwit (*Limosa lapponica*);
- Black-tailed godwit (*Limosa limosa*);
- Turnstone (*Arenaria interpres*);
- Knot (*Calidris canutus*);
- Sanderling (*Calidris alba*);
- Dunlin (*Calidris alpina*);
- Snipe (*Gallinago gallinago*);
- Redshank (*Tringa tetanus*);
- Greenshank (*Tringa nebularia*);
- Red-throated diver;
- Great northern diver;
- Hen harrier (*Circus cyaneus*); and
- Merlin (*Falco columbarius*).

10.6.2 Intertidal – export cable route intertidal landfall area

125. A summary of the baseline environment for ornithology for the intertidal area is provided below. Further details are provided in **Appendix 10.5 Baseline Characterisation Report**, which includes information relating to survey design, methodology data treatment techniques and summaries of survey results.

126. Species assessed for impacts are those which were recorded during landfall surveys and which are considered to be at potential risk due to their abundance and potential sensitivity to impacts. Species

have been scoped into the assessment if the peak count was greater than 0.5% of the Irish wintering population estimate (Burke et al., 2018). Species for which the peak count was less than 0.5% of the Irish wintering population estimate were not scoped into assessment as they were concluded to use the study area in such relatively small numbers so as to have no potential to be significantly adversely affected in relation to development impacts. Abundances of all species observed during site-specific landfall surveys are presented in **Appendix 10.5 Baseline Characterisation Report**. The following species were scoped in:

- Light-bellied Brent Goose;
- Shelduck;
- Pintail;
- Teal;
- Common scoter;
- Great crested grebe;
- Red-breasted merganser;
- Oystercatcher;
- Golden plover;
- Grey plover;
- Ringed plover;
- Curlew;
- Bar-tailed godwit;
- Black-tailed godwit;
- Turnstone;
- Knot;
- Sanderling;
- Dunlin;
- Redshank;
- Greenshank;
- Black-headed gull;
- Mediterranean gull (*Ichthyaetus melanocephalus*);
- Common gull;
- Great black-backed gull;
- Herring gull;
- Lesser black-backed gull;
- Sandwich tern;
- Roseate tern;
- Common tern;
- Arctic tern;
- Black tern (*Chlidonias niger*);
- Black guillemot;
- Red-throated diver;
- Shag;
- Grey heron (*Ardea cinerea*); and
- Little egret (*Egretta garzetta*).

127. It is noted that on review of the available I-WeBS data, this corresponds relatively closely with the intertidal and nearshore bird survey data. This demonstrates that the survey data provide a robust representation of the diversity and abundance of the birds which typically occur within the intertidal ornithology study area.

10.6.3 Onshore (>MHWS)

128. A summary of the baseline environment for ornithology of the onshore study area is provided below. Further details are provided in the **Appendix 10.8 Onshore Baseline Characterisation Report**, which includes information relating to survey design, methodology data treatment techniques and summaries of survey results.

129. Species identified as Important Ecological Features (IEFs) which have been assessed for impacts are those which were recorded during onshore surveys and which are considered to be at potential risk due to their abundance and potential sensitivity to impacts, these species can be seen in **Table 10-16**. Species have been scoped into the assessment based on the target species criteria and the relative abundance and frequency they were recorded at over the survey period. Abundances of all species observed during site-specific onshore surveys are presented in **Appendix 10.8 Onshore Baseline Characterisation Report**.

Table 10-16 Target species identified as IEFs, recorded within the onshore study area during the breeding and wintering surveys between 2021 and 2023

Species	Survey Season*		Protection and Conservation Status**
	Breeding	Wintering	
Target Species			
Greenfinch (*Chloris chloris*)	Probable	-	WA, BoCCI Amber List
Light-bellied Brent Goose	-	Present	WA, BoCCI Amber List
Linnet (*Carduelis cannabina*)	Probable	-	WA, BoCCI Amber List
Peregrine falcon (*Falco peregrinus*)	Probable	-	WA, EU BD Annex I, BoCCI Green List
sand martin (*Riparia riparia*)	Confirmed	-	WA, BoCCI Amber List

* [-] = a species was not recorded over the survey season.
****** EU BD = European Union Birds Directive, WA = Wildlife Acts, BoCCI = Birds of Conservation Concern Ireland 2020-2026.

10.6.4 Estuarine / Liffey

130. A summary of the baseline environment for ornithology of the estuarine / Liffey study area is provided below. Further details are provided in the **Appendix 10.8 Onshore Baseline Characterisation Report and Appendix 10.10 Black guillemot Survey 2023**, which includes information relating to survey design, methodology data treatment techniques and summaries of survey results.

131. Species identified as IEFs which have been assessed for impacts are those which were recorded during the estuarine / Liffey surveys and which are considered to be at potential risk due to their abundance and potential sensitivity to impacts; these species are listed in **Table 10-17**. Species have been scoped into the assessment based on the target species criteria and the relative abundance and frequency they were recorded at over the survey period. Abundances of all species observed during site-specific onshore surveys are presented in **Appendix 10.8 Onshore Baseline Characterisation Report** and **Appendix 10.10 Black guillemot Survey 2023**.

Table 10-17 Target species identified as IEFs, recorded within the estuarine / Liffey study area during the breeding and wintering surveys between 2022 and 2023

Species	Survey Season*		Protection and Conservation Status**
	Breeding	Wintering	
Arctic tern	Confirmed	-	WA, EU BD Annex I, BoCCI Amber List
Black-headed gull	Non-breeding	Present	WA, BoCCI Amber List
Black guillemot	Confirmed	Present	BoCCI Amber List
Common tern	Confirmed	-	WA, EU BD Annex I, BoCCI Amber List

10.6.5 Designated sites

132. The four classes of statutory designated sites, that may contain birds as interest features, are considered in this section. These are, SPAs, Ramsar sites, NHAs and pNHAs.

133. The assessment of likely significant effects on the interest features of the internationally designated sites (SPAs) is carried out under the requirements of the Habitats Directive through the Appropriate Assessment process and will be reported separately in the Natura Impact Statement (NIS) for the project.

Offshore (<MHWS)

Array site and OECC

134. Key designated sites identified in relation to the assessment of impacts upon offshore ornithological receptors are described in **Table 10-18**. These include designated sites that support important populations of breeding seabird and sites that support important numbers of seabirds during non-breeding periods (more details are provided in **Appendix 10.5 Baseline Characterisation Report**). For the purposes of calculating the distances listed in this table the offshore OECC is calculated as anything below MLWS.

Table 10-18 Key designated sites and relevant Qualifying Interest features for offshore ornithology assessment

Site Code	Name	Qualifying Interests	Distance to array site (km)	Distance to OECC (km)
IE004186	The Murrough SPA	Breeding: Little tern Non-breeding: Red-throated diver, Herring gull, Black-headed gull	7.50	0
IE004127	Wicklow Head SPA	Breeding: Kittiwake	10.58	14.04

Site Code	Name	Qualifying Interests	Distance to array site (km)	Distance to OECC (km)
IE0003000	Dalkey Islands SPA	Post-breeding aggregation: Roseate tern, Common tern, Arctic tern	21.12	0.51
IE004236	North-west Irish Sea SPA	Red-throated diver, Great northern diver, Fulmar, Manx shearwater, Cormorant, Shag, Common scoter, Little gull, Black-headed gull, Herring gull, Great black-backed gull, Kittiwake, Roseate tern, Common tern, Arctic tern, Little tern, Guillemot, Razorbill, Puffin	21.35	1.27
IE004024	South Dublin Bay and River Tolka Estuary SPA	Breeding: Common tern Post-breeding aggregation: Roseate tern, Common tern, Arctic tern Non-breeding: Black-headed gull	27.46	0
IE004113	Howth Head Coast SPA	Breeding: Kittiwake	27.49	6.83
IE004006	North Bull Island SPA	Non-breeding: Black-headed gull	30.63	3.0
IE004117	Ireland's Eye SPA	Breeding: Cormorant Breeding and non-breeding: Herring gull, Kittiwake, Guillemot, Razorbill	31.44	8.99
IE004069	Lambay Island SPA	Breeding: Fulmar, Lesser black-backed gull, Kittiwake, Guillemot, Razorbill, Puffin Breeding and non-breeding: Cormorant, Herring gull	38.83	18.27
IE004122	Skerries Islands SPA	Breeding and non-breeding: Cormorant, Herring gull	49.82	26.12
IE004014	Rockabill SPA	Breeding: Arctic tern	47.36	26.39
UK9013121	Aberdaron Coast & Bardsey Island SPA (Wales)	Breeding: Manx shearwater	57.68	67.87
UK9020328	Irish Sea Front SPA	Breeding: Manx shearwater	68.96	73.52
IE004237	Seas off Wexford SPA	Breeding: Kittiwake, Fulmar, Cormorant, Herring gull,	74.82	79.70

Site Code	Name	Qualifying Interests	Distance to array site (km)	Distance to OECC (km)
		Lesser black-backed gull, Guillemot, Razorbill, Puffin, Manx shearwater, Red-throated diver, Common scoter, Gannet		
IE004002	Saltee Islands SPA	Breeding: Fulmar, Gannet, Kittiwake, Lesser black-backed gull, Puffin	107.06	114.10
UK9014041	Grassholm SPA (Wales)	Breeding: Gannet	139.88	149.15
UK9014051	Skomer, Skokholm and Seas off Pembrokeshire SPA (Wales)	Breeding: Manx shearwater, Storm Petrel (*Hydrobates pelagicus*)	137.98	147.65
UK9020291	Copeland Islands SPA (northern Ireland)	Breeding: Manx shearwater	170.51	153.86
UK9003091	Ailsa Craig SPA (Scotland)	Breeding: Manx shearwater	235.67	220.55
IE004150]	West Donegal Coast SPA	Breeding: Fulmar	243.06	210.47
IE002263	Kerry Head SPA	Breeding: Fulmar	268.57	254.90
IE004073	Tory Island SPA	Breeding: Fulmar	280. 39	249.27
IE004154	Inveragh Peninsula SPA	Breeding: Fulmar	300.42	292.53
[IE004153	Dingle Peninsula SPA	Breeding: Fulmar	293.61	281.89
IE004003	Puffin Island SPA	Breeding: Fulmar, Manx shearwater	335.54	328.67
IE004175	Deenish Island and Scariff Island SPA	Breeding: Fulmar, Manx shearwater	328.71	323.98
IE004066	The Bull and the Cow Rocks SPA	Breeding: Gannet	337.77	334.57
IE004007	Skelligs SPA	Breeding: Fulmar, Manx shearwater	344.91	338.34

Site Code	Name	Qualifying Interests	Distance to array site (km)	Distance to OECC (km)
UK9001121	Mingulay and Berneray SPA (Scotland)	Breeding: Fulmar	417.63	390.95
UK0012594	Rum SPA (Scotland)	Breeding: Manx shearwater	418.71	396.30
IE004008	Blasket Islands SPA	Breeding: Fulmar, Manx shearwater	330.65	319. 62

Export cable route intertidal landfall area

135. Key designated sites identified in relation to the assessment of impacts upon intertidal ornithological receptors are described in **Table 10-19**. Typically, these are the closest designated sites to the intertidal landfall area that support important populations of non-breeding waders, wildfowl and other species which utilise estuarine habitats. Also included, however, are several sites which support important numbers of seabirds during non-breeding periods and one site designated in relation to its breeding seabird population. Additional, more distant conservation sites considered for ornithological connectivity with the intertidal landfall area are detailed in **Appendix 10.5 Baseline Characterisation Report**. For the purposes of the distance measurements in **Table 10-19**, OECC intertidal and landfall is considered as the OECC as it occurs between MLWS and MHWS.

Table 10-19 Key designated sites and relevant Special Conservation Interest features for intertidal ornithology assessment

Site code	Name	Special Conservation Interests	Distance to the intertidal landfall area (km)
IE004024	South Dublin Bay and River Tolka Estuary SPA Sandymount Strand / Tolka Estuary Ramsar	Breeding: Common tern Post-breeding aggregation: Roseate tern, Common tern, Arctic tern Non-breeding: Black-headed gull, Light-bellied Brent Goose, Sanderling, Dunlin, Knot, Ringed plover, Oystercatcher, Bar-tailed godwit, Black-tailed godwit, Grey plover, Redshank, wetland and waterbirds	0
IE004006	North Bull Island SPA / Ramsar	Non-breeding: Black-headed gull, Light-bellied Brent Goose, Shelduck, Shoveler, Pintail, Teal, Oystercatcher, Golden plover, Grey plover, Curlew, Bar-tailed godwit, Black-tailed godwit, Turnstone, Knot, Sanderling, Dunlin, Redshank, wetland and waterbirds	1.46

Site code	Name	Special Conservation Interests	Distance to the intertidal landfall area (km)
IE004186	The Murrough SPA	Non-breeding: Herring gull, Black-headed gull, Greylag Goose, Light-bellied Brent Goose, Wigeon, Teal, Red-throated diver, wetland and waterbirds	22.87
IE004016	Baldoyle Bay SPA / Ramsar	Non-breeding: Light-bellied Brent Goose, Shelduck, Ringed plover, Golden plover, Grey plover, Bar-tailed godwit, wetland and waterbirds	7.02
IE004025	Malahide Estuary SPA	Non-breeding: Great crested grebe, Light-bellied Brent Goose, Shelduck, Pintail, Goldeneye, red-breasted merganser, Oystercatcher, Golden plover, Grey plover, Knot, Dunlin, Bar-tailed godwit, Black-tailed godwit, Redshank, wetland and waterbirds	11.83

Onshore (>MHWS) and estuarine / Liffey

136. Key designated sites identified in relation to the assessment of impacts upon onshore ornithological receptors are presented in **Table 10-20**. These sites can be broadly separated into:

- Those designated for their coastal / estuarine bird interests (typically for overwintering aggregations or post breeding terns); and / or
- Those designated for their terrestrial migrant bird interest (overwintering or breeding populations).

137. Terrestrial / coastal sites designated for migrant species outside the breeding season may be connected on the grounds of passage movements through the onshore development area boundary.

Table 10-20 Designated sites with potential connectivity to CWP Project (onshore export cable and onshore substation)

Site name*	Designation	Features with potential connectivity	Distance to onshore and estuarine / Liffey development area
International Sites (European Sites)			
South Dublin Bay and River Tolka Estuary SPA [4024]	SPA	Special Conservation Interests may use onshore study area for feeding, roosting or commuting.	0 m
North Bull Island SPA [4006]	SPA		2.1 km
Baldoyle Bay SPA [4016]	SPA		7.6 km
Dalkey Islands SPA [4172]	SPA		9.1 km
Howth Head Coast SPA [4113]	SPA		9.7 km
Ireland's Eye SPA [4117]	SPA		10.6 km

Site name*	Designation	Features with potential connectivity	Distance to onshore and estuarine / Liffey development area
Malahide Estuary SPA [4025]	SPA		12.3 km
Wicklow Mountains SPA [4040]	SPA		13.1 km
Rogerstown Estuary SPA [4015]	SPA		17.7 km
The Murrough SPA [4186]	SPA		24.6 km
Other International Sites			
Sandymount Strand / Tolka Esturay [832]	RAMSAR	These RAMSAR sites host large numbers of wading and waterbirds, which may use the onshore study area for feeding, roosting or commuting.	0 m
North Bull Island [406]	RAMSAR		2.1 km
Baldoyle Bay [416]	RAMSAR		7.6 km
Broadmeadow Estuary [833]	RAMSAR		12.3 km
Rogerstown Estuary [412]	RAMSAR		17.7 km
National Sites			
Dolphins, Dublin Docks [201]	pNHA	These proposed NSAs host large numbers of wading and waterbirds, which may use the onshore study area for feeding, roosting or commuting	25 m
South Dublin Bay [210]	pNHA		50 m
North Dublin Bay [206]	pNHA		1.2 km
Booterstown Marsh [1205]	pNHA		2.6 km
Dalkey Coastal Zone and Killiney Hill [1206]	pNHA		7.1 km
Howth Head [202]	pNHA		7.3 km
Baldoyle Bay [199]	pNHA		7.6 km
Sluice River Marsh [1763]	pNHA		9.3 km
Ireland's Eye [203]	pNHA		11 km
Malahide Estuary [205]	pNHA		11.3 km
Bray Head [714]	pNHA		17.7 km
The Murrough [730]	pNHA		26.5 km
Vartry Reservoir [1771]	pNHA		27.1 km

*Respective site code numbers are contained within [ ]

10.6.6 Receptor importance

138. The importance of each ornithological receptor selected for assessment is shown in **Table 10-21, Table 10-22**, **Table 10-23** and **Table 10-24**.

139. Each receptor species is assigned an importance level of Very Low, Low, Medium, High or Very High, in accordance with **Table 10-7**.

140. Receptor importance is determined through consideration of factors including their connectivity to designated sites, conservation status as given by the most recent Birds of Conservation Concern Ireland assessment (Gilbert et al., 2021) and their current conservation status according to IUCN Red List Criteria. Receptor importance also considers the likelihood of each species passing through the array site during migration periods, where this is relevant.

Seabird species

Table 10-21 Importance of seabird ornithological receptor

Species	Importance	Justification
Kittiwake	Very High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Red listed. Vulnerable category with regard to IUCN Red List Criteria.
Black-headed gull	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., Non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Little gull	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Great black-backed gull	Medium	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Green listed. Least Concern category with regard to IUCN Red List Criteria.
Common gull	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.

Species	Importance	Justification
Herring gull	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Lesser black-backed gull	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Sandwich tern	Low	Regularly occurring species with low connectivity to internationally designated breeding sites, i.e., not within mean foraging range plus a standard deviation (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Roseate tern	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., Post-breeding aggregation feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Common tern	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., Breeding and Post-breeding aggregation feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Arctic tern	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., Post-breeding aggregation feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Little tern	Low	Very infrequently occurring species within low connectivity to internationally designated breeding sites i.e., SPA breeding colonies not within max foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.

Species	Importance	Justification
Guillemot	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Razorbill	Very High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Black guillemot	Low	Regularly occurring species with low connectivity to internationally designated breeding sites, i.e., not within mean foraging range plus a standard deviation (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Puffin	Very High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Red listed. Vulnerable category with regard to IUCN Red List Criteria.
Red-throated diver	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., Non-breeding feature of The Murrough SPA, through which a small part of the OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Great northern diver	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Fulmar	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Manx shearwater	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021)

Species	Importance	Justification
		Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Gannet	High	Regularly occurring species with very high connectivity to internationally designated breeding sites, i.e., within mean foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Cormorant	Medium	Regularly occurring species with high connectivity to internationally designated breeding sites, i.e., within mean-max foraging range (Woodward et al., 2019) of one or more project areas. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Shag	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Common scoter	Medium	Regularly occurring species with potential connectivity to internationally designated sites, i.e., non-breeding feature of North West Irish Sea cSPA, which is adjacent to OECC. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.

Intertidal species

Table 10-22 Importance of intertidal ornithological receptor species

Species	Importance	Justification
Light-bellied Brent Goose	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Shelduck	Medium	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.

Species	Importance	Justification
Shoveler	Medium	Infrequently occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Pintail	Medium	Infrequently occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Teal	Medium	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Great crested grebe	Low	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs., or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
red-breasted merganser	Low	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Oystercatcher	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Golden plover	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.

Species	Importance	Justification
Grey plover	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Ringed plover	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Curlew	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Bar-tailed godwit	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Black-tailed godwit	High	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Turnstone	Medium	Regularly occurring species with high connectivity to internationally designated sites, i.e., non-breeding feature of North Bull Island SPA, adjacent to South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Knot	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Sanderling	High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al.,

Species	Importance	Justification
		2021) Green listed. Least Concern category with regard to IUCN Red List Criteria.
Dunlin	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Redshank	Very High	Regularly occurring species with very high connectivity to internationally designated sites, i.e., non-breeding feature of South Dublin Bay and River Tolka Estuary SPA, through which intertidal part of OECC runs. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Greenshank	Low	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Green listed. Least Concern category with regard to IUCN Red List Criteria.
Mediterranean gull	Medium	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs. or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Grey heron	Low	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs, or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Green listed. Least Concern category with regard to IUCN Red List Criteria.
Little egret	Low	Regularly occurring species with low connectivity to internationally designated sites, i.e., not a designated feature of South Dublin Bay and River Tolka Estuary SPA through which intertidal part of OECC runs, or adjacent North Bull Island SPA. BOCCI 4 (Gilbert et al., 2021) Green listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Wetland and Waterbirds	International	Regularly occurring species with internationally designated site (non-breeding) within mean maximum foraging range +1 SD of the array site.
Seabird species also regularly recorded in intertidal / inshore survey areas (as per **Table 10-21**, above)		

Other migrant species

Table 10-23 Importance of other migratory ornithological receptors

Species	Importance	Justification
Greenland white-fronted Goose	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Bewick's Swan	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Mallard	Low	Receptor considered to limited potential of connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Pochard	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Vulnerable category with regard to IUCN Red List Criteria.
Eider	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Goldeneye	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Corncrake	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds breeding within Irish SPAs may infrequently pass

Species	Importance	Justification
		through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Hen harrier	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds breeding or wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Lapwing	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Near Threatened category with regard to IUCN Red List Criteria.
Merlin	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds breeding within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Scaup	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Pintail	Low	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Snipe	Medium	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Red listed. Least Concern category with regard to IUCN Red List Criteria.
Tufted Duck	Low	Receptor considered to have limited potential connectivity with international designated populations as

Species	Importance	Justification
		birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Whooper Swan	Low	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria. Listed on Annex I of The Birds Directive.
Wigeon	Low	Receptor considered to have limited potential connectivity with international designated populations as birds wintering within Irish SPAs may infrequently pass through array site during spring and / or autumn migration. BOCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
All other migratory species	Very Low	Receptors with no apparent connectivity with designated populations which may infrequently pass through array site during spring and / or autumn migration.

Onshore species

Table 10-24 Receptor importance of onshore ornithological species

Species	Receptor Importance	Justification
Light-bellied Brent Goose	High	Irregular occurring winter species within the onshore study area. Listed in Annex I of the Bird Directive and SCI (non-breeding) of: The South Dublin Bay and River Tolka Estuary SPA which is directly adjacent to the onshore development boundary (at the landfall) and the North Bull Island SPA, which is located *c*. 2.2 km from the onshore substation. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Peregrine falcon	Medium	Regularly occurring breeding and non-breeding species which occurs in locally important numbers within the onshore study area with a nest site located approx. 300 m from the nearest proposed infrastructure. Listed in Annex I of the Bird Directive. BoCCI 4 (Gilbert et al., 2021) Green listed. Least Concern category with regard to IUCN Red List Criteria.
Greenfinch	Low	Regularly occurring breeding and wintering species which occur in locally important numbers within the onshore

Species	Receptor Importance	Justification
Linnet sand martin		study area, based on baseline survey data. Not Annex I listed, or a Birds Directive Migratory species and no designated sites within the ZoI of the Onshore study area. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.

Estuarine / Liffey species

141. The importance of each ornithological receptor selected for assessment in relation to works in the estuarine / Liffey area is shown in **Table 10-25**, below. Each estuarine / Liffey receptor species is assigned an importance level of Very Low, Low, Medium, High or Very High in accordance with **Table 10-7**.

Table 10-25 Receptor importance of estuarine / Liffey ornithological species

Species	Receptor Importance	Justification
Arctic tern	Medium	Regularly occurring species. Listed in Annex I of the Bird Directive and is an SCI (post-breeding aggregation) of the South Dublin Bay and River Tolka Estuary SPA. The SPA is directly adjacent to the onshore development boundary (at the landfall), there is also a regularly occurring breeding colony located *c*. 25 m north of the onshore substation at the CDL Dolphin. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Black guillemot	Medium	Regularly occurring breeding species. Not designated as a SCI of any SPAs. Number of breeding birds recorded to be of local importance. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Black-headed gull	Low	Regularly occurring species. Listed in Annex I of the Bird Directive and is an SCI (non-breeding) of: The South Dublin Bay and River Tolka Estuary SPA which is directly adjacent to the onshore development boundary (at the landfall) and the North Bull Island SPA, which is located *c*. 2.2 km from the onshore substation. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.
Common tern	Medium	Regularly occurring breeding species. Listed in Annex I of the Bird Directive and is an SCI of The South Dublin Bay and River Tolka Estuary SPA which is directly adjacent to the onshore development boundary (at the landfall), there is also a regularly occurring breeding colony located *c*. 200 m north of the onshore substation at the ESB Dolphin. BoCCI 4 (Gilbert et al., 2021) Amber listed. Least Concern category with regard to IUCN Red List Criteria.

10.6.7 Climate change and natural trends

142. The ornithology baseline environment is not static and is expected to show natural change over time, with this also being the case even if the CWP Project does not go forward. The future baseline scenario for ornithology receptors will involve environmental changes such as climate change and natural annual variation, as well as potential changes due to Highly pathogenic avian influenza (HPAI); and also fluctuations and impacts arising from established activities such as commercial fishing activity in the area.

143. In terms of climate change, Irish waters are exhibiting an increase in sea surface temperature of approximately 0.6 °C per decade (Marine Institute, 2009). Sea temperatures are known to impact on seabirds through impacts on prey (e.g., Carroll et al., 2015), and therefore long-term decreases can be expected for many seabirds due to these continued changes, with these impacts currently being seein in population trends (Davies et al., 2021; Davies et al., 2023; Burnell et al., 2023).

144. HPAI is an extremely contagious virus which occurs mainly in birds. An outbreak of the H5N1 strain of HPAI has been recorded in seabirds in Europe, including those in Ireland, from 2022. Impacts to date have included mortality recorded for species such as Gannet, Black-headed gull, Common tern, Arctic tern, Roseate tern, Sandwich tern, (BirdWatch Ireland, 2022a, 2023).

145. Any fluctuations in commercial fisheries will also have an impact on seabird numbers, again through impacts on prey species.

146. Any changes that may occur during the design life span of the CWP Project should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment. It should also be noted that where there is a change in a population size, any impact arising from the CWP Project will be expected to change proportionately; i.e., if there is a 5% reduction in a population size, then any impacts arising from collision or displacement will also be reduced by 5%.

10.6.8 Predicted future baselines

147. As set out above, future baselines for ornithology are likely to vary due to environmental factors (such as climate change, natural annual variation and HPAI), and also any changes in established activities such as commercial fishing. Consideration will be given, where possible and where relevant to the impacts that may arise on ornithological receptors.

10.7 Scope of the assessment

148. EIA Scoping Reports for the offshore and onshore infrastructure were published on the 6 January 2021 and 6 May 2021, respectively. The Scoping Reports were uploaded to the CWP Project website and shared with regulators, prescribed bodies and other relevant consultees, inviting them to provide relevant information and to comment on the proposed approach being adopted by the Applicant in relation to the both the offshore and onshore elements of the EIA.

149. Based on responses to the Scoping Report, further consultation and refinement of the CWP Project design, potential impacts to ornithology scoped into the assessment are listed below in **Table 10-26**.

150. The impact pathways noted in **Table 10-26** are assessed against each of the identified study areas, with exceptions clearly noted where applicable. For example, collision risk is only applicable to the offshore array, rather than any other project component.

Table 10-26 Potential impacts scoped into the assessment

Impact No.	Description of impact	Notes
Construction		
Offshore and intertidal impacts		
Offshore / intertidal Impact 1	Direct effects on offshore and intertidal habitats during construction phase activities.	Removal or alteration of habitats in such a way as to affect their value to ornithological receptors or prevent or reduce the use of those habitats by receptor.
Offshore / intertidal Impact 2	Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during construction phase activities.	Behavioural responses to wind farm infrastructure or associated activity leading to effective indirect habitat loss through the avoidance of use of particular areas, or barrier effects through additional energetic consequences from the avoidance of passage through particular areas.
Offshore / intertidal Impact 3	Changes in prey availability for ornithological receptors in offshore and intertidal habitats from construction phase activities.	Redistribution or other effects to prey species which change their availability to foraging birds and resultant redistribution of ornithological receptors.
Offshore / intertidal Impact 4	Accidental pollution in offshore and intertidal habitats during construction phase activities.	Effects arising from the accidental release of materials during proposed works which may impact ornithological features by causing mortality or reductions in fitness or reduce the quality of the habitats which they use.
Offshore / intertidal Impact 5	Accidental introduction or spread of invasive species in offshore and intertidal habitats during construction phase activities.	Effects arising from the accidental release or redistribution of non-native invasive species during proposed works which may impact ornithological features directly or reduce the quality of the habitats which they use.
Onshore impacts *assessed alongside estuarine / Liffey impacts		
Onshore Impact 1	Direct effects on onshore habitats during construction phase activities.	The main construction phase impacts associated specifically with the OTI include the loss of nesting, breeding and roosting sites through habitat loss and degradation and the disturbance / displacement of protected bird species.
Onshore Impact 2	Disturbance and displacement to ornithological receptors in onshore habitats (through noise, human presence and / or presence of OTI) during construction phase activities	

Impact No.	Description of impact	Notes
Onshore Impact 3	Onshore habitat degradation as a result of the introduction / spread of non-native invasive plant species	
Estuarine / Liffey impacts *assessed alongside onshore impacts		
Estuarine / Liffey Impact 1	Direct effects on estuarine / Liffey habitats during construction phase activities.	The main construction phase impacts associated specifically with the OTI include the loss of nesting, breeding and roosting sites through habitat loss and degradation and the disturbance / displacement of protected bird species within the estuarine / Liffey area.
Estuarine / Liffey Impact 2	Disturbance and displacement to ornithological receptors in estuarine / Liffey habitats (through noise, human presence and / or presence of OTI) during construction phase activities.	
Operation and Maintenance		
Offshore and intertidal impacts		
Offshore / intertidal Impact 1	Direct effects on offshore and intertidal habitats during the operation and maintenance phase.	Removal or alteration of habitats in such a way as to affect their value to ornithological receptors or prevent or reduce the use of those habitats by receptor.
Offshore / intertidal Impact 2	Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during operation and maintenance phase activities.	Behavioural responses to wind farm infrastructure or associated activity leading to effective indirect habitat loss through the avoidance of use of particular areas, or barrier effects (array site only) through additional energetic consequences from the avoidance of passage through particular areas.
Offshore / intertidal Impact 3	Changes in prey availability for ornithological receptors in offshore and intertidal habitats during the operation and maintenance phase.	Redistribution or other effects to prey species which change their availability to foraging birds and resultant redistribution of ornithological receptors.
Offshore / intertidal Impact 4	Accidental pollution in offshore and intertidal habitats during operation and maintenance phase activities.	Effects arising from the accidental release of materials during proposed works which may impact ornithological features by causing mortality or reductions in fitness or reduce the quality of the habitats which they use.
Offshore / intertidal Impact 5	Accidental introduction or spread of invasive species in offshore and intertidal habitats during operation and maintenance phase activities.	Effects arising from the accidental release or redistribution of non-native invasive species during proposed works which may impact ornithological features directly or

Impact No.	Description of impact	Notes
		reduce the quality of the habitats which they use.
Offshore / intertidal Impact 6	Collision with operational Wind Turbine Generators (WTGs) within array site only.	Where ornithological receptors fly through project infrastructure, specifically turbines within the offshore array site, collision with rotating blades of the wind turbines may result in the death or injury of individuals.
Estuarine / Liffey impacts		
Estuarine / Liffey Impact 1	Disturbance / displacement (noise, human presence and / or lighting) to protected bird species during operation and maintenance activities.	The main impacts during the operational phase associated with the OTI include the disturbance of protected bird species within the vicinity of the onshore substation.
Estuarine / Liffey Impact 2	Presence of buildings and infrastructure in close proximity to a protected species breeding colony, causing potential disturbance / displacement via shadow affects or increase of predation threat.	The presence of the buildings and infrastructure could cast a shadow on surrounding habitat which could potentially impact the breeding colony of Common and Arctic terns on the CDL dolphin (approximately 25 m) from the onshore substation buildings. The presence of the buildings and infrastructure could also create perching opportunities for species such as peregrine falcon or hooded crow (*Corvus cornix*), which may increase the actual or perceived, predator threat on the nesting colony.
Decommissioning		
Offshore and intertidal impacts		
Offshore / intertidal Impact 1	Direct effects on offshore and intertidal habitats during decommissioning phase activities.	Potential impacts during the decommissioning phase are considered to arise from similar pathways to those anticipated during the construction phase and to be of similar or smaller magnitude than during the construction phase.
Offshore / intertidal Impact 2	Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during decommissioning phase activities.	
Offshore / intertidal Impact 3	Changes in prey availability for ornithological receptors in offshore and intertidal habitats from decommissioning phase activities.	

Impact No.	Description of impact	Notes
Offshore / intertidal Impact 4	Accidental pollution in offshore and intertidal habitats during decommissioning phase activities.	
Offshore / intertidal Impact 5	Accidental introduction or spread of invasive species in offshore and intertidal habitats during decommissioning phase activities.	
Onshore and Estuarine / Liffey impacts		
Onshore and Estuarine / Liffey Impact 1	Direct effects on onshore and Estuarine / Liffey habitats during decommissioning phase activities.	Potential impacts during the decommissioning phase are considered to arise from similar pathways to those anticipated during the construction phase and to be of similar or smaller magnitude than during the construction phase.
Onshore and Estuarine / Liffey Impact 2	Disturbance and displacement to ornithological receptors in onshore and Estuarine / Liffey habitats (through noise, human presence and / or presence of OTI) during decommissioning phase activities.	
Onshore Impact 3	Onshore habitat degradation as a result of the introduction / spread of non-native invasive plant species during decommissioning phase activities.	

151. Based on responses to the Scoping Report, further consultation and refinement of the CWP Project design, potential impacts to onshore ornithology scoped out of the assessment are listed below in **Table 10-27**. Feedback from scoping for offshore and intertidal ornithology was not to scope any potential impacts out of the assessment.

Table 10-27 Potential impacts scoped out of the assessment

Description of impact	Justification for scoping out
Habitat degradation (Fresh Water Quality) within the onshore study area.	There is no potential for water quality impacts on freshwater waterbodies, which may be used by bird species, as no streams, rivers, lakes or wetlands were recorded within the onshore study area, so no source-pathway-receptor was identified, thus degradation of freshwater bodies have been scoped out of this assessment.
Accidental pollution on onshore and estuarine / Liffey habitats during construction phase activities.	There is no potential for impacts to birds within the onshore and estuarine / Liffey habitats as any potential pollution events will be extremely localised in area. Species recorded in any areas of impacted habitats, were recorded in limited numbers or not dependent on these areas for breeding or resting, e.g., Greenfinch which nest in trees or scrubs and tern species which nest on mooring platforms within the River Liffey will not be impacted by a potential accidental oil spill on the ground or within the water.

Description of impact	Justification for scoping out
Changes in prey availability for ornithological receptors in estuarine / Liffey habitats from construction phase activities.	There is no potential for impacts to birds within the estuarine / Liffey area. The birds located within this study area were not found to hunt or forage at this location and so there is no potential for a change in prey availability.
Disturbance and displacement of ornithological receptors in onshore habitats from operational and maintenance phase activities.	There is no potential for disturbance and displacement impacts within the onshore study area during the operational and maintenance phase. Operational phase activities will be minimal, short term in nature and consistent with the existing industrial area, without introducing new or heightened disturbances to the onshore environment.
Introduction / spread of invasive non-native species (INNS) to the estuarine / Liffey habitats during construction phase activities.	There is no potential for impacts to birds within the estuarine / Liffey study area as a result of the introduction / spread of INNS during construction phase activities. Terrestrial based invasive plant species (such as Japanese knotweed (*Reynoutria japonica*)) cannot establish within the aquatic habitats of estuarine / Liffey area, and the CWP Project does not propose to use any vessels within the River Liffey.

10.8 Assessment parameters

10.8.1 Background

152. Complex, large-scale infrastructure projects with a terrestrial and marine interface such as the CWP Project, are consented and constructed over extended timeframes. The ability to adapt to changing supply chain, policy or environmental conditions and to make use of the best available information to feed into project design, promotes environmentally sound and sustainable development. This ultimately reduces project development costs and therefore electricity costs for consumers and reduces CO_2 emissions.

153. In this regard the approach to the design development of the CWP Project has sought to introduce flexibility where required, among other things, to enable the best available technology to be constructed and to respond to dynamic maritime conditions, whilst at the same time to specify project boundaries, project components and project parameters wherever possible, whilst having regard to known environmental constraints.

154. **Chapter 4 Project Description** describes the design approach that has been taken for each component of the CWP Project. Wherever possible the location and detailed parameters of the CWP Project components are identified and described in full within the EIAR. However, for the reasons outlined above, certain design decisions and installation methods will be confirmed post-consent, requiring a degree of flexibility in the planning consent.

155. Where necessary, flexibility is sought in terms of:

- Up to two options for certain permanent infrastructure details and layouts such as the WTG layouts.
- Dimensional flexibility; described as a limited parameter range i.e., upper and lower values for a given detail such as cable length.
- Locational flexibility of permanent infrastructure; described as Limit of Deviation from a specific point or alignment.

156. The CWP Project had to procure an opinion from An Bord Pleanála to confirm that it was appropriate that this application be made and determined before certain details of the development were confirmed. An Bord Pleanála issued that opinion on 25 March 2024 (as amended in May 2024) and it confirms that the CWP Project could make an application for permission before the details of certain permanent infrastructure described in **Section 4.3** of **Chapter 4 Project Description**.

157. In addition, the application for permission relies on the standard flexibility for the final choice of installation methods and O&M activities.

158. Notwithstanding the flexibility in design and methods, the EIAR identifies, describes and assesses all of the likely significant impacts of the CWP Project on the environment.

10.8.2 Options and dimensional flexibility

159. Where the application for permission seeks options or dimensional flexibility for infrastructure or installation methods, the impacts on the environment are assessed using a representative scenario approach. A 'representative scenario' is a combination of options and dimensional flexibility that has been selected by the author of this EIAR chapter to represent all of the likely significant effects of the project on the environment. Sometimes, the author will have to consider several representative scenarios to ensure all impacts are identified, described and assessed.

160. For offshore ornithology this analysis is presented in **Appendix 10.2** which identifies one or more representative scenario for each impact with supporting text to demonstrate that no other scenarios would give rise to new or materially different effects; taking into consideration the potential impact of other scenarios on the magnitude of the impact or the sensitivity of the receptor(s) that is being considered.

161. For onshore and Estuarine / Liffey ornithology, the infrastructure design and installation techniques with potential to give rise to ornithological impacts have been confirmed in the planning application and consequently the assessment is confined to a single scenario for all construction and O&M phase impacts.

162. **Table 10-28** below, presents a summarised version of **Appendix 10.2** and describes the representative scenarios on which the construction and O&M phase ornithology assessment has been based. Where options exist, for each receptor and potential impact, the table identifies the representative scenario and provides a justification for this.

10.8.3 Limit of deviation

163. Where the application for permission seeks locational flexibility for infrastructure, the impacts on the environment are assessed using a LoD. The LoD is the furthest distance that a specified element of the CWP Project can be constructed.

164. This chapter assesses the specific preferred location for permanent infrastructure. However, **Appendix 10.2** provides further analysis to determine if the proposed LoD for permanent infrastructure may give rise to any new or materially different effects; taking into consideration the potential impact of the proposed LoD on the magnitude of the impact.

165. For ornithology this analysis is summarised in **Table 10-28** and **Table 10-29**.

166. Where the potential for LoD to cause a new or materially different effect is identified, then this is noted in **Table 10-30** and is considered in more detail within **Section 10.10** of this chapter.

10.8.4 Alternative alignment for the purposes of modelling

167. Where the application for permission seeks locational flexibility for infrastructure, the impacts on the environment are assessed using a LoD. However, for the purposes of noise modelling within the intertidal an approach has been taken which identifies the alternative alignment for the purposes of modelling (AAM), which is the furthest distance that a specified element of the CWP Project can be constructed, alongside the preferred alignment (PA). The AAM is adopted to ensure that impacts from noise are considered from both the more central PA but also the peripheral areas from the intertidal sections of the OECC which maybe subject to noisy activities.

Table 10-28 Array design parameters relevant to assessment of impacts to ornithology

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
Construction				
Impact 1 - Direct effects on offshore and intertidal habitats during construction phase activities.	Offshore			
	WTG tower diameter at LAT (m)	-	9	Impact 1 (Direct effects on habitat during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option B would be the representative scenario due to covering a larger area than Option A.
	Number of WTGs	-	60	
	OSS monopile diameter at mudline (m)	-	9.5	
	Number of OSSs	3		
	Sea surface area covered by WTG bases (m^2)	4,029.68 m^2 (assuming 9 m diameter WTG towers, and therefore 63.62 m^2 per tower, and 9.5 m diameter OSS towers with 70.88 m^2 per OSS)		
	Intertidal			
	Duration of temporary cofferdam once constructed (weeks)	4		Impact 1 (Direct effects on habitat during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on intertidal ornithological features.
	Total seabed disturbed by cofferdam (m^2) (including a 20 m working area the footprint of the cofferdam for installation and subsequent removal).	6,100		
	Number of open cut cable duct trenches from cofferdam to the transition zone	3		
	Maximum length of open cut cable duct trenches (m)	300		
	Depth of open cut cable duct trenches (m)	3		
	Width of open cut cable duct trenches (m)	18		
	Width of seabed affected by installation (m)	40		
	Total seabed disturbed by open cut cable duct installation (m^2)	36,000		
	Total area of seabed in transition zone affected by cable laying support structures (m^2)	6,900		
	Total area of seabed disturbed in the transition zone (m^2)	108,000		
	Total area of disturbed intertidal habitat for landfall (intertidal OECC installation) construction activities (m^2)	**157,000 (0.16km^2)**		
Impact 2 - Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during construction phase activities.	Array site			
	Array site and surrounding buffer + 4km	358.63 km^2		Impact 2 (Disturbance and displacement during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option A would be the representative scenario due to a longer period of piling than Option B.
	Maximum hours of piling per WTG / OSS monopile (WTG Options A and B)	3.5		
	Maximum number of monopiles WTG / OSS installed in 24 hours (WTG Options A and B)	1–2		
	Estimated number of WTG piling days	75	-	
	Estimated number of OSS piling days	3		
	Estimated total WTG piling hours	262.5	-	
	Estimated total OSS piling hours	10.5		

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
	Maximum number of simultaneous piling events	1		
	Construction vessels	2,409		
	OECC			
	Total cable installation period for all three cables within the OECC - based upon 3 cables multiplied by vessel working rates (hours)	720		Impact 2 (Disturbance and displacement during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Maximum number of vessels active in association with cable installation activities within the OECC at any one time	5		
	Maximum length of cable to be installed in 24 hours (km)	25		
	Intertidal			
	Total piling duration for temporary cofferdam (weeks)	2		Impact 2 (Disturbance and displacement during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on intertidal ornithological features.
	Duration of temporary cofferdam once constructed (weeks)	4		
	Number of open cut cable duct trenches from cofferdam to the transition zone	3		
	Maximum length of open cut cable duct trenches (m)	300		
	Depth of open cut cable duct trenches (m)	3		
	Width of open cut cable duct trenches (m)	18		
	Width of seabed affected by installation (m)	40		
	Total seabed disturbed by open cut cable duct installation (m^2)	36,000		
	Total area of seabed in transition zone affected by cable laying support structures (m^2)	6,900		
	Maximum potential number of piling events	26 days, comprising Cofferdam: Two weeks; Tensioner platforms: 9 days; TJBs: 3 days		
Impact 3 - Changes in prey availability for ornithological receptors in offshore and intertidal habitats from construction phase activities.	Array site			
	Permanent infrastructure and installation methods			Impact 3 (Changes in prey availability during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option A would be the representative scenario due to a longer period of piling, longer length of Inter Array Cable (IAC), interconnector and export cables, a higher number of WTG than Option B.
	Boulder clearance: Array site seabed clearance area (m^2)	2,556,000 - 2,934,000		
	Sand wave clearance: Array site seabed clearance area (m^2)	205,250 - 259,250		
	IAC and interconnector cable installation: Total seabed disturbed (m^2)	1,911,000 - 2,214,000		
	WTGs and OSS anchoring operations total impact area (m^2)	280,800		
	IAC and interconnector cable anchoring operations total impact area (m^2)	371,520		
	JUV operations total impact area (m^2)	240,000		
	Maximum total extent of seabed habitat disturbed within array site during construction (m^2)	**6,299,570**		
	Maximum hours of piling per WTG / OSS monopile	3.5		
	Maximum number of monopiles WTG / OSS installed in 24 hours	2		

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
	Estimated number of WTG piling days	75	-	
	Estimated number of OSS piling days	3		
	Estimated total WTG piling hours	262.5	-	
	Estimated total OSS piling hours	10.5		
	Maximum number of simultaneous piling events	1		
	Progressive change in habitat during construction			
	Monopile seabed area per WTG (m^2)	64	-	
	Area of scour protection per location (including monopile footprint) (m^2)	3,640		
	Total WTG monopile seabed area take (with scour protection) across the array site (m^2)	273,000	-	
	Seabed area covered by OSS bases with scour protection (m2)	10,920		
	Interconnector and inter-array cabling total area of seabed covered by cable protection (m^2)	208,600		
	Volume of scour protection per location (m^3)	5,365		
	OECC			
	Clearance corridor width per export cable (m)	20		Impact 3 (Changes in prey availability during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Total length of export cables for boulder clearance (km)	132		
	Clearance impact area (m^2)	2,616,000		
	Sandwave clearance corridor width per cable (m)	50		
	Length of cables affected by sandwave clearance (m)	3,971		
	Sandwave clearance total area (m^2)	198,550		
	Offshore export cable installation: Total seabed disturbed (m^2)	1,890,000 - 2,187,000		
	Offshore export cable anchoring operations total impact area (m^2)	630,720		
	Maximum total extent of seabed habitat disturbed within OECC during construction (m^2)	5,632,270		
	Seabed area covered by OECC and associated infrastructure (m^2)	105,000		
	Intertidal			
	Duration of temporary cofferdam once constructed (weeks)	4		Impact 3 (Changes in prey availability during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on intertidal ornithological features.
	Total seabed disturbed by cofferdam (m^2)	6,100		
	Number of open cut cable duct trenches from cofferdam reception pit(s) to the transition zone	3		
	Maximum length of open cut cable duct trenches (m)	300		
	Depth of open cut cable duct trenches (m)	3		
	Width of open cut cable duct trenches (m)	18		
	Width of seabed affected by installation (m)	40		
	Total seabed disturbed by open cut cable duct installation (m^2)	36,000		

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
	Total area of seabed in transition zone affected by cable laying support structures (m^2)	6,900		
	Total area of seabed disturbed in the transition zone (m^2)	108,000		
	Total area of disturbed intertidal habitat for landfall (intertidal OECC installation) construction activities (m^2)	157,000 ($0.16km^2$)		
Impact 4 - Accidental pollution in offshore and intertidal habitats during construction phase activities.	Array site			Impact 4 (Accidental pollution during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Lubricating oils, hydraulic oils and coolants required for the safe use and operation WTGs and associated equipment: Grease, hydraulic oil, gear oil, nitrogen, transformer silicon / ester oil, diesel fuel, sulphur hexafluoride (SF6), glycol / Coolants and batteries.			
	Intertidal			
	Lubricating oils, hydraulic oils and coolants required for the safe use and operation of Backhoe and / or 360° excavator; 35 t or 45 t excavators: Grease, hydraulic oil, gear oil, nitrogen, transformer silicon / ester oil, diesel fuel, sulphur hexafluoride (SF6), glycol / Coolants and batteries.			
Impact 5 - Accidental introduction or spread of invasive species in offshore and intertidal habitats during construction phase activities.	Array site and OECC			
	Maximum total construction vessels	75 (2,409 round trips)	-	Impact 5 (Accidental introduction or spread of invasive species during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option A would be the representative scenario due to higher number of vessel trips than Option B.
	Intertidal			
	Maximum total construction vessels	17 (118 round trips)	-	Impact 5 (Accidental introduction or spread of invasive species during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option A would be the representative scenario due to higher number of vessel trips than Option B.
Operation and Maintenance				
Impact 1 - Direct effects on offshore and intertidal habitats during the operational phase.	Array site			
	Diameter of WTG towers at LAT (m)	-	9	Impact 1 (Direct effects on habitat during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Option B would be the representative scenario due to larger diameters than Option A.
	Number of WTGs	-	60	
	OSS monopile diameter at mudline (m)	-	9.5	
	Number of OSSs	3		
	Sea surface area covered by WTG bases (m^2)		4,029.68 m^2 (assuming 9 m diameter	

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
			WTG towers, and therefore 63.62 m² per tower, and 9.5 m diameter OSS towers with 70.88 m² per OSS)	
	Intertidal			
	N/A			N/A, as buried infrastructure is passive during O&M phase
Impact 2 - Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during operational phase activities. For Array Site includes barrier effects, where flying individuals may experience increased energetic costs associated with additional travel distances from transiting around the WTG array rather through.	Array site			
	Total area of array site (km²)	125		Impact 2 (disturbance and displacement during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Number of WTGs	75	60	
	Number of OSSs	3		
	Intertidal			
	N/A			N/A, as buried infrastructure is passive during O&M phase, impact limited to occasional maintenance
Impact 3 - Changes in prey availability for ornithological receptors in offshore and intertidal habitats during the operational phase.	Array site			Impact 3 (Changes in prey availability during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Total footprint of infrastructure (km²)	0.60	-	
	OECC			
	Total footprint of infrastructure (km²)	0.11		
	Intertidal			
	N/A			N/A, as buried infrastructure is passive during O&M phase
Impact 4 - Accidental pollution in offshore and intertidal habitats during operational phase activities.	Array site and OECC			
	N/A			Impact 4 (Accidental pollution during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.
	Intertidal			

<table>
<tr><th>Impact</th><th>Representative scenario details and value</th><th>WTG Option A</th><th>WTG Option B</th><th>Notes / Assumptions</th></tr>
<tr><td></td><td colspan="3">Equipment: Likely backhoe and / or 360° excavator; 30 t or 40 t excavators in the event of unplanned maintenance activities</td><td>Impact 4 (Accidental pollution during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on intertidal ornithological features in the event of unplanned maintenance activities which require excavation of the cable.</td></tr>
<tr><td rowspan="5">Impact 5 - Accidental introduction or spread of invasive species in offshore and intertidal habitats during operational phase activities.</td><td colspan="4">Array site and OECC</td></tr>
<tr><td colspan="3">There is the potential that INNS could be introduced to the area through vectors such as ships' ballasts.
Estimated annual vessel traffic:
• Jacked Up Vessel (JUV): 2 (3 round trips)
• Service Operation Vessel (SOV): 1 (26 round trips)
• Crew Transfer Vessel (CTV): 6 (1152 round trips)
• Cable maintenance vessel: 2 (1 round trips)</td><td rowspan="2">Impact 5 (Accidental introduction or spread of invasive species during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features.</td></tr>
<tr><td>Auxiliary vessel (includes survey vessels, ROVs, AUVs, tug operations, cargo vessels, passenger vessels and scour replacement vessels)</td><td colspan="2">3 (27 round trips)</td></tr>
<tr><td colspan="4">Intertidal</td></tr>
<tr><td colspan="3">N/A</td><td>N/A, as buried infrastructure is passive during O&M phase</td></tr>
<tr><td rowspan="10">Impact 6 - For Array Site only. Collision with operational WTGs.</td><td colspan="4">Array site</td></tr>
<tr><td>Number of turbines</td><td>75</td><td>60</td><td rowspan="9">Impact 6 (Collision with operational WTGs during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on offshore ornithological features. Collision estimates are provided for both design options.
It should be noted that the assessment of Impact 6 is herein assessed with Option A considered as a representative scenario for all species, as impact magnitudes although slightly less for Option B are not materially different. The exception to this is Herring gull, for which impact magnitudes are considered to materially differ between Option A and B and impact assessment in relation to both options is provided in this chapter.</td></tr>
<tr><td>Latitude (degrees)</td><td>53.1</td><td>53.1</td></tr>
<tr><td>Number of blades</td><td colspan="2">3</td></tr>
<tr><td>Rotor radius (m)</td><td>125</td><td>138</td></tr>
<tr><td>Air gap (m) (MSL)</td><td colspan="2">36</td></tr>
<tr><td>Tidal offset (m)</td><td colspan="2">-1.72</td></tr>
<tr><td>Blade width (m)</td><td>7.0</td><td>7.9</td></tr>
<tr><td>Mean rotation speed (rpm ± SD)</td><td>6.804±1.246</td><td>5.591±1.402</td></tr>
<tr><td>Pitch (degrees ± SD):</td><td>6.738±5.044</td><td>7.248±6.923</td></tr>
<tr><td colspan="5">Decommissioning</td></tr>
<tr><td>Impact 1 - Direct effects on offshore and intertidal habitats during decommissioning phase activities.</td><td colspan="3">For the purposes of the EIA, at the end of the operational lifetime of the CWP Project, all offshore infrastructure will be rehabilitated.</td><td>Potential impacts during the decommissioning phase are considered to</td></tr>
</table>

Impact	Representative scenario details and value	WTG Option A	WTG Option B	Notes / Assumptions
Impact 2 - Disturbance and displacement to ornithological receptors in offshore and intertidal habitats during decommissioning phase activities. **Impact 3 -** Changes in prey availability for ornithological receptors in offshore and intertidal habitats from decommissioning phase activities. **Impact 4 -** Accidental pollution in offshore and intertidal habitats during decommissioning phase activities. **Impact 5 -** Accidental introduction or spread of invasive species in offshore and intertidal habitats during decommissioning phase activities.	The activities and methodology for decommissioning are likely to include: • Dismantling and removal of offshore equipment; • Removal of cabling, and where required leaving *in-situ*; • Removal and demolition of OSS; and Reinstatement and landscaping works.			arise from similar pathways to those anticipated during the construction phase and to be of similar or smaller magnitude than during the construction phase.

Table 10-29 Onshore and estuarine / Liffey design parameters relevant to assessment of ornithology

Impact	Representative scenario details	Value	Notes / Assumptions
Construction			
Onshore and Estuarine / Liffey - Impact 1: Direct effects on habitats	Landfall		Impact 1 (Direct effects on habitat during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on onshore ornithological features.
	Temporary infrastructure		
	Area of the main construction compound (Construction Compound A) (m^2)	19,800	
	Dimensions of temporary access ramp (including route from main compound) (L x W) (m)	60x10	
	Area of site clearance for temporary access ramp (m^2)	600	
	Installation methods and effects		
	Total area of site clearance at the TJBs through to the HWM (front and back berms) (inc. access ramp) (m^2)	5,000	
	Area of site clearance from TJBs to HWM and front berm (m^2)	2,200	
	Area of site clearance at the TJBs (m^2)	2,200	
	Onshore export cables		
	Temporary infrastructure		
	Number of temporary tunnel shafts and temporary tunnel compounds (with two being situated within the boundary of Construction Compound A & the onshore substation)	3	
	Temporary tunnel compound 2 (reception) area: (m^2)	3,239	
	Combined area for the 3 No. tunnel compounds for the onshore export cable route (m^2)	20,215[1]	
	Installation methods and effects		
	Tunnel invert (m ODM)	-25.3	
	Overall duration to complete construction and cable duct installation (months)	21	
	Onshore substation		
	Installation methods and effects		
	Area of reclaimed land from Liffey, for the ESB buildings (m^2)	1,800	
	Total footprint of temporary site clearance inc. access roads (m^2)	20,090	
	ESBN network cables		
	Temporary infrastructure		
	Number of temporary HDD compounds (*one within Compound C and one within Poolbeg 220 kV substation, therefore no additional temporary habitat loss*)	2	

[1] *Note: temporary tunnel compounds 1 & 3 are located within Compound A and the onshore substation site respectively.*

Impact	Representative scenario details	Value	Notes / Assumptions
	Area of temporary HDD compounds 1 & 2 (m^2)	3,434	
	Installation methods and effects		
	Number of onshore export cable circuits	3	
	Number of open cut sections	1	
	Number of HDD sections	1	
	Length of ESBN network cable ducts and associated cables (m)	400	
	Total length of open cut section (m)	265	
	Total length of HDD section (m)	135	
	Depth of the HDD installation at its deepest (m bgl)	10	
	Construction compounds		
	Compound A area (m^2)	19,800	
	Compound B area (m^2)	32,300	
	Compound C area (m^2)	3,350	
	Compound D area (m^2)	360	
Onshore and Estuarine / Liffey - Impact 2: Disturbance / displacement	Landfall	Open cut	Impact 2 (disturbance and displacement during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on onshore ornithological features.
	Installation methods and effects		
	Open cut excavation including piling works for the temporary cofferdam Combined Sound Power (L_w) dB (A)	120	
	TJB piling works Combined Sound Power (L_w) dB (A)	116	
	Total piling duration for temporary cofferdam [weeks]	2	
	Duration of temporary cofferdam once constructed [weeks]	4	
	Piling duration for the TJB excavations (days)	3	
	Onshore export cable	Tunnel	
	Installation methods and effects		
	Excavation of the underground tunnel shafts (launch / receptions shaft sites) Combined Sound Power (L_w) dB (A)	113	
	Overall duration to complete construction and installation (months)	21	
	Onshore substation		
	Installation methods and effects		
	Piling works with a simultaneous excavator - Combined Sound Power (Lw) dB (A)	119	
	Duration of civils work to construct the combi-wall (weeks)	20	
	Duration of the overall construction period (months)	36	

Impact	Representative scenario details	Value	Notes / Assumptions
	ESBN network cable	Open cut and HDD	
	Installation methods and effects		
	Overall duration to complete construction and installation (months)	6	
	HDD installation activities - Combined Sound Power (Lw) dB (A)	115	
	Vibration		
	Elements of the construction phase works such as the piling, HHD drilling and mechanical excavation will result in some level of vibration.		
	Lighting		
	Localised task lighting will be required during the construction phase. This is required for the safety and productivity of construction workers and for construction works to be undertaken properly. Additionally, once commenced, certain activities will operate continuously over 24hr periods. This would include activities such as tunnelling activities for the onshore export cable and HDD activities for the ESBN network cables. It is expected that lighting would generally be in the form of mounted flood lights, which will be cowled and directional to minimise light splay from the working areas.		
Onshore - Impact 3: Introduction of non-native species	OTI (landfall, onshore export cables, onshore substation, ESBN network cables)		Impact 3 (introduction of non-native species during construction) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on onshore ornithological features.
	Refer to Impact 1 for details.		
Operations and maintenance			
Onshore and Estuarine / Liffey Impact 1: Disturbance / displacement	Onshore substation		Impact 1(disturbance and displacement during operation and maintenance) requires assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on onshore ornithological features.
	Permanent infrastructure		
	Contribution of noise from the onshore substation to the existing baseline levels	The predicted levels from the onshore substation is at least 10dB below the existing baseline noise levels	
	Lighting	External lighting of the onshore substation during the O&M phase will be only required for the following purposes: • access and egress; • security lighting; • car park lighting; and • repair / maintenance. At night substation lighting will be switched off as the substation will be unmanned. Lights will only be used during periods where and when work is to be carried out (i.e., maintenance) and lights will be positioned to suit the work.	
	Onshore substation		Impact 2 (disturbance and displacement during operation and maintenance) requires
	Permanent infrastructure		

Impact	Representative scenario details	Value	Notes / Assumptions
Estuarine / Liffey Impact 2: Presence of buildings and infrastructure	Total footprint of permanent onshore substation infrastructure - Operational site area (m^2)	16,050	assessment of receptors in response to quantified levels of impact. The parameters herein provide the information required upon which to base the assessment of this impact on onshore ornithological features.
	Length of new access bridge (m)	25	
	Width of new access bridge (m)	9.5	
	Number of buildings	4	
	Maximum building height (+mOD)	35.20	
	Height of lightning protection masts above buildings (m)	3.00	
	Main GIS building dimensions (L x W x H) (m)	62.75 x 20.67 x 35.20 (+mOD)	
	ESB GIS building dimensions (L x W x H) (m)	35.97 x 15.95 x 23.10 (+mOD)	
	ESB MV building dimensions (L x W x H) (m)	10.14 x 5.64 x 8.07 (+mOD)	
	Statcom building dimensions (L x W x H) (m)	94.02 x 27.87 x 29.50 (+mOD)	
Decommissioning			
Onshore and Estuarine / Liffey - Impact 1: Direct effects on habitats **Onshore and Estuarine / Liffey - Impact 2**: Disturbance / displacement **Onshore - Impact 3**: Introduction of non-native species	It is recognised that legislation and industry best practice change over time. However, for the purposes of the EIA, at the end of the operational lifetime of the CWP Project, it is assumed that all OTI will be removed where practical to do so. In this regard, for the purposes of an assessment scenario for decommissioning impacts, the following assumptions have been made: • The TJBs and onshore export cables (including the cable ducting) will be completely removed. • The landfall cable ducts and associated cables will be completely removed. • The underground tunnel, within which the onshore export cables will be installed will be left *in-situ* and may be re-used for the same or another purpose. • The onshore substation buildings and electrical infrastructure will be completely removed. • The reclaimed land, substation platform, perimeter structures and the new access bridge at the onshore substation site will remain *in-situ* and may re-used for the same or another purpose. • The ESBN network cables (including the cable ducting) will be completely removed. The general sequence for decommissioning is likely to include: • Dismantling and removal of electrical equipment; • Removal of ducting and cabling, where practical to do so; • Removal and demolition of buildings, fences and services equipment; and • Reinstatement and landscaping works. Closer to the time of decommissioning, it may be decided that removal of certain infrastructure, such as the TJBs, landfall cable ducts and associated cables, onshore export cables and ESBN networks cables, would lead to a greater environmental impact than leaving the components *in-situ*. In this case it may be preferable not to remove these components at the end of their operational life. In any case, the final requirements for decommissioning of the OTI, including landfall infrastructure, will be agreed at the time with the relevant statutory consultees. It is anticipated that, for the purposes of an assessment scenario, the impacts will be no greater than those identified for the construction phase.		Potential impacts during the decommissioning phase are considered to arise from similar pathways to those anticipated during the construction phase and to be of similar or smaller magnitude than during the construction phase.

Table 10-30 Limit of deviation relevant to assessment of ornithology

Project component	Limit of deviation	Conclusion from Appendix 10.2
WTGs / OSSs	100 m from the centre point of each WTG and OSS location is proposed to allow for small adjustments to be made to the structure locations.	No potential for new or materially different effects
IACs / interconnector cables	100 m either side of the preferred alignment of each IAC and interconnector cable 200 m from the centre point of each WTG location	No potential for new or materially different effects
Offshore export cables	250 m either side of the preferred alignment within the array site. The offshore export cable corridor (OECC) outside of the array site	New and potentially material different impacts considered within this assessment in the intertidal area (AAM).
TJBs	0.5 m either side (i.e., east / west) of the preferred TJB location	No potential for new or materially different effects
Landfall cable ducts (and associated offshore export cables within the ducts)	Defined LoD boundary with 30 – 55 m horizontal width	New and potentially material different impacts considered within this assessment in the intertidal area (AAM).
Intertidal cable ducts (and associated offshore export cables within the ducts)	The OECC	New and potentially material different impacts considered within this assessment in the intertidal area (AAM).
Intertidal offshore export cables (non ducted sections)	The OECC	New and potentially material different impacts considered within this assessment in the intertidal area (AAM).
Location of onshore substation revetment perimeter structure	Defined LoD for sheet piling at toe of the revetement with 0.5 – 1.0 m horizontal width	No potential for new or materially different effects

10.9 Primary mitigation measures

10.9.1 Introduction

168. Throughout the evolution of the CWP Project, measures have been adopted as part of the evolution of the project design and approach to construction, to avoid or otherwise reduce adverse impacts on the environment. These mitigation measures are referred to as 'primary mitigation'. They are an inherent part of the CWP Project and are effectively 'built in' to the impact assessment.

169. Primary mitigation measures relevant to the assessment of ornithology are set out in **Table 10-31**. Where additional mitigation measures are proposed, these are detailed in the impact assessment in **Section 10.10**. Additional mitigation includes measures that are not incorporated into the design of the CWP Project and require further activity to secure the required outcome of avoiding or reducing impact significance.

Table 10-31 Primary mitigation measures

Project Element	Description
All offshore infrastructure	Positions of WTGs and OSSs have been informed by a wide range of site-specific data, including metocean data (e.g., wind speed and direction), geophysical and geotechnical survey data (e.g., bathymetry), environmental data (e.g., benthic surveys and archaeological assessment) and stakeholder consultation. Designing and optimising the layout of the WTGs has considered multiple constraints identified from analysis of these datasets, alongside the consideration of layout principles taken from relevant guidance on the design of OWFs. A summary of the key actions taken to avoid or otherwise reduce impacts is provided below: • The WTG layout options include Search and Rescue (SAR) access lanes to allow a SAR resource to fly on the same orientation continuously through the array site. This is provided to minimise risks to surface vessels and / or SAR resource transiting through the array site. • Archaeological exclusion zones (AEZs) around known features of archaeological interest have been avoided. No works that impact the seabed will be undertaken within the extent of an AEZ during the construction, operational, or decommissioning phases. • The locations of offshore infrastructure been developed to avoid known sensitive ecological habitats, including areas with suitable conditions for *Sabellaria spinulosa* which can form reefs under some circumstances. Whilst reefs were not identified during the characterisation surveys, as an ephemeral feature it will be necessary to validate the results in advance of construction. A pre-construction geophysical survey will therefore be undertaken to facilitate the micro-siting around sensitive habitats such as *Sabellaria spinulosa*. • The WTG layout options have been developed to avoid or minimise interaction with known areas of high fishing density, where possible. As avoidance is not always possible, the layouts have also been developed to increase the potential for coexistence. • A paleochannel (the remnants of a river or stream channel that flowed in the past) in the centre west of the array site has been avoided.

Project Element	Description
All offshore infrastructure	A Construction Environmental Management Plan (CEMP) has been prepared to provide a management framework, to ensure appropriate controls are in place to manage environmental risks associated with the construction of the CWP Project. It outlines environmental procedures that require consideration throughout the construction process, in accordance with legislative requirements and industry best practice. In summary, the CEMP includes details of: • The Environmental Management Framework for the CWP Project including environmental roles and responsibilities (i.e., ecological clerk of works) and contractor requirements (i.e., method statements for specific construction activities); • Mitigation measures and commitments made within the EIAR, Natura Impact Statement (NIS) and supporting documentation for the CWP Project; • Measures proposed to ensure effective handling of chemicals, oils and fuels including compliance with the MARPOL convention; • A Marine Pollution Prevention and Contingency Plan to address the procedures to be followed in the event of a marine pollution incident originating from the operations of the CWP Project; • An Emergency Response Plan adhered to in the event of discovering unexploded ordnance; • Offshore biosecurity and invasive species management detailing how the risk of introduction and spread of invasive non-native species will be minimised; and • Offshore waste management and disposal arrangements. The CEMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.
WTGs and OSSs	A Marine Mammal Mitigation Protocol (MMMP) has been prepared to outline the mitigation requirements for minimising the impacts on marine mammals during the construction of the CWP Project. The MMMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.
WTGs	All WTGs for both layout options will feature a minimum blade tip clearance of 36 m above Mean Sean Level (MSL) (+37.72 m LAT). This is beyond the minimum 22 m clearance required for safety of navigation and has been set by the Applicant to reduce the potential collision risk for offshore ornithology receptors.
Onshore substation	The Codling Wind Park **Onshore Substation Architectural Design Statement** accompanies the planning application. As part of the design of the façade for the onshore substation bird of prey deterrents were incorporated at 2 locations: • Creating a steep angle (+60°) to the band between the brick base and metal cladding of the façade; and • Raising of the metal cladding above roof parapet, impairing hunting birds' view of target platform.

Project Element	Description
All offshore infrastructure	An Ecological Vessel Management Plan (EVMP) has been prepared to determine vessel routing to and from construction sites and ports and to include a code of conduct for vessel operators. The EVMP includes details of: • The types and specifications of vessels for the CWP Project; How vessels will be monitored and coordinated; and • The use of defined transit routes to site from key construction and operation ports, where practicable to do so. The EVMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.
All infrastructure	A Rehabilitation Schedule is provided as part of the planning application. This has been prepared in accordance with the MAP Act (as amended by the Maritime and Valuation (Amendment) Act 2022) to provide preliminary information on the approaches to decommissioning the offshore and onshore components of the CWP Project. A final Rehabilitation Schedule will require approval from the statutory consultees prior to the undertaking of decommissioning works. This will reflect discussions held with stakeholders and regulators to determine the exact methodology for decommissioning, taking into account available methods, best practice and likely environmental effects.
WTGs and OSSs	A Marine Mammal Mitigation Protocol (MMMP) has been prepared to outline the mitigation requirements for minimising the impacts on marine mammals during the decommissioning of the CWP Project. The MMMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of decommissioning.

10.10 Impact assessment

10.10.1 Introduction

Offshore and intertidal impacts

170. Potential impacts included within the assessment for ornithological receptors, due to the construction, operation and / or decommissioning of the CWP Project within offshore and intertidal areas as are as below.

171. There are three impacts which may result in the redistribution of ornithological receptors as a result of project activities and / or infrastructure which are identified for assessment. These impacts act upon receptor habitats, receptors themselves, or receptor prey species in such a way that may result in consequences to receptor populations.

- **Impact 1 - Direct effects on habitat:** Removal or alteration of habitats in such a way as to affect their value to ornithological receptors or prevent or reduce the use of those habitats by receptors.
- **Impact 2 - Disturbance and displacement:** Behavioural responses to wind farm infrastructure or associated activity leading to effective **indirect habitat loss** through the avoidance of use of

particular areas, or **barrier effects** through additional energetic consequences from the avoidance of passage through particular areas.
- **Impact 3 - Changes in prey availability**: Redistribution or other effects to prey species which change their availability to foraging birds and resultant redistribution of ornithological receptors.

172. Three impacts which may result in consequences to receptor populations, but which are not classed as distributional responses, are also identified.

- **Impact 4 - Pollution:** Effects arising from the accidental release of materials during proposed works which may impact ornithological features by causing mortality or reductions in fitness or reduce the quality of the habitats which they use.
- **Impact 5 - Introduction or spread of invasive non-native species:** Effects arising from the accidental release or redistribution of non-native invasive species during proposed works which may impact ornithological features directly or reduce the quality of the habitats which they use.
- **Impact 6 - Collision:** Where ornithological receptors fly through project infrastructure, specifically turbines within the offshore array site, collision with rotating blades of the wind turbines may result in the death or injury of individuals.

173. In the assessment of the above potential impacts set out in the following sections, these impacts are assessed for works and infrastructure within offshore and intertidal areas in the order of construction phase, operation and maintenance phase and decommissioning phase (excluding collision impacts, which are only considered in relation to infrastructure within offshore areas during the operational and maintenance phase). The order in which each impact is considered during each project phase is provided in **Table 10-32**.

Onshore and estuarine / Liffey impacts

174. Potential impacts included within the ornithology assessment for ornithology receptors, due to the construction, operation and maintenance and / or decommissioning of the CWP Project are as follows:

- **Impact 1 - Direct effects on habitat:** Effects which remove or alter habitats in such a way as to affect their value to ornithological receptors.
- **Impact 2 - Disturbance and displacement:** Distributional responses to construction activity and infrastructure or associated activity can lead to effective **indirect habitat loss** through the avoidance of use of particular areas by ornithological receptors.
- **Impact 3 - Introduction or spread of non-native invasive species:** Effects arising from the accidental release or redistribution of non-native invasive species during proposed works which may impact ornithological features directly or reduce the quality of the habitats which they use.
- **Impact 4 - Presence of buildings / infrastructures:** Such structures could cast a shadow on surrounding habitat which could potentially impact the breeding colony of Common and Arctic tern on the CDL dolphin (approximately 25 m). The presence of the onshore buildings and infrastructure could also create perching opportunities for species such as peregrine falcon or hooded crow, which may increase the actual or perceived, predator threat on the nesting colony.

175. In the assessment of potential impacts set out in the following sections, all impacts are assessed in the order of construction phase, operation and maintenance phase, and decommissioning phase. This will follow the impact assessment methodology described in **Section 10.4**, on the basis of the scenarios set out in **Section 10.8**, and accounting for the primary mitigation described in **Section 10.9.**

Table 10-32 Offshore and intertidal ornithological impact reference list

Order in impact assessment	Impact reference	Impact type
1	Offshore and intertidal - Construction: Impact 1	Direct effects on habitat
2	Offshore and intertidal - Construction: Impact 2	Disturbance and displacement
3	Offshore and intertidal - Construction: Impact 3	Changes in prey availability
4	Offshore and intertidal - Construction: Impact 4	Pollution
5	Offshore and intertidal - Construction: Impact 5	Introduction of invasive non-native species
6	Onshore and Estuarine / Liffey – Construction: Impact 1	Direct effects on habitat
7	Onshore and Estuarine / Liffey – Construction: Impact 2	Disturbance and displacement
8	Onshore – Construction: Impact 3	Introduction / spread of non-native species
9	Offshore and intertidal - Operation and Maintenance: Impact 1	Direct effects on habitat
10	Offshore and intertidal - Operation and Maintenance: Impact 2	Disturbance and displacement
11	Offshore and intertidal - Operation and Maintenance: Impact 3	Changes in prey availability
12	Offshore and intertidal - Operation and Maintenance: Impact 4	Pollution
13	Offshore and intertidal - Operation and Maintenance: Impact 5	Introduction of invasive non-native species
14	Offshore - Operation and Maintenance: Impact 6	Collision
15	Estuarine / Liffey – Operation and Maintenance: Impact 1	Disturbance and displacement
16	Estuarine / Liffey – Operation and Maintenance: Impact 2	Presence of buildings / infrastructures
17	Offshore and intertidal - Decommissioning: Impact 1	Direct effects on habitat
18	Offshore and intertidal - Decommissioning: Impact 2	Disturbance and displacement
19	Offshore and intertidal - Decommissioning: Impact 3	Changes in prey availability
20	Offshore and intertidal - Decommissioning: Impact 4	Pollution
21	Offshore and intertidal - Decommissioning: Impact 5	Introduction of invasive non-native species

Order in impact assessment	Impact reference	Impact type
22	Onshore and Estuarine / Liffey – Decommissioning: Impact 1	Direct effects on habitat
23	Onshore and Estuarine / Liffey – Decommissioning: Impact 2	Disturbance and displacement
24	Onshore – decommissioning: Impact 3	Introduction / spread of non-native species

176. Assessment of impacts listed in **Table 10-32** will follow the impact assessment methodology described in **Section 10.4**, on the basis of the scenarios set out in **Section 10.8**, and accounting for the primary mitigation described in **Section 10.9**.

10.10.2 Construction phase

177. Within the offshore development area construction will include site preparation for, then assembly and / or installation of, infrastructure within the array site and OECC including turbines, offshore sub-stations, inter-array cables, export cables and ancillary structures such as scour and cable protection.

178. Within the intertidal area construction will include site preparation for, then installation of the export cable.

179. Within the onshore and estuarine areas construction will include site preparation and assembly and / or installation of the landfall site including temporary access ramp and TJBs, the onshore export cable, onshore substation, ESB network cables and ancillary structures such site compounds.

Offshore and intertidal – construction: impact 1 – direct effects on habitat

Offshore – array site and OECC (below MLWS)

180. Within the marine environment direct effects which remove or alter areas of habitat, principally impact benthic habitats. Such impacts to benthic habitats translate to potential impacts upon seabird receptors as impacts to prey species. Such impacts are addressed within the assessment of changes in prey availability (**Section 10.10**).

181. Direct effects to sea-surface areas which may be utilised by seabirds for non-foraging behaviours are considered only to relate to the physical footprint of above water infrastructure (i.e., WTG towers and the OSS).

Receptor sensitivity

182. As the marine areas used by seabird species during breeding, non-breeding and migratory periods are large (Woodward et al., 2019; Furness, 2015), the tolerance of seabird species using or passing through the array site or OECC to such impacts is considered to be very high as all receptors are considered able to:

- Tolerate direct effects on habitats during construction within offshore areas such that any potential effects upon reproduction and / or survival rates would be negligible / imperceptible;
- Recover rapidly upon cessation of impacts (i.e., immediately reoccupy sea areas when construction phase footprints are removed); and

- Adapt behaviours to usually avoid effects.

183. The importance of seabird receptors is assessed as low to very high (**Table 10-21**).

184. When receptor tolerance and conservation importance are considered together to determine an overall assessment of receptor sensitivity as per **Table 10-9**, receptor sensitivities are assessed as very low (i.e., very high tolerance and low / medium importance) or low (i.e., very high tolerance and high / very high importance) (**Table 10-33**).

Table 10-33 Determination of receptor sensitivity by consideration of conservation importance and tolerance to direct effects on habitat during the construction phase

Species	Conservation importance	Tolerance	Receptor sensitivity
Common scoter	high	very high	low
Kittiwake	very high		low
Black-headed gull	high		low
Little gull	high		low
Great black-backed gull	medium		very low
Common gull	high		low
Herring gull	high		low
Lesser black-backed gull	high		low
Sandwich tern	low		very low
Roseate tern	high		low
Common tern	high		low
Arctic tern	high		low
Little tern	low		very low
Guillemot	high		low
Razorbill	very high		low
Black guillemot	low		very low
Puffin	very high		low
Red-throated diver	high		low
Great northern diver	high		low
Fulmar	high		low
Manx shearwater	high		low
Gannet	high		low
Cormorant	medium		very low
Shag	high		low

Magnitude of impact

185. Relative to the spatial extent of habitats used by breeding and non-breeding seabirds, the sea surface footprint of construction phase activities is negligible.

186. As the construction phase progresses through the planned duration of approximately 2 years (for OECC and WTG installation) the above sea level spatial extent of infrastructure will increase to a maximum of less than 0.005 km^2 within the array site (i.e., combined sea level area of all turbines and OSSs), and no above water infrastructure will be installed within the OECC.

187. Due to the limited extent of sea level footprint occupied by infrastructure in relation to the spatial extent of habitats used by breeding and non-breeding seabirds, predicted impacts associated with direct effects on habitat are considered to be of very low consequence to all affected populations, and therefore magnitude of impact assessed as negligible for all receptors.

Significance of the effect

188. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be very low or low and magnitude of impact is assessed to be negligible, the potential effect of displacement and disturbance, through direct effects on habitat within the array site and OECC, during the construction phase is considered to be **Imperceptible**, and **Not Significant** in EIA terms (**Table 10-34**).

Table 10-34 Summary of significance of impact 1 – direct effects on habitat for offshore receptors during construction

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Common scoter	low	negligible	**Imperceptible**	**No**
Kittiwake	low		**Imperceptible**	**No**
Black-headed gull	low		**Imperceptible**	**No**
Little gull	low		**Imperceptible**	**No**
Great black-backed gull	very low		**Imperceptible**	**No**
Common gull	low		**Imperceptible**	**No**
Herring gull	low		**Imperceptible**	**No**
Lesser black-backed gull	low		**Imperceptible**	**No**
Sandwich tern	very low		**Imperceptible**	**No**
Roseate tern	low		**Imperceptible**	**No**
Common tern	low		**Imperceptible**	**No**
Arctic tern	low		**Imperceptible**	**No**
Little tern	very low		**Imperceptible**	**No**
Guillemot	low		**Imperceptible**	**No**
Razorbill	low		**Imperceptible**	**No**
Black guillemot	very low		**Imperceptible**	**No**
Puffin	low		**Imperceptible**	**No**
Red-throated diver	low		**Imperceptible**	**No**
Great northern diver	low		**Imperceptible**	**No**
Fulmar	low		**Imperceptible**	**No**
Manx shearwater	low		**Imperceptible**	**No**
Gannet	low		**Imperceptible**	**No**
Cormorant	very low		**Imperceptible**	**No**

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Shag	low		**Imperceptible**	**No**

Additional mitigation

189. As the impacts associated with Direct Effects on Habitat during construction phase activities within the array site and OECC are assessed to be **Imperceptible**, and **Not Significant** in EIA terms no additional mitigation is necessary.

Residual effect

190. As no additional measures are required to mitigate Direct Effects on Habitat during construction phase activities within the array site and OECC, the residual effect is assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

191. Impacts considered to be direct effects on intertidal habitat may arise as a consequence of activities which temporarily alter areas of intertidal habitat which are utilised by ornithological receptors and their prey species. Impacts to intertidal habitats which translate into potential impacts upon ornithological receptors via impacts to prey species are addressed within the assessment of changes in prey availability (**Section 10.10 Construction: Changes in prey availability – Intertidal**).

192. Direct effects to intertidal areas which may be utilised by birds for non-foraging behaviours (such as roosting, loafing and maintenance) are considered only to relate to the physical footprint of the proposed intertidal infrastructure and works (i.e., the intertidal cable route during construction and any infrastructure at the proposed landfall location).

Receptor sensitivity

193. The extent of intertidal habitat within South Dublin Bay is limited to a maximal area 21.40 km^2 (between MLWS and MHWS), and ornithological receptors which occur within intertidal habitats may have limited access to other similar habitats locally for undertaking non-foraging behaviours (i.e., limited ability to adapt behaviours to avoid effects).

194. Where species abundances within South Dublin Bay are relatively low, such that populations therein constitute only a small proportion of total regional populations, direct effects on habitats during construction within intertidal areas may result in potential effects upon reproduction and / or survival rates of regional populations at a negligible / imperceptible level. Species are considered to have very high tolerances to impacts in such cases.

195. Conversely, where species abundances within South Dublin Bay are greater, such that populations constitute relatively larger proportions of total regional populations, direct effects on habitats during construction within intertidal areas may result in potential effects upon reproduction and / or survival rates of regional populations which may be greater. Species are considered to have lower tolerances to impacts in such cases.

196. In all cases, due to the dynamic nature of intertidal habitats within South Dublin Bay which is characterised as surrounded by industrial works and moving skyline, receptors are considered to recover rapidly upon cessation of direct effects upon habitats, reoccupying areas once the physical footprint of intertidal plant and infrastructure are removed.

197. Receptor tolerances (**Table 10-35**) are determined by consideration of the importance of the intertidal landfall area for each species, on the rationale that where impacts occur within areas that are used by large relative numbers of a species, then the receptor may be less able to avoid that impact and the probability of demographic consequences to the receptor population increases. To describe the importance of the intertidal landfall area reference is made to the peak count during intertidal baseline surveys as a percentage of the most relevant population estimate for that species: for waders and estuarine waterbirds the all-Ireland wintering population (Burke et al., 2018) is used; for seabirds the regional non-breeding population (**Table 10-14**) is used; and for Mediterranean gull the most recent wintering population estimate (Lewis et al., 2019) is used.

198. The following definitions are used: <1% is very high (i.e., the potentially impacted area is used by a very small proportion of the regional population, such that potential impacts are avoidable and will not result in noticeable effects on reproductive or survival rates of regional population); 1-5% is high; 5-10% is medium; 10-20% is low; and >20% is very low (i.e., the potentially impacted area is used by a very large proportion of the regional population, such that potential impacts are unavoidable and may result in severe effects on reproductive or survival rates of the regional population).

199. As gull species are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998) the receptor tolerance for these species is assessed as being one category higher than their peak count as a proportion of the regional population would otherwise indicate.

Table 10-35 Tolerances of ornithological receptors utilising intertidal habitats within South Dublin Bay

Species	Peak count during diurnal intertidal baseline surveys	Peak count as % of the most relevant population estimate for that species	Receptor tolerance
Light-bellied Brent Goose	602	1.72% (Burke et al., 2018)	high
Shelduck	45	0.45% (Burke et al., 2018)	very high
Shoveler	6	0.30% (Burke et al., 2018)	very high
Pintail	12 (flyover)	0.76% (Burke et al., 2018)	very high
Teal	71	0.20% (Burke et al., 2018)	very high
Common scoter	99	0.90% (Burke et al., 2018)	very high
red-breasted merganser	151	6.21% (Burke et al., 2018)	medium
Red-throated diver	71	0.56% (**Table 10-14**)	very high
Great crested grebe	912	30.40% (Burke et al., 2018)	very low
Grey heron	25	0.96% (Burke et al., 2018)	very high
Little egret	90	6.47% (Burke et al., 2018)	high
Oystercatcher	3,677	6.03% (Burke et al., 2018)	medium
Golden plover	475	0.52% (Burke et al., 2018)	very high
Grey plover	45	1.50% (Burke et al., 2018)	high
Ringed plover	398	3.32% (Burke et al., 2018)	high
Curlew	237	0.68% (Burke et al., 2018)	very high
Bar-tailed godwit	1,260	7.41% (Burke et al., 2018)	medium

<table>
<tr><th>Species</th><th>Peak count during diurnal intertidal baseline surveys</th><th>Peak count as % of the most relevant population estimate for that species</th><th>Receptor tolerance</th></tr>
<tr><td>Black-tailed godwit</td><td>830</td><td>4.19% (Burke et al., 2018)</td><td>high</td></tr>
<tr><td>Turnstone</td><td>310</td><td>3.27% (Burke et al., 2018)</td><td>high</td></tr>
<tr><td>Knot</td><td>10,890</td><td>66.93% (Burke et al., 2018)</td><td>very low</td></tr>
<tr><td>Sanderling</td><td>408</td><td>4.86% (Burke et al., 2018)</td><td>high</td></tr>
<tr><td>Dunlin</td><td>5,495</td><td>11.95% (Burke et al., 2018)</td><td>low</td></tr>
<tr><td>Redshank</td><td>1,337</td><td>5.62% (Burke et al., 2018)</td><td>high</td></tr>
<tr><td>Greenshank</td><td>109</td><td>8.26% (Burke et al., 2018)</td><td>high</td></tr>
<tr><td>Black-headed gull</td><td>3,826</td><td>3.83% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Shag</td><td>83</td><td>0.49% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Mediterranean gull</td><td>87</td><td><<i>c</i>. 10% (Lewis et al., 2019)</td><td>medium</td></tr>
<tr><td>Common gull</td><td>512</td><td>0.76% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Great black-backed gull</td><td>241</td><td>0.45% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Herring gull</td><td>5,646</td><td>3.02% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Lesser black-backed gull</td><td>150</td><td>0.09% (Table 10-14)</td><td>very high</td></tr>
<tr><td>Black guillemot</td><td>32</td><td>3.07% (Table 10-14)</td><td>high</td></tr>
<tr><td colspan="4">Terns</td></tr>
<tr><th></th><th>Peak count during post-breeding roost surveys</th><th>Peak count as % of estimated regional post-breeding migration population (Table 10-14)</th><th></th></tr>
<tr><td>Sandwich tern</td><td>462</td><td>3.18% (Table 10-14)</td><td rowspan="3">Although for tern receptors the peak numbers of birds using the South Dublin Bay area represent only a modest proportion of their respective regional post-breeding migration populations, there is known to be a high level of</td></tr>
<tr><td>Common tern</td><td rowspan="2">4,868 (Cumulative total of all Common, Arctic and Roseate Terns)</td><td rowspan="2">3.19% (cumulative total of Common, Arctic and Roseate tern regional post-breeding migration populations per Table 10-14)</td></tr>
<tr><td>Arctic tern</td></tr>
</table>

Species	Peak count during diurnal intertidal baseline surveys	Peak count as % of the most relevant population estimate for that species	Receptor tolerance
Roseate tern			turnover individuals within post-breeding tern aggregations within this area. As such, receptor tolerance for all species is assessed to be low.

200. The receptor importance of species occurring within intertidal areas are assessed as low to very high (**Table 10-21** to **Table 10-23**).

201. When receptor tolerances and importance are considered together to determine overall assessments of receptor sensitivities (as per **Table 10-36**), receptor sensitivities are assessed as very low (i.e., very high tolerance and low / medium importance) through to very high (i.e., very low tolerance and high / very high importance, or low tolerance and very high importance).

Table 10-36 Sensitivities of ornithological receptors utilising intertidal habitats within South Dublin Bay

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	high	medium
Shelduck	medium	very high	very low
Shoveler	medium	very high	very low
Pintail	medium	very high	very low
Teal	medium	very high	very low
Common scoter	high	very high	low
red-breasted merganser	low	medium	low
Red-throated diver	high	very high	low
Great crested grebe	low	very low	medium
Grey heron	low	very high	very low
Little egret	low	high	low
Oystercatcher	very high	medium	high
Golden plover	high	very high	low
Grey plover	high	high	medium
Ringed plover	high	high	medium
Curlew	high	very high	low
Bar-tailed godwit	very high	medium	high

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Black-tailed godwit	high	high	medium
Turnstone	medium	high	low
Knot	very high	very low	very high
Sanderling	high	high	medium
Dunlin	very high	low	very high
Redshank	very high	high	medium
Greenshank	low	high	low
Black-headed gull	high	very high	low
Shag	high	very high	low
Mediterranean gull	medium	medium	medium
Common gull	high	very high	low
Great black-backed gull	medium	very high	very low
Herring gull	high	very high	low
Lesser black-backed gull	high	very high	low
Black guillemot	low	high	low
Sandwich tern	low	low	medium
Common tern	high	low	high
Arctic tern	high	low	high
Roseate tern	high	low	high

202. In addition to ornithological receptors, impacts to wetland habitat within the South Dublin Bay area are also considered.

203. As intertidal habitats which support ornithological receptors are a designated feature of the South Dublin Bay and River Tolka Estuary SPA, the conservation importance of this feature is considered to be very high.

204. As intertidal habitats will recover rapidly after construction phase activities within the intertidal area, such as the excavation of trenches to bury export cables, to function again as areas to support non-foraging behaviours for ornithological receptors, the tolerance of this feature is considered to be very high.

205. When the conservation importance and tolerance of this feature are considered together to determine an overall assessment of receptor sensitivity (as per **Table 10-36**), the sensitivity of wetland habitat is assessed as low.

Magnitude of impact

206. The spatial extent of intertidal habitat within South Dublin Bay and River Tolka Estuary SPA is 21.40 km^2. The magnitude of intertidal habitat within the SPA area predicted to be impacted by direct effects on habitat is considered herein in relation to the AAM scenario.

207. Approximately 0.16 km^2 of intertidal habitat is estimated to be subject to direct effects as a result of intertidal cable landfall activities (0.04 km^2 from open cut landfall cable duct installation and 0.11 km^2 from cable laying activities in the transition zone). This equates to approximately 0.73% of the total intertidal habitat area within the SPA being subject to temporary direct effects on habitat during the construction phase of the proposed intertidal landfall works.

208. Cable duct installation from MHWS to the transition zone requires the excavation and backfilling of three trenches, each up to 2 km long (with 100 m to 150 m open at any one time) and 3 m deep. The cables, having been pulled in from the Cable Lay Vessel (CLV) located offshore (beyond the transition zone) will lifted and lowered into the open trench sections by means of an excavator. Although the total duration of excavation and burial of the cable ducts (including installation of cable protection) is expected to take two to three weeks per circuit (and therefore six to nine weeks in total), the duration for which each 100 m to 150 m excavated section is open will be comparatively shorter than this.

209. Following the backfilling of any excavated sections of trenching and removal of any supporting vehicles and / or infrastructure, it is considered that the re-establishment of intertidal habitat available to birds for non-foraging activities (i.e., roosting, loafing and maintenance behaviours) would occur rapidly due to the dynamic nature of intertidal habitats within South Dublin Bay. Any effects on the physical habitat around active intertidal construction loci would be brief, lasting less than several tidal cycles. Intertidal mudflats are considered resilient to isolated physical disturbances and can recover well (OSPAR, 2023).

210. Given that the total area anticipated to be subject to temporary direct effects on habitat during the construction phase of the proposed intertidal landfall works equates to 0.73% of the intertidal SPA habitat available to intertidal waterbirds, and that this proportion will be even smaller at any given moment in time during trenching activities, and given the rate of recoverability of available habitat following backfilling and removal of supporting infrastructure and / or vehicles, the magnitude of impact for loss of habitat within the intertidal zone to ornithological receptors is assessed as negligible for all receptors.

Significance of the effect

211. **Table 10-37** below considers each screened-in species' assessed sensitivity against the predicted magnitude of impact in order to determine the level of significance of effect in EIA terms.

Table 10-37 Significance of the effects of direct effects on habitat to intertidal waterbirds during the construction phase

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Light-bellied Brent Goose	medium	negligible	**Imperceptible**	**Not significant**
Shelduck	very low	negligible	**Imperceptible**	**Not significant**
Shoveler	very low	negligible	**Imperceptible**	**Not significant**
Pintail	very low	negligible	**Imperceptible**	**Not significant**
Teal	very low	negligible	**Imperceptible**	**Not significant**

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Common scoter	low	negligible	**Imperceptible**	**Not significant**
red-breasted merganser	low	negligible	**Imperceptible**	**Not significant**
Great crested grebe	medium	negligible	**Imperceptible**	**Not significant**
Oystercatcher	high	negligible	**Not significant**	**Not significant**
Golden plover	low	negligible	**Imperceptible**	**Not significant**
Grey plover	medium	negligible	**Imperceptible**	**Not significant**
Ringed plover	medium	negligible	**Imperceptible**	**Not significant**
Curlew	low	negligible	**Imperceptible**	**Not significant**
Bar-tailed godwit	high	negligible	**Not significant**	**Not significant**
Black-tailed godwit	medium	negligible	**Imperceptible**	**Not significant**
Turnstone	low	negligible	**Imperceptible**	**Not significant**
Knot	very high	negligible	**Slight**	**Not significant**
Sanderling	medium	negligible	**Imperceptible**	**Not significant**
Dunlin	very high	negligible	**Slight**	**Not significant**
Redshank	medium	negligible	**Imperceptible**	**Not significant**
Greenshank	low	negligible	**Imperceptible**	**Not significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not significant**
Mediterranean gull	medium	negligible	**Imperceptible**	**Not significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not significant**
Common gull	low	negligible	**Imperceptible**	**Not significant**
Herring gull	low	negligible	**Imperceptible**	**Not significant**
Lesser black-backed gull	low	negligible	**Imperceptible**	**Not significant**
Common tern	high	negligible	**Not significant**	**Not significant**
Arctic tern	high	negligible	**Not significant**	**Not significant**
Roseate tern	high	negligible	**Not significant**	**Not significant**
Sandwich tern	medium	negligible	**Imperceptible**	**Not significant**
Black guillemot	low	negligible	**Imperceptible**	**Not significant**
Red-throated diver	medium	negligible	**Imperceptible**	**Not significant**
Shag	low	negligible	**Imperceptible**	**Not significant**
Grey heron	low	negligible	**Imperceptible**	**Not significant**
Little egret	medium	negligible	**Imperceptible**	**Not significant**
Wetland habitats	low	negligible	**Imperceptible**	**Not significant**

212. The magnitude the of impact for all species (and for wetland habitats) is assessed as negligible. Therefore (as per the matrix in **Table 10-10**), any effects on intertidal ornithology as a result of temporary direct habitat loss is predicted to be **Imperceptible** to **Slight** and **Not Significant** in EIA terms for all receptors. Where flexibility in the proposed design exists, there is no other scenario which would lead to a more **Significant Effect**.

Additional mitigation

213. Given that it is considered that there will be no significant effects in relation to direct effects upon habitat to intertidal ornithological receptors during the construction phase, no additional mitigation is specifically outlined to reduce this impact magnitude. It is considered, however, that additional mitigation which is recommended in relation to disturbance and displacement (see subsection **Additional mitigation** in section **Construction: Disturbance and displacement – Intertidal** below) will further reduce impact magnitudes of direct effects upon habitat, as any potentially impacted receptors are likely to be present in much reduced numbers or absent altogether during the proposed mitigation period.

214. Furthermore, as described in within the additional mitigation section for intertidal impacts in the assessment of **Offshore and Intertidal – Construction: Impact 2 – Disturbance and Displacement**, in addition to having effects upon impact magnitude, additional mitigation will also affect receptor sensitivities. The rationale for this being that receptors are more tolerant to impacts when temporal restrictions to works occurring mean that the receptors are not present within an area to be impacted.

Residual effect

215. The significance of effect of direct effects on habitat from construction activities within the intertidal area is reassessed with the application of proposed additional mitigation measures outlined in relation to disturbance and displacement impacts within the intertidal area (see **Offshore and intertidal - Construction impact 2: Disturbance and displacement**) all impacts significance levels reduce to imperceptible.

Offshore and intertidal – construction: impact 2 – disturbance and displacement

Offshore – array site and OECC (below MLWS)

216. The construction of WTGs and associated vessel activities within the array site has the potential to disturb and displace birds which would otherwise either directly utilise areas within and around the array site, or pass through the array site.

217. Similarly, the installation of export cables and associated vessel activities within the OECC has the potential to disturb and displace birds which would otherwise either directly utilise areas within and around the OECC.

218. The displacement of individuals which would otherwise potentially utilise sea areas within or around the array site or OECC effectively equates to indirect temporary habitat loss for those individuals. The displacement of individuals which would otherwise potentially fly through areas within or around the array site effectively equates to a barrier to the movement (barrier effects) of those individuals.

219. Indirect habitat loss as a consequence of displacement reduces the potential spatial extent of habitat available to impacted receptors. Receptors utilising such areas of marine habitat are, by definition, seabird species, and this distributional response does not apply to migratory non-seabird species. Reductions in the areas available for seabirds to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

220. Barrier effects result in individuals altering flight pathways, which may increase energetic demands upon individuals where routes are altered to deviate around WTG arrays. This distributional response applies to both seabird species and migratory non-seabird species. Such increased energetic consequences may result in changes to key demographic rates (specifically reductions in productivity, or survival rates), which in turn may negatively impact populations. Increased energetic consequences

may arise in relation to infrequent annual migration movements of migratory species, or more frequent movements of seabirds which utilise the array site and its vicinity to undertake key non-migratory behaviours (for example foraging by breeding seabirds).

221. Displacement impacts associated with construction phase activities and / or the presence of infrastructure within the array site are therefore described in terms of indirect habitat loss and barrier effects to seabird species, but only in terms of barrier effects for migratory non-seabird species.

Impact screening

222. Seabird species vary in their distributional responses to WTGs and construction phase vessel activity within the array site. The following studies, which have been widely applied in OWF EIAs, are referenced to characterise species-specific responses for the purpose of impact screening (with values from very low to very high attributed to each species, based on an overall consensus drawn from the studies listed):

- Garthe and Hüppop (2004) – Initial scoring system for factors considered to contribute to species disturbance responses.
- Furness and Wade (2012) – For seabirds in Scottish waters, considers disturbance response ratings to wind farm structures and associated vessel traffic alongside scores for habitat use flexibility and conservation importance.
- Bradbury et al., (2014) - Updates Furness and Wade (2012) to consider seabirds in English waters.
- Dierschke et al., (2016) – Meta-analysis of published avoidance or attraction responses by species in response to OWFs.
- Camphuysen, 1995; Hüppop and Wurm, 2000 – Attraction of particular species groups to vessels – specifically fulmar and gull species.
- Fliessbach et al., 2019 – Vessel traffic vulnerability index for northwest European seabird species.

223. Information on which seabird species are screened in or out in relation to construction phase disturbance or displacement impacts associated with activities within the array site and OECC is provided in **Table 10-38**, below, on the basis of the following distinctions.

224. In addition to specific seabird species sensitivities to disturbance and displacement (columns 1 and 4), the extent to which species utilise the array site and its surroundings (column 2) are considered, with similar information relating to site use of the OECC also presented (column 5). This is done (for the array site only – column 2) through reference to the maximum bio-seasonal mean peak density (individuals per km^2) of each species within areas potentially experiencing disturbance and displacement impacts. The following site use levels are defined: very low, less than 0.2 individuals/km^2, low – 0.2 to 0.5 individuals/km^2, medium – 0.5 to 5 individuals/km^2, high – 5 to 10 individuals/km^2 and very high – more than 10 individuals/km^2. Site use values for the OECC (column 5) are from a subjective interpretation of the importance of the approximate location of the OECC area in relation to Irish east coast seasonal density maps presented in Jessop et al., 2018. These values are, however, only categorised to three levels (low, medium and high) and, as no 'very low' category is defined, have not been used as a basis to screen out any species.

225. Seabird species which are insensitive to disturbance and displacement effects (i.e., very low sensitivity in column 1) and / or make minimal use of areas within or surrounding the array site (i.e., very low peak density in column 2) are not considered to be at risk of impacts of indirect habitat loss above a significance level of imperceptible, and therefore are not considered further in assessment in relation to such impacts from construction activities within the array site (i.e., screened out in column 3).

226. Seabird species which are insensitive to disturbance and displacement effects from construction phase activities within the OECC (i.e., very low sensitivity in column 4) are not considered to be at risk of impacts of indirect habitat loss above a significance level of imperceptible, and therefore are not

considered further in assessment in relation to such impacts from construction activities within the OECC (i.e., screened out in column 6).

codling wind park

Table 10-38 Screening of seabird species for risk of disturbance and displacement at array site and OECC during construction

Species	Array site			OECC		
	Sensitivity to displacement (construction: vessel activity + presence of WTGs)	Maximum bio-season mean peak density (birds/km sq). Array Site + 2 km buffer (4 km buffer for divers)	Screened in or out	Sensitivity to displacement (construction: vessel activity	OECC area use relative to distribution within wider western Irish Sea (from ObSERVE data: Jessop et al., 2018)	Screened in or out
Column number	1	2	3	4	5	6
Common scoter	High[2,3,4,5]	0 (very low)	Out	High[2,3,4,5]	Medium	In
Kittiwake	Very low[2,3,5,6]	5.936 (high)	Out	Very low[2,3,5,6]	High	Out
Black-headed gull	Very low[2,3,5,6,7]	0.051 (very low)	Out	Very low[2,3,5,6,7]	High	Out
Little gull	Very low[2,3,4,5,6,7]	0.255 (low)	Out	Very low[2,3,4,5,6,7]	High	Out
Great black-backed gull	Very low[2,3,5,6,7]	0.291 (low)	Out	Very low[2,3,5,6,7]	Medium	Out
Common gull	Very low[2,3,5,6,7]	0.231 (low)	Out	Very low[2,3,5,6,7]	Medium	Out
Herring gull	Very low[2,3,5,6,7]	1.231 (medium)	Out	Very low[2,3,5,6,7]	Medium	Out
Lesser black-backed gull	Very low[2,3,5,6,7]	0.040 (very low)	Out	Very low[2,3,5,6,7]	Medium	Out
Sandwich tern	Very low[2,3,4,5,6]	0.035 (very low)	Out	Very low[2,3,4,5,6]	Low	Out
Roseate tern	Very low[3,6]	0.013 (very low)	Out	Very low[3,6]	Medium	Out

[2] Garthe & Hüppop (2004)
[3] Bradbury et al. (2014)
[4] Dierschke et al. (2016)
[5] Fliessbach et al. (2019)
[6] Furness & Wade (2012)
[7] Camphuysen (1995); Hüppop & Wurm (2000)

Species	Array site			OECC		
	Sensitivity to displacement (construction: vessel activity + presence of WTGs)	Maximum bio-season mean peak density (birds/km sq). Array Site + 2 km buffer (4 km buffer for divers)	Screened in or out	Sensitivity to displacement (construction: vessel activity	OECC area use relative to distribution within wider western Irish Sea (from ObSERVE data: Jessop et al., 2018)	Screened in or out
Column number	1	2	3	4	5	6
Common tern	Very low[2,3,5,6]	2.922 (medium)	Out	Very low[2,3,5,6]	Medium	Out
Arctic tern	Very low[2,3,5,6]	1.126 (medium)	Out	Very low[2,3,5,6]	Medium	Out
Little tern	Very low[3,6]	0 (very low)	Out	Very low[3,6]	Medium	Out
Guillemot	Medium[2,3,4,5,6]	58.100 (very high)	In	Medium[2,3,4,5,6]	High	In
Razorbill	Medium[3,4,5,6]	18.990 (very high)	In	Medium[3,4,5,6]	High	In
Black guillemot	Medium[3,5,6]	0.076 (very low)	Out	Medium[3,5,6]	Low	In
Puffin	Medium[2,3,6]	0.408 (low)	In	Medium[2,3,6]	Medium	In
Red-throated diver	High[2,3,5,6]	0.577 (medium)	In	High[2,3,5,6]	Medium	In
Great northern diver	High[3,5,6]	0.051 (very low)	Out	High[3,5,6]	Medium	In
Fulmar	Very low[2,3,4,5,6,7]	0.114 (very low)	Out	Very low[2,3,4,5,6,7]	Low	Out
Manx shearwater	Medium[3,4,6]	4.900 (medium)	In	Very low[3,4,6]	Medium	Out
Gannet	Medium[2,3,4,5,6]	0.457 (low)	In	Very low[2,3,4,5,6]	Medium	Out
Cormorant	Medium[2,3,4,5,6]	0.055 (very low)	Out	Medium[2,3,4,5,6]	High	In
Shag	Medium[3,4,6]	0.190 (very low)	Out	Medium[3,4,6]	High	In

227. In relation to barrier effects to seabird species, only those species which demonstrate avoidance of offshore WTGs and would otherwise utilise or pass through the array site, i.e., those species screened in using the metrics in **Table 10-38**, are considered susceptible and considered in subsequent assessment. As all other seabird species are either insensitive to operational phase displacement effects (i.e., do not demonstrate avoidance of offshore WTGs) or occur within the vicinity of the array site only in very low numbers (**Table 10-35**, **Section 10.10**), these species are screened out for further consideration in relation to barrier effects.

228. Should migrating non-seabirds fly around the array site rather than through it, those individuals may experience barrier effects associated with that single transit of the CWP Project. Although evidence demonstrating non-seabird migrant avoidance of offshore wind turbine Array Site is limited, an assessment has been undertaken for all non-seabird migrants (which are designated features of one or more Irish SPAs) on the conservative assumption that all migratory species do change their flight pathways in response to the presence of offshore WTGs, and thus, these receptors are collectively screened in for further assessment in relation to barrier effects.

Receptor sensitivity

Array site

229. As seabird receptor sensitivities to disturbance and displacement impacts during the construction phase of the array site relate to the same disturbance and displacement inducing stimuli (namely vessel activity and the presence of OWF infrastructure) as during the operation and maintenance phase, receptor sensitivities during the construction phase are considered to be as per during the operation and maintenance phase. These sensitivities are fully outlined in **Section 10.10.3** – **Offshore and intertidal – operation and maintenance: impact 2 – disturbance and displacement**, and summarised in **Table 10-39**, below.

Table 10-39 Receptor sensitivities of seabird species to disturbance and displacement impacts during the construction phase of the array site (summarised as per during the operation and maintenance phase)

Species	Receptor sensitivity
Guillemot	High
Razorbill	High
Puffin	Medium
Red-throated diver	High
Manx shearwater	Medium
Gannet	High

Guillemot

230. On the basis of scientific literature (Bradbury et al., 2014; Dierschke et al., 2016; Garthe and Hüppop, 2004; Fliessbach et al., 2019) Guillemot are considered to have moderate inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

231. Although there is growing evidence of habituation to the presence of operational infrastructure (Vallejo et al., 2017, Trinder, 2021 and Trinder, 2023), this has not been documented in relation to construction phase vessel activity and newly installed infrastructure.

232. Although Guillemot forage over large areas during breeding (mean maximum foraging range + 1 SD = 153.7 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), peak densities of Guillemot recorded within the array site and surrounding 2 km buffer area are considered to be very high. This indicates that although the location of potential disturbance and displacement inducing activities and infrastructure may correspond with areas of high importance to Guillemot, the receptor may have some ability to avoid such impacts due to the large spatial extent of its habitat use.

233. The tolerance of Guillemot to construction phase disturbance and displacement impacts within the array site is therefore assessed to be medium.

234. The conservation importance of Guillemot is assessed to be high (**Table 10-21**).

235. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Razorbill

236. On the basis of scientific literature (Bradbury et al., 2014; Dierschke et al., 2016; Garthe and Hüppop, 2004; Fliessbach et al., 2019) Razorbill are considered to have medium inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

237. Although there is growing evidence of habituation to the presence of operational infrastructure (Vallejo et al., 2017, Trinder, 2021 and Trinder, 2023), this has not been documented in relation to construction phase vessel activity and newly installed infrastructure.

238. Although Razorbill forage over large areas during breeding (mean maximum foraging range + 1 SD = 164.6 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), peak densities of Razorbill recorded within the array site and surrounding 2 km buffer area are considered to be very high. This indicates that although the location of potential disturbance and displacement inducing activities and infrastructure may correspond with areas of high importance to Razorbill, the receptor may have some ability to avoid such impacts due to the large spatial extent of its habitat use.

239. The tolerance of Razorbill to construction phase disturbance and displacement impacts within the array site is therefore assessed to be medium.

240. The conservation importance of Razorbill is assessed to be very high (**Table 10-21**).

241. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and very high importance).

Puffin

242. On the basis of scientific literature (Bradbury et al., 2014; Dierschke et al., 2016; Garthe and Hüppop, 2004; Fliessbach et al., 2019) Puffin are considered to have moderate inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

243. On the basis of scientific literature (Bradbury et al., 2014; Garthe and Hüppop, 2004) Puffin are considered to be moderately insusceptible to disturbance and displacement impacts in relation to construction phase vessel activity and the presence of infrastructure within the array site. This receptor is assessed as having moderate ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase activities and infrastructure in the array site and limited potential to experience survival or productivity consequences resultant from displacement.

244. Habituation to the presence of vessel traffic and newly installed infrastructure has not been documented for this receptor.

245. The tolerance of Puffin to construction phase disturbance and displacement impacts within the array site is therefore assessed to be medium.

246. The conservation importance of Puffin is assessed to be very high (**Table 10-21**).

247. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and very high importance).

<u>Red-throated diver</u>

248. On the basis of scientific literature (Garthe and Hüppop, 2004; Schwemmer et al., 2011; Furness and Wade 2012; Furness et al., 2013; Bradbury et al., 2014; Dierschke et al., 2016; Fliessbach et al., 2019; Jarrett et al., 2022) Red-throated diver are considered to be highly or very highly susceptible to disturbance and displacement impacts in relation to construction phase vessel activity and widely recognised among seabird species as being particularly sensitive the presence of WTGs.

249. This receptor is assessed as having very limited ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase activities and infrastructure in the array site and may experience survival or productivity consequences resultant from potential displacement. Furthermore, non-habituation to the presence of vessel traffic (i.e., avoidance of regularly used shipping lanes – i.e., Burger et al., 2019) has been documented for this receptor.

250. The tolerance of Red-throated diver to construction phase disturbance and displacement impacts within the array site is therefore assessed to be very low.

251. The conservation importance of Red-throated diver is assessed to be high (**Table 10-21**).

252. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as very high (i.e., very low tolerance and high importance).

<u>Manx shearwater</u>

253. Manx shearwater are considered to be relatively insusceptible to disturbance and displacement impacts in relation to vessel activity (Furness and Wade, 2012), but their likelihood of spatial response to the presence of WTG infrastructure is less well understood. Given the extremely large foraging range of this species, this receptor is assessed as having a large relative degree of ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase activities and infrastructure in the array site and extremely unlikely to experience survival or productivity consequences resultant from potential displacement.

254. The tolerance of Manx shearwater to construction phase disturbance and displacement impacts within the array site is therefore assessed to be high.

255. The conservation importance of Manx shearwater is assessed to be high (**Table 10-21**).

256. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

<u>Gannet</u>

257. Gannet are considered to be relatively insusceptible to disturbance and displacement impacts in relation to vessel activity (Garthe and Hüppop, 2004; Fliessbach et al., 2019), but consistently have been demonstrated to completely or entirely avoid entering operational windfarms (Peschko et al., 2021, Trinder, 2023). Their distributional response to non-operational standing WTG infrastructure (i.e., during construction) is less well understood. Given the very large foraging range of this species, this receptor is assessed as having a large relative degree of ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase activities and infrastructure in the array site and unlikely to experience survival or productivity consequences resultant from potential displacement.

258. The tolerance of Gannet to construction phase disturbance and displacement impacts within the array site is therefore assessed to be medium.

259. The conservation importance of Gannet is assessed to be high (**Table 10-21**).

260. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Migratory species

261. As WTGs are erected within the array site over a period within the construction phase, the presence of these structures within the array site may result in barrier effects to migratory receptors which increase from zero, prior to the erection of the first WTG, to equalling those during the operational phase. For the purpose of this assessment, disturbance and displacement impacts through barrier effects to migratory species are conservatively treated as being the same as during the operational phase (albeit spanning a much shorter duration than those during the operational phase; 16 months, from initial turbine erection to operational, compared to a 25 year operational lifespan – see **Chapter 4: Project Description**).

262. Migratory species are considered to have very high tolerance to barrier effects associated with infrastructure within the array site during the construction phase as:

263. Migratory movements occur across broad geographic fronts, of which the project turbine array occupies a very small proportion. As such, the large majority of migrants will avoid impacts entirely, while those individuals which would otherwise pass through the array site may generally avoid doing so (should they choose to do so), though subtle alterations to flight trajectories or altitudes. Such changes (if any) to migratory flight paths may, at most, increase migratory energetic costs only negligibly and in such a way as to have no noticeable effect upon survival rates or future reproductive outputs.

264. Receptor sensitivities of these species are summarised in **Table 10-40**.

Table 10-40 Determination of receptor sensitivity by consideration of conservation importance and tolerance to barrier effects on migratory species during the construction phase

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	very high	low
Greenland white-fronted Goose	medium	very high	very low
Bewick's Swan	medium	very high	very low
Whooper Swan	low	very high	very low
Shelduck	medium	very high	very low
Shoveler	medium	very high	very low
Wigeon	low	very high	very low
Mallard	low	very high	very low
Pintail	medium	very high	very low
Teal	medium	very high	very low
Pochard	medium	very high	very low
Tufted duck	low	very high	very low
Scaup	medium	very high	very low
Eider	medium	very high	very low

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Common scoter	high	very high	low
Goldeneye	medium	very high	very low
red-breasted merganser	low	very high	very low
Corncrake	medium	very high	very low
Great crested grebe	low	very high	very low
Oystercatcher	very high	very high	low
Lapwing	medium	very high	very low
Golden plover	high	very high	low
Grey plover	high	very high	low
Ringed plover	high	very high	low
Curlew	high	very high	low
Bar-tailed godwit	very high	very high	low
Black-tailed godwit	high	very high	low
Turnstone	medium	very high	very low
Knot	very high	very high	low
Sanderling	high	very high	low
Dunlin	very high	very high	low
Snipe	medium	very high	very low
Redshank	very high	very high	low
Greenshank	low	very high	very low
Red-throated diver	high	very high	low
Great northern diver	high	very high	low
Hen harrier	medium	very high	very low
Merlin	medium	very high	very low
All other migratory species	very low	very high	very low

OECC

265. The large majority of vessel movements associated with construction phase activity within the OECC will overlap with areas of high usage by cargo, fishing and recreational use vessels throughout the year, as much of the southern and central extent of the OECC lies within a major shipping corridor on the southern approach to Dublin Port (**Chapter 16 Shipping and Navigation**). This shipping corridor is used by very large cargo vessels travelling between Dublin and a number of other ports (most notably Rotterdam), with average daily passage rates of approximately 9–12 cargo vessels, in addition to additional fishing and recreational vessel traffic. Furthermore, the northern extent of the OECC corresponds with the busy inshore traffic zone of Dublin Bay and passes Dun Laoghaire Harbour, the

Irish terminus of the main passenger ferry between the UK and Ireland, with up to approximately 20 daily ferry vessel movements; see **Figures 16-3**, **16-4** and **16-5** in **Section 16.6.3**. of **Chapter 16 Shipping and Navigation** showing AIS vessel tracking data within the vicinity of the OECC during the summer (2021 and 2022) and winter (2022/23) periods.

Guillemot

266. On the basis of scientific literature (Garthe and Hüppop, 2004; Fliessbach et al., 2019) Guillemot are considered to be moderately susceptible to disturbance and displacement impacts in relation to vessel activity. However, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

267. The tolerance of Guillemot to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

268. The conservation importance of Guillemot is assessed to be high (**Table 10-21**). The conservation importance of Guillemot is assessed to be high (**Table 10-21**).

269. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

Razorbill

270. On the basis of scientific literature (Garthe and Hüppop, 2004; Fliessbach et al., 2019) Razorbill are considered to be moderately susceptible to disturbance and displacement impacts in relation to vessel activity. However, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

271. The tolerance of Razorbill to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

272. The conservation importance of Razorbill is assessed to be very high (**Table 10-21**).

273. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and very high importance).

Puffin

274. On the basis of scientific literature (Garthe and Hüppop, 2004) Puffin are considered to be moderately insusceptible to disturbance and displacement impacts in relation to vessel activity. Furthermore, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid

disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

275. The tolerance of Puffin to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

276. The conservation importance of Puffin is assessed to be very high (**Table 10-21**).

277. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and very high importance).

Red-throated diver

278. On the basis of scientific literature (Garthe and Hüppop, 2004; Schwemmer et al., 2011; Furness and Wade 2012; Furness et al., 2013; Fliessbach et al., 2019; Jarrett et al., 2022) Red-throated River are considered to be highly or very highly susceptible to disturbance and displacement impacts in relation to construction phase vessel activity.

279. As construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it may be assumed that, should individuals be present within this area, they will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). However, non-habituation to the presence of vessel traffic (i.e., avoidance of regularly used shipping lanes – i.e., Burger et al., 2019) has been documented for this receptor elsewhere. As such, it follows that if Red-throated diver avoid shipping lanes to the south of Dublin, the potential for construction phase activities within the OECC (which overlaps this shipping lane) to disturb Red-throated diver in such a way as to impact survival rates is limited.

280. The tolerance of Red-throated diver to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be medium.

281. The conservation importance of Red-throated diver is assessed to be high (**Table 10-21**).

282. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Black guillemot

283. On the basis of scientific literature (Jarrett et al., 2022) Black guillemot are considered to be moderately insusceptible to disturbance and displacement impacts in relation to vessel activity. Furthermore, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

284. The tolerance of Black guillemot to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

285. The conservation importance of Black guillemot is assessed to be low (**Table 10-21**).

286. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as low (i.e., high tolerance and low importance).

Great northern diver

287. On the basis of a limited body of scientific literature (Gittings et al., 2016; Jarrett et al., 2022) Great northern diver are considered to be less susceptible to disturbance and displacement impacts in

relation to vessel activity than other diver species. Although habituation or otherwise to the presence of vessel traffic has not been documented for this receptor, a recent study comparing the behavioural responses of several non-breeding waterbird species to marine traffic (Jarrett et al., 2022) noted that avoidance responses of Great northern diver occur much less frequently in relation to vessel activity than for Red-throated Divers. Furthermore, avoidance responses which do occur are typically less energetically costly, with temporary displacement more localised (i.e., birds swimming away rather than flushing and flying). This observation of Great northern diver's relative insensitivity to disturbance from vessel traffic is supported by a study by Gittings et al., 2016, which noted zero of a total of 64 individuals flushing in response to vessel traffic passage within the Inner Galway Bay, even when the survey vessel passed within 10 to 20 m of some individuals.

288. As construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it may be assumed that, should individuals be present within this area, they will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). However, non-habituation to the presence of vessel traffic (i.e., avoidance of regularly used shipping lanes – i.e., Burger et al., 2019) has been documented for other diver species. As such, it follows that if Great northern diver avoid shipping lanes to the south of Dublin, the potential for construction phase activities within the OECC (which overlaps this shipping lane) to disturb great northern diver in such a way as to impact survival rates is limited.

289. The tolerance of Great northern diver to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

290. The conservation importance of Great northern diver is assessed to be high (**Table 10-21**).

291. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

Cormorant

292. On the basis of scientific literature (Garthe and Hüppop, 2004; Fliessbach et al., 2019) Cormorant are considered to be moderately to highly susceptible to disturbance and displacement impacts in relation to vessel activity. However, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

293. The tolerance of Cormorant to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be medium.

294. The conservation importance of Cormorant is assessed to be Medium (**Table 10-21**).

295. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as medium (i.e., medium tolerance and medium importance).

Shag

296. On the basis of scientific literature (Jarrett et al., 2022) shag are considered to be moderately susceptible to disturbance and displacement impacts in relation to vessel activity. However, as construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it is assumed that individuals present within this area will be to some extent habituated to the presence of vessel

traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

297. The tolerance of shag to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be high.

298. The conservation importance of shag is assessed to be high (**Table 10-21**).

299. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

Common scoter

300. On the basis of scientific literature (Garthe and Hüppop, 2004; Schwemmer et al., 2011; Furness and Wade 2012; Fliessbach et al., 2019) Common scoter are considered to be very highly susceptible to disturbance and displacement impacts in relation to construction phase vessel activity.

301. As construction phase vessel activity within the OECC will consist of relatively slowly moving vessels within an area in which baseline levels of shipping (to and from Dublin Port) are very high, it may be assumed that, should individuals be present within this area, they will be to some extent habituated to the presence of vessel traffic (or they would likely already have been displaced in response to ongoing shipping activity). As such, this receptor is assessed as having the ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase vessel activities within the OECC and unlikely to experience survival or productivity consequences resultant from potential displacement.

302. The tolerance of Common scoter to construction phase disturbance and displacement impacts within the OECC is therefore assessed to be medium.

303. The conservation importance of Common scoter is assessed to be medium (**Table 10-21**).

304. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., medium tolerance and medium importance).

Magnitude of impact

Array site

Indirect habitat loss and barrier effects to seabird species

305. Construction related disturbance and displacement impacts to seabird receptors within and surrounding the array site will arise from the presence of construction vessels within the array site and the associated visual and acoustic stimuli associated with the installation of wind farm infrastructure. Such impacts will occur only within those parts of the array site in which construction vessels are operating, which will represent a limited proportion of the array site at any given time, and / or around installed infrastructure, the spatial extent of which across the array site will increase throughout the construction period. Construction activities within the array site will be spatially and temporally restricted as outlined in **Chapter 4 Project Description**. Construction activities within the array site (including turbine foundation installation, IAC installation, turbine installation, OSS installation and associated commissioning) will occur over a period of approximately 28 months; however, elements that have the potential to be particularly disruptive within the construction program will be limited during the total construction period. For example WTG and OSS foundation piling activities would occur up to an estimated total of 78 days across a 14 month period. As potentially disturbance inducing infrastructure will occur over a smaller area than during the operational phase until the end of the

construction period, the potential impact of disturbance and displacement effects, either through indirect habitat loss or barrier effects, will also be lower during construction.

306. In comparison to the number of studies which consider operational phase distributional responses, there are fewer which provide empirically derived displacement proportions in relation to OWF construction phase activities. For auks (Guillemot, Razorbill, Puffin), construction phase displacement responses have been demonstrated to be either significantly lower than during the operational phase (Royal Haskoning, 2013) or similar (Vallejo et al., 2017). Similarly, in a review of Gannet displacement responses by APEM (2022), while some OWFs noted no significant displacement during construction (i.e., much less than during the operational phase), others noted construction phase displacement rates which were broadly similar, or slightly lower than during those collected during the operational phase. As such, construction phase displacement studies indicate that, although impacts can occur, as effects are over a smaller area, overall displacement effects (across the array site and across the construction period) are less than during the operational phase.

307. In the general absence of construction specific displacement rates and following the precedent of recent UK OWF assessment of construction phase disturbance and displacement impacts to seabirds (for example, Awel y Mor EIAR, 2022), impact magnitude has been determined as per during the operational phase (see **Section 10.10**), with displacement central values considered to be half of those used in the operational phase assessment. For example, where operational phase Gannet displacement within the array site is undertaken on the basis of a central value of 70%, a central value of 35% is used in the construction-phase. The same mortality rates resultant from displacement are used to determine construction phase disturbance and displacement impact magnitudes within the array site as during the operational phase assessment. **Table 10-41**, outlines species-specific displacement central values and mortality rates resulting from displacement used to predict seabird construction phase displacement impacts associated with works within the array site.

Table 10-41 Species-specific displacement and mortality proportions during construction

Species / Species group	Displacement central value	Mortality central value
Auks	25%	1%
Red-throated diver	50%	1%
Manx shearwater	25%	1%
Gannet	35%	1%

308. Calculated additional mortality from construction phase activities within the array site for each species in each relevant bio-season, and annually, are presented in **Table 10-42**, and predicted proportional increases in bio-season and annual regional population mortality rates are presented in **Table 10-43**. Baseline population mortality rates have been calculated by multiplying estimated regional bio-seasonal populations presented in **Table 10-14**, with average mortality rates presented in **Table 10-15**. Note that for breeding and migration-free breeding bio-seasons, as two methods are presented for regional population estimates in **Table 10-14**, two proportional increases to baseline population mortality rates are presented in **Table 10-43**.

Table 10-42 Additional mortality (individuals) from disturbance and displacement during construction – array site

Species	Additional mortality in each bio-season and annually						
	Bio-season						Annual
	RM	MFB	PB	MFNB	B	NB	
Guillemot	NA				9.060	33.351	42.410
Razorbill	1.023	1.687	10.901	1.601	NA		15.211
Puffin	0.016	0.235	0.139	0.112	NA		0.501
Red-throated diver	0.897	0.045	0.316	1.033	NA		2.291
Manx shearwater	1.951	0.451	2.831	NA			5.214
Gannet	0.367	0.367	0.194	NA			0.928

Table 10-43 Increased mortality rates from disturbance and displacement during construction – array site

Species	Bio-seasonal and annual increases in baseline mortality (%)							Assessed impact magnitude
	Bio-season						Annual	
	RM	MFB	PB	MFNB	B	NB		
Guillemot	NA				0.007 / 0.021	0.016	0.020	negligible
Razorbill	0.001	0.004 / 0.034	0.013	0.003	NA		0.018	negligible
Puffin	0	0.001 / 0.001	0	0	NA		0.001	negligible
Red-throated diver	0.031	0.004 / NA	0.011	0.111	NA		0.080	negligible
Manx shearwater	0.001	0 / 0	0.001	NA			0.002	negligible
Gannet	0	0	0	NA			0.001	negligible

309. For all seabird species receptors, disturbance and displacement from the array site construction phase activities are considered to minimal in relation to the sizes of potentially impacted populations, and the construction phase duration is temporally limited. Impact magnitude to all such receptors is therefore assessed as **Negligible**.

Barrier effects to migratory species

310. For the purpose of this assessment disturbance and displacement impacts through barrier effects to migratory species are conservatively treated as being the same as during the operational phase (albeit spanning a much shorter duration than those during the operational phase; 16 months, from initial turbine erection to operational, compared to a 25-year operational lifespan – **Chapter 4 Project Description**).

311. For migratory species, one-off energetic costs associated with relatively small deviations during typically large migratory movements are considered to be inconsequential in relation to energy reserves recruited for migration (Masden et al., 2009).

312. Therefore, the potential magnitude of impact on birds that only migrate through the array site (including waders and estuarine waterbirds, migratory terrestrial species and migratory seabirds) is considered negligible (i.e., <0.1% increase to baseline mortality rates for all species).

OECC

Indirect temporary habitat loss to seabird species

313. Nine seabird species, considered as moderately to highly sensitive to disturbance and displacement impacts in response to vessel traffic, utilise areas within or around the OECC, and may potentially experience indirect habitat loss effects as a result of construction phase activities. These species are: Guillemot, Razorbill, Black guillemot, Puffin, Red-throated diver, Great northern diver, Cormorant, Shag and Common scoter.

314. Construction activities within the OECC are scheduled to be undertaken within a 27-month window, with cable installation activities occurring after preparation of the seabed within the OECC. Vessels undertaking seabed preparation activities and subsequent cable installation works will be present within the OECC and surrounding areas only during a limited proportion of the total scheduled OECC construction window.

315. For each of the three export cables which are to be installed within the OECC, the estimated duration of installation works is 21 days, i.e., a total duration of all cable installation works for the OECC of 63 days. Within this period, assuming the majority of cables are installed using jet trenching or cable plough methods and associated indicative cable installation rates (summarised in **Table 13** of **Chapter 4 Project Description)**, the total cable installation period for all three cables within the OECC is estimated to be up to 720 hours. The maximum number of vessels active in association with cable installation activities within the OECC at any one time would be seven (548 round trips) during seabed preparation works (including TSHD for sandwave clearance and disposal off site, PLGR, OOS removal, boulder clearance, pre-crossing protection and survey vessel), five (37 round trips) during export cable installation works (and includes support, cable protection and anchor handling vessels) and up to a total of 17 barges, tug and small work boats (118 round trips) for nearshore cable installation elements.

316. Given the limited spatial footprint of construction activities within the OECC at any time, the limited duration of construction vessel activity within the OECC, and that additional vessel activity corresponds with areas in which existing vessel activity levels are very high, the potential for construction phase activity within the OECC to cause meaningful additional displacement effects to exclude seabird receptors from areas they would otherwise utilise, is considered to be low. Therefore, the potential

magnitude of construction phase disturbance and displacement impacts on all seabird species within the OECC is assessed to be negligible.

Significance of the effect

Array site

Indirect habitat loss and barrier effects to seabird species

317. In **Table 10-44** accordance with the IAM in **Table 10-11**, impact significance levels for assessed sensitivities and magnitudes of each seabird species potentially effected by disturbance and displacement impacts from construction phase activities within the Array Site are presented in **Table 10-44**.

318. For all species considered the potential effects of displacement and disturbance, during the construction phase are considered to be **Imperceptible or Not Significant**, and **Not Significant** in EIA terms (**Table 10-44**).

Table 10-44 Significance of the potential effect of displacement and disturbance, through habitat loss, during construction on migratory species

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Guillemot	High	Negligible	**Not significant**	**Not significant**
Razorbill	High	Negligible	**Not significant**	**Not significant**
Puffin	Medium	Negligible	**Imperceptible**	**Not significant**
Red-throated diver	High	Negligible	**Not significant**	**Not significant**
Manx shearwater	Medium	Negligible	**Imperceptible**	**Not significant**
Gannet	High	Negligible	**Not significant**	**Not significant**

Barrier effects to migratory species

319. In **Table 10-45**, in accordance with the IAM in **Table 10-11**, assessed sensitivities and magnitudes for each migratory species are considered in order to determine the potential effect of displacement and disturbance, through barrier effects during the construction phase.

320. For all migratory species the potential effects of displacement and disturbance, through barrier effects, during the construction phase are considered to be **Imperceptible** to **Slight**, and **Not Significant** in EIA terms (**Table 10-45**).

Table 10-45 Significant of the potential effect of displacement and disturbance, through barrier effects, during construction on migratory species

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Light-bellied Brent Goose	low	negligible	**Imperceptible**	**Not Significant**
Greenland white-fronted Goose	very low	negligible	**Imperceptible**	**Not Significant**
Bewick's Swan	very low	negligible	**Imperceptible**	**Not Significant**

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Whooper Swan	very low	negligible	**Imperceptible**	**Not Significant**
Shelduck	very low	negligible	**Imperceptible**	**Not Significant**
Shoveler	very low	negligible	**Imperceptible**	**Not Significant**
Wigeon	very low	negligible	**Imperceptible**	**Not Significant**
Mallard	very low	negligible	**Imperceptible**	**Not Significant**
Pintail	very low	negligible	**Imperceptible**	**Not Significant**
Teal	very low	negligible	**Imperceptible**	**Not Significant**
Pochard	very low	negligible	**Imperceptible**	**Not Significant**
Tufted duck	very low	negligible	**Imperceptible**	**Not Significant**
Scaup	very low	negligible	**Imperceptible**	**Not Significant**
Eider	very low	negligible	**Imperceptible**	**Not Significant**
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Goldeneye	very low	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	very low	negligible	**Imperceptible**	**Not Significant**
Corncrake	very low	negligible	**Imperceptible**	**Not Significant**
Great crested grebe	very low	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	low	negligible	**Imperceptible**	**Not Significant**
Lapwing	very low	negligible	**Imperceptible**	**Not Significant**
Golden plover	low	negligible	**Imperceptible**	**Not Significant**
Grey plover	low	negligible	**Imperceptible**	**Not Significant**
Ringed plover	low	negligible	**Imperceptible**	**Not Significant**
Curlew	low	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Black-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Turnstone	very low	negligible	**Imperceptible**	**Not Significant**
Knot	low	negligible	**Imperceptible**	**Not Significant**
Sanderling	low	negligible	**Imperceptible**	**Not Significant**
Dunlin	low	negligible	**Imperceptible**	**Not Significant**
Snipe	very low	negligeable	**Imperceptible**	**Not Significant**
Redshank	low	negligible	**Imperceptible**	**Not Significant**
Greenshank	very low	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	low	negligible	**Imperceptible**	**Not Significant**

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Great northern diver	low	negligible	**Imperceptible**	**Not Significant**
Hen harrier	very low	negligible	**Imperceptible**	**Not Significant**
Merlin	very low	negligible	**Imperceptible**	**Not Significant**
All other migratory species	very low	negligible	**Imperceptible**	**Not Significant**

OECC (below MLWS)

<u>Indirect habitat loss to seabird species</u>

321. In **Table 10-46**, in accordance with the IAM in **Table 10-11**, assessed sensitivities and magnitudes for each species potentially effected by habitat loss, are considered in order to determine the potential effect of displacement and disturbance, through indirect habitat loss effects during the construction phase.

322. For all species considered the potential effects of displacement and disturbance, through indirect habitat loss, during the construction phase are considered to be **Not Significant**, and **Not Significant** in EIA terms (**Table 10-46**).

Table 10-46 Significance of the potential effect of displacement and disturbance, through habitat loss, during construction on migratory species

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Guillemot	Medium	Negligible	**Imperceptible**	**Not significant**
Razorbill	Medium	Negligible	**Imperceptible**	**Not significant**
Puffin	Medium	Negligible	**Imperceptible**	**Not significant**
Red-throated diver	High	Negligible	**Not significant**	**Not significant**
Black guillemot	Low	Negligible	**Imperceptible**	**Not significant**
Great northern diver	Medium	Negligible	**Imperceptible**	**Not significant**
Cormorant	Medium	Negligible	**Imperceptible**	**Not significant**
Shag	Medium	Negligible	**Imperceptible**	**Not significant**
Common scoter	Medium	Negligible	**Imperceptible**	**Not significant**

Additional mitigation

323. Despite disturbance and displacement impacts associated with construction phase activities within the array site and OECC being assessed as non-significant in EIA terms to all receptors, due to the proximity of the array site and OECC to the recently extended Murrough SPA (for which Red-throated diver is a designated non-breeding feature), primary mitigation in the form of protocols within a construction phase ecological vessel management plan (EVMP) including a code of conduct for vessel

operators, will be implemented to further minimise potential vessel related disturbance to Red-throated diver.

324. These protocols will include avoiding any non-essential vessel transits through The Murrough SPA where practicable and routing construction vessel movements to make preferential use of existing shipping lanes in order to minimise vessel activities outside of areas in which baseline levels of vessel transit are high.

325. Although this additional mitigation is targeted at minimising disturbance and displacement impacts to Red-throated diver, preferential use of existing shipping lanes may also reduce potential disturbance and displacement impacts to other seabird receptors.

Residual effect

326. Residual Disturbance and Displacement impacts during construction phase activities within the array site and OECC are assessed to be **Imperceptible**, **Not Significant or Slight** and therefore **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

327. Cable landfall duct installation and cable laying activities within the South Dublin Bay intertidal area have the potential to disturb and displace birds which would otherwise directly utilise areas within and around the areas where these works are proposed to take place.

328. The disturbance and resultant displacement of individuals which would otherwise potentially utilise intertidal areas within or around the area of intertidal landfall works effectively equates to temporary indirect habitat loss for those individuals.

329. Indirect habitat loss as a consequence of disturbance and displacement reduces the potential spatial extent of useable habitat available to impacted receptors. Receptor species utilising such areas of intertidal habitat include waders, wildfowl, gulls, terns, seabirds and other waterbird species. Reductions in the areas available for these species to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

330. Use of the South Dublin Bay area by receptor species is primarily as a wintering / non-breeding migration site. As such, potential disturbance and displacement impacts would affect non-breeding populations using the site. For Common and Arctic tern, however, for which there are breeding colonies within the nearby Dublin Port, consideration is also given to potential impacts to the local breeding population (breeding Common tern is a designated feature of South Dublin Bay and River Tolka Estuary SPA).

331. Specific additional consideration is also given to tern species in relation to their use of intertidal habitats within the South Dublin Bay area as an important aggregation / roosting site during the post-breeding period (mid-July to mid-September, with the Common, Arctic and Roseate tern post-breeding aggregation being a designated feature of South Dublin Bay and River Tolka Estuary SPA).

332. Further information on the following baseline surveys to characterise potential construction phase disturbance and displacement impacts within intertidal areas is provided in (**Appendix 10.5 Baseline Characterisation Report**):

- Tidal landfall bird surveys – A total of 81 diurnal surveys between October 2019 and March 2023, to record the numbers and distributions of ornithological receptors across intertidal habitats within South Dublin Bay throughout the tidal cycle.

- Post-breeding tern aggregation surveys – A total of eight crepuscular (dusk) surveys between the second half of July and the first half of September in 2020 and 2021, to record the numbers and distributions of terns in attendance at roosting areas within South Dublin Bay.

Impact screening

333. Intertidal bird species vary in their behavioural responses to sources of anthropogenic disturbance, including reactions to both visual and acoustic stimuli. The following studies are referenced to characterise species-specific responses for the purpose of impact screening:

- Cutts et al. (2013) – Waterbird Disturbance Mitigation Toolkit. Primary source of species-specific acoustic and visual disturbance thresholds. Reference for high, medium and low acoustic and visual disturbance thresholds;
- Goodship & Furness (2022) – Disturbance distances review: An updated literature review of disturbance distances of selected seabird species;
- Goodship & Furness (2019) – Seaweed hand-harvesting: Literature review of disturbance distances and vulnerabilities of marine coastal birds;
- Bregnballe et al. (2017) – Differential flight responses of spring staging teal (*Anas crecca*) and Wigeon (*A.* [*sic*] *Penelope*) to human versus natural disturbance;
- Gittings & O'Donoghue (2016) – Disturbance response of red-breasted mergansers (*Mergus serrator*) to boat traffic in Wexford Harbour;
- Keller (1989) – Variations in the response of Great crested grebes (*Podiceps cristatus*) to human disturbance – A sign of adaptation?;
- Valente & Fischer (2011) – Reducing human disturbance to waterbird communities near corps of engineers projects; and
- Novčić (2022) – Behavioural responses of Grey Herons (*Ardea cinerea*) and Great Egrets (*Ardea alba*) to human-caused disturbance.

334. In addition to species-specific intertidal waterbird sensitivities to disturbance and displacement, the extents to which each species utilises the intertidal area within South Dublin Bay are also considered.

335. Species which are insensitive to disturbance and displacement effects and / or make minimal use of areas within or surrounding the area associated with intertidal landfall works are not considered to be at risk of indirect habitat loss impacts above a significance level of imperceptible and are therefore not considered further in assessment in relation to such impacts from construction activities within the South Dublin Bay intertidal area.

336. Bird species shown in **Table 10-47** were recorded within the CWP Project intertidal landfall area at South Dublin Bay during baseline tidal landfall bird surveys (plus post-breeding aggregation surveys, for tern species). A number of species were recorded in the study area in numbers considered to be too low to warrant screening into the impact assessment. The threshold for this distinction was generally considered to be species for which the maximum count during any survey was less than 0.5% of the All-Ireland wintering population (i.e., half of the one percent national threshold value presented in Burke et al., 2018). As this threshold value is not available for the majority of seabird species which may occur in estuarine habitats, expert opinion was used to determine whether numbers were too low to warrant detailed species accounts. Decisions to this effect were made on the basis of maximum numbers recorded as being very low, and / or the frequency of species presence recorded as being low.

337. An exception to the selection criteria outlined above was made in relation to SCIs of South Dublin Bay and River Tolka Estuary SPA or the adjacent and functionally connected North Bull Island SPA. These species were automatically screened in for assessment regardless of the numbers recorded during landfall survey works, on account of the OECC passing through South Dublin Bay and River Tolka Estuary SPA.

338. For tern species, peak numbers of individuals recorded during crepuscular post-breeding tern aggregation surveys are also provided, in brackets, in addition to peak counts during diurnal baseline tidal landfall surveys. For three closely related and morphologically similar species (Common, Arctic and Roseate – hereafter referred to as *Sterna* tern spp.), differentiation to species level was generally not possible for the majority of roosting individuals during low light conditions, hence an aggregated peak count value of all three species is provided in relation to post-breeding tern aggregation surveys instead of species-specific counts).

Table 10-47 Screening of intertidal bird species for risk of disturbance and displacement within the vicinity of intertidal landfall works during construction

Species	Peak count during baseline tidal landfall bird surveys	0.5% of the all-Ireland wintering population (Burke et al., 2018), for waterbirds	Screened in or out	Rationale if screening out
Light-bellied Brent Goose	602	175	In	
Pink-footed Goose (*Anser brachyrhynchus*)	49	-	Out	Scarce in Ireland (infrequent individuals or flocks from GB population) and only recorded once during baseline surveys. No Irish regional population defined., but peak count very small in relation to GB wintering population (510,000 individuals – 2015/16;, BTO, 2023). Small peak count. Scarce in Ireland and only recorded once during baseline surveys.
Mute Swan (*Cygnus olor*)	2	45	Out	Very small peak count in relation to regional population and only recorded three times during baseline surveys.
Shelduck	45	50	In	
Wigeon	4	280	Out	Very small peak count in relation to regional population and only recorded once during baseline surveys.
Mallard	8	140	Out	Very small peak count in relation to regional population.
Shoveler*	6	10	In	
Pintail	16	8	In	
Eider	8	27	Out	Very small peak count in relation to regional population and only recorded once during baseline surveys.
Teal*	71	180	In	
Common scoter	99	55	In	
Long-tailed duck (*Clangula hyemalis*)	3	-	Out	No regional population defined, but very small peak count.

Species	Peak count during baseline tidal landfall bird surveys	0.5% of the all-Ireland wintering population (Burke et al., 2018), for waterbirds	Screened in or out	Rationale if screening out
Goldeneye	5	20	Out	Very small peak count in relation to regional population.
red-breasted merganser	151	12	In	
Red-throated diver	71	10	In	
Great northern diver	5	-	Out	Very small peak count in relation to regional non-breeding population (**Table 10-14** at least 751 individuals).
Manx shearwater	9	-	Out	Very small peak count in relation to regional population (**Table 10-14** – at least 1,585,474 individuals).
Great crested grebe	912	15	In	
Little Grebe (*Tachybaptus ruficollis*)	2	10	Out	Very small peak count in relation to regional population.
Grey heron	25	12	In	
Gannet	23	-	Out	Very small peak count in relation to regional population (**Table 10-14** – at least 420,278 individuals).
Little egret	90	5	In	
Shag	83	-	In	
Cormorant	37		Out	Very small peak count in relation to regional non-breeding population (**Table 10-14** –18,406 individuals).
Oystercatcher	3,677	305	In	
Lapwing	53	425	Out	Very small peak count in relation to regional population.
Golden plover	475	460	In	
Grey plover	45	15	In	
Ringed plover	398	60	In	

Species	Peak count during baseline tidal landfall bird surveys	0.5% of the all-Ireland wintering population (Burke et al., 2018), for waterbirds	Screened in or out	Rationale if screening out
Ruff (*Calidris pugnax*)	6	-	Out	No regional population defined, but very small peak count and only recorded once during baseline surveys.
Whimbrel (*Numenius phaeopus*)	6	-	Out	No regional population defined, but very small peak count.
Curlew	237	175	In	
Bar-tailed godwit	1,260	85	In	
Black-tailed godwit	830	100	In	
Common sandpiper (Actitis hypoleucos)	2	-	Out	No regional population defined, but very small peak count and only recorded three times during baseline surveys.
Turnstone	310	47	In	
Curlew sandpiper (*Calidris ferruginea*)	7	-	Out	No regional population defined, but very small peak count.
Knot	10,890	80	In	
Sanderling	408	42	In	
Dunlin	5,495	230	In	
Purple sandpiper (*Calidris maritima*)	6	-	Out	No regional population defined, but very small peak count.
Little Stint (*Calidris minuta*)	1	-	Out	No regional population defined, but very small peak count and only recorded once during baseline surveys.
Snipe	3	-	Out	No regional population defined, but very small peak count and only recorded three times during baseline surveys.
Redshank	1,337	120	In	

Species	Peak count during baseline tidal landfall bird surveys	0.5% of the all-Ireland wintering population (Burke et al., 2018), for waterbirds	Screened in or out	Rationale if screening out
Greenshank	109	10	In	
Lesser Yellowlegs (*Tringa flavipes*)	1	-	Out	No regional population defined, but very small peak count and only recorded twice during baseline surveys.
Kittiwake	34	-	Out	Very small peak count in relation to regional population (**Table 10-14** – at least 127,666 individuals).
Black-headed gull	3,826	-	In	
Little gull	2	-	Out	Very small peak count in relation to regional non-breeding population (**Table 10-14** –1,539 individuals) and only recorded twice during baseline surveys.
Mediterranean gull	87	-	In	
Common gull	512	-	In	
Great black-backed gull	241	-	In	
Herring gull	5,646	-	In	
Yellow-legged gull (*Larus michahellis*)	1	-	Out	No regional population defined, but very small peak count and only recorded three times during baseline surveys.
Lesser black-backed gull	150	-	In	
Sandwich tern	231 (462)	-	In	
Common tern	35 (NA)	-	In	
Arctic tern	16 (NA)	-	In	
Roseate tern	1 (NA)	-	In	

Species	Peak count during baseline tidal landfall bird surveys	0.5% of the all-Ireland wintering population (Burke et al., 2018), for waterbirds	Screened in or out	Rationale if screening out
Common, Arctic or Roseate tern (*Sterna* tern sp)	497 (4,868)	-	In	
Black tern	0 (4)	-	Out	No regional population defined, but very small peak count and only recorded once during baseline surveys
Guillemot	27	-	Out	Very small peak count in relation to regional population (**Table 10-14** – at least 335,387 individuals).
Razorbill	32	-	Out	Very small peak count in relation to regional population (**Table 10-14** – at least 44,341 individuals).
Black guillemot	32	-	In	
Kingfisher (*Alcedo atthis*)	1	-	Out	No regional population defined, but very small peak count and only recorded three times during baseline surveys.
Hooded Crow	53	-	Out	No regional population defined, but primarily terrestrial species with small peak count.
Starling (*Sturnus vulgaris*)	129	-	Out	No regional population defined, but primarily terrestrial species with very small peak count and only recorded three times during baseline surveys.
Wetland habitats	NA	NA	Out	There is no potential route to for impacts for impacts to supporting wetland habitats via disturbance and displacement.

*Table notes: *Species screened in as it is a feature of the adjacent and functionally connected North Bull Island SPA*

Receptor sensitivity

339. Intertidal waterbird species screened in for assessment in relation to disturbance and displacement impacts may experience effects as a consequence of temporary indirect habitat loss due to the visual and acoustic impacts of landfall construction activities.

340. Species-specific tolerances to disturbance and displacement to construction phase activities within the intertidal habitats of South Dublin Bay differ as a result of inherent differences between species in their responses to acoustic and visual stimuli (hereafter referred to as 'inherent ecological sensitivity'), in addition to variability in receptor site use levels and the regional significance of those site use levels (i.e., the regional importance of South Dublin Bay for those species). These factors are considered to influence the extent to which receptors may experience disturbance and displacement impacts (at a population level), in addition to their ability to potentially avoid such impacts and the probability that such impacts may affect population survival and / or productivity rates (see receptor tolerance criteria in **Table 10-8**).

341. Inherent ecological sensitivity to disturbance and displacement impacts, i.e., a species response to acoustic or visual stimuli, has been benchmarked in relation to general reviews of species responses (Cutts et al., 2013; Goodship and Furness, 2022) or species / group specific literature where required.

342. Receptor site use levels and their regional significance have been benchmarked in relation to peak abundance recorded during baseline surveys as a proportion of the relevant regional population (generally the all-Ireland wintering population estimate from Burke et al., 2018 for estuarine waders and wildfowl and estimated regional bio-seasonal populations from **Table 10-14** for seabird species).

343. Where the peak abundance of a species within the South Dublin Bay area has been observed to be high, the potential for individuals to alter behaviours to avoid impacts within South Dublin Bay is considered to be lower than if only low peak numbers of the species were recorded. Similarly, where the peak abundance of a species within the South Dublin Bay Area indicates that the area is of regionally high importance to that species (i.e., a high proportion of the regional population uses the site), the potential for that receptor to avoid impacts by using other sites within the region is reduced and the probability of impacts to that receptor resulting in significant consequences to the regional population is considered greater. For such scenarios and where inherent ecological sensitivities are considered to be high, species tolerance to construction phase disturbance and displacement impacts within the intertidal landfall area is assessed to be very low or low.

344. Conversely, where the peak abundance of a species within the South Dublin Bay area has been observed to be low, the potential for individuals to alter behaviours to avoid impacts within South Dublin Bay is considered to be greater than if high peak numbers of the species were recorded. Similarly, where the peak abundance of a species within the South Dublin Bay Area indicates that the area is of regionally low importance to that species (i.e., a low proportion of the regional population uses the site), the potential for that receptor to avoid impacts by using other sites within the region is increased and the probability of impacts to that receptor resulting in significant consequences to the regional population is considered lower. For such scenarios and where ecological sensitivities are considered to be low, species tolerance to construction phase disturbance and displacement impacts within the intertidal landfall area is assessed to be very high or high.

345. Where inherent ecological sensitivity and site importance assessments differ, a median tolerance value is assigned. For example, if a species is highly ecologically sensitive to disturbance and displacement stimuli, but the potentially affected area is of low regional significance to the wider population, a medium receptor tolerance value would be assigned.

346. As noted in Goodship and Furness, 2022, an important consideration in relation to receptor tolerance to impacts which occur within highly disturbed areas, such as much of the intertidal habitat within South Dublin Bay (this area serves as an important amenity area for nearby urban conurbations and is

surrounded by areas of industrial and urban activity), is that birds within such areas are likely to demonstrate 'a high degree of habituation to disturbance'. Furthermore, for gull species, these receptors are considered to be particularly adaptable, typically demonstrating a high level of tolerance and habituation to human activities (Calladine et al., 2006). This adaptability, along with a high degree of flexibility in their usage of habitats, provides these species with an ability to adapt to very high levels of visual and acoustic disturbance which may arise as a result of anthropogenic activities.

347. Receptor tolerance (partly informed by inherent ecological sensitivity) and importance are considered together to determine receptor sensitivity, as per **Table 10-9**.

Light-bellied Brent Goose

348. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Light-bellied Brent Goose is generally considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013).

349. Despite this, within Dublin Bay and surrounding locations, Light-bellied Brent Geese have been observed to alter their behaviours in order to forage within highly disturbed industrial and urban areas (for example, Dublin Bay Birds Project, 2015[8]), evidencing a much greater degree of disturbance tolerance for populations within this area than is suggested for this species in general.

350. Although the observed peak count during baseline intertidal surveys was moderately high at 602 individuals, this represents only a modest proportion (1.72%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts through use of alternative sites in the wider region. Furthermore, as peak numbers of Light-bellied Brent Goose utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant demographic consequences to the regional population is considered to be limited.

351. As Light-bellied Brent Goose is usually considered to be highly sensitive to disturbance and displacement, but populations of this species around Dublin appear to be considerably less so than is generally the case elsewhere, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

352. The conservation importance of Light-bellied Brent Goose is assessed as being high (**Table 10-22**).

353. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Light-bellied Brent Goose is assessed as being medium (i.e., high tolerance and high importance).

Shelduck

354. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Shelduck is considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013), however individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

355. The observed peak count is moderately low at 45 individuals, representing only a very small proportion (0.45%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore

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[8] https://dublinbaybirds.blogspot.com/2015/02/dining-on-dublin-docks.html [Accessed March 2024].

considered to have some capacity by which to avoid impacts through use of alternative sites in the wider region. Furthermore, as peak numbers of shelduck utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant demographic consequences to the regional population is considered to be limited.

356. As shelduck is considered to be generally highly sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

357. The conservation importance of shelduck is assessed as being medium (**Table 10-22**).

358. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of shelduck is assessed as being low (i.e., high tolerance and medium importance).

Shoveler

359. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Shoveler is considered to have medium inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

360. The observed peak count of shoveler is very low at just six individuals, representing a very small proportion (0.3%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of shoveler utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant demographic consequences to the regional population is considered to be limited.

361. As shoveler is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

362. The conservation importance of shoveler is assessed as being medium (**Table 10-22**).

363. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of shoveler is assessed as being low (i.e., high tolerance and medium importance).

Pintail

364. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Pintail is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

365. The observed peak count of pintail is very low at just 16 individuals, representing a very small proportion (1.02%) of the estimated all-Ireland wintering population (Burke et al., 2018). Furthermore, the 16 individuals of this species recorded during the baseline survey period were recorded as one in-flight flock, passing through the survey area. This receptor is considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region.

Furthermore, as peak numbers of pintail observed from South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant demographic consequences to the regional population is considered to be limited.

366. As pintail is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

367. The conservation importance of pintail is assessed as being medium (**Table 10-22**).

368. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of pintail is assessed as being low (i.e., high tolerance and medium importance).

Teal

369. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Teal is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Bregnballe et al., 2017); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

370. The observed peak count is moderately low at 71 individuals, representing a very small proportion (0.2%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of teal utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

371. As teal is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

372. The conservation importance of teal is assessed as being medium (**Table 10-22**).

373. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of teal is assessed as being low (i.e., high tolerance and medium importance).

Common scoter

374. This species was recorded within the South Dublin Bay survey area throughout the survey period. Common scoter is considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

375. Although the observed peak count is moderate at 99 individuals, this represents only a very small proportion (0.93%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Common scoter utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

376. As Common scoter is considered to be generally highly sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

377. The conservation importance of Common scoter is assessed as being high (**Table 10-22**).

378. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Common scoter is assessed as being medium (i.e., high tolerance and high importance).

red-breasted merganser

379. This species was recorded within the South Dublin Bay survey area throughout the survey period. red-breasted merganser is considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Gittings and O'Donoghue, 2016); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

380. The observed peak count is moderate at 147 individuals, representing a moderate proportion (6.2%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have a limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of red-breasted merganser utilising South Dublin Bay represent a moderate proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be medium.

381. As red-breasted merganser is considered to be generally highly sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a moderate proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

382. The conservation importance of red-breasted merganser is assessed as being low (**Table 10-22**).

383. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of red-breasted merganser is assessed as being low (i.e., medium tolerance and low importance).

Great crested grebe

384. This species was recorded within the South Dublin Bay survey area throughout the survey period. Great crested grebe is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Keller, 1989); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

385. The observed peak count of Great crested grebe is high at 912 individuals, representing a very high proportion (30.4%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have a limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Great crested grebe utilising South Dublin Bay represent a very large proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be large.

386. As Great crested grebe is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, but that any potential impacts within the OECC intertidal landfall area would be to, at most, a very large proportion of the regional population, this species is considered to have low tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

387. The conservation importance of Great crested grebe is assessed as being low (**Table 10-22**).

388. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Great crested grebe is assessed as being medium (i.e., low tolerance and low importance).

Oystercatcher

389. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to species including wintering wildfowl and waders. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Oystercatcher is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

390. Although the observed peak count is high at 3,677 individuals, this represents only a moderate proportion (6%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have a limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Oystercatcher utilising South Dublin Bay represent a moderate proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be relatively limited.

391. As Oystercatcher is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a moderate proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

392. The conservation importance of Oystercatcher is assessed as being very high (**Table 10-22**).

393. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Oystercatcher is assessed as being high (i.e., medium tolerance and very high importance).

Golden plover

394. This species which occurs within South Dublin Bay is a SCI of the adjacent and functionally connected North Bull Island SPA. Golden plover is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

395. Although the observed peak count is moderately high at 475 individuals, this represents only a very small proportion (0.5%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Golden plover utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

396. As Golden plover is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

397. The conservation importance of Golden plover is assessed as being high (**Table 10-22**).

398. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Golden plover is assessed as being low (i.e., high tolerance and high importance).

Grey plover

399. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to migratory wildfowl and waders. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Grey plover is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

400. The observed peak count is moderately low at 45 individuals, representing a modest proportion (1.5%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Grey plover utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

401. As Grey plover is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

402. The conservation importance of Grey plover is assessed as being high (**Table 10-22**).

403. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Grey plover is assessed as being medium (i.e., high tolerance and high importance).

Ringed plover

404. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to migratory wildfowl and waders. Ringed plover is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013) and individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

405. Although the observed peak count is moderately high at 398 individuals, this represents only a modest proportion (3.3%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Ringed plover utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

406. As Ringed plover is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

407. The conservation importance of Ringed plover is assessed as being high (**Table 10-22**).

408. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity of Ringed plover is assessed as being low (i.e., high tolerance and high importance).

Curlew

409. This species which occurs within South Dublin Bay is a SCI of the adjacent and functionally connected North Bull Island SPA. Curlew is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

410. Although the observed peak count is moderate at 237 individuals, this represents only a very small proportion (0.7%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of curlew utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

411. As Curlew is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

412. The conservation importance of Curlew is assessed as being high (**Table 10-22**).

413. When receptor tolerance and importance are considered together as per **Table 10-9**, he overall receptor sensitivity of Curlew is assessed as being low (i.e., very high tolerance and high importance).

Bar-tailed godwit

414. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to migratory wildfowl and waders. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Bar-tailed godwit is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

415. The observed peak count is moderately high 1,260 individuals, representing a moderate proportion (7.4%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Bar-tailed godwit utilising South Dublin Bay represent a moderate proportion of the regional population, there is considered to be potential for impacts at this site to result in significant consequences to the regional population.

416. As Bar-tailed godwit is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a moderate proportion of the regional population, this species is considered to have moderate tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

417. The conservation importance of Bar-tailed godwit is assessed as being very high (**Table 10-22**).

418. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Bar-tailed godwit is assessed as being high (i.e., medium tolerance and very high importance).

Black-tailed godwit

419. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Black-tailed godwit is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

420. Although the observed peak count is moderately high at 589 individuals, this represents only a modest proportion (4.2%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Black-tailed godwit utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

421. As Black-tailed godwit is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

422. The conservation importance of Black-tailed godwit is assessed as being high (**Table 10-22**).

423. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Black-tailed godwit is assessed as being medium (i.e., high tolerance and high importance).

Turnstone

424. This species occurs within South Dublin Bay and is a SCI of the adjacent and functionally connected North Bull Island SPA. Turnstone is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013) and individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

425. Although the observed peak count is moderate at 310 individuals, this represents only a modest proportion (3.3%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Turnstone utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

426. As Turnstone is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

427. The conservation importance of Turnstone is assessed as being medium (**Table 10-22**).

428. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Turnstone is assessed as being very low (i.e., very high tolerance and medium importance).

Knot

429. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Knot is considered to have high inherent ecological sensitivity to acoustic disturbance stimuli, but low inherent ecological sensitivity to visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

430. The observed peak count is very high 10,890 individuals, representing a very large proportion (66.9%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have very limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of knot utilising South Dublin Bay represent a very large proportion of the regional population, there is considered to be very high potential for impacts at this site resulting in significant consequences to the regional population.

431. As Knot is considered to have generally high sensitivity to acoustic disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very large proportion of the regional population, this species is considered to have low tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

432. The conservation importance of Knot is assessed as being very high (**Table 10-22**).

433. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Knot is assessed as being very high (i.e., very low tolerance and very high importance).

Sanderling

434. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Sanderling is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013) and individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

435. Although the observed peak count is moderately high 408 individuals, this represents only a small proportion (4.9%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Sanderling utilising South Dublin Bay represent a moderate proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be relatively limited.

436. As Sanderling is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

437. The conservation importance of Sanderling is assessed as being high (**Table 10-22**).

438. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Sanderling is assessed as being low (i.e., very high tolerance and high importance).

Dunlin

439. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Dunlin is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Cutts et al., 2013) and individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

440. The observed peak count is very high at 5,495 individuals, representing a moderately high proportion (11.9%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have relatively limited capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Dunlin utilising South Dublin Bay represent a moderately high proportion of the regional population, there is considered to be moderate potential for impacts at this site resulting in significant consequences to the regional population.

441. As Dunlin is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a moderate proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

442. The conservation importance of Dunlin is assessed as being very high (**Table 10-22**).

443. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Dunlin is assessed as being high (i.e., medium tolerance and very high importance).

Redshank

444. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Redshank is considered to have high inherent ecological sensitivity to acoustic disturbance stimuli, but low inherent ecological sensitivity to visual disturbance stimuli (Cutts et al., 2013); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

445. Although the observed peak count is moderately high at 709 individuals, this represents only a modest proportion (5.6%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Redshank utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

446. As Redshank is considered to have generally high sensitivity to acoustic disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

447. The conservation importance of Redshank is assessed as being very high (**Table 10-22**).

448. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Redshank is assessed as being high (i.e., medium tolerance and very high importance).

Greenshank

449. This species was recorded within the South Dublin Bay survey area throughout the survey period. Greenshank is considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

450. The observed peak count is low at 109 individuals, representing only a modest proportion (8.3%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Greenshank utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

451. As Greenshank is considered to be generally highly sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

452. The conservation importance of Greenshank is assessed as being low (**Table 10-22**).

453. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Greenshank is assessed as being low (i.e., medium tolerance and low importance).

Black-headed gull

454. This species is a SCI of the South Dublin Bay and River Tolka Estuary SPA. It is also a SCI of the adjacent and functionally connected North Bull Island SPA. Black-headed gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

455. Although the observed peak count is moderately high 3,826 individuals, this represents a small proportion (3.83%) of the estimated wintering population (**Table 10-35**), and gulls are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998) and particularly adaptable in relation to anthropogenic activities (Calladine et al., 2006). This receptor is therefore considered to have a substantial capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Black-headed gull utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

456. As Black-headed gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

457. The conservation importance of Black-headed gull is assessed as being high (**Table 10-22**).

458. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Black-headed gull is assessed as being low (i.e., very high tolerance and high importance).

Mediterranean gull

459. This species was recorded within the South Dublin Bay survey area throughout the survey period. Mediterranean gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

460. Although the observed peak count is moderately low at 87 individuals, this represents a high proportion (38%) of the mean Republic of Ireland estimated wintering population (winters 2011/12 to 2015/16; Lewis et al., 2019). Gulls are, however, notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998) and particularly adaptable in relation to anthropogenic activities (Calladine et al., 2006). This receptor is therefore considered to have a substantial capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. As peak numbers of Mediterranean gull utilising South Dublin Bay represent a large proportion of the regional population, there is considered to be potential for impacts at this site to result in in significant consequences to the regional population.

461. As Mediterranean gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, but that any potential impacts within the OECC intertidal landfall area would be to, at most, a large proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

462. The conservation importance of Mediterranean gull is assessed as being medium (**Table 10-22**).

463. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Mediterranean gull is assessed as being low (i.e., high tolerance and medium importance).

Common gull

464. This species was recorded within the South Dublin Bay survey area throughout the survey period. Common gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

465. The observed peak count of Common gull is 512 individuals, which represents only a very small proportion (0.78%) of the estimated migration population (**Table 10-35**), and gulls are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998) and particularly adaptable in relation to anthropogenic activities (Calladine et al., 2006). This receptor is therefore considered to have a substantial capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak

numbers of Common gull utilising South Dublin Bay represent only a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

466. As Common gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

467. The conservation importance of Common gull is assessed as being high (**Table 10-22**).

468. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Common gull is assessed as being low (i.e., very high tolerance and high importance).

Great black-backed gull

469. This species was recorded within the South Dublin Bay survey area throughout the survey period. Great black-backed gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

470. Although the observed peak count is moderate at 241 individuals, this represents a very small proportion (0.45%) of the estimated migration population (**Table 10-35**), and gulls are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of great black-backed gull utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

471. As Great black-backed gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

472. The conservation importance of Great black-backed gull is assessed as being medium (**Table 10-22**).

473. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Great black-backed gull is assessed as being very low (i.e., very high tolerance and medium importance).

Herring gull

474. This species was recorded within the South Dublin Bay survey area throughout the survey period. Herring gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

475. Although the observed peak count is high at 5,646 individuals, this represents a small proportion (3.02%) of the estimated migration population (**Table 10-35**) and gulls are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin

Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Herring gull utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

476. As Herring gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

477. The conservation importance of Herring gull is assessed as being high (**Table 10-22**).

478. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Herring gull is assessed as being low (i.e., very high tolerance and high importance).

Lesser black-backed gull

479. This species was recorded within the South Dublin Bay survey area throughout the survey period. Lesser black-backed gull is considered to have low inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022) and individuals present with the South Dublin Bay area are likely to demonstrate a very high degree of habituation to potential disturbance inducing stimuli.

480. The observed peak count is moderate at 150 individuals, which represents only a very small proportion (0.29%) of the estimated migration free winter population (**Table 10-35**) and gulls are notably flexible in their use of a wide range of habitats for undertaking foraging and other behaviours (Snow & Perrins, 1998). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Lesser black-backed gull utilising South Dublin Bay represent only a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

481. As Lesser black-backed gull is considered to have generally low sensitivity to disturbance and displacement, and likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

482. The conservation importance of Lesser black-backed gull is assessed as being high (**Table 10-22**).

483. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Lesser black-backed gull is assessed as being low (i.e., very high tolerance and high importance).

Black guillemot

484. Black guillemot is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Valente & Fischer, 2011); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

485. The observed peak count is moderately low at 32 individuals, representing a small proportion (3.07%) of the estimated non-breeding population (**Table 10-35**). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Black guillemot utilising South Dublin Bay

represent only a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

486. As Black guillemot is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

487. The conservation importance of Black guillemot is assessed as being low (**Table 10-22**).

488. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Black guillemot is assessed as being low (i.e., high tolerance and low importance).

Red-throated diver

489. Red-throated diver is considered to have high inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

490. The observed peak count is 71 individuals, representing only a very small proportion (0.56%) of the estimated regional non-breeding population (**Table 10-35**). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Red-throated diver utilising South Dublin Bay represent a modest proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

491. As Red-throated diver is considered to be generally highly sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

492. The conservation importance of Red-throated diver is assessed as being high (**Table 10-22**).

493. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Red-throated diver is assessed as being medium (i.e., high tolerance and high importance).

Shag

494. Shag is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Goodship and Furness, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

495. The observed peak count is moderate at 83 individuals, representing only a very small proportion (0.49%) of the estimated migration-free winter population (**Table 10-35**). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Shag utilising South Dublin Bay represent a very small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

496. As Shag is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is

considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

497. The conservation importance of Shag is assessed as being high (**Table 10-22**).

498. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Shag is assessed as being low (i.e., high tolerance and high importance).

Grey heron

499. Grey heron is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Novčić, 2022); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

500. The observed peak count is 25 individuals, representing only a very small proportion (0.96%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Grey heron utilising South Dublin Bay represent a small proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

501. As Grey heron is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a very small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

502. Given the above, Grey heron is therefore considered to have very high tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

503. The conservation importance of Grey heron is assessed as being low (**Table 10-22**).

504. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Grey heron is assessed as being low (i.e., high tolerance and low importance).

Little egret

505. Little egret is considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli (Novčić, 2022; Xu et al., 2021); however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli.

506. The observed peak count is 90 individuals, representing a moderate proportion (6.5%) of the estimated all-Ireland wintering population (Burke et al., 2018). This receptor is therefore considered to have some capacity by which to avoid impacts within the South Dublin Bay area through use of alternative sites in the wider region. Furthermore, as peak numbers of Little egret utilising South Dublin Bay represent a modest proportion of the regional population, the potential for impacts at this site resulting in significant consequences to the regional population is considered to be limited.

507. As Little egret is considered to be generally moderately sensitive to disturbance and displacement, but likely highly habituated to impacts within this area, and that any potential impacts within the OECC intertidal landfall area would be to, at most, a moderate proportion of the regional population, this species is considered to have medium tolerance to disturbance and displacement impacts within the intertidal area of South Dublin Bay during the landfall construction phase.

508. The conservation importance of Little egret is assessed as being low (**Table 10-22**).

509. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Little egret is assessed as being low (i.e., medium tolerance and low importance).

tern species

<u>Sterna terns</u>

510. This genus includes three closely related and morphologically similar tern species, namely Common, Arctic and Roseate Terns. These species are SCIs of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to post-breeding tern aggregations.

511. Away from their breeding colonies, during diurnal periods within marine habitats, *Sterna* tern species are considered to be moderately insensitive to anthropogenic disturbance (i.e., moderately low disturbance response scores to vessels in Garthe and Hüppop, 2004; and minimal response to vessels in Perrow et al., 2011). The sensitivity of terns to disturbance when they are present within intertidal habitats during diurnal periods has not been described; however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli. As such, *Sterna* terns are considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli during diurnal periods.

512. These species are, however, SCIs of the South Dublin Bay and River Tolka Estuary SPA, a designated site of international importance to post-breeding tern aggregations and form overnight roosts within the intertidal habitats of South Dublin Bay in internationally important numbers. Unlike during diurnal periods, for which information relating to the ecological sensitivity of *Sterna* terns to visual and acoustic stimuli is available, disturbance responses of nocturnal roosting terns to such stimuli are unknown. Studies of roosting tern locations within South Dublin Bay (Tierney et al., 2016) have, however, been interpreted to indicate a preference for the selection of minimally disturbed areas (Goodship and Furness, 2022), which is suggestive that *Sterna* terns are more sensitive to disturbance when attending nocturnal roost aggregations.

513. The observed peak count is moderately high at 4,686 individuals during crepuscular post-breeding tern aggregation surveys and 542 (combined total of all *Sterna* tern species) during diurnal tidal landfall baseline surveys, which represents a low proportion (3.07% and 0.36%) of the estimated overall regional post-breeding migration population (from sum of *Sterna* tern species migration populations - **Table 10-35**). Peak counts were recorded during the month of September, when post-breeding aggregations of these species occur within South Dublin Bay, with birds arriving from the wider region in pre-migration flocks.

514. Despite this relatively modest proportion of the wider regional population using the South Dublin Bay area at any one time, studies suggest a high level of turnover of individuals present within the site's post-breeding aggregation within each season (Burke and Crowe, 2016). This, in turn indicates the potential for a considerably greater proportion of the regional population to pass through this important pre-migration staging area during each late-summer / early-autumn period.

515. Furthermore, post-breeding tern aggregation sites which are used by a large number of individuals are relatively uncommon (i.e., only four sites supporting peak counts in excess of 1,000 individuals were identified around the Irish south and east coast during a co-ordinated survey of post-breeding tern sites in 2016 (Burke and Crowe, 2016), with the South Dublin Bay post-breeding tern aggregation in particular being far larger than all other sites (Burke and Crowe, 2016, estimated a combined peak count for sites within South Dublin Bay of 25,756 terns of all species – which would be equivalent to 15.41% of the combined regional *Sterna* and Sandwich tern regional population). The same areas are used consistently within and between years across the South Dublin Bay Area (specifically around Merrion Gates and Sandymount Strand - see **Appendix 10.5 Baseline Characterisation Report**).

516. Therefore, as a relatively large proportion of regional *Sterna* tern populations may pass through the South Dublin Bay post-breeding aggregation sites each year between mid-July and September, inclusive, and, should impacts occur to those sites, individuals would appear not to have a choice of using other roosting locations within Dublin Bay or elsewhere locally so as to avoid those impacts, all *Sterna* tern species are considered to have low tolerance to disturbance and displacement impacts associated with construction phase activities within intertidal areas of South Dublin Bay. In particular, this assessed low tolerance relates to the possibility that works may be undertaken during times at which terns are nocturnally roosting (typically after one hour before sunset – NPWS, 2015)

517. The conservation importance of all three *Sterna* tern species is assessed as being high (**Table 10-22**).

518. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of all three *Sterna* tern species is assessed as being high (i.e., low tolerance and high importance).

<u>Sandwich tern</u>

519. Away from their breeding colonies, during diurnal periods within marine habitats, Sandwich tern are considered to be moderately insensitive to anthropogenic disturbance (i.e., moderately low disturbance response scores to vessels in Garthe and Hüppop, 2004; and minimal response to vessels in Perrow et al., 2011). The sensitivity of Sandwich tern to disturbance when they are present within intertidal habitats during diurnal periods has not been described; however, individuals present with the South Dublin Bay area are likely to demonstrate a high degree of habituation to potential disturbance inducing stimuli. As such, Sandwich tern are considered to have moderate inherent ecological sensitivity to acoustic and visual disturbance stimuli during diurnal periods.

520. However, as per *Sterna* terns, above, Sandwich Terns primarily utilise the intertidal habitats of South Dublin Bay when attending post breeding aggregation nocturnal roost sites. Unlike during diurnal periods, for which information relating to the ecological sensitivity of Sandwich Terns to visual and acoustic stimuli is available, disturbance responses of nocturnal roosting terns to such stimuli are unknown. Studies of roosting tern locations within South Dublin Bay (Tierney et al., 2016) have, however, been interpreted to indicate a preference for the selection of minimally disturbed areas (Goodship and Furness, 2022), which is suggestive that Sandwich Terns are more sensitive to disturbance when attending nocturnal roost aggregations.

521. The observed peak counts of Sandwich Terns during crepuscular post-breeding tern aggregation surveys and diurnal tidal landfall baseline surveys was 462 and 231 individuals, respectively. This represents a small proportion (3.18% and 1.59%) of the of the estimated post-breeding migration population (**Table 10-35**). Peak counts were recorded during the month of September, when post-breeding aggregations of this species occur within South Dublin Bay, with birds arriving from the wider region in pre-migration flocks.

522. Despite this relatively modest proportion of the wider regional population using the South Dublin Bay area at any one time, studies suggest a high level of turnover of individuals present within the site's post-breeding aggregation within each season (Burke and Crowe, 2016). This, in turn indicates the potential for a considerably greater proportion of the regional population to pass through this important pre-migration staging area during each late-summer / early-autumn period.

523. Furthermore, post-breeding tern aggregation sites which are used by a large number of individuals are relatively uncommon (i.e., only four sites supporting peak counts in excess of 1,000 individuals were identified around the Irish south and east coast during a co-ordinated survey of post-breeding tern sites in 2016 (Burke and Crowe, 2016), with the South Dublin Bay post-breeding tern aggregation in particular being far larger than all other sites (Burke and Crowe, 2016, estimated a combined peak count for sites within South Dublin Bay of 25,756 terns of all species – which would be equivalent to 15.41% of the combined regional *Sterna* and Sandwich tern regional population). The same areas are

used consistently within and between years across the South Dublin Bay Area (specifically around Merrion Gates and Sandymount Strand - see **Appendix 10.5 Baseline Characterisation Report**).

524. Therefore, as a relatively large proportion of regional Sandwich populations may pass through the South Dublin Bay post-breeding aggregation sites each year and, should impacts occur to those sites, individuals would appear not to have a choice of using other roosting locations within Dublin Bay or elsewhere locally so as to avoid those impacts, Sandwich tern are considered to have low tolerance to disturbance and displacement impacts associated with construction phase activities within intertidal areas of South Dublin Bay. In particular, this assessed low tolerance relates to the possibility that works may be undertaken during times at which terns are nocturnally roosting (typically after one hour before sunset – NPWS, 2015)

525. The conservation importance of Sandwich tern is assessed as being low (**Table 10-22**).

526. When receptor tolerance and importance are considered together as per **Table 10-9**, the overall receptor sensitivity of Sandwich tern is assessed as being medium (i.e., low tolerance and low importance).

Magnitude of impact

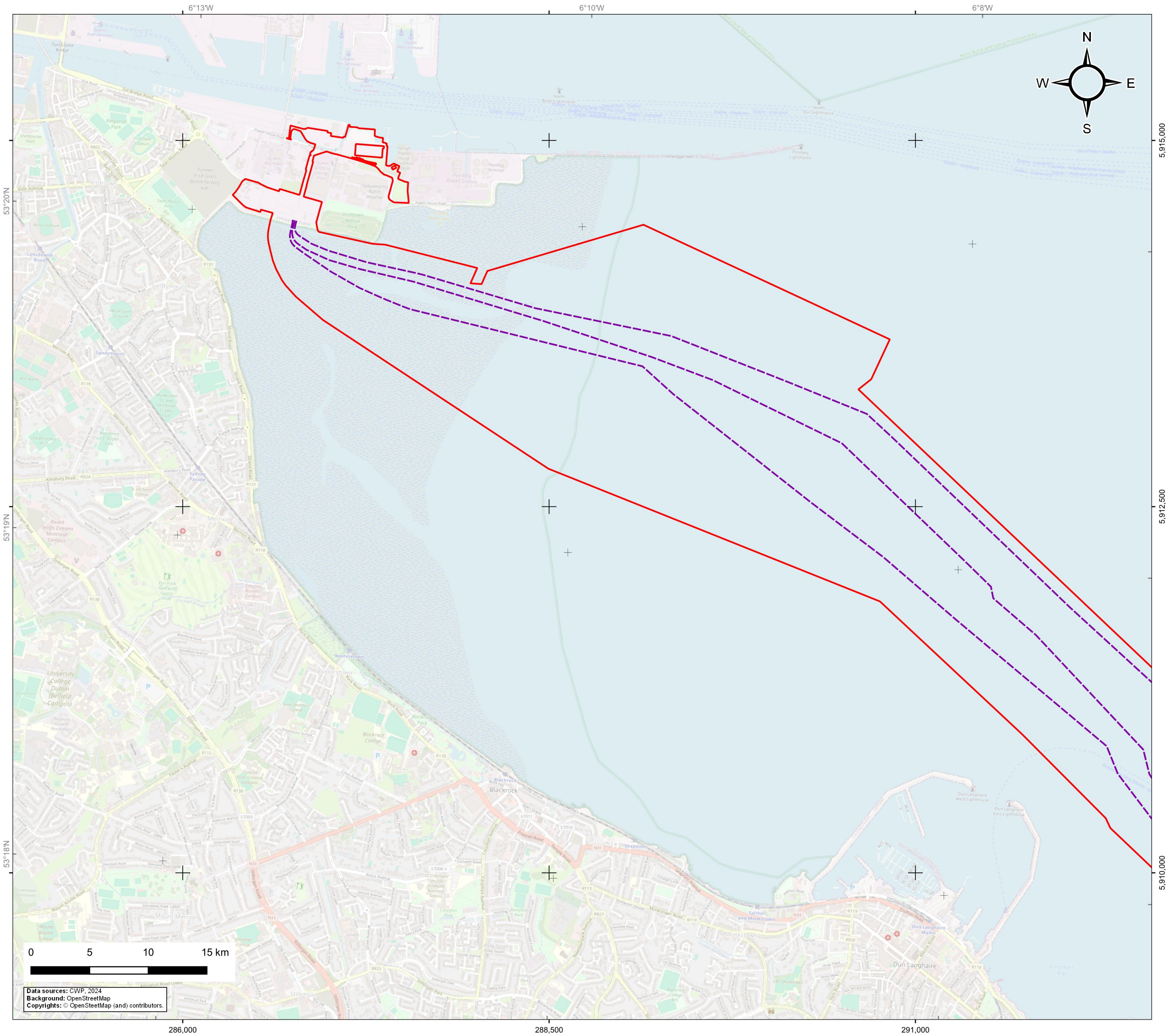
Description of works

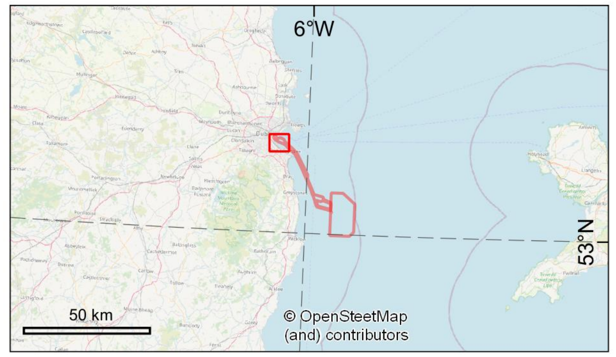
<u>Intertidal landfall construction activities</u>

527. The landfall works within the intertidal are expected to comprise two main activities, namely:

- Landfall cable duct installation; and
- Cable laying

528. The method of cable duct installation is expected to utilise open cut techniques. Two cable lay scenarios are included in the construction activities described below. Firstly, a Preferred Alignment (PA) scenario, which represents the most likely route the three cables will take from the seaward end of the cable ducts towards the CLV (**Figure 10-5**). Secondly, an Alternative Alignment for the purposes of Modelling (AAM) scenario, which represents the cable routing scenario which would amount to maximal ‘spread’ of potential visual and acoustic disturbance to intertidal waterbirds (**Figure 10-6**).





Legend

- Planning Application Boundary (PAB)
- Offshore export cable

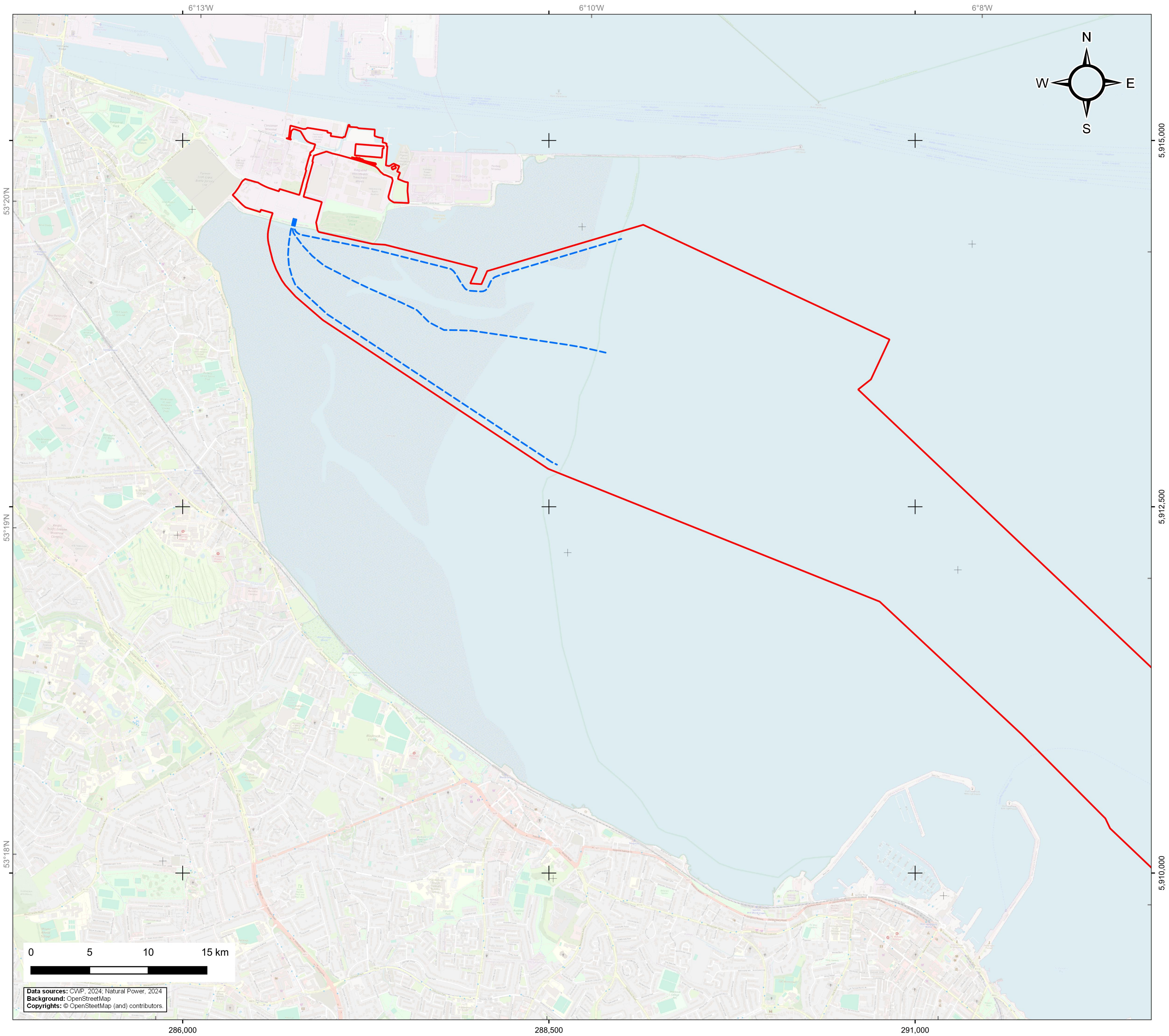
Project: Codling Wind Park	Contractor: www.naturalpower.com

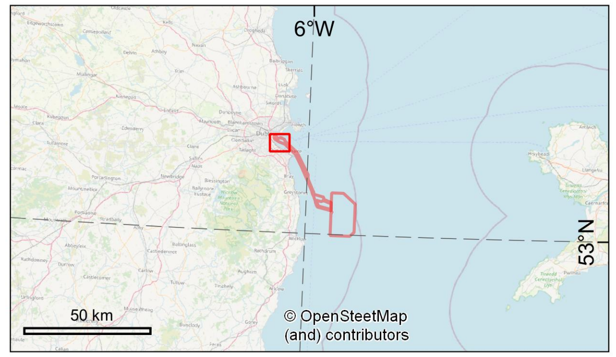
Figure 10.5
Offshore export cable layout scenario

CWP doc. number: CWP-NPC-ENG-08-01-MAP-1176

Internal descriptive code:	*Size:* A3	*CRS:*
PB..DLH - PAB..OECs.3PB.Opt8 - (EIAR.FIG.10.05)	*Scale:* 1:25,000	EPSG 25830

Rev.	Updates	Date	By	Chk'd	App'd
A	Final version	2024/07/18	AC	FM/EA	CP





Legend

- Planning Application Boundary (PAB)
- Offshore export cable – alternative alignment

codling wind park	Project: Codling Wind Park	Contractor: natural power www.naturalpower.com

Figure 10.6
Alternative alignment cable layout scenario

CWP doc. number: CWP-NPC-ENG-08-01-MAP-1527

Internal descriptive code:	*Size:* A3	*CRS:*
PB..DLH - PAB..OECs.3PB.Opt8.INTERTIDAL.ALTER. ALIGN - (EIAR.FIG.10.06)	*Scale:* 1:25,000	EPSG 25830

Rev.	*Updates*	*Date*	*By*	*Chk'd*	*App'd*
A	Final version	2024/07/18	AC	FM/EA	CP

529. A detailed account of the construction activities is provided in **Chapter 4 Project Description**. Activities which have the potential to result in disturbance and displacement impacts to intertidal waterbirds are summarised below.

Landfall cable duct installation

530. The open cut method of cable duct installation will involve various excavations, backfilling and landscaping activities, as well as the construction and removal of a temporary cofferdam and associated berms. These works will require vehicular and personnel access onto the intertidal area, including dump trucks, excavators and / or tipper trucks and bulldozers.

531. For the purposes of the assessment, construction of the cofferdam is assumed within the representative scenario. This comprises the installation of steel sheet piles using vibropiling techniques. Sheet piles are expected to be installed using a leader rig with a vibratory hammer (such as a MRZV 30VV), together with a 50-tonne crawler crane. During construction, the walls of the cofferdam will be constructed on a low tide cycle, culminating in the final phase of the piling works to construct the front face of the cofferdam.

532. Construction of the cofferdam in this way is expected to take six weeks, with a total piling duration of two weeks. Installation of the temporary cofferdam will be required to take place during the low tide cycle (twice per day) which varies each day. All piling from within the intertidal area will be undertaken during the low tide cycle, with an anticipated maximum of four hours of piling per day. Due to the timing of the low tide cycle, sheet piling works for the temporary cofferdam may take place outside core working hours (i.e., piling may be required to take place at night-time or during the hours of dawn and / or dusk). Any lighting required would be localised task lighting and would minimise the potential impact of light pollution at night.

533. The total area of the intertidal zone expected to be disrupted by installation of the temporary cofferdam is 3,375 m^3. The total duration of the presence of the cofferdam within the intertidal zone is four weeks, including construction and removal. All works associated with the cofferdam are expected to take place from mid-April up to and including mid-July in year 1 of construction.

534. Construction of a temporary access ramp will be necessary in order to facilitate works within the intertidal zone. It is expected that the total area of 500 m^2 (50 m by 10 m) will be required to accommodate the ramp, facilitating access between the construction compound (terrestrial) and the intertidal area. The total area below the MHWS will likely be considerably less than this.

535. Following the removal of the cofferdam, intertidal cable ducting activities will require the excavation of trenches seaward from the landfall location, extending up to approximately 300 to 350 m from the shoreline. Each trench will be 3 m in depth and 19 m wide (1 m at base). Cable ducts will be laid in sections, connected and stabilised using concrete weighted collars. The trench will then be backfilled with the end of the ducts capped and buried, ready for the cables to be pulled through the installed ducts during phase two of the landfall works. The total area of intertidal seabed expected to be disturbed as part of the trench excavation associated with the cable ducting activities is expected to be approximately 36,000 m^2.

Landfall cable duct installation: facilitation of works

536. Construction of a temporary access ramp will be necessary in order to facilitate works within the intertidal zone. It is expected that the total area of 500 m^2 (50 m by 10 m) will be required to accommodate the ramp, facilitating access between the construction compound (terrestrial) and the intertidal area. The total area below the MHWS will likely be considerably less than this.

537. Following the removal of the cofferdam, intertidal cable ducting activities will require the excavation of trenches seaward from the landfall location, extending up to approximately 300 to 350 m from the shoreline. Each trench will be 3 m in depth and 19 m wide (1 m at base). Cable ducts will be laid in sections, connected and stabilised using concrete weighted collars. The trench will then be backfilled

with the end of the ducts capped and buried, ready for the cables to be pulled through the installed ducts during phase two of the landfall works. The total area of intertidal seabed expected to be disturbed as part of the trench excavation associated with the cable ducting activities is expected to be approximately 36,000 m^2.

538. For the purposes of the EIA, a 40 m temporary disturbance width is assessed for cable duct installation between the cofferdam and the transition zone. This encompasses the trenching works, the footprint for associated excavators and any spoil that is be generated at either side of the trench. Excavation and burial of the cable ducts (including installation of cable protection) is expected to take two to three weeks per circuit and therefore six to nine weeks in total.

<u>Cable laying</u>

539. The works described above will facilitate cable installation within the intertidal zone, up to approximately 300 to 350 m of the shoreline. From this point onwards, cable laying activities will continue to extend seawards through the transition zone to the locations of the CLV. For the purposes of the EIA, both PA and AAM cable laying scenarios are described (**Figure 10-5** and **Figure 10-6**).

540. The PA scenario will see three approximately parallel cables extending east through the intertidal zone from the seaward end of the landfall cable ducts towards the transition zone. The distance or 'spread' between the northern- and southernmost cables will be up to approximately 250 m (**Figure 10-5**).

541. The AAM scenario represents the maximal 'spread' of the three cable routes within the OECC as they fan out seaward from the landfall cable ducts to the CLV locations. The maximal 'spread' of potential disturbance was determined by directing the northern- and southernmost cables along hypothetical routes that lie approximately 50 m inwards from south and north of the bounds of the OECC. The third cable was directed along a hypothetical route approximately halfway between the northern- and southernmost AAM cable routes. At approximately 2 km seaward from MHWS, the maximum distance between the northern- and southernmost cables under the AAM scenario is approximately 1.4 km (**Figure 10-6**).

542. For both cable laying scenarios, cabling activities will require the erection of support structures, including a mid-support pontoon (MSP) and tensioner platforms.

543. The MSP is expected to be 1,000 m^2 in size (20 x 50 m) and will be in place for approximately six months. The MSP will be affixed to the seabed within the intertidal zone using four anchors, or two spud holes, alternating between floating and resting on the mudflat through each tidal cycle.

544. Up to three tensioner platforms are expected to be installed along the cable ducts between the TJB and the CLV at approximately 1 km intervals. Each platform will be approximately 15 x 10 m (150 m^2). For the purposes of EIA, it is assumed that a temporary sheet piled wall will be installed for each of the three tensioner platforms using vibropiling. This is expected to require one day of sheet piling activity for each platform and therefore nine days in total for three cable circuits. Piling for the tensioner platforms will be undertaken using an excavator mounted vibratory piling tool during the low tide cycle. Cable laying activities will also include pull-in and burial activities.

545. The total area of intertidal seabed affected by the installation of temporary support structures under both the PA and AAM scenarios is 6,900 m^2. The total area of seabed affected by the installation of cables using either open cut trenching or a shallow water trenching tool is 0.108 km^2.

Determination of spatial extents of acoustic and visual impact magnitudes

546. Disturbance and displacement impacts from construction phase activities within the intertidal landfall area result from the response of individuals of each species to acoustic and visual stimuli. Cutts et al. (2013) provides a framework for linking the inherent ecological sensitivity of species within intertidal habitats to the spatial extent at which those species experience visual and acoustic impacts, and thereby quantifying the number of individuals from each species which may experience potential

impacts. Where species are not included within Cutts et al. (2013), no information differentiating between responses to acoustic and visual disturbance stimuli are available and generic disturbance sensitivity assessments (such as Goodship and Furness, 2019) are used to define species specific impacts spatial extents.

547. Modelling was undertaken to define the total spatial extent of activities that may result in visual and acoustic impacts, the results of which are summarised below, in **Table 10-48**.

Table 10-48 Spatial extent of intertidal habitat impacted

Spatial extent of intertidal habitat impacted	
Maximum area experiencing low level acoustic impacts (40-55 dB) (km^2) per piling event	5.77
Maximum area experiencing moderate level acoustic impacts (55-70 dB) (km^2) per piling event	0.55
Maximum area experiencing high level acoustic impacts (>70 dB) (km^2) per piling event	0.02
Area experiencing low level visual impacts (within 300-500 m of cable installation activities) (km^2)	1.09
Area experiencing moderate level visual impacts (within 100-300 m of cable installation activities) (km^2)	1.83
Area experiencing high level visual impacts (within 100 m of cable installation activities) (km^2)	1.39

548. In general terms, species which are considered more highly sensitive to disturbance impacts are considered to experience disturbance or displacement in response to lower stimuli thresholds, i.e., in response to experiencing lower acoustic impact volumes or lower levels of visual effect further from the impact source, and therefore the area of disturbance is greater for such species.

549. For the purposes of quantifying the spatial extents of disturbance impacts, and corresponding with literature used to define receptor tolerance, acoustic and visual disturbance spatial extent have been defined in relation to three inherent ecological sensitivity levels as described by Cutts et al. (2013) and are provided in **Table 10-49** below.

Table 10-49 Disturbance level thresholds from Cutts, et al. (2013)

Disturbance stimuli type	Spatial extent of disturbance impacts around activities in relation to inherent ecological sensitivity to anthropogenic disturbance		
	Low sensitivity species	Medium sensitivity species	High sensitivity species
Acoustic	Disturbance impacts experienced within areas in which noise levels from activity exceed 70 dB	Disturbance impacts experienced within areas in which noise levels from activity exceed 55 dB	Disturbance impacts experienced within areas in which noise levels from activity exceed 40 dB
Visual	Disturbance impacts experienced within 100 m of activity	Disturbance impacts experienced within 300 m of activity	Disturbance impacts experienced within 500 m of activity

550. Species specific inherent ecological sensitivities to disturbance impacts are described in the receptor sensitivity section, above, but are repeated and related to associated impact extents in **Table 10-50**, below.

Table 10-50 Species sensitivity to anthropogenic disturbance

Species	Inherent ecological sensitivity			Disturbance and displacement area of impact
	Acoustic	Visual	Reference	
Light-bellied Brent Goose	high	high	Cutts et al., (2013)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
Shelduck	high	high	Cutts et al., (2013)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
Shoveler	medium		Goodship & Furness (2022)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Pintail	medium		Goodship & Furness (2022)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Teal	medium		Bregnballe et al., (2017)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Common scoter	high		Goodship & Furness (2022)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
red-breasted merganser	high		Gittings & O'Donoghue (2016)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
Great crested grebe	medium		Keller (1989)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Oystercatcher	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Golden plover	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Grey plover	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Ringed plover	low	low	Cutts et al., (2013)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Curlew	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli

Species	Inherent ecological sensitivity			Disturbance and displacement area of impact
	Acoustic	Visual	Reference	
Bar-tailed godwit	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Black-tailed godwit	medium	medium	Cutts et al., (2013)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Turnstone	low	low	Cutts et al., (2013)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Knot	high	low	Cutts et al., (2013)	Where noise levels exceed 40 dB and within 100 m of visual stimuli
Sanderling	low	low	Cutts et al., (2013)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Dunlin	low	low	Cutts et al., (2013)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Redshank	high	low	Cutts et al., (2013)	Where noise levels exceed 40 dB and within 100 m of visual stimuli
Greenshank	high		Goodship & Furness (2022)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
Black-headed gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Mediterranean gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Common gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Great black-backed gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Herring gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Lesser black-backed gull	low*1		Goodship & Furness (2019)	Where noise levels exceed 70 dB and within 100 m of visual stimuli
Sandwich tern	moderate		Garthe and Hüppop (2004); Perrow et al., (2011)	Where noise levels exceed 55 dB and within 300 m of visual stimuli

Species	Inherent ecological sensitivity			Disturbance and displacement area of impact
	Acoustic	Visual	Reference	
Roseate tern	moderate		Garthe and Hüppop (2004); Perrow et al., (2011)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Common tern	moderate		Garthe and Hüppop (2004); Perrow et al., (2011)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Arctic tern	moderate		Garthe and Hüppop (2004); Perrow et al., (2011)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Black guillemot	medium		Valente & Fischer (2011)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Red-throated diver	high		Goodship & Furness (2022)	Where noise levels exceed 40 dB and within 500 m of visual stimuli
Shag	medium		Goodship & Furness (2019)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Grey heron	medium		Novčić (2022)	Where noise levels exceed 55 dB and within 300 m of visual stimuli
Little egret	medium		Novčić (2022); Xu et al., (2021)	Where noise levels exceed 55 dB and within 300 m of visual stimuli

*Table notes: *1 gull species are considered to be particularly insensitive to anthropogenic disturbance and displacement away from breeding colonies and within industrialised / urban areas with high levels of human activity. Inherent sensitivity used to define impact extents is considered particularly conservative for this species group.*

551. Two potential disturbance and displacement scenarios are presented:

- The PA scenario; and
- An AAM scenario (See **Section 10.8.4**).

552. **Figures 1** to **26 (Appendix 10.6)** show the extents of areas which have the potential to be impacted **at least once** under each scenario, using the acoustic and visual disturbance thresholds described in **Table 10-50** above.

553. It is emphasised that the piling activities which give rise to the disturbance areas in these figures **will not take place concurrently**, and that the areas represented in **Appendix 10.6** are illustrative only of areas predicted to be impacted **at least once**. As works occur, potential acoustic and visual impacts will be situated only at the loci at which works are being undertaken at that given time.

Preferred Alignment

554. **Figures 1** to **9 (Appendix 10.6)** show areas of intertidal habitat within South Dublin Bay that are predicted to experience acoustic disturbance as a result of piling activities associated with mobile tensioner platforms, **Figures 19** to **21 (Appendix 10.6)** show areas of intertidal habitat within South Dublin Bay that are predicted to experience acoustic disturbance as a result of piling activities associated with TJBs and **Figure 22 (Appendix 10.6)** shows areas of intertidal habitat within South Dublin Bay that are predicted to experience acoustic disturbance as a result of piling activities associated with construction of a temporary cofferdam under the PA scenario.

555. **I**ntertidal habitat within South Dublin Bay predicted to experience visual disturbance as a result of activities associated with open cut cable duct installation methods under the PA scenario are considered to be the given preferred cable alignment, plus 100, 300 and 500 m buffers for high, medium and low levels of visual disturbance respectively.

Alternative Alignment for the purposes of modelling

556. **Figures 10** to **18 (Appendix 10.6)** show areas of intertidal habitat within South Dublin Bay that are predicted to experience acoustic disturbance as a result of piling activities associated with mobile tensioner platforms under the AAM scenario.

557. Areas of intertidal habitat within South Dublin Bay predicted to experience visual disturbance at as a result of activities associated with cable duct installation under the AAM scenario are considered to be the given cable AAM cable alignment plus 100, 300 and 500 m buffers for high, medium and low levels of visual disturbance respectively.

Assessment of acoustic and visual impacts

558. On the basis of the construction phase activities outlined in the 'Description of works' section, above, and the spatial extent of potential disturbance and displacement impacts associated with those activities for each species outlined in the 'determination of spatial extents of acoustic and visual impact magnitudes' section, above, the numbers of individuals from each species predicted to be impacted are presented in this section. The numbers of individuals impacted are then considered in relation to other supporting criteria such as impact duration and frequency (as outlined in **Table 10-10**), in order to attribute impact magnitudes on the basis of consequence to affected receptor populations.

559. It should be noted that, for this impact, there is no formal mechanism or precedent by which to translate a number of individuals displaced over a period, or periods, of time into a predicted increase in baseline mortality (and thereby allow a quantitative comparison with impact consequence guidelines outlined in **Table 10-11**). In the absence of such an approach, expert opinion has been applied to decide which impact magnitude best describes potential impact consequences to affected populations.

560. For example, if, on average, 19.19 light-bellied brent geese are predicted to be within the area around each piling event in which they may experience disturbance from the noise from that piling and this is predicted to occur 26 times over a duration of one day each time, it is not possible to quantitively translate the potential energetic cost associated with such displacement into an estimated increase to baseline mortality rates of the regional population. It can, however, be observed that 19.19 individuals represents a very small proportion of the regional population and therefore, even if disturbance results in a non-negligible consequence to the demographic parameters of an individual (i.e., likelihood of survival), this would, at most, result in only a small to negligible effect upon regional baseline mortality. As such, an impact magnitude of negligible or low would be considered appropriate, while also highly conservative.

561. For each species screened in for intertidal disturbance and displacement during the construction period, the overall assessment of impact includes the consideration of the overlap between areas occupied by each species as they occurred within South Dublin Bay during the baseline survey period and areas predicted to be subject to acoustic and visual impacts.

562. Acoustically impacted areas have been quantified using the results of intertidal noise modelling, wherein each discrete piling event has been simulated and the resulting sound propagation contours mapped. Visually impacted areas have been determined by applying distance buffers to the continuum of each of the PA and AAM cable route scenarios, as it is considered that visible disturbance has the potential to occur at any position along the cable routes, albeit non-concurrently. High, medium and low levels of acoustic and visual impact are defined in **Table 10-50**, above. The areas of potential impact calculated around each event to which species are susceptible are dependent on each receptors' ecological sensitivity to visual or acoustic impacts, as defined in **Table 10-50**, above. For example, if a receptor is considered to be highly sensitive to acoustic impacts, the area of potential impact around a construction event which generates a potential acoustic impact is taken to be the full extent of the high, medium and low impact level areas. Conversely, if a receptor is considered to have low sensitivity to acoustic impacts, the area of potential impact around a construction event which generates potential acoustic impact is taken to be only the extent of the high impact level area.

563. In order to characterise the magnitudes of acoustic disturbance impacts, the average numbers of each species recorded within the South Dublin Bay survey area during each visit throughout the baseline survey period (81 visits) were estimated. These were compared to the average numbers of individuals predicted to be disturbed by any individual discrete piling event and piling events within the most sensitive identified location.

564. In order to characterise the magnitudes of visual disturbance impacts estimated numbers of individuals within visual disturbance areas (i.e., specific distances from intertidal cable routes dependant on species sensitivities) are compared to mean numbers of individuals recorded during each survey throughout the entire survey period (81 visits).

565. Information to characterise the magnitude of acoustic and visual impacts to each receptor is provided in **Table 10-51** below. These impact parameters are then interpreted in order to conclude overall construction phase disturbance and displacement impact magnitudes for both the PA and AAM scenarios (See **Appendix 10.11 Intertidal disturbance and displacement – Magnitude of impact and residual effects**). In order to convert impact parameters to relative metrics, the scales shown in Table A have been applied.

Table 10-51 Impact parameter ranges used for the conversion of disturbance impact metrics into relative metrics to describe those impacts

Relative metric	Impact parameter type	
	Percentage (of regional population or mean survey count)	Value
Very small	<5%	<10 individuals
Small	5-10%	10-25 individuals
Medium	10-20%	25-100 individuals
Large	20-50%	100-500 individuals
Very large	>50%	>500 individuals

566. For example, where peak counts are less than 5% of the regional population, the South Dublin Bay area is assessed to be utilised by a very small proportion of that regional population. Similarly, where acoustic stimuli are predicted to result in potential disturbance to less than 5% of individuals present within the South Dublin Bay area, or fewer than 10 individuals in total, the proportion and absolute number of individuals potentially impacted, respectively, is assessed to be very small. Conversely, where acoustic stimuli are predicted to result in potential disturbance to more than 50% of individuals present within the South Dublin Bay area, or more than 500 individuals in total, the proportion and absolute number of individuals potentially impacted, respectively, is assessed to be very large.

567. **Table 10-52** and **Table 10-53** below summarise the acoustic and visual impact magnitude parameters that are predicted to result from anthropogenic activities in South Dublin Bay during the construction phase. The average number of individuals of each species predicted to be impacted by acoustic and visual disturbance at levels to which they are sensitive are presented as well as Acoustic and visual impact magnitudes being summarised for both the PA and AAM cable lay scenarios.

568. A more detailed table of the acoustic and visual impact magnitude parameters is provided in **Appendix 10.6**, providing the number as a proportion of the mean survey count for each species. In addition, the maximum number of individuals (and as a proportion of the mean survey count) predicted to be impacted by any single piling activity is given for acoustic disturbance, along with the most impactful piling activity for each species assessed in **Appendix 10.6**.

569. Each species is subsequently assessed in detail. Visual and acoustic impacts to each species are considered, taking into account the impact magnitude to the screened-in species in South Dublin Bay against the wider context of each receptors' regional population size and importance. Quantified impact magnitudes are converted to relative metrics using the parameters described in **Table 10-51**, above. These metrics are then used to assign an assessed impact magnitude to each species for both acoustic and visual disturbance, for both the PA and AAM cable route scenarios.

Table 10-52 Acoustic impact magnitude parameters resultant from construction phase activities within intertidal areas of South Dublin Bay for each species and each intertidal cable route scenario

Species	Mean count per survey across all 81 baseline surveys	Intertidal cable route scenario	Acoustic impacts associated with piling activity		
			Average no. of individuals impacted per piling event	Max average no. of individuals impacted per piling event	
				Value	Activity (Map location)
Light-bellied Brent Goose	77.98	PA	16.70	21.59	Tensioner platform piling PA scenario 3.6 (Appendix 10.6 - Figure 6)
		AAM	19.93	21.98	Tensioner platform piling AAM scenario 3.6 (Appendix 10.6 - Figure 15)
Shelduck	5.49	PA	1.64	2.17	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	1.85	2.01	Tensioner platform piling AAM scenario 3.6 (Appendix 10.6 - Figure 15)
Shoveler	0.09	PA and AAM	There is no level of overlap between the occurrence of shoveler recorded throughout the survey period and areas which are predicted to be subject to acoustic or visual disturbance at levels to which this species is sensitive under either the PA or AAM scenarios		
Teal	3.41	PA	0.00	0.03	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	0.00	0.03	Tensioner platform piling AAM scenario 3.5 (Appendix 10.6 - Figure 14)
Oystercatcher	861.19	PA	40.22	71.90	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	50.88	109.11	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Golden plover	24.14	PA	0.21	0.89	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	0.44	2.20	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Grey plover	3.07	PA	0.12	0.55	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	0.22	0.95	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Ringed plover	33.14	PA	0.01	0.02	Tensioner platform piling PA scenario 3.2 (Appendix 10.6 - Figure 2)
		AAM	0.01	0.04	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Curlew	47.73	PA	1.61	4.28	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	2.12	5.28	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Bar-tailed godwit	177.62	PA	1.69	4.50	Cofferdam piling PA scenario 1a (Appendix 10.6 - Figure 22)
		AAM	4.26	14.86	Tensioner platform piling AAM scenario 3.9 (Appendix 10.6 - Figure 18)
Black-tailed godwit	110.81	PA	0.62	0.76	Tensioner platform piling PA scenario 3.6 (Appendix 10.6 - Figure 6)
		AAM	1.38	4.25	Tensioner platform piling AAM scenario 3.9 (Appendix 10.6 - Figure 18)
Turnstone	66.37	PA	0.01	0.11	Tensioner platform piling PA scenario 3.3 (Appendix 10.6 - Figure 3)
		AAM	0.03	0.28	Tensioner platform piling AAM scenario 3.3 (Appendix 10.6 - Figure 12)
Knot	775.28	PA	116.06	283.89	Cofferdam piling PA scenario 1a (Appendix 10.6 - Figure 22)
		AAM	136.83	251.98	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Sanderling	53.06	PA	0.01	0.07	Tensioner platform piling PA scenario 3.6 (Appendix 10.6 - Figure 6)
		AAM	0.04	0.29	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Dunlin	596.75	PA	1.62	4.20	Tensioner platform piling PA scenario 3.2 (Appendix 10.6 - Figure 2)
		AAM	1.74	4.20	Tensioner platform piling AAM scenario 3.2 (Appendix 10.6 - Figure 11)
Redshank	166.7	PA	49.60	61.47	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	54.48	81.28	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Black-headed gull	753.3	PA	2.03	6.35	Cofferdam piling PA scenario 1a (Appendix 10.6 - Figure 22)
		AAM	2.08	4.56	Tensioner platform piling AAM scenario 3.3 (Appendix 10.6 - Figure 12)
Sterna terns (diurnal)	20.16	PA	0.19	0.58	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	0.30	0.99	Tensioner platform piling AAM scenario 3.9 (Appendix 10.6 - Figure 18)
Great crested grebe	57.49	PA	0.87	3.09	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	1.34	3.09	Tensioner platform piling AAM scenario 3.7 (Appendix 10.6 - Figure 16)
red-breasted merganser	17.62	PA	2.86	4.50	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	3.69	5.97	Tensioner platform piling AAM scenario 3.7 (Appendix 10.6 - Figure 16)
Red-throated diver	4.19	PA	0.07	0.21	Cofferdam piling PA scenario 1a (Appendix 10.6 - Figure 22)
		AAM	0.20	0.32	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Herring gull	355.09	PA	0.34	1.18	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	0.47	0.40	Tensioner platform piling AAM scenario 3.1 (Appendix 10.6 - Figure 10)
Little egret	8.15	PA	0.29	0.45	Tensioner platform piling PA scenario 3.6 (Appendix 10.6 - Figure 6)
		AAM	0.33	0.40	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Greenshank	4.47	PA	0.69	1.01	Tensioner platform piling PA scenario 3.1 (Appendix 10.6 - Figure 1)

Species	Mean count per survey across all 81 baseline surveys	Intertidal cable route scenario	Acoustic impacts associated with piling activity		
			Average no. of individuals impacted per piling event	Max average no. of individuals impacted per piling event	
				Value	Activity (Map location)
		AAM	0.74	1.02	Tensioner platform piling AAM scenario 3.1 (Appendix 10.6 - Figure 10)
Mediterranean gull	12.59	PA	0.01	0.03	Tensioner platform piling PA scenario 3.6 (Appendix 10.6 - Figure 6)
		AAM	0.01	0.04	Tensioner platform piling AAM scenario 3.6 (Appendix 10.6 - Figure 15)
Common gull	59.26	PA	0.03	0.14	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	0.03	0.09	Tensioner platform piling AAM scenario 3.6 (Appendix 10.6 - Figure 15)
Great black-backed gull	35.59	PA	0.03	0.14	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	0.04	0.10	Tensioner platform piling AAM scenario 3.6 (Appendix 10.6 - Figure 15)
Lesser black-backed gull	12.47	PA	0.01	0.02	Tensioner platform piling PA scenario 3.2 (Appendix 10.6 - Figure 2)
		AAM	0.01	0.06	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Sandwich tern (diurnal)	16.81	PA	0.07	0.18	Tensioner platform piling PA scenario 3.7 (Appendix 10.6 - Figure 7)
		AAM	0.11	0.24	Tensioner platform piling AAM scenario 3.4 (Appendix 10.6 - Figure 13)
Shag	8.11	PA	0.04	0.22	Tensioner platform piling PA scenario 3.4 (Appendix 10.6 - Figure 4)
		AAM	0.06	0.22	Tensioner platform piling AAM scenario 3.5 (Appendix 10.6 - Figure 14)
Black guillemot	4.15	PA	0.00	0.02	Tensioner platform piling PA scenario 3.9 (Appendix 10.6 - Figure 9)
		AAM	0.00	0.02	Tensioner platform piling AAM scenario 3.9 (Appendix 10.6 - Figure 18)
Common scoter	6.88	PA	0.36	1.13	Tensioner platform piling PA scenario 3.7 (Appendix 10.6 - Figure 7)
		AAM	0.69	2.97	Tensioner platform piling AAM scenario 3.7 (Appendix 10.6 - Figure 16)
Grey heron	3.21	PA	0.09	0.18	Tensioner platform piling PA scenario 3.5 (Appendix 10.6 - Figure 5)
		AAM	0.09	0.15	Tensioner platform piling AAM scenario 3.5 (Appendix 10.6 - Figure 14)

Table 10-53 Visual impact magnitude parameters resultant from construction phase activities within intertidal areas of South Dublin Bay for each species and each intertidal cable route scenario

Species	Mean count per survey across all 81 baseline surveys	Intertidal cable route scenario	Visual impacts associated with activities along intertidal cable routes
			Average no. of individuals impacted
Light-bellied Brent Goose	77.98	PA	19.05 (24.43%)
		AAM	23.18 (29.73%)
Shelduck	5.49	PA	1.95 (35.44%)
		AAM	2.05 (37.23%)
Shoveler	0.09	PA and AAM	There is no level of overlap between the occurrence of shoveler recorded throughout the survey period and areas which are predicted to be subject to acoustic or visual disturbance at levels to which this species is sensitive under either the PA or AAM scenarios
Teal	3.41	PA	0.04 (1.09%)
		AAM	0.04 (1.09%)
Oystercatcher	861.19	PA	176.02 (20.44%)
		AAM	250.42 (29.08%)
Golden plover	24.14	PA	0.89 (3.68%)
		AAM	2.45 (10.15%)
Grey plover	3.07	PA	0.49 (15.83%)
		AAM	1.10 (35.85%)
Ringed plover	33.14	PA	1.08 (3.26%)
		AAM	4.36 (13.16%)
Curlew	47.73	PA	7.35 (15.41%)
		AAM	11.20 (23.47%)
Bar-tailed godwit	177.62	PA	7.91 (4.45%)
		AAM	24.69 (13.90%)
Black-tailed godwit	110.81	PA	3.52 (3.18%)
		AAM	8.44 (7.62%)
Turnstone	66.37	PA	0.61 (0.92%)
		AAM	0.74 (1.12%)
Knot	775.28	PA	15.42 (1.99%)
		AAM	77.16 (9.95%)
Sanderling	53.06	PA	0.58 (1.09%)
		AAM	1.77 (3.34%)
Dunlin	596.75	PA	99.10 (16.61%)
		AAM	160.17 (26.84%)
Redshank	166.7	PA	18.41 (11.04%)
		AAM	26.74 (16.04%)
Black-headed gull	753.3	PA	81.07 (10.76%)
		AAM	116.94 (15.52%)
Sterna terns (diurnal)	20.16	PA	1.25 (6.22%)
		AAM	2.20 (10.91%)

Species	Mean count per survey across all 81 baseline surveys	Intertidal cable route scenario	Visual impacts associated with activities along intertidal cable routes
			Average no. of individuals impacted
Great crested grebe	57.49	PA	6.13 (10.67%)
		AAM	14.18 (24.66%)
red-breasted merganser	17.62	PA	3.00 (17.03%)
		AAM	3.65 (20.73%)
Red-throated diver	4.19	PA	0.07 (1.60%)
		AAM	0.09 (2.17%)
Herring gull	355.09	PA	29.14 (8.21%)
		AAM	38.99 (10.98%)
Little egret	8.15	PA	1.17 (14.34%)
		AAM	1.28 (15.71%)
Greenshank	4.47	PA	0.73 (16.37%)
		AAM	0.81 (18.06%)
Mediterranean gull	12.59	PA	0.35 (2.78%)
		AAM	0.39 (3.09%)
Common gull	59.26	PA	2.31 (3.89%)
		AAM	2.73 (4.60%)
Great black-backed gull	35.59	PA	1.65 (4.64%)
		AAM	2.17 (6.10%)
Lesser black-backed gull	12.47	PA	0.98 (7.85%)
		AAM	1.42 (11.38%)
Sandwich tern (diurnal)	16.81	PA	0.47 (2.78%)
		AAM	0.95 (5.68%)
Shag	8.11	PA	0.33 (4.10%)
		AAM	0.39 (4.87%)
Black guillemot	4.15	PA	0.02 (0.60%)
		AAM	0.02 (0.60%)
Common scoter	6.88	PA	0.40 (5.75%)
		AAM	0.58 (8.43%)
Grey heron	3.21	PA	0.38 (11.83%)
		AAM	0.39 (12.02%)

570. Determination of the overall disturbance and displacement impacts to all species assessed as a result of landfall construction activities are provided in **Appendix 10.11 Intertidal disturbance and displacement – magnitude of impact and residual effects**. **Appendix 10.11** provides a detailed account of how impact magnitude conclusions were assessed for both acoustic and visual disturbance types. For determination of acoustic and visual impact magnitudes, taken into consideration were the numbers and proportions of individuals for each given species in relation to that species' most sensitive piling location (distributions within the South Dublin Bay survey area varied between species) and the same metrics as an average for all piling activities and visual cable route activities. These proportions and numbers of individuals impacted were compared to the maximum site use as a proportion of each species' regional population, in order to contextualise the overall disturbance impacts to that regional population. This determination of overall impact magnitude was carried out for both the PA and AAM intertidal landfall scenarios.

Significance of the effect

571. In accordance with the IAM outlined to determine impact significance level in **Table 10-54**, assessed receptor sensitivities are considered in relation to assessed impact magnitudes to determine impact significance level prior to the application of additional mitigation measures.

Table 10-54 Significance of the potential effect of disturbance and displacement during construction on intertidal bird species

Species	Receptor sensitivity	Intertidal cable route scenario	Impact magnitude	Significance level	Impact significance in EIA terms
Light-bellied Brent Goose	medium	PA	low	**Slight**	**Not Significant**
		AAM	low	**Slight**	**Not Significant**
Shelduck	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Shoveler	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Pintail	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Teal	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	high	PA	low	**Slight**	**Not Significant**
		AAM	low	**Slight**	**Not Significant**
Golden plover	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Grey plover	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Ringed plover	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Curlew	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	high	PA	negligible	**Not Significant**	**Not Significant**
		AAM	negligible	**Not Significant**	**Not Significant**
Black-tailed godwit	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Turnstone	very low	PA	negligible	**Imperceptible**	**Not Significant**

Species	Receptor sensitivity	Intertidal cable route scenario	Impact magnitude	Significance level	Impact significance in EIA terms
		AAM	negligible	**Imperceptible**	**Not Significant**
Knot	very high	PA	medium	**Significant**	**Significant**
		AAM	medium	**Significant**	**Significant**
Sanderling	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Dunlin	high	PA	low	**Slight**	**Not Significant**
		AAM	medium	**Significant**	**Significant**
Redshank	high	PA	low	**Slight**	**Not Significant**
		AAM	low	**Slight**	**Not Significant**
Black-headed gull	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Sterna terns	high	PA	high	**Significant**	**Significant**
		AAM	high	**Significant**	**Significant**
Great crested grebe	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	low	**Slight**	**Not Significant**
red-breasted merganser	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Herring gull	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Little egret	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Greenshank	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Common gull	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**

Species	Receptor sensitivity	Intertidal cable route scenario	Impact magnitude	Significance level	Impact significance in EIA terms
Lesser black-backed gull	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	medium	PA	high	**Significant**	**Significant**
		AAM	high	**Significant**	**Significant**
Shag	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Black guillemot	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Common scoter	medium	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**
Grey heron	low	PA	negligible	**Imperceptible**	**Not Significant**
		AAM	negligible	**Imperceptible**	**Not Significant**

Additional mitigation

572. In the absence of additional mitigation, significant or potentially significant effects are identified for the following features:

- Knot;
- Dunlin (AAM intertidal cable route scenario only);
- *Sterna* terns; and
- Sandwich tern.

573. The above listed ornithological features, with the exception of Sandwich and *Sterna* terns, are wader and waterbird species which primarily utilise intertidal habitats within South Dublin Bay during their wintering periods. As such, with the exception of Sandwich and *Sterna* terns, additional mitigation in the form of a temporal restriction as to when construction activities are permitted to occur within and around the intertidal zone is considered to be effective to reduce the magnitude of construction phase disturbance and displacement impacts such that their residual significance would be considered not significant in EIA terms.

574. The following mitigation measures will be implemented to mitigate potentially significant effects associated the installation of the export cables and OTI within the nearshore (<500 m from MLWS), intertidal and landfall.

- During the period September to March, inclusive, the following restrictions will apply to the proposed CWP construction:
  - Cable route installation or associated activities, including preparatory works, will not be undertaken within the OECC between MLWS and MHWS;
  - Vessel activities will not occur within 300 m of the MLWS datum;
  - Construction activities relating to cofferdam installation will not be undertaken;
  - Construction activities relating to open cut trenching at landfall will not be undertaken;
  - Piling activities associated with TJB construction, where required, will not be undertaken;

- ○ Screening will be required between Construction Compound A (and associated AAM; and the terrestrial habitat to the north of the Irishtown Nature Park (Goose Green).
- With the exception of notifiable events, for which notification of stakeholders will be required prior to works, the same restrictions will apply between one hour prior to sunset and the following sunrise during the period 15 July to 31 August, inclusive.

575. Given that tern species are summer migrants, the proposed period of mitigation (excluding activities between September and March inclusive as described above) does not reduce the magnitude of potential disturbance and displacement impacts associated with construction phase activity in intertidal areas upon tern species. Further additional mitigation measures are required in order to ensure that residual disturbance and displacement impact magnitudes on these species are reduced to levels that are considered to be not significant in EIA terms.

576. As intertidal habitats within South Dublin Bay are primarily used by *Sterna* tern species and Sandwich terns during their post-breeding migration periods (mid-July to late-September) as nocturnal roosting areas, additional mitigation in the form of daily temporal restrictions during the mid-July to late-August period (as September is already included within the restriction period outlined above) is considered to be effective to reduce the magnitude of construction phase disturbance and displacement impacts such that their residual significance would be would be considered not significant in EIA terms.

577. **Appendix 10.11 Intertidal Disturbance and Displacement – Magnitude of Impact and Residual Effects** evidences the efficacy of this additional mitigation. Estimated impact magnitudes are presented for when the mitigations outlined above are implemented (i.e., where construction works within intertidal areas are constrained to occurring within the April to August period and, for terns, where daily temporary restrictions are applied during the post-breeding period). The species for which pre-mitigation assessment predicted a significant effect are identified therein and are listed in **Table 10-55**, below. Residual peak counts recorded during the April to August non-restricted period are presented, along with this what this peak count represents as a proportion of the regional species population. The mean counts of each species are compared when considering the total baseline survey period (81 survey visits) against each species' residual mean count during the April to August non-restricted period only (27 survey visits).

578. The 'non-restricted' period refers to the months during works can be undertaken (i.e., the period during which numbers of intertidal waterbirds within South Dublin Bay and River Tolka Estuary SPA will be greatly reduced).

Table 10-55 Species assessed as having a significant impact in EIA terms; peak counts during the April to August non-restricted period and mean species counts recorded during the total baseline period, versus the April to August mitigation period

Species	Residual peak count during April to August (proportion of regional population)	Mean count per survey across all 81 baseline surveys (Number of surveys receptor recorded)	Residual mean count per survey across 27 baseline surveys corresponding with non-restricted April to August period in which works can be undertaken (Number of surveys receptor recorded)
Knot	0 (0% of regional non-breeding population)	775.28 (36/81)	0 (0/27)
Dunlin	422 (0.92% of regional non-breeding population)	596.75 (57/81)	44.74 (4/27)
Sterna terns (diurnal)	497 (0.33% of regional *Sterna* tern post-breeding migration population)	20.16 (23/81)	57.78 (16/27)
Sandwich tern (diurnal)	231 (1.59% of regional Sandwich tern post-breeding migration population)	16.81 (28/81)	43.85 (16/27)

579. **Table 10-56**, below, quantifies the acoustic and visual impacts during the non-restricted April to August period for species which were predicted to be subject a significant effect pre-mitigation. For acoustic disturbance, average and maximum average numbers of individuals impacted per piling event are presented, along with this number as a proportion of the mean count recorded during all surveys. For visual disturbance, average numbers of individuals impacted are also presented, along with this number as a proportion of the mean count recorded during all surveys.

Table 10-56 Acoustic and visual impacts to during the non-restricted April to August period

Species	Intertidal cable route scenario	Acoustic impacts associating with piling activity during non-restricted April to August period in which works can be undertaken		Visual impacts associated with activities along intertidal cable routes during non-restricted April to August period in which works can be undertaken
		Average no. of individuals impacted per piling event (proportion of all survey mean count)	Max average no. of individuals impacted per piling event (proportion of all survey mean count)	Average no. of individuals impacted (proportion of mean count)
Knot	PA	0 (NA)	0 (NA)	0 (NA)
	AAM	0 (NA)	0 (NA)	0 (NA)
Dunlin	PA	0 (NA)	0 (NA)	0 (NA)
	AAM	0 (NA)	0 (NA)	0 (NA)
Sterna terns (diurnal)	PA	0.19 (0.96%)	0.58 (2.91%)	1.25 (0.25%)
	AAM	0.30 (1.50%)	0.99 (4.96%)	2.20 (0.44%)
Sandwich tern (diurnal)	PA	0.05 (0.31%)	0.40 (2.35%)	0.63(3.74%)
	AAM	0.19 (1.10%)	0.73 (4.36%)	2.16(12.83%)

580. As the application of mitigation in the form of a seasonal restriction limiting construction activities to take place between the months of April to August (inclusive) results in potential changes to impact magnitude for all screened-in species (not just those for which a significant effect was predicted), residual impact magnitudes for each receptor are also reassessed.

581. **Table 10-57**, below, summarises an interpretation of the residual visual and acoustic impact magnitude parameters resulting from construction phase activities within intertidal areas of South Dublin Bay under each intertidal cable route scenario, in order to determine residual overall residual impact magnitudes for each species assessed as having a significant impact from visual and / or acoustic disturbance pre-mitigation. The equivalent reassessed values for all other species can be found in **Appendix 10.11 Intertidal disturbance and displacement – magnitude of impact and residual effects**.

Table 10-57 Interpretation of residual visual and acoustic impact magnitude parameters resultant from construction phase activities within intertidal areas of South Dublin Bay to determine residual overall residual impact magnitudes for each species and each intertidal cable route scenario

Intertidal cable route scenario	Peak count during April to August as proportion of regional population	Acoustic impacts				Visual impacts	
		Average piling		Most sensitive piling location		Average all cable route	
		Proportion of individuals impacted	No. individuals impacted	Proportion of individuals impacted	No. individuals impacted	Proportion of individuals impacted	No. individuals impacted
Knot							
PA	Zero	NA	Zero	NA	Zero	NA	Zero
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period is not predicted to result in any potential disturbance to knot within South Dublin Bay area, as this species was absent during baseline surveys which took place during the months of April to August. The number of potentially impacted individuals is therefore predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a very large proportion of the regional wintering population. Similarly, visual impacts associated with intertidal cable route installation during the non-restricted April to August period are not predicted to result in any potential disturbance to knot within South Dublin Bay, as this species was absent during baseline surveys which took place during the months of April to August. The number of potentially impacted individuals is therefore predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a very large proportion of the regional wintering population. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the overall residual impact magnitude of construction phase disturbance and displacement for the preferred alignment cable-route scenario to knot within the South Dublin Bay area is assessed to be negligible on account that any potential impact will be of, at most, very low consequence to the regional population (a reduction from medium prior to consideration of additional mitigation measures).						
AAM	Zero	NA	Zero	NA	Zero	NA	Zero
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period is not predicted to result in any potential disturbance to knot within South Dublin Bay area, as this species was absent during baseline surveys which took place during the months of April to August. The number of potentially impacted individuals is therefore predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a very large proportion of the regional wintering population.						

	Similarly, visual impacts associated with intertidal cable route installation during the non-restricted April to August period are not predicted to result in any potential disturbance to knot within South Dublin Bay, as this species was absent during baseline surveys which took place during the months of April to August. The number of potentially impacted individuals is therefore predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a very large proportion of the regional wintering population. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the overall residual impact magnitude of construction phase disturbance and displacement for the AAM cable-route scenario to knot within the South Dublin Bay area is assessed to be negligible on account that any potential impact will be of, at most, very low consequence to the regional population (a reduction from medium prior to consideration of additional mitigation measures).						
			Dunlin				
PA	very small	NA	Zero	NA	Zero	NA	Zero
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period is not predicted to result in any potential disturbance to dunlin present within South Dublin Bay area, and the number of potentially impacted individuals is also predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a medium proportion of the regional wintering population. Similarly, visual impacts associated with intertidal cable route installation during the non-restricted April to August period are not predicted to result in any potential disturbance to dunlin present within South Dublin Bay, and the number of potentially impacted individuals is also predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a medium proportion of the regional wintering population. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the overall residual impact magnitude of construction phase disturbance and displacement for the preferred alignment cable-route scenario to dunlin within the South Dublin Bay area is assessed to be negligible on account that any potential impact will be of, at most, very low consequence to the regional population (a reduction from low prior to consideration of additional mitigation measures).						
AAM	very small	NA	Zero	NA	Zero	NA	Zero
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period is not predicted to result in any potential disturbance to dunlin present within South Dublin Bay area, and the number of potentially impacted individuals is also predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a medium proportion of the regional wintering population. Similarly, visual impacts associated with intertidal cable route installation during the non-restricted April to August period are not predicted to result in any potential disturbance to dunlin present within South Dublin Bay, and the number of potentially impacted individuals is also predicted to be zero. The South Dublin Bay area is used at any one time by, at most, a medium proportion of the regional wintering population. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the overall residual impact magnitude of construction phase disturbance and displacement for the AAM cable-route scenario to dunlin within the South Dublin Bay area is						

	assessed to be negligible on account that any potential impact will be of, at most, very low consequence to the regional population (a reduction from medium prior to consideration of additional mitigation measures).						
***Sterna* terns (diurnal)**							
PA	very small, but considerable turnover	very small	very small	small	very small	medium	very small
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period and between sunrise and one hour before sunset during the period of 15th July - 31st August, inclusive, is predicted to result in potential disturbance to, on average a very small proportion of *Sterna* terns present within South Dublin Bay and this number of potentially impacted individuals is, on average, considered to be very small. Visual impacts associated with intertidal cable route installation during the non-restricted April to August period and between sunrise and one hour before sunset during the period of 15th July - 31st August, inclusive, are predicted to result in potential disturbance to, on average, a moderate proportion of *Sterna* terns present within South Dublin Bay, although the number of potentially impacted individuals is, on average, considered to be very small. Although the South Dublin Bay area is used at any one time by, at most, a very small proportion of the regional *Sterna* tern population, there is considered to be considerable turnover of individuals using tern aggregation sites in South Dublin Bay within each season, therefore a much greater proportion of the regional population is predicted to pass through this area each post-breeding season. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the residual impact magnitude of construction phase disturbance and displacement for the preferred alignment cable-route scenario to *Sterna* terns within the South Dublin Bay area is assessed to be low on account that any potential impact will be of, at most, low consequence to the regional population (a reduction from high prior to consideration of additional mitigation measures).						
AAM	very small, but considerable turnover	very small	very small	small	very small	large	very small
	Residual Impact magnitude conclusion: The magnitudes of numbers and proportions of *Sterna* terns impacted by visual and acoustic disturbance under the AAM scenario are the same as those assessed under the PA scenario, with the exception of the proportion of individuals impacted by visual disturbance, which is assessed as large under the AAM scenario (compared with medium under the PA scenario. Nevertheless, the overall conclusion of residual impact magnitude under the AAM scenario remains the same as that assessed for the PA scenario above; namely that the residual impact magnitude of construction phase disturbance and displacement for the limit of deviation cable-route scenario to *Sterna* terns within the South Dublin Bay area is assessed to be low on account that any potential impact will be of, at most, low consequence to the regional population (a reduction from high prior to consideration of additional mitigation measures).						
Sandwich tern (diurnal)							

PA	very small, but considerable turnover	very small	very small	very small	very small	very small	very small
	Residual Impact magnitude conclusion: Any given piling event during the non-restricted April to August period and between sunrise and one hour before sunset during the period of 15th July - 31st August, inclusive, is predicted to result in potential disturbance to, on average a very small proportion of Sandwich terns present within South Dublin Bay and this number of potentially impacted individuals is, on average, considered to be very small. Similarly, visual impacts associated with intertidal cable route installation during the non-restricted April to August period and between sunrise and one hour before sunset during the period of 15th July - 31st August, inclusive, are predicted to result in potential disturbance to, on average, a very small proportion of Sandwich terns present within South Dublin Bay and the number of potentially impacted individuals is, on average, considered to be very small. Although the South Dublin Bay area is used at any one time by, at most, a very small proportion of the regional Sandwich tern population, there is considered to be considerable turnover of individuals using tern aggregation sites in South Dublin Bay within each season, therefore a much greater proportion of the regional population is predicted to pass through this area each post-breeding season. As such, and given the limited duration of potential acoustic and visual disturbance impacts, the residual impact magnitude of construction phase disturbance and displacement for the preferred alignment cable-route scenario to Sandwich terns within the South Dublin Bay area is assessed to be low on account that any potential impact will be of, at most, low consequence to the regional population (a reduction from high prior to consideration of additional mitigation measures).						
AAM	very small, but considerable turnover	very small	very small	small	very small	medium	very small
	Residual Impact magnitude conclusion: The magnitudes of numbers and proportions of Sandwich terns impacted by visual and acoustic disturbance under the AAM scenario are the same as those assessed under the PA scenario, with the exception of the proportion of individuals impacted by visual disturbance, which is assessed as medium under the AAM scenario (compared with very small under the PA scenario and the proportion of individuals impacted at the most sensitive piling location for this species (small under the AAM scenario, compared with very small under the PA scenario). Nevertheless, the overall conclusion of residual impact magnitude under the AAM scenario remains the same as that assessed for the PA scenario above; namely that the residual impact magnitude of construction phase disturbance and displacement for the limit of deviation cable-route scenario to Sandwich terns within the South Dublin Bay area is assessed to be low on account that any potential impact will be of, at most, low consequence to the regional population (a reduction from high prior to consideration of additional mitigation measures).						

582. In addition to affecting impact magnitudes, the proposed additional mitigation to constrain activities to periods in which the majority of receptors are absent from the site or present in reduced numbers also affects receptor sensitivity assessments. This occurs as a result of changes to receptor tolerance as receptor population is more tolerant to an impact when fewer of the individuals within that population experience the impact.

583. For example, while knot occur within the South Dublin Bay area in the winter period in very large numbers, representing a very large proportion of the Irish national population, they were observed to be absent from this area during the April to August period. Therefore, should activities occur during the winter and potentially impact a very large number of individuals, representing a very large proportion of the Irish population, the tolerance of the receptor to such impacts is assessed as very low. However, should such activities be undertaken during the April to August period in which knot are absent from the South Dublin Bay area, they would have the potential to impact no knot, and hence the tolerance of the receptor to impacts within this period would be assessed as high.

584. **Table 10-58**, below, presents tolerances of each species assessed both before and after additional mitigation measures are applied. Where proportions of the regional population present within the South Dublin Bay area do not meaningfully differ between the restricted period and the all year average (i.e., if, for example, the maximum proportion of the regional population present within the South Dublin Bay area is classed as 'very low' during both periods), post-mitigation tolerances and associated receptor sensitivities remain unchanged (rows for these species are shaded grey in **Table 10-58**). Re-assessed receptor tolerances (i.e., the level of species tolerance taking into account the numbers observed during the April to August mitigation period) are then considered in assigning each species a residual receptor sensitivity.

Table 10-58 Receptor tolerance and sensitivity, pre and post additional mitigation

Species	Receptor importance	Inherent ecological sensitivity (highest sensitivity if differing response to visual and acoustic stimuli)	Without additional mitigation			With additional mitigation		
			Maximum proportion of regional population	Assessed tolerance	Receptor sensitivity	Maximum proportion of regional population	Re-assessed tolerance	Residual receptor sensitivity
Light-bellied Brent Goose	high	high	1.71% (Very small)	high	medium	1.17% (Very small)	high	moderate
Shelduck	medium	high	0.44% (Very small)	high	low	0.44% (Very small)	high	low
Shoveler	medium	medium	0.30% (Very small)	high	low	<0.001% (Very small)	high	low
Pintail	medium	medium	0 (0.00%)	high	low	0	high	low
Teal	medium	medium	0.20% (Very small)	high	low	0.00% (Very small)	high	low
Oystercatcher	very high	medium	6.07% (Small)	medium	high	1.97% (Very small)	high	medium
Golden plover	high	medium	0.52% (Very small)	high	moderate	0.00% (Very small)	high	moderate
Grey plover	very high	medium	1.70% (Very small)	high	medium	0.00% (Very small)	high	moderate
Ringed plover	high	low	3.41% (Very small)	very high	low	0.85% (Very small)	very high	low
Curlew	high	medium	0.67% (Very small)	high	moderate	0	high	moderate
Bar-tailed godwit	very high	medium	7.62% (Small)	medium	high	0	high	medium
Black-tailed godwit	high	medium	4.19% (Very small)	high	medium	0	high	medium
Turnstone	medium	low	3.27% (Very small)	very high	very low	2.76% (Very small)	very high	very low
Knot	very high	high	66.93% (Very large)	low	very high	0.00% (Very small)	high	moderate
Sanderling	high	low	4.85% (Very small)	very high	low	0.46% (Very small)	very high	low
Dunlin	very high	low	12.01% (Medium)	moderate	high	0 (0.00%)	very high	low
Redshank	very high	high	5.62% (Small)	moderate	high	0.87% (Very small)	moderate	high
Black-headed gull	high	low	3.83% (Very small)	very high	low	0	very high	low
Sterna terns	high	medium	3.07% (very small – note this relates to nocturnal roost numbers)	low (corrected to account for considerable population turnover and potential for impacts to nocturnal roosts)	high	0.33% (very small – note this relates to diurnal impacts only)	high (corrected to account for considerable population turnover, but with no potential for impacts to nocturnal roosts)	medium
Great crested grebe	low	medium	31.13% (Large)	low	medium	0	high	low
red-breasted merganser	low	high	6.21% (Small)	medium	low	6.21% (Small)	medium	low
Red-throated diver	high	high	9.22% (Small)	high	moderate	0.78% (Very small)	high	moderate
Herring gull	high	low	3.02% (Very small)	very high	low	1.10% (Very small)	very high	low

Species	Receptor importance	Inherent ecological sensitivity (highest sensitivity if differing response to visual and acoustic stimuli)	Without additional mitigation			With additional mitigation		
			Maximum proportion of regional population	Assessed tolerance	Receptor sensitivity	Maximum proportion of regional population	Re-assessed tolerance	Residual receptor sensitivity
Little egret	low	medium	6.47% (Small)	medium	low	0	high	low
Greenshank	low	high	8.26% (Small)	moderate	low	0	moderate	low
Mediterranean gull	medium	low	37.99% (Large)	high	low	37.99% (Large)	high	low
Common gull	high	low	0.76% (Very small)	very high	low	0	very high	low
Great black-backed gull	medium	low	0.45% (Very small)	very high	very low	0	very high	very low
Lesser black-backed gull	high	low	0.09% (Very small)	very high	low	0.09% (Very small)	very high	low
Sandwich tern	low	medium	3.18% (very small – note this relates to nocturnal roost numbers)	low (corrected to account for considerable population turnover and potential for impacts to nocturnal roosts)	high	1.59% (very small – note this relates to diurnal impacts only)	medium (corrected to account for considerable population turnover, but with no potential for impacts to nocturnal roosts)	low
Shag	high	medium	0.49% (Very small)	high	moderate	0.15% (Very small)	high	moderate
Black guillemot	low	medium	3.07% (Very small)	high	low	1.73% (Very small)	high	low
Common scoter	medium	high	0.93% (Very small)	high	moderate	0	high	moderate
Grey heron	low	medium	0.96% (Very small)	high	low	0	high	low

Residual effect

585. The significance of effect of disturbance and displacement impacts from construction activities within the intertidal area is reassessed with the application of proposed additional mitigation measures outlined above and this is summarised in **Table 10-59**.

Table 10-59 Residual significance of disturbance and displacement impacts upon ornithological receptors from construction phase activities within intertidal areas

Species	Intertidal cable route scenario	Impact magnitude following additional mitigation	Receptor sensitivity following mitigation	Residual level of significance	Significant / Not Significant
Light-bellied Brent Goose	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Shelduck	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Shoveler	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Pintail	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Teal	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Oystercatcher	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Golden plover	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Grey plover	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	Negligible		**Imperceptible**	**Not Significant**
Ringed plover	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Curlew	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**

Species	Intertidal cable route scenario	Impact magnitude following additional mitigation	Receptor sensitivity following mitigation	Residual level of significance	Significant / Not Significant
Bar-tailed godwit	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Black-tailed godwit	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Turnstone	PA	negligible	very low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Knot	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Sanderling	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Dunlin	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Redshank	PA	negligible	high	**Not significant**	**Not Significant**
	AAM	negligible		**Not significant**	**Not Significant**
Black-headed gull	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Great crested grebe	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
red-breasted merganser	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Red-throated diver	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Herring gull	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Little egret	PA	negligible	low	**Imperceptible**	**Not Significant**

Species	Intertidal cable route scenario	Impact magnitude following additional mitigation	Receptor sensitivity following mitigation	Residual level of significance	Significant / Not Significant
	AAM	negligible		**Imperceptible**	**Not Significant**
Greenshank	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Mediterranean gull	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Common gull	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Great black-backed gull	PA	negligible	very low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Lesser black-backed gull	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Shag	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Black guillemot	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Common scoter	PA	negligible	medium	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Grey heron	PA	negligible	low	**Imperceptible**	**Not Significant**
	AAM	negligible		**Imperceptible**	**Not Significant**
Sterna terns	PA	low	medium	**Slight**	**Not Significant**
	AAM	low		**Slight**	**Not Significant**
Sandwich tern	PA	low	low	**Not Significant**	**Not Significant**
	AAM	low		**Not Significant**	**Not Significant**

Offshore and intertidal – construction: impact 3 – changes in prey availability

Offshore – array site and OECC (below MLWS)

586. Construction phase activities may impact the prey species of ornithological receptors within offshore areas in such a way as to alter the availability to those ornithological receptors. These impacts include those resulting from the production of underwater noise (e.g., during piling for WTG and OSS foundations), the introduction of suspended sediments to the water column (e.g., during preparation of the seabed for WTG and OSS foundations and burial of export and inter array cables), and the alteration of habitats which support seabird prey species (e.g., during preparation of the seabed for WTG and OSS foundations, burial of export and inter array cables and the presence of infrastructure footprints on the seabed). Such activities may temporarily change the distribution or behaviour or accessibility of prey species for seabirds.

- Underwater noise may cause injury or mortality to fish and mobile invertebrate species, or result in their redistribution should they respond to avoid areas of construction noise and may also affect their physiology and other aspects of their behaviour.
- Increased suspended sediment levels may alter the distribution of fish and mobile invertebrate species should they respond to avoid areas of altered water column condition. Settlement of suspended sediment may also smother or otherwise obscure immobile benthic prey species, with the potential to cause mortality to those species or reduce their availability to foraging seabirds.
- Alteration of habitats which support seabird prey species may reduce the capacity of those habitats to hold or produce seabird prey species, thereby reducing the abundance of prey available to foraging seabirds within and around impacted areas.

587. These pathways may result in a reduction in the availability of prey to seabirds foraging within construction areas. Potential impacts to fish and invertebrate species have been assessed within **Chapter 9 Fish, Shellfish and Turtle Ecology**, and conclusions of those assessments inform this assessment on changes in prey availability to ornithological receptors.

Receptor sensitivity

588. Tolerance of each seabird receptor to impacts on prey species has been determined by consideration of four factors which may influence the probability that receptors experience impacts, their ability to avoid or habituate to those impacts and ultimately the potential for impact to result in population level demographic consequences (as outlined in **Table 10-8**):

1. The specificity of prey within receptor diets. Where species are considered to have broad diets, and predate a large number of prey species without specialising on the consumption of one or a few key prey species their potential tolerances to impacts to prey availability are generally assessed to be higher than for species for which one or a few species form the majority of the diet.
2. Dietary composition and the level of reliance on prey species that are susceptible to construction phase activity have been considered. Where a receptor has a highly specific diet, for example, it primarily depredates one prey species or species group, but that species or species group is not considered likely to be affected by noise, habitat or sediment impacts during the construction phase, then it follows that receptor would not be impacted indirectly. Conversely, should a receptor with a highly specific diet primarily depredate a species group which is considered likely to be affected by noise, habitat or sediment impacts, then that receptor is more likely to be impacted indirectly through changes to prey availability.
3. The abundance of the receptor within and around the array site and OECC, where potential impacts to prey species are considered to be most acute. If large numbers of a receptor (in a

regional context) make use of areas in which construction activities will occur, then the potential for impacts to prey species within those areas to affect regional receptor populations is considered greater than if receptors do not utilise those areas in large numbers.

4. Receptor foraging range. Marine areas used by seabird species across non-breeding and migratory periods are generally large (Furness, 2015) in relation to the footprint of works within the array site and OECC and the resultant spatial extents of potential impacts to prey species resulting from those works. The extent of marine areas used by breeding adult seabirds during breeding periods relates to the foraging range characteristics of seabird species, with widely foraging species utilising much larger marine areas than species with small foraging ranges. It is reasoned that species with larger foraging ranges (taken from Woodward et al., 2019), will have less foraging area overlap with areas in which prey species are potentially impacted by works, and consequently more ability to avoid impacted areas if required.

589. Full considerations used to arrive at designated species-specific receptor tolerances are presented in **Appendix 10.12 Ornithological Receptor Tolerance: Offshore construction phase prey effects**. Tolerances of offshore ornithological receptors in relation to changes in prey availability are assessed by considering four factors, namely:

- Dietary specificity;
- Impact magnitudes to key prey groups;
- Species use of project areas; and
- Species foraging range.

590. Receptor tolerances have the potential to range from very low through to very high. Receptor tolerances in relation to changes in prey availability range from high to very high (**Table 10-60**).

591. Seabird receptor importances are assessed as low to very high (**Table 10-60**).

592. When receptor tolerances and importances are considered together to determine overall assessments of receptor sensitivities as per **Table 10-9** receptor sensitivities are assessed as very low, low or medium (**Table 10-24**).

Table 10-60 Determination of receptor sensitivity by consideration of conservation importance and tolerance to changes in prey availability on offshore receptors during the construction phase

Species	Conservation importance	Tolerance	Receptor sensitivity
Common scoter	high	very high	low
Kittiwake	very high	high	medium
Black-headed gull	high	very high	low
Little gull	high	very high	low
Great black-backed gull	medium	very high	very low
Common gull	high	very high	low
Herring gull	high	very high	low
Lesser black-backed gull	high	very high	low
Sandwich tern	low	very high	very low
Roseate tern	high	very high	low
Common tern	high	high	medium
Arctic tern	high	high	medium
Little tern	low	very high	very low

Species	Conservation importance	Tolerance	Receptor sensitivity
Guillemot	high	high	medium
Razorbill	very high	high	medium
Black guillemot	low	very high	very low
Puffin	very high	high	medium
Red-throated diver	high	high	medium
Great northern diver	high	very high	low
Fulmar	high	very high	low
Manx shearwater	high	very high	low
Gannet	high	very high	low
Cormorant	medium	high	low
Shag	high	high	medium

Magnitude of impact

Underwater noise

593. Underwater noise impacts to seabird prey species are assessed as Impact 2 in **Chapter 9 Fish, Shellfish and Turtle Ecology**. Noise impacts to seabird prey species are predicted to result from construction phase activities such as pile driving for WTG and OSS foundation installation and UXO clearance. Underwater noise may adversely impact seabird prey species by causing direct injury / mortality, or through behavioural effects (Specifically temporary reductions in hearing sensitivity, referred to as 'Temporary Threshold Shift' – TTS, which may cause a decrease in communication, predator / prey detection and alter assessment of the environment (Popper et al., 2014)).

594. It should be noted that the consequences of differing underwater noise impacts upon prey species do not translate directly to their seabird predators. This is insofar that while underwater noise which causes mortality to prey species effectively removes individuals which could otherwise be predated by seabirds and prevents those individuals from reproducing (to create future individuals available for predation by seabirds), recoverable injury inducing noise may only potentially reduce the likelihood of individuals reproducing, while TTS inducing noise may result lesser impacts still to predator populations.

595. Injury or mortality for prey species may occur for individuals occurring very close to high noise level construction activities (primarily piling operations); however, such effects will be localised and will be minimised by 'soft start' procedures allowing mobile prey individuals to vacate very high noise level areas, prior to noise levels resulting in injury or mortality being reached. TTS impacts may result from exposure of prey species to lower underwater noise levels and consequently are experienced over a larger area than direct injury / mortality impacts.

596. Due to differing sensitivities to underwater noise between prey species, the extent of areas in which prey species may be impacted by construction phase works will differ between prey species. For the key prey species identified for seabird receptors in **Table 10-61**, the maximum spatial extents in relation to mortality, injury and TTS associated with piling activities during the construction phase are shown in **Table 10-61**. These impacts will be associated with the installation of 75 turbine monopile bases and three OSSs and will occur over up to 262.5 days, over a period of up to 3 years.

Table 10-61 Maximum spatial extent of impact (km²) arising from underwater noise and assessed level of impact significance to regional population of fish prey species

Prey species / species group	Maximum spatial extent of underwater noise impacts to key seabird prey species (km^2)		
	Mortality inducing underwater noise	Injury inducing underwater noise	TTS inducing underwater noise
Sandeel	1.1	2.7	3,500
Mackerel	15	34	
Herring	34	94	
Gadoid (cod)	34	94	
Sprat	34	94	
All invertebrates	0 - Because technically marine invertebrates don't hear, underwater noise is considered unlikely to result in injury or mortality and no range is applicable in relation to behavioural effects		

597. Although differing levels of impact to prey species may result in differing potential for demographic consequences to seabird receptor populations, it is generally the case that seabird foraging ranges are extremely large in relation to underwater noise impacted areas and consequently that the potential for underwater noise to affect regional population demographics is very low.

598. It should be noted that, for this impact, there is no formal mechanism or precedent by which to translate estimated impacts to prey availability into a predicted increase in baseline mortality (and thereby allow a quantitative comparison with impact consequence guidelines outlined in **Table 10-10**). In the absence of such an approach, expert opinion has been applied to decide which impact magnitude best describes potential impact consequences to affected populations. For the majority of seabird receptors, on the basis of the localised nature of underwater noise impacts in relation to habitat use extents (with the exception of TTS effects, for which demographic consequence to seabird populations is considered negligible), the potential for underwater noise to affect regional population demographics is assessed to be very low.

599. For example, where a seabird receptor depredates a wide range of prey species and potential impacts to prey species are limited in relation total available prey resources, then there is considered to be extremely limited potential for changes in prey availability to result in changes to the receptor population's baseline mortality (or productivity rates), which in turn supports attribution of negligible impact magnitude values. As noted in **Table 10-13**, it is generally the case that seabird foraging ranges are extremely large in relation to underwater noise impacted areas and consequently that the potential for underwater noise to affect regional population demographics is very low.

600. One exception to this relates to little tern. This species breeds within The Murrough SPA at Kilcoole and has a limited foraging range (maximum 5 km, Woodward et al., 2019). As such, although there is likely to be no connectivity between the breeding colony foraging areas and areas in which underwater noise impacts may result in injury or mortality to prey species (separation between the breeding colony and the array site is greater than 12 km), it may be the case that a large proportion of prey species within this colony's foraging range may experience TTS effects. Although the potential for TTS impacts to prey species to result in demographic consequences to their predators is considered to be extremely limited, as there is the potential that a large proportion of the prey of this important regional little tern breeding population may experience such effects, the potential for underwater noise to affect regional population demographics of little tern is assessed as low.

Increased suspended sediment concentrations

601. Increased suspended sediment impacts to seabird prey species are predicted to result from construction phase activities within the array site and OECC. In particular, the two activities that will result in the largest levels of SSC and associated deposition are dredging and trenching, as described in **Chapter 6 Marine Geology, Sediments and Coastal Processes**.

602. The impact of increased SSC levels to prey fish and invertebrate species are assessed in **Chapter 9 Fish, Shellfish and Turtle Ecology**. Adults of these species are more mobile than juveniles, and therefore more able to avoid localised areas which may experience increased suspended sediment levels resulting from construction activities within the array site and OECC, therefore juvenile age classes of these species are considered more likely to be affected by such impacts. However, natural temporary increases in suspended sediment concentration associated with winter storm events are also likely to occur in the area. Therefore it is expected that most juvenile fish likely to occur in the vicinity of construction activities within the array site and OECC will be largely unaffected by resultant low level temporary increases in suspended sediment concentration, as the concentrations are likely to be within the range of natural variability tolerated by these species and will reduce to background concentrations within a very short period. Assessed levels of impact significance based upon maximum theoretical increased SSC scenarios to key seabird prey species are presented in **Table 10-62**.

Table 10-62 Assessed level of impact significance to regional population of prey species, based upon greatest received magnitude of increased SSC effect

Prey species / species group	Assessed level of impact significance
Sandeel	**Moderate / Slight**
Mackerel	**Not Significant**
Herring	**Imperceptible**
Gadoid (cod)	**Not Significant**
Sprat	**Not Significant**
All invertebrates	**Slight / Not Significant**

603. It should be noted that the level of impact from increased SSCs to seabird prey species does not translate directly to their seabird predators. This is insofar that while increased SSC levels may result in potential limited demographic consequences to seabird prey species, the level of demographic consequence to their predators is likely to be far lower (if detectable at all), particularly where such impacts are temporary and localised and predators consume a range of prey species. Furthermore, the foraging spatial extents of all seabird species are considerably larger than the extent of areas which may experience temporary increases in suspended sediment concentrations during construction activities. Consequently, there is assessed to be **very low potential for impacts from increased SSC levels to affect regional populations of any seabird receptor through impacts to the availability of prey species**.

Removal or alteration of areas of benthic habitat

604. Direct effects including removal or alteration of areas of benthic habitat for seabird prey species are assessed as Impact 1 in **Chapter 9 Fish, Shellfish and Turtle Ecology**. The following activities during

offshore infrastructure construction will have direct effects on seabird prey species habitat within the array site and OECC, as described in **Chapter 8 Subtidal and Intertidal Ecology**:

605. Assessed levels of impact significance from **Chapter 9 Fish, Shellfish and Turtle Ecology**, based upon maximum theoretical removal or alteration of Benthic habitat scenarios to key seabird prey species are presented in **Table 10-63**.

Table 10-63 Assessed level of impact significance to regional population of prey species, based upon greatest received magnitude of removal / alteration of benthic habitat

Prey species / species group	Assessed level of impact significance
Sandeel	**Slight / Not Significant**
Mackerel	**Imperceptible**
Herring	**Imperceptible**
Gadoid (cod)	**Not Significant**
Sprat	**Imperceptible**
All invertebrates	**Slight**

606. For all seabird receptors, with the exception of Black guillemot and Little tern, areas which may experience removal or alteration of benthic habitats which may support key prey species populations constitute only a very small proportion (<1%) of the extent of foraging areas. For the former two species, due to their small foraging ranges in addition to their use of primarily coastal foraging areas, any potential for connectivity with impacted habitat areas within the array site and OECC is considered, at most, very limited. On this basis, and with consideration that the majority of seabird receptors consume a range of prey species, there is assessed to be **very low potential for impacts from removal or alteration of areas of benthic habitat to affect regional populations of any seabird receptor through impacts to the availability of prey species.**

Integration of impacts to prey species to attribute impact magnitude to seabird receptors

607. For all seabird receptors, with the exception of Little tern, as the potential for demographic consequence to regional populations resulting from habitat alteration / removal during the construction phase is assessed to be very low, the overall impact magnitude from changes to prey availability is assessed to be negligible.

608. For little tern, as the potential for demographic consequence to the regional population resulting from habitat alteration / removal is assessed to be low, the overall impact magnitude from changes to prey availability is assessed to be low.

Significance of the effect

609. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, receptor sensitivities are assessed to be Low or Medium and impact magnitude is assessed to be Low, the potential effect of changes in prey availability resulting from construction phase works within the array site and OECC, is considered to be **Slight** or **Not Significant**, and **Not Significant** in EIA terms (**Table 10-64**).

Table 10-64 Assessment of significance of effect to offshore ornithological features arising from changes in prey availability during the construction phase

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Kittiwake	medium	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not Significant**
Little gull	low	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Common gull	low	negligible	**Imperceptible**	**Not Significant**
Herring gull	low	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	low	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	very low	negligible	**Imperceptible**	**Not Significant**
Roseate tern	low	negligible	**Imperceptible**	**Not Significant**
Common tern	medium	negligible	**Imperceptible**	**Not Significant**
Arctic tern	medium	negligible	**Imperceptible**	**Not Significant**
Little tern	very low	low	**Imperceptible**	**Not Significant**
Guillemot	medium	negligible	**Imperceptible**	**Not Significant**
Razorbill	medium	negligible	**Imperceptible**	**Not Significant**
Black guillemot	very low	negligible	**Imperceptible**	**Not Significant**
Puffin	medium	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	medium	negligible	**Imperceptible**	**Not Significant**
Great northern diver	low	negligible	**Imperceptible**	**Not Significant**
Fulmar	low	negligible	**Imperceptible**	**Not Significant**
Manx shearwater	low	negligible	**Imperceptible**	**Not Significant**
Gannet	low	negligible	**Imperceptible**	**Not Significant**
Cormorant	low	negligible	**Imperceptible**	**Not Significant**
Shag	medium	negligible	**Imperceptible**	**Not Significant**

Additional mitigation

610. As the impacts associated with changes in prey availability during construction phase activities within the array site and OECC are assessed to be **Imperceptible**, and **Not Significant** in EIA terms, or **Slight**, and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

611. As no additional measures are required to mitigate changes in prey availability during construction phase activities within the array site and OECC, residual effects are assessed to be **Imperceptible**, and **Not Significant** in EIA terms or **Slight**, and **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

612. Construction phase activities may impact the prey species of intertidal birds in such a way as to alter their availability to those ornithological receptors. These impacts have the potential to arise via the disturbance of the intertidal habitat where such prey species are found.

613. Prey species upon which intertidal birds (primarily waders and gulls) predate include invertebrates such as molluscs (including bivalves) and annelids (including polychaetes). Some species (including terns, divers, grebes and auks) also prey on smaller fish species such as sandeels.

614. The alteration of habitats which support intertidal waterbird prey species (e.g., during preparation of the seabed for trenching and cabling activities, the burial of export cables within the intertidal zone and the presence of infrastructure footprints within the intertidal zone) have the potential to change the distribution, behaviour or accessibility of prey species for intertidal waterbirds through:

- Increased suspended sediment levels, which may alter the distribution of fish and mobile invertebrate species should they respond to avoid areas of altered water column condition.
- Alteration of habitats which support seabird prey species may reduce the capacity of those habitats to hold or produce intertidal waterbird prey species, thereby reducing the abundance of prey available to foraging intertidal waterbirds within and around impacted areas.

615. These pathways may result in a reduction in the availability of prey to intertidal waterbirds foraging within construction areas. Potential impacts to invertebrate and fish species have been assessed within **Chapter 8 Subtidal and Intertidal Ecology** and **Chapter 9 Fish, Shellfish and Turtle Ecology**, and conclusions of those assessments inform this assessment on changes in prey availability to ornithological receptors.

Impact screening

616. The screening process in relation to changes in prey availability within the intertidal zone as an impact to intertidal waterbirds during the construction phase is considered to be the same as that carried out in relation to disturbance and displacement of ornithological receptors during the construction phase with the exception of potential impacts upon wetland habitats. See subsection **Impact screening** in section **Construction: Disturbance and displacement – Intertidal**, above. This is due to the consideration that the changes in prey availability impact has the potential to affect the same suite of species (i.e., intertidal waterbirds) screened-in for assessment in relation to disturbance and displacement and that the thresholds for inclusion which form the basis for disturbance and displacement screening remain valid for the changes in prey availability impact (i.e., there are no characteristics of this impact that should warrant an alternative approach to screening).

617. While there is considered to be no route to impact for disturbance and displacement impacts to affect wetland habitats which support intertidal ornithological receptors, changes in prey availability are considered to have a route to impact to affect the ability of wetland habitats to support ornithological receptors and are therefore screened in for further consideration.

Receptor sensitivity

618. Receptor sensitivity is assessed on the basis of the criteria outlined in **Table 10-7** and **Table 10-8**, and takes into account each species' importance (including conservation designation and connectivity to the proposed area of works) and tolerance (including consideration of changes to species' reproductivity and survival rates). It is therefore considered that the sensitivities of ornithological receptors in relation to changes in prey availability during the construction phase will be the same as those assessed in relation to disturbance and displacement of intertidal waterbirds during the construction phase. See subsection **Receptor sensitivity** in section **Construction: Disturbance and displacement – Intertidal**, above.

619. **Table 10-65** below summarises the impact screening and receptor sensitivities of each intertidal ornithological receptor. Taken into account are each species' relative abundance and peak counts over the baseline survey period (See **Table 10-35**), their connectivity to the site, tolerance to impacts within South Dublin Bay and designated status as part of the South Dublin Bay and Tolka Estuary SPA or the adjacent and functionally connected North Bull Island SPA (**Table 10-35**), as well as their conservation status as per the IUCN Red List of Threatened Species and / or BoCCI red list (**Table 10-22**).

Table 10-65 Receptor screening and sensitivity in relation to changes in prey availability to intertidal waterbirds during the construction phase

Species	Screened in or out	Receptor sensitivity parameters and overall assessed receptor sensitivity		
		Conservation importance	Tolerance	Receptor sensitivity
Light-bellied Brent Goose	In	high	high	medium
Pink-footed Goose	Out	-	-	-
Mute Swan	Out	-	-	-
Shelduck	In	medium	very high	very low
Wigeon	Out	-	-	-
Mallard	Out	-	-	-
Pintail	Out	-	-	-
Shoveler	In	medium	very high	very low
Eider	Out	-	-	-
Teal	In	medium	very high	very low
Common scoter	In	high	very high	low
Long-tailed Duck	Out	-	-	-
Goldeneye	Out	-	-	-
red-breasted merganser	In	low	medium	low
Red-throated diver	In	high	very high	low
Great northern diver	Out	-	-	-
Manx shearwater	Out	-	-	-
Great crested grebe	In	low	very low	medium
Little Grebe	Out	-	-	-
Grey heron	In	low	very high	very low
Gannet	Out	-	-	-
Little egret	In	low	high	low
Shag	In	high	very high	low
Cormorant	Out	-	-	-
Oystercatcher	In	very high	medium	high

Species	Screened in or out	Receptor sensitivity parameters and overall assessed receptor sensitivity		
		Conservation importance	Tolerance	Receptor sensitivity
Lapwing	Out	-	-	-
Golden plover	In	high	very high	low
Grey plover	In	high	high	medium
Ringed plover	In	high	high	medium
Ruff	Out	-	-	-
Whimbrel	Out	-	-	-
Curlew	In	high	very high	low
Bar-tailed godwit	In	very high	medium	high
Black-tailed godwit	In	high	high	medium
Common sandpiper	Out	-	-	-
Turnstone	In	medium	high	low
Curlew sandpiper	Out	-	-	-
Knot	In	very high	very low	very high
Sanderling	In	high	high	medium
Dunlin	In	very high	low	very high
Purple sandpiper	Out	-	-	-
Little Stint	Out	-	-	-
Snipe	Out	-	-	-
Redshank	In	very high	high	medium
Greenshank	In	low	high	low
Lesser Yellowlegs	Out	-	-	-
Kittiwake	Out	-	-	-
Black-headed gull	In	high	very high	low
Little gull	Out	-	-	-
Mediterranean gull	In	medium	medium	medium
Common gull	In	high	very high	low
Great black-backed gull	In	medium	very high	very low
Herring gull	In	high	very high	low
Yellow-legged gull	Out	-	-	-
Lesser black-backed gull	In	high	very high	low
Sandwich tern	In	low	low	medium
Sterna terns	In	high	low	high
Guillemot	Out	-	-	-

Species	Screened in or out	Receptor sensitivity parameters and overall assessed receptor sensitivity		
		Conservation importance	Tolerance	Receptor sensitivity
Razorbill	Out	-	-	-
Black guillemot	In	low	high	low
Kingfisher	Out	-	-	-
Hooded Crow	Out	-	-	-
Starling	Out	-	-	-
Wetland habitats	In			

620. In addition to ornithological receptors, impacts to the prey species of intertidal waterbirds are also considered in the context of their forming a component of the supporting wetland habitats within the South Dublin Bay and River Tolka Estuary SPA (i.e., the 'Wetland habitats' feature contains prey species which have the potential to be impacted by the proposed works).

621. As intertidal habitats which support ornithological receptors are a designated feature of the South Dublin Bay and River Tolka Estuary SPA, the conservation importance of this feature is considered to be very high.

622. As intertidal habitats will recover rapidly after construction phase activities within the intertidal area, such as the excavation of trenches to bury export cables, to function again as areas to support foraging behaviours for ornithological receptors, the tolerance of this feature is considered to be very high. For the Wetland habitats feature, this is considered to be reflected by 'the high ability for [the feature] to rapidly recover following cessation of an impact' (**Table 10-8**).

623. When the conservation importance and tolerance of this feature are considered together to determine an overall assessment of receptor sensitivity (as per **Table 10-9**), receptor sensitivity is assessed as low.

Magnitude of impact

624. For intertidal birds, key prey species are likely to be invertebrates such as catworm (*Nephtys hombergii*) and molluscs such as Baltic tellin (*Macoma balthica*) living in the littoral mud and sand flats. Part of this habitat also includes seagrass (*Zostera noltei*) beds. The primary impacts to these habitats and prey species will include disturbance of the littoral sandy mud within which invertebrate prey occurs, as well as a temporary increase in suspended sediments associated with trenching activities as the cables come ashore. Components of the intertidal trenching are likely to occur at low tide and therefore will not have associated increased SSCs.

625. Prey species are not considered to be sensitive to sediment deposition, as the majority of species present are highly mobile and able to move away from areas affected by sediment deposition. The intertidal habitat in itself is a dynamic habitat and is subject to constant natural disturbance. As such, the species present therein are adapted to this type of disturbance and can recover quickly (see **Chapter 9 Fish, Shellfish and Turtle Ecology**; **Section 9.9.1**; paragraphs 227–229).

626. The extent of intertidal areas (between MLWS and MWHS) within South Dublin Bay is approximately 21.8 km^2, within which approximately 0.115 km^2 (0.53%) are predicted to be disturbed during landfall cable installation (see **Chapter 4 Project Description**; **Section 4.6, Table 4.33**). As the intertidal habitat available to foraging bird species is considerably larger than the area which may experience

changes in prey availability during construction activities, there will be large amounts of unaffected habitat for birds to utilise. Furthermore, given the high rate of recoverability of the impacted habitat (and associated organisms) and the short-term nature of the trenching activity, the magnitude of an impact on foraging intertidal and inshore marine waterbirds is considered to be negligible. Impact magnitudes in relation to the intertidal zone are also considered in **Chapter 8 Subtidal and Intertidal Ecology** and **Chapter 9 Fish, Shellfish and Turtle Ecology**.

627. The magnitude the of impact for all species is assessed as negligible. Therefore (as per the matrix in **Table 10-10**), any effects on intertidal ornithology as a result of temporary impacts upon prey species availability is predicted to be Imperceptible to Slight and not significant for all species assessed in EIA terms. Where flexibility in the proposed design exists, there is no other scenario which would lead to a more significant effect.

Significance of the effect

Table 10-66 Significance of the effects of changes in prey availability to intertidal waterbirds during the construction phase

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Light-bellied Brent Goose	medium	negligible	**Imperceptible**	**Not Significant**
Shelduck	very low	negligible	**Imperceptible**	**Not Significant**
Shoveler	very low	negligible	**Imperceptible**	**Not Significant**
Pintail	very low	negligible	**Imperceptible**	**Not Significant**
Teal	very low	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	high	negligible	**Not Significant**	**Not Significant**
Golden plover	low	negligible	**Imperceptible**	**Not Significant**
Grey plover	medium	negligible	**Imperceptible**	**Not Significant**
Ringed plover	medium	negligible	**Imperceptible**	**Not Significant**
Curlew	low	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	high	negligible	**Not Significant**	**Not Significant**
Black-tailed godwit	medium	negligible	**Imperceptible**	**Not Significant**
Turnstone	low	negligible	**Imperceptible**	**Not Significant**
Knot	very high	negligible	**Slight**	**Not Significant**
Sanderling	medium	negligible	**Imperceptible**	**Not Significant**
Dunlin	very high	negligible	**Slight**	**Not Significant**
Redshank	medium	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not Significant**
Sterna terns	high	negligible	**Not Significant**	**Not Significant**

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Great crested grebe	medium	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	low	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	low	negligible	**Imperceptible**	**Not Significant**
Herring gull	low	negligible	**Imperceptible**	**Not Significant**
Little egret	low	negligible	**Imperceptible**	**Not Significant**
Greenshank	low	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	medium	negligible	**Imperceptible**	**Not Significant**
Common gull	low	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	low	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	low	negligible	**Imperceptible**	**Not Significant**
Shag	low	negligible	**Imperceptible**	**Not Significant**
Black guillemot	low	negligible	**Imperceptible**	**Not Significant**
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Grey heron	very low	negligible	**Imperceptible**	**Not Significant**
Wetland habitats	low	negligible	**Imperceptible**	**Not Significant**

Additional mitigation

628. Given that it is considered that there will be no significant effects in relation to impacts upon prey species availability to intertidal ornithological receptors during the construction phase, no additional mitigation is specifically outlined to reduce this impact magnitude. It is of note, however, that additional mitigation which is recommended in relation to disturbance and displacement (see subsection **Additional mitigation** in section **Construction: Disturbance and displacement – Intertidal,** above) will further reduce impact magnitudes of changes in prey availability, as any potentially impacted receptors are likely to be present in much reduced numbers or absent altogether during the proposed mitigation period.

Residual effect

629. The significance of effect of changes in prey species availability from construction activities within the intertidal area is reassessed with the application of proposed additional mitigation measures outlined in relation to disturbance and displacement impacts within the intertidal area (see Offshore and intertidal – Construction impact 2: Disturbance and displacement) and this is summarised in **Table 10-67** Residual significance of changes in prey availability impacts upon ornithological receptors from construction phase activities within intertidal areas.

Table 10-67 Residual significance of changes in prey availability impacts upon ornithological receptors from construction phase activities within intertidal areas

Receptor	Residual magnitude	Impact significance level	Significant / Not Significant
Light-bellied Brent Goose	negligible	**Imperceptible**	**Not Significant**
Shelduck	negligible	**Imperceptible**	**Not Significant**
Shoveler	negligible	**Imperceptible**	**Not Significant**
Pintail	negligible	**Imperceptible**	**Not Significant**
Teal	negligible	**Imperceptible**	**Not Significant**
Common scoter	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	negligible	**Imperceptible**	**Not Significant**
Great crested grebe	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	negligible	**Imperceptible**	**Not Significant**
Golden plover	negligible	**Imperceptible**	**Not Significant**
Grey plover	negligible	**Imperceptible**	**Not Significant**
Ringed plover	negligible	**Imperceptible**	**Not Significant**
Curlew	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	negligible	**Imperceptible**	**Not Significant**
Black-tailed godwit	negligible	**Imperceptible**	**Not Significant**
Turnstone	negligible	**Imperceptible**	**Not Significant**
Knot	negligible	**Imperceptible**	**Not Significant**
Sanderling	negligible	**Imperceptible**	**Not Significant**
Dunlin	negligible	**Imperceptible**	**Not Significant**
Redshank	negligible	**Imperceptible**	**Not Significant**
Greenshank	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	negligible	**Imperceptible**	**Not Significant**
Common gull	negligible	**Imperceptible**	**Not Significant**
Herring gull	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	negligible	**Imperceptible**	**Not Significant**
Common tern	negligible	**Imperceptible**	**Not Significant**
Arctic tern	negligible	**Imperceptible**	**Not Significant**
Roseate tern	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	negligible	**Imperceptible**	**Not Significant**
Black guillemot	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	negligible	**Imperceptible**	**Not Significant**
Shag	negligible	**Imperceptible**	**Not Significant**
Grey heron	negligible	**Imperceptible**	**Not Significant**

Receptor	Residual magnitude	Impact significance level	Significant / Not Significant
Little egret	negligible	**Imperceptible**	**Not Significant**
Wetland and waterbirds	negligible	**Imperceptible**	**Not Significant**

630. When additional mitigation to address disturbance and displacement impacts within intertidal areas during the construction phase is considered, the residual significance level of changes in prey availability during construction phase activities on intertidal receptors, is assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Offshore and intertidal – construction: impact 4 – pollution

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

631. Accidental pollution events during construction have the potential to negatively affect ornithological receptors within offshore and intertidal study areas. Potential pollutants are outlined in the **Table 10-28** in **Section 10.8 Assessment parameters**, and are as follows: grease, hydraulic oil, gear oil, nitrogen, transformer silicon / ester oil, diesel fuel, SF6, glycol / coolants, drill fluid and batteries.

Receptor sensitivity

632. Ornithological receptors may be sensitive to direct effects (i.e., through the ingestion of toxic substances, or from fouling of plumage), or indirect effects (i.e., upon habitat and / or prey species) from the release of pollutants. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to pollution events (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Magnitude of impact

633. Although there is the potential for significant impacts to arise from accidental pollution events in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation outlined in **Section 10.9**, in the form of a Construction Environmental Management Plan (CEMP). This will ensure that vessels follow best practice guidelines to prevent the pollution and that analogous protocols are adhered to minimise such risk associated with works in inter-tidal habitats. The final CEMP will follow IMO and OSPAR guidelines in relation to industry best practices regarding pollution management. As such, the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

634. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of pollution impacts during the construction phase upon all offshore and intertidal ornithology receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

635. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

636. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Offshore and intertidal – construction: impact 5 – introduction of invasive non-native species

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

637. There is the potential that INNS could be introduced by construction-related activities and that the presence of INNS could result in negative effects to ornithological receptors within offshore and intertidal areas. **Table 10-68** outlines key potential INNS, identified in the NBDC Invasive Alien Species in Ireland online resource (https://invasives.ie/), which may be introduced to, or spread within, offshore and intertidal habitats in association with construction phase activities. **Table 10-68** also describes the areas or habitats where these key species may become established, in addition to potential activities which may result in their introduction and risks posed to ecosystems associated with their establishment.

Table 10-68 Key potential INNS

INNS	Areas where species may become established	Key means of introduction	Ecosystem risk
Zebra Mussel	Intertidal (Estuaries)	Dispersal from fouled vessel hulls	Competition, Predation, Bio-fouling, Interaction with other invasive species
American Slipper Limpet	Marine	Contaminant during vessel ballast water transfer	Competition, Bio-fouling
Wakame	Marine		Competition, Bio-fouling
Leathery Sea Squirt	Marine		Competition, Bio-fouling
Chinese Mitten Crab	Intertidal (Coastal and Estuaries)		Competition, Predation

Receptor sensitivity

638. Ornithological receptors may be sensitive to direct effects (for example, invasive plant species over-growing nesting locations), or indirect effects (i.e., upon habitat and / or prey species) associated with the introduction or spread of INNS. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to invasive species impacts (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Magnitude of impact

639. Although there is the potential for significant impacts to arise from INNS in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation stemming from consideration of the mitigation and control of invasive species measures in line with International Maritime Organization guidance (IMO, 2019) which are secured through the implementation of the CEMP described in **Section 10.9**, specifically that all vessels working on the CWP Project will have a Biosecurity Plan in place. The associated standards and procedures will be incorporated by all vessels and as such the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

640. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of introduction or spread of INNS impacts during the construction phase upon all receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

641. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

642. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Onshore and estuarine / Liffey – construction: impact 1 – direct effects on habitat

Onshore

643. The permanent or temporary loss of habitat as a result of construction may impact on the breeding, roosting, commuting and / or foraging behaviour of protected bird species at the proposed landfall location and could result in negative impacts to these species.

644. Reductions in the areas available to onshore bird species may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

645. An impact screening is conducted to determine if Impact 1: Direct effects on habitat in the onshore development area is applicable to each of the identified IEF species listed in **Table 10-16**. Each IEF species is examined in **Table 10-69** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-69 Impact screening of IEF species for impact 1 – direct effects on habitat during construction

IEF species	Potential for impact	Rationale
Light-bellied Brent Goose	**No**	The species are not dependent on the habitats which will be subject to permanent and / or temporary habitat loss and were not recorded utilising these habitats during surveys. Similarly, there was no / little suitable breeding, roosting or foraging habitats for these species at the proposed development areas. Therefore, can be screened out for this impact.
Peregrine falcon	**No**	
Greenfinch	**Yes**	This species has been assessed as at risk to *direct effects on habitats.* The species is dependent on some of the impacted habitats (scrub and treelines) which will be subject to permanent and / or temporary habitat loss and were recorded utilising the impacted habitats during onshore surveys. **Therefore, this species is screened in and the significance of this impact and effects assessed.**
Linnet	**Yes**	This species has been assessed as at risk to *direct effects on habitats.* The species is dependent on some of the impacted habitats (scrub, treelines and grasslands) which will be subject to permanent and / or temporary habitat loss and were recorded utilising the impacted habitats during onshore surveys. **Therefore, this species is screened in and the significance of this impact and effect assessed.**
sand martin	**Yes**	This species has been assessed as at risk to *direct effects on habitats.* The species is dependent on some of the habitats (harbour walls), for resting and breeding, which will be subject to permanent and / or temporary habitat loss and were recorded utilising these habitats during onshore surveys. **Therefore, sand martin can be screened in and the significance of this impact and effects assessed.**

Receptor sensitivity

646. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-70**. The conservation importance of IEF species has been determined in **Table 10-24**, and tolerance to the impact discussed below.

647. The IEF bird populations recorded during the onshore surveys were considered to be of local importance (higher value), this was determined based on the numbers recorded over the survey period, the suitability of the site to each species and the overall national and international population

size. Any potential impacts as a result of direct effects on habitats during the construction phase within the onshore study area, will be at a low level and so have a reduced effect on the reproduction and / or regional population survival rates. Therefore, these species are considered to have a high tolerance to this impact.

Table 10-70 Receptor sensitivity of IEF species for impact 1 – direct effects on habitat during construction

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Greenfinch	low	high	low
Linnet			
sand martin		medium	medium

Magnitude of impact

648. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-71** below along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters listed in **Table 10-10** and the criteria for defining impact magnitude, which is determined based on extent, duration, frequency and probability of potential impacts.

Table 10-71 Magnitude of impact on IEF species impact 1 – direct effects on habitat during construction

IEF species	Magnitude	Rationale
Greenfinch	low	A total of 18,272 m^2 of temporary habitat loss will occur as a result the OTI, of this 13,743 m^2 of habitat will be permanently lost. Approximately 1,629 m^2 of suitable Greenfinch habitat (scrub and grassland) will be permanently lost following the construction of the OTI (predominantly from the onshore substation). Approximately 6,834 m^2 of suitable habitat will be temporarily lost during the construction of the OTI (predominantly associated with site compounds and the temporary access ramp). This temporary loss will occur over 24-36 months where it will then be fully reinstated following the completion of the works. The size of the permanently lost habitat is considered negligible due to its small area and the availability of similar habitat within the surrounding area.
Linnet	low	A total of 18,272 m^2 of temporary habitat loss will occur as a result the OTI, of this 13,743 m^2 of habitat will be permanently lost. Approximately 1,629 m^2 of suitable Linnet habitat (scrub and grassland) will be permanently lost following the construction of the OTI (predominantly from the onshore substation). Approximately 6,834 m^2 of suitable habitat will be temporarily lost during the construction of the

IEF species	Magnitude	Rationale
		onshore infrastructure (predominantly associated with site compounds and the temporary access ramp). This temporary loss will occur over 24-36 months where it will then be fully reinstated following the completion of the works. The size of the permanently lost habitat is considered negligible due to its small area and the availability of similar habitat within the surrounding area.
sand martin	medium	The construction of the onshore substation will require the permanent reclamation of 1,800 m^2 of estuarine, rock armour and sea wall habitat, where sand martin were recorded breeding. This permanent habitat loss will displace at least four pairs of breeding sand martin, which will affect the population at this location in the short-term but is not predicted to affect the long-term viability of the population. Recovery from the change is predicted to be achieved after the end of the project activity.

Significance of the effect

649. The receptor sensitivity and magnitude of impacts of the screened in IEF species, within the onshore study area, has been determined in **Table 10-70** and **Table 10-71**. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-72** below.

Table 10-72 Significance of the effect of impact 1 – direct effects on habitat for onshore IEF species during construction

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Greenfinch	low	low	In the absence of additional mitigation measures, the sensitivity of Greenfinch in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **long term, not significant, negative effect** for Greenfinch.	**Not significant**
Linnet	low	low	In the absence of additional mitigation measures, the sensitivity of Linnet in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is	**Not significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			predicted to be **long term, not significant, negative effect** for Linnet.	
sand martin	medium	medium	In the absence of mitigation measures, the sensitivity of sand martin in the onshore development area is considered to be low and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, moderate effect** for sand martin. This moderate determination has been considered as significant in EIA terms, as the extent and potential for this impact to occur would likely have a potentially significant impact on the sand martin that occur in the area.	**Significant**

Additional mitigation

650. Vegetation removal / clearance will commence outside of the breeding bird season (which is from 1 March to 31 August inclusive) to avoid impacts on nesting birds. Where the construction programme does not allow this time restriction to be observed, then these areas will be inspected be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within three days of the nest survey, otherwise repeat surveys will be required. The Environmental Management Framework for the CWP Project including the role and responsibilities of the appointed ECoW are described in the Construction Environmental Management Plan (CEMP).

651. Where possible, vegetation clearance will be kept to a minimum. The proposed construction work areas will be demarcated prior to the construction works commencing. No clearance of vegetation will be undertaken outside of the demarcated areas within the onshore development boundary. Construction vehicles will be restricted to designated areas and access tracks to avoid impacting adjacent habitats. All disturbed ground will be fully reinstated following the completion of the works.

652. The replanting of vegetation (*c*. 7,856 m^2) will be undertaken within the onshore development area following the completion of the works. The replanting will include the planting of native woodland (*c*. 4098 m^2), native shrub (*c*. 2,708 m^2) and wildflower beds (*c*. 1,050 m^2) at the landfall site, along Shelly Banks Road and Pigeon House Road (refer to **Figures 23.7, 23.8** and **23.9 in Chapter 23 Landscape and Visual Impact**).

653. All planted species will be certified native stock and from an approved supplier of the Green, Low-Carbon Agri-Environmental Scheme (GLAS). The replanting will include a variety of plant species which will increase the species diversity, particularly at the landfall site, which currently comprises dense bramble and invasive plant species.

654. Appropriately sized exclusion nets will be installed over the harbour wall prior to the sand martin breeding season (April to September) to exclude birds from the nesting holes, should it not be possible to avoid works on the harbour wall or reclamation work for the harbour wall during this period. In

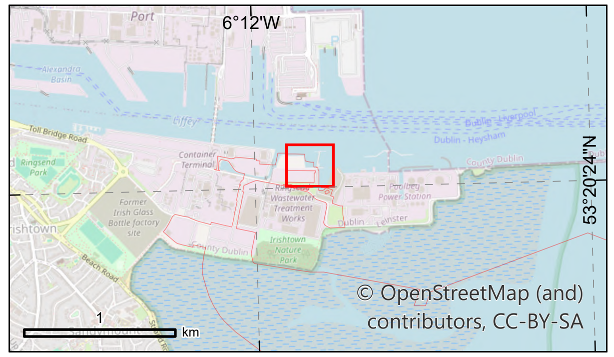
addition, prior to any works a suitably qualified ecologist will ensure there are no active sand martin nests. The net will be approximately 80 m in length and its location can be seen in **Plate 10-1**.

Plate 10-1 Location of exclusion netting for sand martin near the onshore substation

655. As there is very limited suitable breeding habitat for sand martin on the Poolbeg Peninsula, it is proposed to construct a sand martin wall within the vicinity of the onshore substation, the location of which can be seen in **Figure 10-7**. The construction of the wall will use a precast structure with the approximate dimensions of 3000 mm x 3400 mm x 500 mm (see **Plate 10-2** for an example precast sand martin wall). The first row of nests will be at a height of 1.5 m or more from the ground to prevent predators (e.g., mink or fox) reaching them. The nest chamber will be 100 mm in diameter and 225 mm long, and each tunnel is 50 mm in diameter and 275 mm long. The nests will be 250 mm apart and 300 mm between rows. The rear of the nesting chamber will be sealed with a sewer cap and lockable steel doors fitted to prevent human interference to the nests. These doors can be opened, and the sewer caps removed for nest maintenance. The wall will be located in a similar location to the existing nest sites, located close to a retaining wall near the entrance of the substation area (see **Plate 10-1**). To encourage a larger population of sand martin to area, the wall will contain a minimum of 36 nesting cavities.

656. When construction completed and the wall is operational, a schedule of annual maintenance will be agreed with relevant stakeholders. This involves the removal of old nesting material and other remains to reduce parasite load and add more sand to the nesting chambers for the birds to excavate.

Plate 10-2 Example of precast sand martin wall



Legend

- Planning application boundary
- Onshore substation boundary (operational)
- Onshore substation layout
- High water mark
- Proposed sand martin wall location

codling wind park	*Project:* Codling Wind Park	*Contractor:* TOBIN *Website: www.tobin.ie*

Figure 10.7
Proposed sand martin wall location

CWP doc. number: CWP-TOB-ENG-08-01-MAP-1778

Internal descriptive code:	*Size:* A3	*CRS:*
PB.PP - PAB..SS.PP.PL..SS.PP.LO.CIV..MIT.WALL. FOR.SAND.MARTIN - HWM - (EIAR.Vol.03.Ch.10.FIG.07)	*Scale:* 1:1,000	EPSG 2157

Rev.	*Updates*	*Date*	*By*	*Chk'd*	*App'd*
00	Final for issue	2024/08/19	SP	DM/EA	ES

Residual effect

657. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-73** below.

Table 10-73 Residual effect on IEFs for impact 1 – direct effects on habitat during construction, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Greenfinch	With the adoption of the additional mitigation measures the magnitude of the effect on Greenfinch will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Greenfinch	**Not significant**
Linnet	With the adoption of the additional mitigation measures the magnitude of the effect on Linnet will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Linnet.	**Not significant**
sand martin	With the adoption of the additional mitigation measures the magnitude of the effect on sand martin will be low. The significance of the residual effect is therefore predicted to be a **long term, Slight negative effect** for sand martin, which causes noticeable changes in the character of the environment but without significant consequences	**Not significant**

Estuarine / Liffey

658. The permanent or temporary loss of habitat as a result of construction may impact on the breeding, roosting, commuting and / or foraging behaviour of protected bird species within the estuarine / Liffey area and could result in negative impacts to these species.

659. Reductions in the areas available to bird species within the estuarine / Liffey area may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

660. Impact screening is conducted to determine if Impact 1: direct effects on habitats at the estuarine / Liffey area is applicable to each of the identified IEF species listed in **Table 10-17**. Each IEF species is examined in **Table 10-74** below and a rationale is provided on whether to screen in or out the species and to assess the impact significance.

Table 10-74 Impact screening of IEF species for impact 1 – direct effects on habitat during construction

IEF species	Potential for impact	Rationale
Arctic tern	**No**	These species have been assessed as not at risk to *Direct effects on habitats.* The species are not dependent on the habitats which will be subject to permanent and / or temporary habitat loss and were not recorded utilising these habitats during surveys. Similarly, there was no suitable breeding, roosting or foraging habitats for these species at the proposed development areas. Therefore, can be screened out for this impact.
Black-headed gull	**No**	
Common tern	**No**	
Black guillemot	**Yes**	This species has been assessed as at risk to *direct effects on habitats.* The species is dependent on some of the habitats (harbour walls), for resting and breeding, which will be subject to permanent and / or temporary habitat loss and were recorded utilising these habitats during estuarine / Liffey surveys. **Therefore, Black guillemot can be screened in and the significance of this impact and effects assessed.**

Receptor sensitivity

661. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-75**, below. The conservation importance of IEF species has been determined in **Table 10-25**, and tolerance to the impact discussed below.

662. The Black guillemot populations recorded during surveys was considered to be of medium conservation importance. This was determined based on the numbers recorded over the survey period, the suitability of the site to the species and the overall national and international population size. Any potential impacts as a result of direct effects on habitats during the construction phase within the estuarine / Liffey study area, will be at a low level for this population, but still have a reduced effect on the reproduction and / or regional population survival rates. Similarly, there was a low number of suitable breeding and resting areas at the construction locations and in the surrounding areas, meaning the loss of suitable sites could further impact on the species. Therefore, this species is considered to have a medium tolerance to this impact.

Table 10-75 Receptor sensitivity of IEF species for impact 1 – direct effects on habitat during construction

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Black guillemot	medium	medium	medium

Magnitude of impact

663. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-76** below along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters listed in **Table 10-10** and the criteria for defining impact magnitude, which is determined based on extent, duration, frequency and probability of potential impacts.

Table 10-76 Magnitude of impact on IEF species for impact 1 – direct effects on habitat during construction

IEF species	Magnitude	Rationale
Black guillemot	medium	The construction of the onshore substation will require the permanent reclamation of 1,800 m^2 of estuarine, rock armour and sea wall habitat, where Black guillemot were recorded breeding, foraging and resting. This permanent habitat loss will displace at least two pairs of breeding Black guillemot, which will affect the population at this location in the short-term but is not predicted to affect the long-term viability of the population. Recovery from the change is predicted to be achieved after the end of the project activity.

Significance of the effect

664. The receptor sensitivity and magnitude of impact of the screened in IEF species, within the onshore study area at the onshore substation site, have been determined in **Table 10-75** and **Table 10-76**. Using the matrix detailed in **Table 10-11** and in the absence of mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-77** below.

Table 10-77 Significance of the effect of impact 1 – direct effects on habitat for estuarine / Liffey IEF species during construction

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Black guillemot	medium	medium	In the absence of mitigation measures, the sensitivity of Black guillemot in the onshore substation area is considered to be medium and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, moderate negative effect** for Black guillemot. This moderate determination has been considered as significant in EIA terms, as the extent and potential for this impact to occur would likely have a potentially significant impact on the Black guillemot that occur in the area.	**Significant**

Additional mitigation

665. Appropriately sized exclusion nets will be installed over the harbour wall prior to the Black guillemot breeding season (April to September) to exclude birds from the nesting holes, should it not be possible to avoid works on the harbour wall or reclamation work for the harbour wall during this period. In addition, prior to any works a suitably qualified ecologist will ensure there are no active Black guillemot nests. The net will be approximately 80 m in length and its location can be seen in **Plate 10-3.**

Plate 10-3 Location of exclusion netting for Black guillemot near the onshore substation

666. Nesting areas have been identified as a limiting factor in the area for Black guillemots during the survey period at the onshore substation, with some very suboptimal sites being used. Therefore, new Black guillemot nest boxes will be provided. Based on the recommendations outlined in the ALCnature Black guillemot survey report (**Appendix 10.10**), a minimum of 4 no. nest boxes for Black guillemots will be provided to offset removal of suboptimal nesting habitat. These will be in-built or 'bolt-on' nestboxes (see **Plate 10-4**), suitable for Black guillemots placed at on / within perimeter quay walls at the onshore substation, following a similar design to those used already in the Dublin port area (Dublin Port Company, 2017).

Plate 10-4 Example of 'bolt-on' Black guillemot nest box located on harbour quay walls

Residual effect

667. Using the matrix detailed in **Table 10-11** and with the adoption of mitigation measures, the significance of the residual effect on the IEFs has been determined in **Table 10-78** below.

Table 10-78 Residual effect on estuarine / Liffey IEFs for impact 1 – direct effects on habitat during construction, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Black guillemot	With the adoption of the mitigation measures the magnitude of the effect on Black guillemot will be low. The significance of the residual effect is therefore predicted to be a **long term, Slight negative effect** for Black guillemots.	**Not Significant**

Onshore and estuarine / Liffey – construction: impact 2 – disturbance and displacement

Onshore

668. Cable duct installation at the landfall, onshore export and ESBN network cable installation, clearance and development for the onshore substation and clearance for temporary construction compounds have the potential to disturb and displace birds which would otherwise directly utilise areas within and around the areas where these works are proposed to take place.

669. The disturbance and resultant displacement of individuals which would otherwise potentially utilise onshore areas effectively equates to temporary indirect habitat loss for those individuals.

670. Indirect habitat loss as consequence of disturbance and displacement reduces the potential spatial extent available to impacted receptors. Reductions in the areas available to onshore bird species to forage, roost and breed may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

671. An impact screening is conducted to determine if disturbance / displacement within the onshore development area during construction phase activities, is applicable to each of the identified IEF species listed in **Table 10-16**. Each IEF species is examined in **Table 10-79** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-79 Impact screening of IEF species for impact 2 – disturbance during construction

IEF species	Potential for impact	Rationale
Light-bellied Brent Goose	**Yes**	This species has been assessed as at risk to disturbance / displacement following a precautionary approach. Although this species was irregularly recorded during onshore surveys, it has been recorded utilising some onshore habitats based on results during intertidal surveys and following a desktop review. More detail on potential impacts to this species as a result of disturbance and displacement within the offshore / intertidal area can be seen in **Section 10.10.2** (**Table 10-52** and **Table 10-53**). The species is known to be sensitive to noise and visual disturbance (Cutt et al., 2013). **Therefore, following a precautionary approach Light-bellied Brent Goose within the onshore development area has been screened in and the significance of this impact and effects assessed.**
Greenfinch	**Yes**	This species has been assessed as at risk to disturbance / displacement. This species has been regularly observed breeding and feeding within the onshore development area during onshore surveys. **Therefore, Greenfinch has been screened in and the significance of this impact and effects assessed.**

IEF species	Potential for impact	Rationale
Linnet	**Yes**	This species has been assessed as at risk to disturbance / displacement. This species has been regularly observed breeding and feeding within the onshore development area during onshore surveys. **Therefore, Linnet has been screened in and the significance of this impact and effects assessed.**
Peregrine falcon	**Yes**	This species has been assessed as at risk to disturbance / displacement. This species has been regularly observed breeding, roosting and hunting near to the onshore substation area during onshore surveys, with the closest recording being approximately 300 m from the nearest construction works area. **Therefore, Peregrine falcon will be screened in and the significance of this impact and effects assessed.**
sand martin	**Yes**	This species has been assessed as at risk to disturbance / displacement. This species has been regularly observed breeding and feeding within the onshore development area during onshore surveys. **Therefore, sand martin can be screened in and the significance of this impact and effects assessed.**

Receptor sensitivity

672. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-80** below and a rationale provided on this designation. The conservation importance of IEF species has been determined in **Table 10-24**, and tolerance to the impact discussed below.

673. The IEF bird populations recorded during the onshore surveys were considered to be of local importance (higher value) (with the exception of Peregrine falcon), this was determined based on the numbers recorded over the survey period, the suitability of the site to each species and the comparing observations to the overall national and international population size.

674. For Greenfinch, Linnet and sand martin, potential impacts as a result of disturbance and displacement during the construction phase within the onshore study area, will be at a low level and so have a reduced effect on the reproduction and / or regional population survival rates for these species. Therefore, these species are considered to have a high tolerance to this impact.

675. Peregrine falcon was considered to be of county importance during the onshore surveys, due to the presence of a breeding pair, approximately 300 m from the nearest proposed construction works. The species has been documented nesting successfully in urban environments, often in close proximity to human activities, demonstrating a certain tolerance to disturbance and are known to adapt their nesting sites to various settings, including cliffs, buildings and bridges, showcasing their capacity to coexist with human disturbances (Goodship and Furness, 2018), it has therefore considered that the species will have a high tolerance to this impact.

676. Light-bellied Brent Goose is considered sensitive to noise disturbance and has a variable tolerability to visual disturbances (Cutt et al., 2013). The species occurs within the onshore development area in close proximity to construction activities (approximately 150 m from the onshore landfall area) and it is expected that there will be noise impacts occurring in this area. However, within Dublin Bay and surrounding locations, Light-bellied Brent Geese have been observed to alter their behaviours in order to forage within highly disturbed industrial and urban areas (for example, Dublin Bay Birds Project, 2015), evidencing a much greater degree of disturbance tolerance for populations within this area than is suggested for this species in general. As Light-bellied Brent Goose is usually considered to be highly sensitive to disturbance and displacement, but populations of this species around Dublin appear to be considerably less so than is generally the case elsewhere, and that any potential impacts within the onshore development area would be to, at most, a small proportion of the regional population, this species is considered to have high tolerance to disturbance and displacement impacts within the onshore area.

Table 10-80 Receptor sensitivity of IEF species

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	high	medium
Greenfinch	low	high	low
Linnet	low		
Peregrine falcon	medium		
sand martin	Low		

Magnitude of impact

677. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-81**, along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters and the criteria listed in **Table 10-10**, which is determined based on extent, duration, frequency and probability of potential impacts.

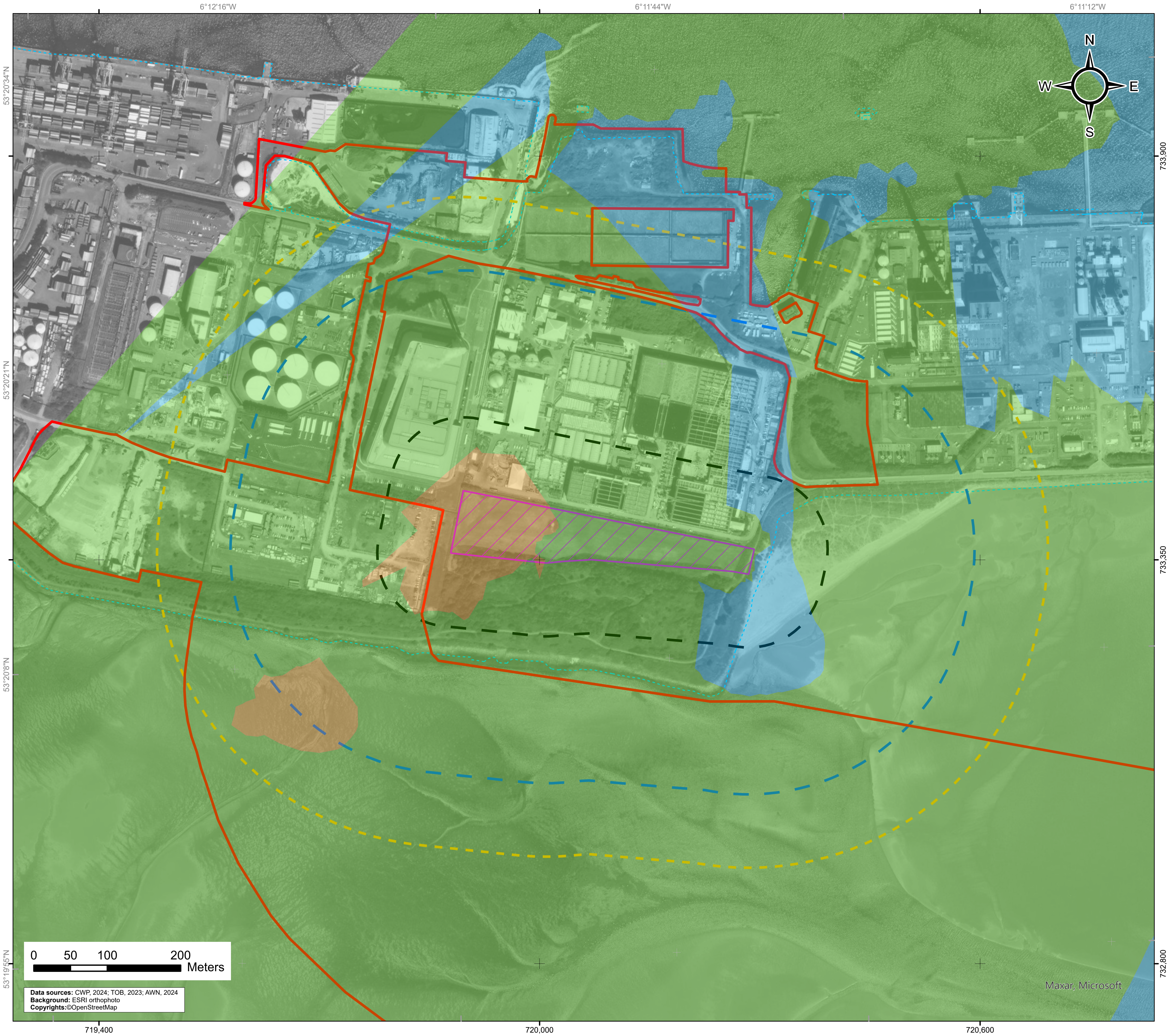
Table 10-81 Magnitude of impact on IEF species

IEF species	Magnitude	Rationale
Light-bellied Brent Goose	medium	As discussed, Light-bellied Brent Geese were recorded irregularly over the survey period but large numbers have previously been recorded to the east of the landfall construction area based on desktop study results. The species was recorded foraging in grassland areas in Sean Moore Park and the area known as 'Goose Green' (approx. 150 m northeast of the landfall works area and Construction Compound A). More details on the magnitude of

IEF species	Magnitude	Rationale
		impact on Light-bellied Brent Goose in the offshore / intertidal area can be seen in **Section 10.10.2** (**Table 10-52** and **Table 10-53**). During the construction phase of the onshore infrastructure, a number of parameters were identified with the potential to cause disturbance to this species, including some noise, presence of personnel and lighting (**Table 10-29**). *Construction lighting* Construction works for the OTI and landfall are expected for a period of 36 months with general lighting used when needed. The overall duration to complete the tunnel construction and cable duct installation will be 21 months. Works within this period such as the tunnel boring and excavation of the shafts will be undertaken on a 24/7 continuous period and which will therefore require nighttime lighting. Similarly, HDD activities for the ESBN networks cables will operate on a 24/7 cycle, on commencement of the drilling activities and will require lighting. *Construction vibrations* Vibration energy levels dissipate significantly with distance as a result of geometrical spreading of the vibration energy and its dissipation by soil viscosity and / or friction. The construction works associated with HDD installation, piling, significant excavations and tunnelling are all in excess of 130 m away from Goose Green. Given the distance between Goose Green and where these activities are to occur, it is expected that any vibration transmission will have dissipated to significantly low levels and would not result in any impacts to the area. *Construction noise* Consideration was given to construction noise levels from key activities in proximity to Goose Green. These included: • Piling for the temporary cofferdam; • Pilling for the TJBs; • Tunnel excavation activities associated with the onshore export cable (specifically the tunnel shaft located within Compound A); and • HDD installation associated with the ESBN network cables. Noise contours presented below demonstrate that in the absence of mitigation the noise levels from these construction activities will be at levels between 55-70 dB in western and eastern portions of Goose Green, for both the tunnel excavations (**Figure 10-8**) and the HDD installation for the ESBN network cables (**Figure 10-9**) which is considered to be at a medium level (Cutts et al., 2013) and

IEF species	Magnitude	Rationale
		has potential to cause disturbance to Light-bellied Brent Geese within Goose Green. Based on the information provided, light-bellied brent geese have been found to be highly sensitive to noise and visual disturbances of various degrees (Cutts et al., 2013). However, due to the low number of birds recorded during the survey period (with no records adjacent to proposed construction areas, although up to 350 birds have been previously recorded in the area according to a desktop study) and the availability of alternative habitats nearby, it is not expected that small-scale disturbances will affect the long-term viability of the population. Consequently, the magnitude of the impact has been assessed as medium.
Greenfinch	low	Construction phase activities involving site clearance, installation and reinstatement works, movement of machinery and lighting, will all be required within the construction areas. Greenfinch were recorded regularly but in limited numbers within or near the construction areas. The species was recorded calling or in pairs during the breeding season, indicating breeding activity. Due to the low level of birds recorded (23 records adjacent to proposed construction areas over the survey period) and the availability of alternative habitats in the area, a change to the population distribution due to disturbance effects, on a small-scale is not predicted to affect the long-term viability of the population. Therefore, a magnitude of the impact was assigned as low.
Linnet	low	Construction phase activities involving site clearance, installation and reinstatement works, movement of machinery and lighting, will all be required within the construction areas. Linnet was recorded regularly but in limited numbers within or near the construction areas. Birds were recorded calling, in pairs or observed building nests during the breeding season in this area indicating breeding activity. Due to the low level of birds recorded (37 records adjacent to proposed construction areas over the survey period) and the availability of alternative habitats in the area, a change to the population distribution due to disturbance effects, on a small-scale is not predicted to affect the long-term viability of the population. Therefore, a magnitude of the impact was assigned as low.
Peregrine falcon	low	Construction phase activities involving site clearance, installation and reinstatement works, movement of machinery and lighting, will all be required within the construction areas. Peregrine was recorded regularly but in limited numbers near the onshore substation area. Birds were recorded hunting, roosting and breeding near the onshore substation during the breeding and non-breeding seasons. A breeding nest site has been recorded

IEF species	Magnitude	Rationale
		approximately 300 m from the onshore substation. According to Goodship and Furness (2022) the species is assessed to have a medium sensitivity to human disturbance at breeding sites and suggests a 500-750 m buffer zone around the nest area to protect the species from pedestrian and noise disturbance, but that a large buffer may be required during the early / egg laying period. It is also noted by Ruddock and Whitfield, (2007), that tolerance level of individual Peregrines is likely to depend on the regularity and type of disturbance individuals are exposed and that birds located within urban areas or quarries can readily habituate to disturbances. The location of the breeding Peregrine falcon pair is located within the greater Dublin port / Poolbeg Peninsula, which is a busy shipping and industrial area. The pair at this location are regularly exposed to boat, vehicle traffic, human and aircraft disturbances. As such the magnitude of impacts is assessed to be low, resulting in a change to the population distribution, on a small-scale but is not predicted to affect the long-term viability of the population or integrity of the protected site associated with the population.
sand martin	low	Construction phase activities involving site clearance, installation and reinstatement works, movement of machinery and lighting, will all be required within the construction areas. sand martin were recorded regularly but in limited numbers near the onshore substation area. Birds were recorded at the onshore substation site during the breeding season, where a small breeding colony of at least four nests were recorded within the harbour wall. Due to the low level of birds recorded and the availability of alternative habitats in the area, a change to the population distribution due to disturbance effects, on a small-scale is not predicted to affect the long-term viability of the population. Therefore, a magnitude of the impact was assigned as low.



Legend

- Planning application boundary
- High water mark
- Goose green area - South Dublin bay and river Tolka estuary SPA

Goose green buffers

- 100 m
- 300 m
- 400 m

Noise model for the onshore export cables installation (without mitigation)

- Background: 0 – 40 dB
- Low: 40 – 55 dB
- Medium: 55 – 70 dB

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.8
Noise model for onshore export cables tunnel installation activities (without mitigation)

CWP doc. number: CWP-NPC-ENG-08-01-MAP-1697

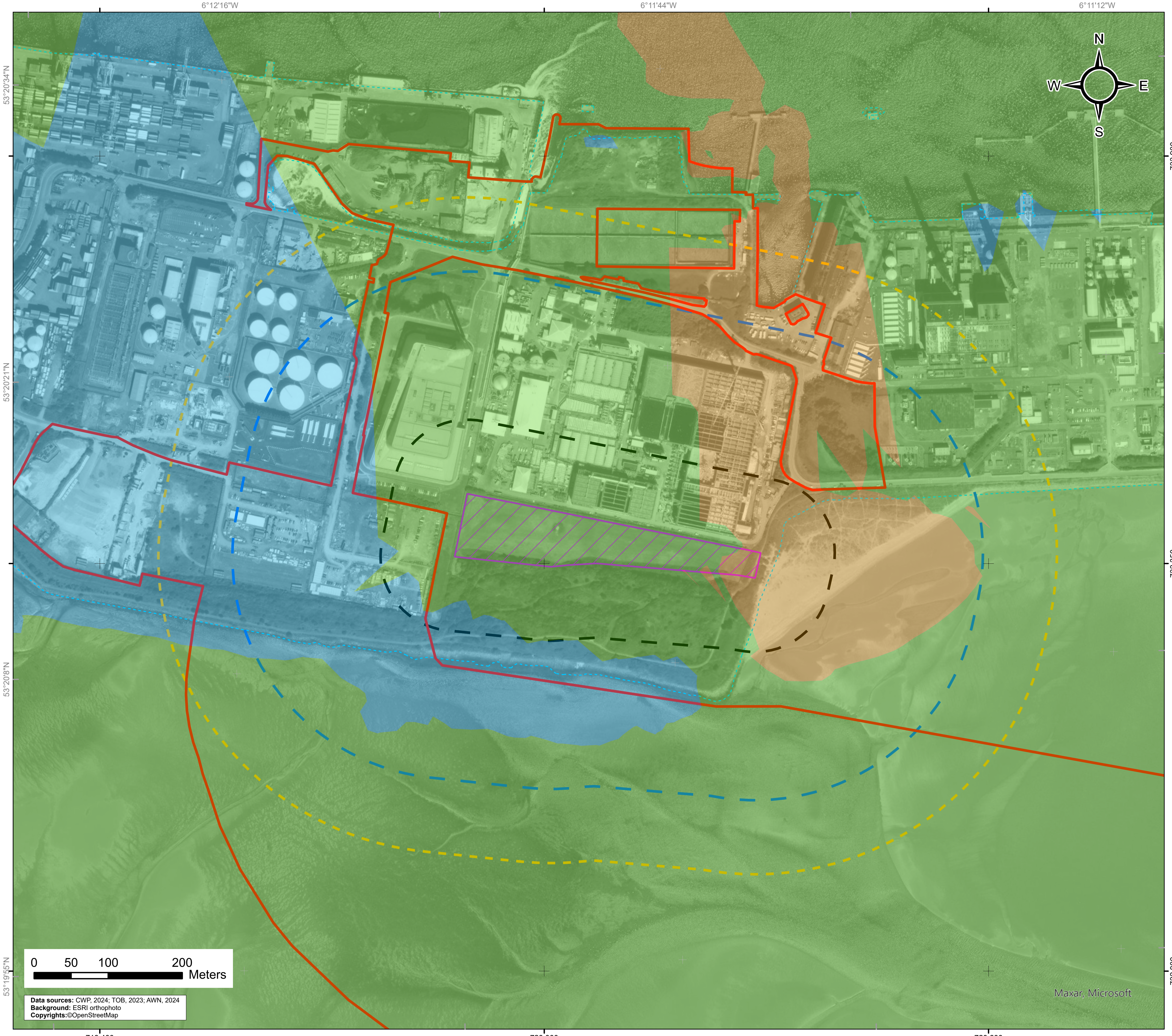
Internal descriptive code: PB - PAB..T.NOISE.MODEL - HWM..SDBaRTE.SPA. GOOSE.GA..BUFF.100m.300m.400m - (SAT..EIAR.Vol.03.Ch.10.FIG.08)

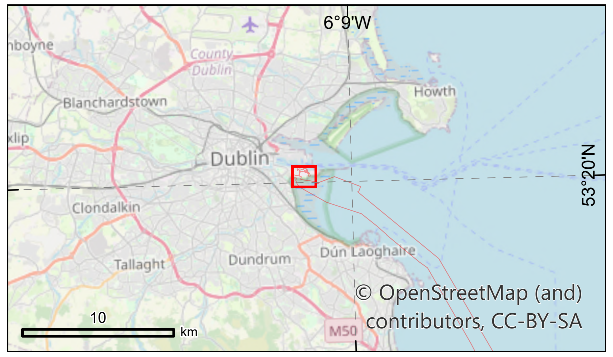
Size: A3

Scale: 1:5,000

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES





Legend

- Planning application boundary
- High water mark
- Goose green area - South Dublin bay and river Tolka estuary SPA

Goose green buffers

- 100 m
- 300 m
- 400 m

Noise model for the network cables installation (without mitigation)

- Background: 0 – 40 dB
- Low: 40 – 55 dB
- Medium: 55 – 70 dB

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.9
Noise model for ESBN network cables installation activities (without mitigation)

CWP doc. number: CWP-TOB-ENG-08-01-MAP-1780

Internal descriptive code: PB - PAB..ENC.NOISE.MODEL - HWM..SDBaRTE.SPA. GOOSE.GA..BUFF.100m.300m.400m - SAT..EIAR.Vol.03.Ch.10.FIG.09)

Size: A3
Scale: 1:5,000

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES

Significance of the effect

678. The receptor sensitivity and magnitude of impact of the screened in IEF species, within the onshore study area, has been determined in **Table 10-80** and **Table 10-81**. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-82** below.

Table 10-82 Significance of the effect of impact 2 – disturbance and displacement for onshore IEF species during construction

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Light-bellied Brent Goose	medium	medium	In the absence of additional mitigation measures, the sensitivity of Light-bellied Brent Goose in the onshore development area is considered to be medium and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, moderate, negative effect** for Light-bellied Brent Goose. This moderate determination has been considered as significant in EIA terms, as the extent and potential for this impact to occur would likely have a potentially significant impact on the light-bellied brent geese that occur in the area.	**Significant**
Greenfinch	low	low	In the absence of additional mitigation measures, the sensitivity of Greenfinch in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, n**o**t significant, negative effect** for Greenfinch.	**Not Significant**
Linnet	low	low	In the absence of additional mitigation measures, the sensitivity of Linnet in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, not significant, negative effect** for Linnet.	**Not Significant**
Peregrine falcon	low	low	In the absence of mitigation measures, the sensitivity of Peregrine falcon in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is	**Not Significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			predicted to be a **short term, not significant, negative effect** for Peregrine falcon.	
sand martin	low	low	In the absence of additional mitigation measures, the sensitivity of sand martin in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, not significant, negative effect** for sand martin.	**Not Significant**

Additional mitigation

679. Construction noise will be kept to a minimum, in accordance with British Standard BS 5228 1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites –Part 1: Noise' to reduce the level of noise during the construction phase. The appointed Contractor will be obliged to take specific noise abatement measures and will comply with the best practice measures outlined in BS 5228 and the National Road Authority (NRA) guidelines '*Good practice Guideline for the Treatment of Noise during the Planning of National Road Schemes*' (NRA, 2014).

680. To reduce the level of artificial lighting, all temporary lighting associated with the construction works will be placed strategically by the appointed Contractor following consultation with the appointed ECoW. This will ensure that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light splay.

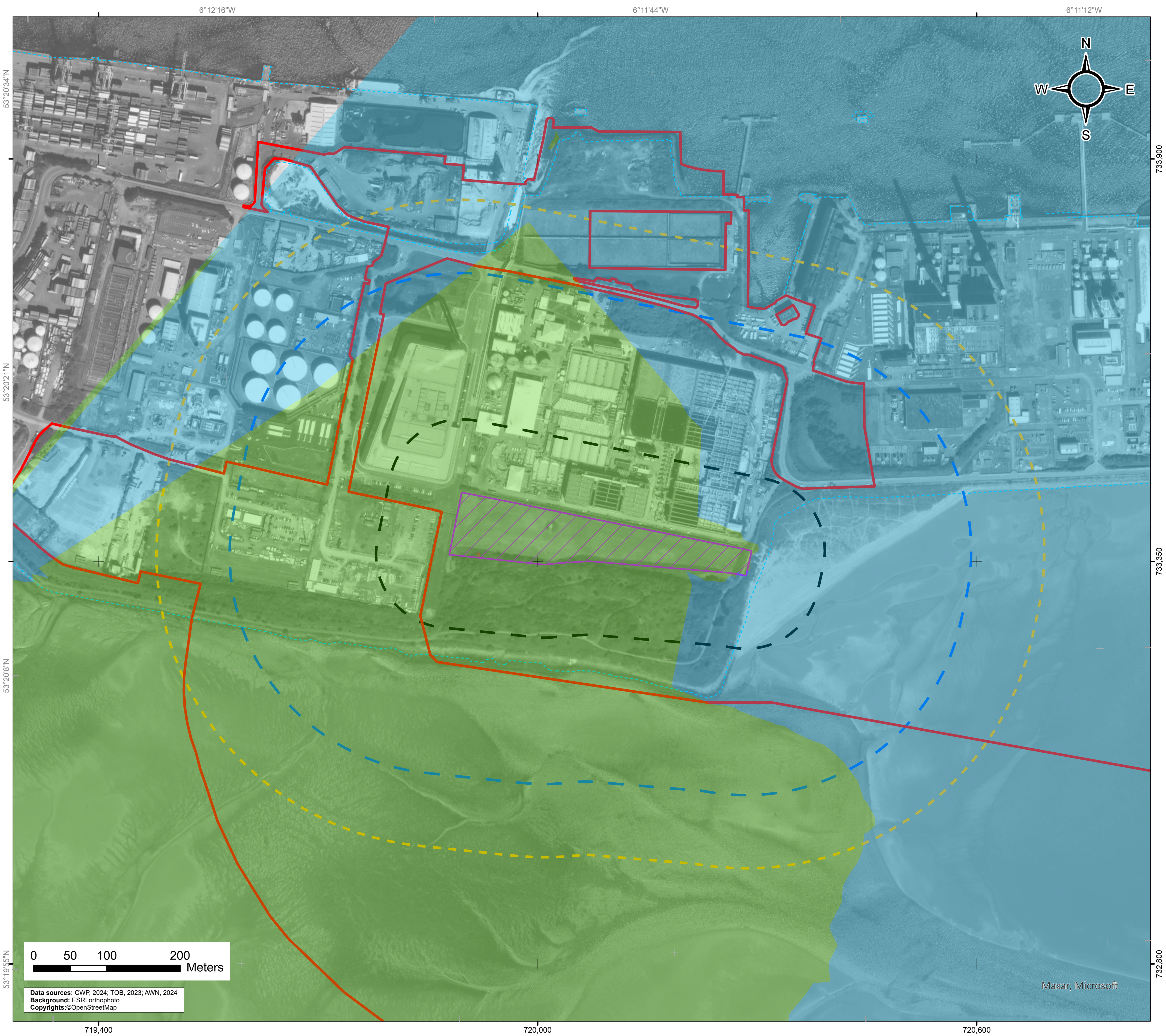
681. To reduce the level of noise disturbance from construction activities, the following will be undertaken:

- 2.6 m localised screening will be erected around noisy plant sources associated with the open cut excavation including piling works at the temporary cofferdam, tunnel excavation works (within the Compound A) and the HDD installation of the ESBN networks cables;
- 2.6 m hoarding will be erected around the perimeter of the temporary tunnel compound, located in Compound A and the temporary HDD compound located in Compound C; and
- 2.6 m high perimeter hoarding will also be erected around the boundaries of Compound A and Compound C.

682. Following the implementation of this mitigation, noise contours presented below demonstrate that the noise levels from these construction activities will be at levels between 40-55 dB across all of Goose Green, for both the tunnel excavations (**Figure 10-10**) and the HDD installation for the ESBN network cables (**Figure 10-11**) which is considered to be at a low level (Cutts et al., 2013).

683. To reduce noise and visual disturbance in the intertidal area, a number of robust mitigation measures have been proposed (see **Section 10.10.2 Additional mitigation**)**,** the effect of these mitigation measures will also contribute to mitigating disturbance and displacement effects at the onshore area, particularly at 'Goose Green' and on any potential Light-bellied Brent Goose within the onshore area.

684. Vegetation removal / clearance will commence outside of the breeding bird season (which is from 1 March to 31 August inclusive) to avoid impacts on nesting birds. Where the construction programme does not allow this time restriction to be observed, then these areas will be inspected be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within three days of the nest survey, otherwise repeat surveys will be required.'. The Environmental Management Framework for the CWP Project including the role and responsibilities of the appointed ECoW are described in the Construction Environmental Management Plan (CEMP).



Legend

- Planning application boundary
- High water mark
- Goose green area - South Dublin bay and river Tolka estuary SPA

Goose green buffers

- 100 m
- 300 m
- 400 m

Noise model for onshore export cables tunnel installation activities (including mitigation)

- Background: 0 – 40 dB
- Low: 40 – 55 dB
- Medium: 55 – 70 dB

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.10
Noise model for onshore export cables tunnel installation activities including mitigation

CWP doc. number: CWP-TOB-ENG-08-01-MAP-1763

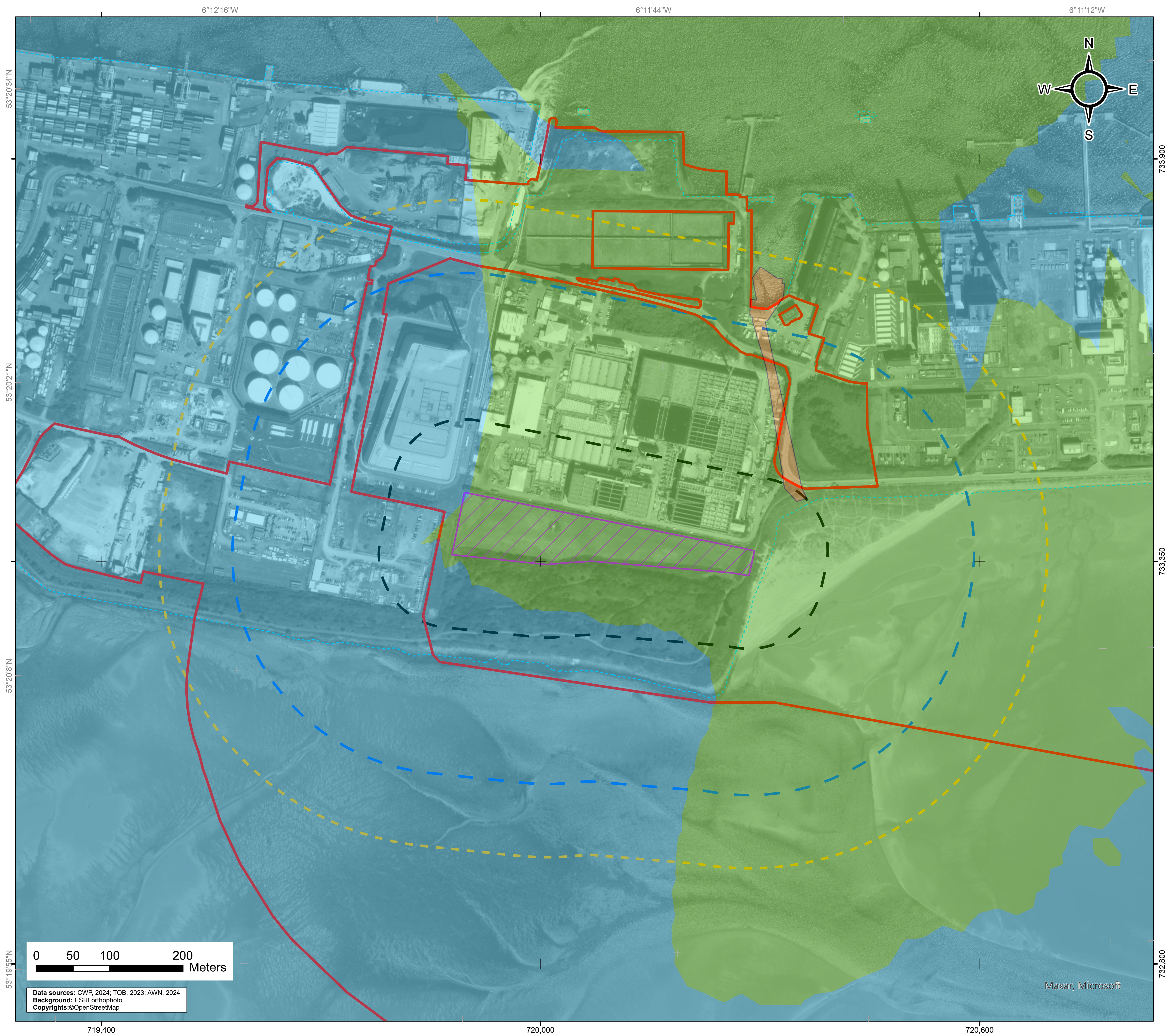
Internal descriptive code: PB - PAB..T.NOISE.MODEL.MIT - HWM..SDBaRTE.SPA. GOOSE.GA..BUFF.100m.300m.400m - (SAT..EIAR.Vol.03.Ch.10.FIG.10)

Size: A3

Scale: 1:5,000

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES



Legend

- Planning application boundary
- High water mark
- Goose green area - South Dublin bay and river Tolka estuary SPA

Goose green buffers

- 100 m
- 300 m
- 400 m

Noise model for the network cables installation (including mitigation)

- Background: 0 – 40 dB
- Low: 40 – 55 dB
- Medium: 55 – 70 dB

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.11
Noise model for ESBN network cables installation activities including mitigation

CWP doc. number: CWP-TOB-ENG-08-02-MAP-1777

Internal descriptive code: PB - PAB..ENC.NOISE.MODEL.MIT - HWM ..SDBaRTE.SPA.GOOSE.GA..BUFF.100m.300m.400m - (SAT..EIAR.Vol.03.Ch.10.FIG.11)

Size: A3

Scale: 1:5,000

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES

Residual effect

685. Using the matrix detailed in **Table 10-11** and with the adoption of the above mitigation measures, the significance of the residual effects on the IEFs has been determined in **Table 10-83** below.

Table 10-83 Residual effect on onshore IEFs for impact 2 – disturbance and displacement during construction, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Light-bellied Brent Goose	With the adoption of the mitigation measures the magnitude of effect on Light-bellied Brent Goose will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Light-bellied Brent Goose.	**Not significant**
Greenfinch	With the adoption of the mitigation measures the magnitude of effect on Greenfinch will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Greenfinch	**Not Significant**
Linnet	With the adoption of the mitigation measures the magnitude of effect on Linnet will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Linnet.	**Not Significant**
Peregrine falcon	With the adoption of the mitigation measures the magnitude of effects on Peregrine falcon will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Peregrine falcon.	**Not Significant**
Sand martin	With the adoption of the mitigation measures the magnitude of effect on sand martin will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to sand martin.	**Not Significant**

Estuarine / Liffey

686. Construction of the onshore substation adjacent to the estuarine / Liffey area has the potential to disturb and displace birds which would otherwise directly utilise areas within and around where these works are proposed to take place.

687. The disturbance and resultant displacement of individuals which would otherwise potentially utilise estuarine / Liffey areas within or around the area of the onshore substation works effectively equates to temporary indirect habitat loss for those individuals.

688. Indirect habitat loss as consequence of disturbance and displacement reduces the potential spatial extent available to impacted receptors. Reductions in the areas available to onshore bird species to forage, roost and breed may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

689. An impact screening is conducted to determine if Impact 2 – Disturbance / displacement within the estuarine / Liffey area is applicable to each of the identified IEF species listed in **Table 10-17**. Each IEF species is examined in **Table 10-84** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-84 Impact screening of IEF species

IEF species	Potential for impact	Rationale
Arctic tern	**Yes**	This species has been assessed as at risk to *disturbance / displacement.* One breeding colony for this species was recorded near to the onshore substation, which is approximately 25 m from the nearest construction works. **Therefore, Arctic tern will be screened in and the significance of this impact and effects assessed.**
Black guillemot	**Yes**	This species has been assessed as at risk to *disturbance / displacement.* Black guillemot were recorded breeding and resting near to the onshore substation area during onshore survey, the closest breeding activity was recorded approximately 1 m from the nearest construction works. **Therefore, Black guillemot will be screened in and the significance of this impact and effects assessed.**
Black-headed gull	**Yes**	This species has been assessed as at risk to *disturbance / displacement.* A large number of roosting individuals were regularly recorded (outside the breeding season) near to the onshore substation area during onshore surveys, the roost area was located approximately 50 m from the nearest construction works area. **Therefore, Black-headed gull will be screened in and the significance of this impact and effects assessed.**
Common tern	**Yes**	This species has been assessed as at risk to *disturbance / displacement.* One breeding colony for this species was recorded near to the onshore substation area during onshore surveys, which is approximately 250 m from the nearest construction works. **Therefore, Common tern will be screened in and the significance of this impact and effects assessed.**

Receptor sensitivity

690. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-85**. The conservation importance of IEF species has been determined in **Table 10-25**, and tolerance to the impact discussed below.

691. Arctic tern is considered to have low tolerance to disturbance and displacement impacts at the estuarine / Liffey area during the construction phase. This species was found to be breeding in close proximity to the onshore substation (the nearest colony being the CDL Dolphin approximately 25 m from the northern boundary). The number of breeding birds at this colony ranged from 0 to 105 nests, between the period of 2013 to 2022. The proximity of this colony and the potential to disturbance is expected to be at a high level, with noticeable impacts to the reproduction and / or regional population survival rates.

692. The Black guillemot populations recorded during surveys was considered to be of medium conservation importance. This was determined based on the numbers recorded over the survey period, the suitability of the site to the specie and the overall national and international population size. Any potential impacts as a result of disturbance and displacement during the construction phase within the estuarine / Liffey study area, will be at a low level for this population and so have a reduced effect on the reproduction and / or regional population survival rates. Similarly, there was a low number of suitable breeding and resting areas at the construction locations. Therefore, this species is considered to have a high tolerance to this impact.

693. The Black-headed gull population recorded during surveys was considered to be of low conservation importance. This was determined based on the numbers recorded over the survey period, the suitability of the site to the species and the overall national and international population size. Any potential impacts as a result of disturbance and displacement during the construction phase within the estuarine / Liffey study area, will be at a low level for this population and so have a reduced effect on the reproduction and / or regional population survival rates. Therefore, this species is considered to have a high tolerance to this impact.

694. Common tern is considered to have medium tolerance to disturbance and displacement impacts at the estuarine / Liffey area during the construction phase. This species was found to be breeding in close proximity to the onshore substation (the nearest colony being the CDL Dolphin approximately 25 m from the northern boundary). The number of breeding birds at this colony ranged from 138 to 427 nests, between the period of 2013 to 2022. The proximity of this colony and the potential to disturbance is expected to be at a medium level, with minor impacts to the reproduction and / or regional population survival rates.

Table 10-85 Receptor sensitivity of IEF species

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Arctic tern	high	low	high
Black guillemot	medium	high	low
Black-headed gull	low	high	low

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Common tern	high	medium	high

Magnitude of impact

695. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-86** below, along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters and the criteria listed in **Table 10-10**, which is determined based on extent, duration, frequency and probability of potential impacts.

Table 10-86 Magnitude of impact on IEF species

IEF species	Magnitude	Rationale
Arctic tern	medium	During the construction of the onshore substation, several parameters are identified as having the potential to cause disturbance to this species, including noise, presence of machinery and construction personnel (**Table 10-28**). Works at this location are expected to last 24-36 months. An established Arctic tern breeding colony occurs approximately 25 m to the north of the onshore substation area during the breeding season. According to Goodship and Furness (2022) the species is assessed as having medium sensitivity to human disturbance at breeding colonies and suggest a 200 m buffer zone around colonies to protect the species from pedestrian disturbance, but that a larger buffer may be required if terns are not habituated to disturbance or if there is likely to be aerial disturbance. It is important to note that the colonies near the onshore substation are located within Dublin Port, which is a busy shipping and industrial area. A report prepared by ALCnature on behalf of CWP (see **Appendix 10.9**), was commissioned to determine the current disturbance tolerance of the breeding terns near the onshore substation. The results concluded that the terns within this study area have significantly habituated to high levels of background disturbance and show low levels of disturbance to several current forms of more severe sporadic disturbance events (boats, traffic, predators, humans and aircraft). Experimental disturbances tested (in the form of personnel, machinery, light and moderate noise) had minimal apparent disturbance effects. As such and due to the close proximity of the breeding colony to the proposed construction works, the magnitude of likely impact at the construction stage is assessed to be medium.

IEF species	Magnitude	Rationale
Black guillemot	low	During the construction of the onshore substation, a number of parameters were identified as having the potential to cause disturbance to this species, including noise, presences of machinery and construction personnel, and vibrations (**Table 10-28**). Works at this location are expected to last 24-36 months. Black guillemot was regularly recorded breeding in cavities or ledges of sea walls, quays and jetties near the onshore substation area during the breeding season. Black guillemot is considered to habituate to the majority of human disturbances with some examples occurring near the onshore substation area, where Black guillemot was recorded breeding adjacent to redevelopment construction works (including piling) at Dublin Port, for the Alexandra Basin Redevelopment project in 2016 (RPS, 2019). Considering the species tolerance to disturbance, the change to the population distribution due to disturbance effects, will be on a small-scale and is not predicted to affect the long-term viability of the population. Recovery from the change is predicted to be achieved in the short-term after the end of the project activity. Therefore, the magnitude of impact was assigned as low.
Black-headed gull	low	During the construction of the onshore substation, a number of parameters were identified as having the potential to cause disturbance to this species, including noise, presences of machinery and construction personnel, and vibrations (**Table 10-28**). Works at this location are expected to last 24-36 months. Black-headed gull were recorded irregularly near the onshore substation area. Birds were recorded roosting on piers and jetties within the River Liffey estuary during the non-breeding season often with other gull species. Due to the limited number of records and the availability of alternative habitats in the wider area, the change to the population distribution due to disturbance effects, will be on a small-scale and is not predicted to affect the long-term viability of the population. Recovery from the change is predicted to be achieved in the short-term after the end of the project activity Therefore, a magnitude of impact was assigned as low.
Common tern	low	During the construction of the onshore substation, a number of parameters were identified as having the potential to cause disturbance to this species, including noise, presences of machinery and construction personnel, and vibrations (**Table 10-28**). Works at this location are expected to last 24-36 months The established Common tern colony occurs approximately 250 m to the northeast of the onshore substation area during the breeding season. According to Goodship and Furness (2022) the species is assessed as having medium sensitivity to human disturbance at breeding colonies and suggest a 200 m buffer zone around colonies to protect the species from pedestrian disturbance, but that a large

IEF species	Magnitude	Rationale
		buffer may be required if terns are not habituated to disturbance or if there is likely to be aerial disturbance. It is important to note that the colonies near the onshore substation area are located within Dublin Port, which is a busy shipping and industrial area. A report prepared by ALCnature on behalf of CWP (see **Appendix 10.9**), was commissioned to determine the current disturbance tolerance of the breeding terns near the proposed onshore substation. The results concluded that the terns within this study area have significantly habituated to high levels of background disturbance and show low levels of disturbance to several current forms of more sever sporadic disturbance events (boats, traffic, predators, humans and aircraft). Experimental disturbances tested (in the form of personnel, machinery, light and moderate noise) had minimal apparent disturbance effects. As such and due to the distance between the breeding colony and the proposed construction works, the magnitude of likely impact at the construction stage is assessed to be low.

Significance of the effect

696. The receptor sensitivity and magnitude of impacts of the screened in IEF species, within the onshore study area at the onshore substation site, has been determined in **Table 10-80** and **Table 10-80**. Using the matrix detailed in **Table 10-11** and in the absence of mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-87** below.

Table 10-87 Significance of the effect of impact 2 – disturbance and displacement for estuarine / Liffey IEF species during construction

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Arctic tern	high	medium	In the absence of mitigation measures, the sensitivity of Arctic tern in the onshore substation area is considered to be high and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is predicted to be a **short term, Significant, negative effect** for Arctic tern.	**Significant**
Black guillemot	low	low	In the absence of mitigation measures, the sensitivity of Black guillemot in the onshore substation area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effects is predicted to be a **short term, Not**	**Not significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			Significant, negative effect for Black guillemot.	
Black-headed gull	low	low	In the absence of mitigation measures, the sensitivity of Black-headed gull in the onshore substation area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effect is predicted to be a **short term, Not Significant, negative effect** for Black-headed gull.	**Not significant**
Common tern	high	low	In the absence of mitigation measures, the sensitivity of Common tern in the onshore substation area is considered to be medium and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is predicted to be a **short term, Slight, negative effect** for Common tern.	**Not significant**

Additional mitigation

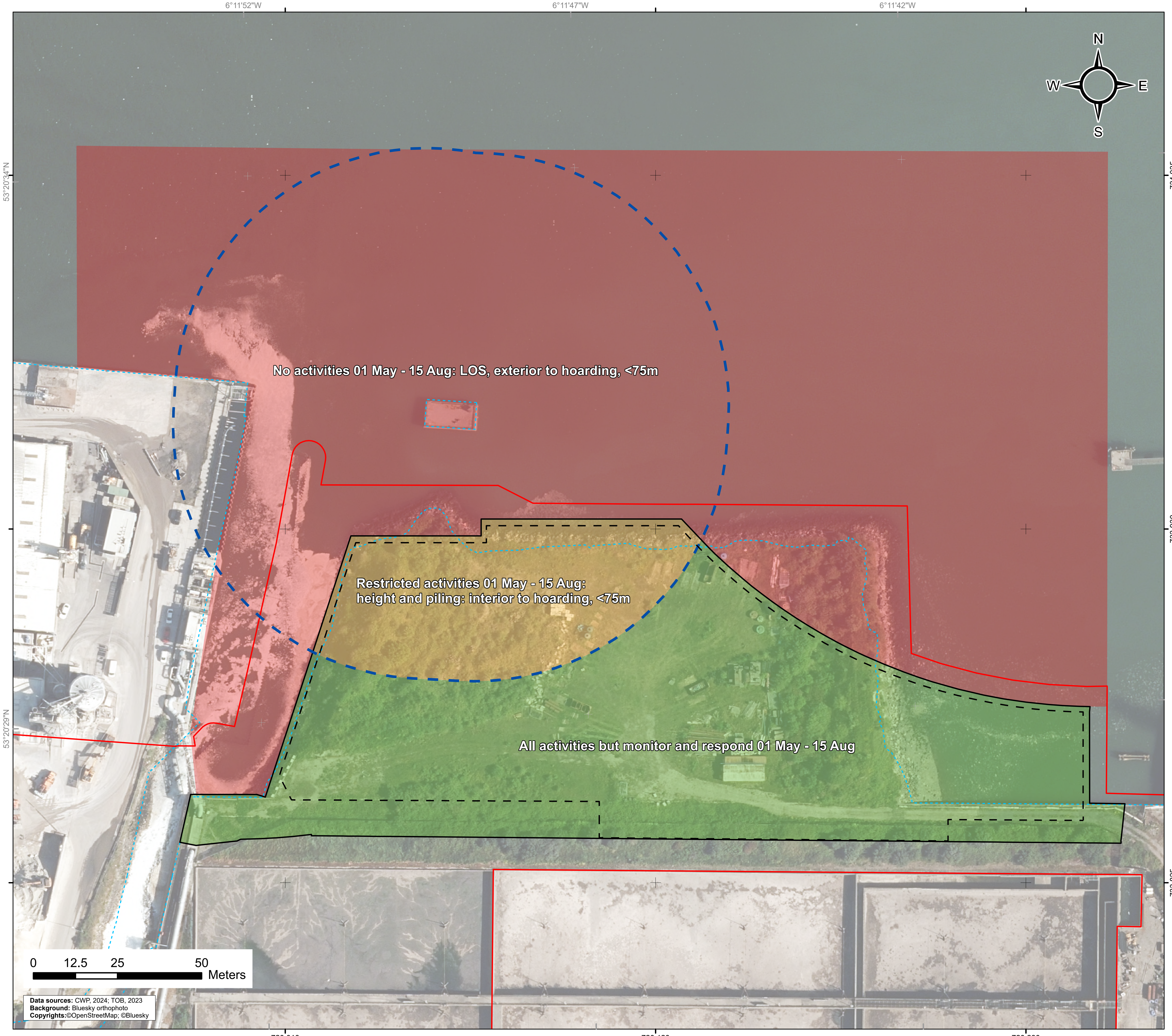
697. Construction noise will be kept to a minimum, in accordance with British Standard BS 5228 1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites –Part 1: Noise' to reduce the level of noise during the construction phase. The appointed Contractor will be obliged to take specific noise abatement measures and will comply with the best practice outlined in BS 5228 and the NRA guidelines 'Good practice Guideline for the Treatment of Noise during the Planning of National Road Schemes' (NRA, 2014).

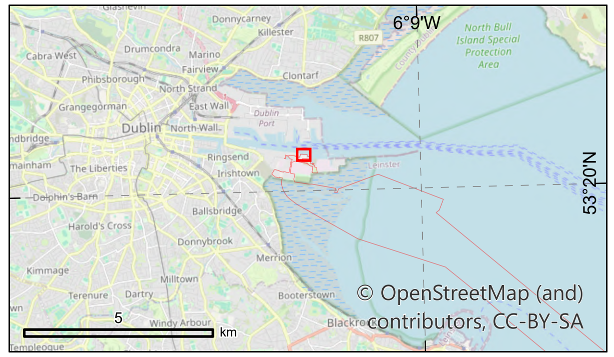
698. To reduce the level of artificial lighting, all temporary lighting associated with the construction works will be placed strategically by the appointed Contractor following consultation with the appointed ECoW. This will ensure that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light splay.

699. Mitigations applicable to terns have been detailed in a tern disturbance report prepared by ALCnature (**Appendix 10.9**) a breakdown of these mitigations includes the following:

- General restrictions period:
    - The period from 1 May – 15 August will be defined as the tern breeding season and restrictions may apply as detailed below. The latter date may require amendment subject to progress of the breeding season and this should be monitored as the season progresses.
- Visual screening:
    - A solid screen (hoarding) of 2.5m in height.

- Erected and maintained to a height which hides / screens all activities, up to and including the maximum height extent of operating machinery within 75 m of the CDL tern colony.
    - Screening duration period 1 May – 15 August.
    - Working (movement and noise of machinery or personnel) above hoarding height and within 40 metres, limited to periods of <5 minutes per hour.
- Construction sequencing:
    - A visualisation of the following proposed mitigation measures can be seen in **Figure 10-12** below.
    - All works out of line of sight and beyond 75 m of the CDL tern colony (except piling or works involving high intensity or long duration noise or vibration) may proceed at any time.
    - No works within line of sight of tern colony (or above hoarding height within 50 m), to proceed during 1 May – 15 August.
    - Works behind hoarding during 1 May – 15 August (except high noise / vibration activities, such as piling – restricted to outside 75 m buffer) are acceptable.
- Noise & lighting limits:
    - High noise & vibration activities (e.g., piling) restricted within 75 m buffer zone of tern colony 1 May – 15 August.
    - No lighting on exterior of hoarding in line of sight of tern colony 1 May – 15 August.
    - No works in hours of darkness 1 May – 15 August.
- Monitoring and response:
    - Monitoring of tern colony response to be carried out to structured plan throughout breeding season to enable response to disturbance events (enabling or restricting works subject to response observed).
- Special measures during fledging period:
    - During the period when chicks are fledging and may leave the colony platform (typically July – mid Aug) they may move to shoreline areas to seek dry perches and there is risk of tern chicks entering the site and adults defending chicks on or close to the site by attacking personnel. The potential loss of chicks through exclusion of adults or through injury on site is apparent and during this period a trained ecologist should be on hand to locate and capture chicks in close proximity to the site and relocate them to suitable safe areas to avoid these issues.





Legend

- Planning application boundary
- Onshore substation boundary (operational)
- Onshore substation fence: heigth 2.5 m on final topo (5 mODM)
- High water mark
- Tern colony 75 m buffer

Mitigation zones

- green
- orange
- red

codling wind park

Project: Codling Wind Park

Contractor: TOBIN

Website: www.tobin.ie

Figure 10.12
Tern construction sequencing and mitigation zones

CWP doc. number: CWP-TOB-ENG-08-01-MAP-1178

Internal descriptive code:

Size: A3

Scale: 1:1,100

CRS: EPSG 2157

Rev.	Updates	Date	By	Chk'd	App'd
00	Final for issue	2024/08/19	SP	DM/EA	ES

700. With regards to disturbance / displacement effects on Black guillemot, a number of other nest sites were located to the east and southeast of the onshore substation. To avoid disturbance of these nesting areas it is proposed to install hoarding / screening around the perimeter of the onshore substation.

Residual effect

701. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-88** below.

Table 10-88 Residual effect on estuarine / Liffey IEFs for impact 2 – disturbance and displacement during construction, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Arctic tern	With the adoption of the mitigation measures the magnitude of effects on Arctic tern will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Arctic tern.	**Not significant**
Black guillemot	With the adoption of the mitigation measures the magnitude of effects on Black guillemot will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Black guillemot.	**Not significant**
Black-headed gull	With the adoption of the mitigation measures the magnitude of effects on Black-headed gull will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Black-headed gull.	**Not significant**
Common tern	With the adoption of the mitigation measures the magnitude of effects on Common tern will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Common tern.	**Not significant**

Onshore – construction impact 3 – introduction / spread of non-native species.

702. There is the potential that INNS could be spread and / or introduced by construction-related activities and that the presence of INNS could result in negative effects to ornithological receptors within the onshore development area. A total of four high risk INNS that are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 were recorded within the onshore development area during field surveys. They included Japanese knotweed, bohemian knotweed (*Fallopia x bohemica*), three-cornered leek (*Allium triquetrum)* and sea buckthorn (*Hippophae rhamnoides*). The introduction or spread of these species into additional habitats in

association with construction phase activities, have the potential to impact on suitable foraging and roosting habitat for IEFs.

Onshore

Impact screening

703. An impact screening conducted to determine if Impact 3 – Introduction / spread of non-native species, within the onshore development area is applicable to each of the identified IEF species listed in **Table 10-16** has been conducted. Each IEF species is examined in Each IEF species is examined in **Table 10-89** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-89 Impact screening of IEF species for impact 3 – introduction / spread of non-native species during construction

IEF species	Potential for impact	Rationale
Greenfinch	**No**	These species have been assessed as not at risk to the introduction / spread of non-native invasive species. The species are not dependent on potentially impacted habitats which maybe degraded by the spread of INNS and / or were not recorded utilising the impacted habitats during onshore survey. Therefore, can be screened out for this impact.
Linnet	**No**	
Peregrine falcon	**No**	
sand martin	**No**	
Light-bellied Brent Goose	**Yes**	This species has been assessed as at risk to the introduction / spread of non-native invasive species. The species is dependent on some of the potentially impacted habitats (grassland) which maybe be subject to degradation due to the potential spread of INNS and were recorded utilising the potentially impacted habitats during bird surveys. **Therefore, can be screened in and the significance of this impact assessed.**

Receptor sensitivity

704. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-90**. The conservation importance of IEF species has been determined in **Table 10-24**, and tolerance to the impact discussed below.

705. The Light-bellied Brent Goose was not found to be dependent on the habitat with the potential to be affected (known as 'Goose Green') by the introduction / spread of INNS during the construction phase. Observations indicate that the species was not recorded regularly foraging or roosting in the potentially impacted area. Similarly, numerous alternative suitable habitats can also be found in close proximity to the potentially impacted habitat. Given these factors, any potential consequences arising from the introduction / spread of INNS during the construction phase within the onshore development area are

expected to be minimal. Therefore, these species are considered to have a high tolerance to this impact.

Table 10-90 Receptor sensitivity of IEF species for impact 3 – introduction / spread of non-native species during construction

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Light-bellied Brent Goose	low	high	low

Magnitude of impact

706. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-91** below along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters and the criteria listed in **Table 10-10**.

Table 10-91 Magnitude of impact on IEF species for impact 3 – introduction / spread of non-native species during construction

IEF species	Magnitude	Rationale
Light-bellied Brent Goose	low	Taking a precautionary approach there is potential for the accidental spread of INNS into this area. The INNS Japanese Knotweed has been recorded in the embankment where landfall works are required and along the route of the onshore export cable. Its potential spread to the grassland to the north of the Irishtown Nature Park, has the potential to form dense stands which is an unusable habitat for this species. Once established this INNS can remain long term and cause adverse effects. Light-bellied Brent Geese have been recorded using the grassland to the north of Irishtown Nature Park (Goose Green). This area is not within the onshore development area and no construction works are required in this area. Therefore, the magnitude for this impact has been assessed as low.

Significance of the effect

707. The receptor sensitivity and magnitude of impact of the screened in IEF species, within the onshore study area, has been determined in **Table 10-89** and **Table 10-90**. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-92** below.

Table 10-92 Significance of the effect for impact 3 – introduction / spread of non-native species for onshore IEF species during construction

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Light-bellied Brent Goose	low	low	In the absence of additional mitigation measures, the sensitivity of Light-bellied Brent Goose in the onshore export cable area is considered to be low and the magnitude the of impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, Not Significant, negative effect** for Light-bellied Brent Goose, which will cause noticeable changes in the character of the environment but without significant consequences.	**Not significant**

Additional mitigation

708. Based on the predicted level of effect, which is not significant in EIA terms, additional mitigation is not required beyond the embedded mitigation described in **Section 10.9**. However, the following additional mitigation will also be implemented during the construction phase of the OTI to further reduce the impact on the potentially affected species.

709. An Onshore Invasive Species Management Plan has been prepared to outline control and management options for Invasive Alien Plant Species (IAPS) identified within the onshore development area boundary. The Onshore Invasive Species Management Plan includes details of:

- Survey observations and photographs illustrating invasive species infestation;
- Control, treatment and management options for each type of invasive species identified; and
- Biosecurity standard operating procedures for personnel and equipment.

710. The Onshore Invasive Species Management Plan will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.

Residual effect

711. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-93** below.

Table 10-93 Residual effect on IEFs for impact 3 – introduction / spread of non-native species during construction, following the adoption of additional mitigation measures.

IEF species	Residual effect	Impact significance in EIA terms
Light-bellied Brent Goose	With the adoption of the additional mitigation measures the magnitude of effect on will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Light-bellied Brent Goose.	**Not Significant**

10.10.3 Operation and maintenance phase

712. The potential environmental impacts arising from the operation and maintenance of the CWP Project are listed in **Table 10-94** along with the parameters against which each operation and maintenance phase impact has been assessed. A description of the potential effect on ornithological receptors caused by each identified impact is given below.

Offshore and intertidal – operation and maintenance: impact 1 – direct effects on habitat

Offshore – array site and OECC (below MLWS)

713. Within the marine environment direct effects which remove or alter areas of habitat principally impact benthic habitats. Such impacts to benthic habitats translate to potential impacts upon seabird receptors as impacts to prey species and are therefore addressed within the assessment of changes in prey availability (**Section 10.10**).

714. Direct effects to sea-surface areas which may be utilised by seabirds for non-foraging behaviours are considered only to relate to the physical footprint of above water infrastructure (i.e., WTG towers and the OSS).

Receptor sensitivity

715. As the marine areas used by seabird species during breeding, non-breeding and migratory periods are large (Woodward et al., 2019; Furness, 2015), the tolerance of species using or passing through the array site or OECC is considered to be very high.

716. All receptors are considered able to:

- Tolerate direct effects on habitats within offshore areas during the operation and maintenance phase of the project such that any potential effects upon reproduction and / or survival rates would be negligible / imperceptible;
- Recover rapidly upon cessation of impacts; and
- Adapt behaviours to usually avoid effects.

717. Seabird receptor importance is assessed as low to very high (**Table 10-94**).

718. When receptor tolerances and importance are considered together to determine overall assessments of receptor sensitivities as per **Table 10-9, Section 10.4**, receptor sensitivities are assessed as **Very**

Low (i.e., Very High Tolerance and Low / Medium Importance) **or Low** (i.e., Very High Tolerance and High / Very High Importance) (**Table 10-94**).

Table 10-94 Assessment of sensitivities of offshore ornithological receptors

Species	Conservation importance	Tolerance	Receptor sensitivity
Common scoter	high	very high	low
Kittiwake	very high		low
Black-headed gull	high		low
Little gull	high		low
Great black-backed gull	medium		very low
Common gull	high		low
Herring gull	high		low
Lesser black-backed gull	high		low
Sandwich tern	low		very low
Roseate tern	high		low
Common tern	high		low
Arctic tern	high		low
Little tern	low		very low
Guillemot	high		low
Razorbill	very high		low
Black guillemot	low		very low
Puffin	very high		low
Red-throated diver	high		low
Great northern diver	high		low
Fulmar	high		low
Manx shearwater	high		low
Gannet	high		low
Cormorant	medium		very low
Shag	high		low

Impact magnitude

719. Relative to the spatial extent of habitats used by breeding and non-breeding seabirds, the sea surface footprint of operation and maintenance phase activities is negligible.

720. As the operation and maintenance phase progresses through its planned duration of approximately 25 years, the above sea level spatial extent of infrastructure will remain at a maximum of less than 0.005 km^2 within the array site (i.e., combined sea level area of all turbines and OSSs), and no above water infrastructure will have been installed within the OECC. Minimal maintenance is anticipated to be carried out within the OECC during the operation and maintenance phase, representing a very limited spatial range relative to those used by potentially impacted seabird populations.

721. Due to the limited extent of sea level footprint occupied by infrastructure in relation to the spatial extent of habitats used by breeding and non-breeding seabirds, predicted impacts associated with direct effects on habitat are considered to be of very low consequence to all affected populations, and therefore magnitude of impact assessed as negligible for all receptors.

Significance of the effect

722. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be Very Low or Low and impact magnitude is assessed to be negligible, the potential effect of direct effects on habitat within the array site and OECC, during the operation and maintenance phase is considered to be **Imperceptible**, and **Not Significant** in EIA terms (**Table 10-95**).

Table 10-95 Determination of receptor sensitivity by consideration of conservation importance and tolerance to direct effects on habitat during the operation and maintenance phase

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Kittiwake	low		**Imperceptible**	**Not Significant**
Black-headed gull	low		**Imperceptible**	**Not Significant**
Little gull	low		**Imperceptible**	**Not Significant**
Great black-backed gull	very low		**Imperceptible**	**Not Significant**
Common gull	low		**Imperceptible**	**Not Significant**
Herring gull	low		**Imperceptible**	**Not Significant**
Lesser black-backed gull	low		**Imperceptible**	**Not Significant**
Sandwich tern	very low		**Imperceptible**	**Not Significant**
Roseate tern	low		**Imperceptible**	**Not Significant**
Common tern	low		**Imperceptible**	**Not Significant**
Arctic tern	low		**Imperceptible**	**Not Significant**
Little tern	very low		**Imperceptible**	**Not Significant**
Guillemot	low		**Imperceptible**	**Not Significant**
Razorbill	low		**Imperceptible**	**Not Significant**
Black guillemot	very low		**Imperceptible**	**Not Significant**
Puffin	low		**Imperceptible**	**Not Significant**
Red-throated diver	low		**Imperceptible**	**Not Significant**
Great northern diver	low		**Imperceptible**	**Not Significant**
Fulmar	low		**Imperceptible**	**Not Significant**
Manx shearwater	low		**Imperceptible**	**Not Significant**
Gannet	low		**Imperceptible**	**Not Significant**
Cormorant	very low		**Imperceptible**	**Not Significant**
Shag	low		**Imperceptible**	**Not Significant**

Additional mitigation

723. As the impacts associated with Direct Effects on Habitat during operation and maintenance phase activities within the array site and OECC are assessed to be **Imperceptible**, and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

724. As no additional measures are required to mitigate Direct Effects on Habitat during operation and maintenance phase activities within the array site and OECC, the residual effect is assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

725. Direct effects on intertidal habitat may arise as a consequence of activities which temporarily alter areas of intertidal habitat. Any such impacts to intertidal habitats are directly related to potential impacts upon ornithological receptors via effects on prey species. These are addressed within the assessment of changes in prey availability (**Section 10.10.3**: **Operation and Maintenance: Changes in prey availability – Intertidal**).

726. Direct effects to intertidal areas which may be utilised by ornithological receptors for non-foraging behaviours (such as roosting, loafing or maintenance behaviours) are considered only to relate to the physical footprint of any equipment or associated excavation activities required as part of maintenance on the buried export cable as it approaches the landfall location via the intertidal zone.

Impact screening

727. Impact screening for operational phase direct effects on habitat to ornithological receptors within intertidal areas is considered to be as per that outlined for the equivalent impact during the construction phase. The species screened in for assessment are as per those listed in **Receptor sensitivity** in section **Construction: Direct Effects on Habitat – Intertidal**, above.

Receptor sensitivity

728. The relative spatial extent of habitats within South Dublin Bay which are available to intertidal waterbirds for non-foraging behaviours is large (See **Section 10.10.3 Operation and Maintenance phase – Intertidal – Magnitude of impact**, below), and maintenance activities on passive buried infrastructure are expected to be infrequent and localised.

729. In all cases, receptors are therefore considered likely to be able to adapt behaviours to avoid these temporary, localised impacts and have the capacity to occupy those areas shortly after cessation of any maintenance activities, such that any effects upon reproduction or survival rates of regional populations would be negligible / imperceptible. The tolerance of all receptors to direct effects on habitat in intertidal areas during the operation and maintenance is therefore considered to be very high (**Table 10-8**).

730. The receptor importance of species occurring within intertidal areas are assessed as low to very high (**Table 10-96**).

731. When receptor tolerances and importance are considered together in **Table 10-96**, to determine overall assessments of receptor sensitivities as per **Table 10-11**, **Section 10.4**, receptor sensitivities are assessed as very low (i.e., very high tolerance and low / medium importance) or low (i.e., very high tolerance and high / very high importance).

Table 10-96 Assessment of sensitivities of receptors utilising intertidal habitat within South Dublin Bay

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	very high	low
Shelduck	medium		very low
Shoveler	medium		very low
Pintail	medium		very low
Teal	medium		very low
Common scoter	high		low
red-breasted merganser	low		very low
Red-throated diver	high		high
Great crested grebe	low		very low
Grey heron	low		very low
Little egret	low		very low
Oystercatcher	very high		low
Golden plover	high		low
Grey plover	high		low
Ringed plover	high		low
Curlew	high		low
Bar-tailed godwit	very high		low
Black-tailed godwit	high		low
Turnstone	medium		very low
Knot	very high		low
Sanderling	high		low
Dunlin	very high		low
Redshank	very high		low
Greenshank	low		very low
Black-headed gull	high		low
Shag	high		low
Mediterranean gull	medium		very low
Common gull	high		low
Great black-backed gull	medium		very low
Herring gull	high		low

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Lesser black-backed gull	high		low
Black guillemot	low		very low
Sandwich tern	low		very low
Common tern	high		low
Arctic tern	high		low
Roseate tern	high		low
Wetland habitats	very high		low

732. In addition to ornithological receptors, impacts to wetland habitat within the South Dublin Bay area are also considered. 'Wetland and waterbirds' [A999] is a feature of the South Dublin Bay and River Tolka Estuary SPA. This feature comprises the wetland habitats that support waterbirds within the SPA and is therefore considered as part of the ornithological assessment.

733. As intertidal habitats which support ornithological receptors are a designated feature of the South Dublin Bay and River Tolka Estuary SPA, the conservation importance of this feature is considered to be very high.

734. As intertidal habitats will recover rapidly after any operational phase maintenance activities within the intertidal area, to function again as areas to support non-foraging behaviours for ornithological receptors, the tolerance of this feature is considered to be very high.

735. When the conservation importance and tolerance of this feature are considered together to determine an overall assessment of receptor sensitivity (as per **Table 10-11**), receptor sensitivity is assessed as low.

Magnitude of impact

736. When considering the PA and AAM scenarios representing the maximum possible 'spread' of OECs buried within the intertidal zone), it is considered that neither scenario would represent a greater potential magnitude of impact than the other. This is due to the highly localised spatial extent and limited temporal duration and frequency of any potential maintenance works.

737. Although the AAM scenario may allow for maintenance works to take place in locations that the PA scenario would not, the relative spatial extent of remaining intertidal habitat available to waterbirds (there are 21.40 km^2 of intertidal habitat within the South Dublin Bay and Tolka Estuary SPA) would remain the same.

738. The magnitude of direct effects on habitat within the intertidal zone during the operation and maintenance phase to ornithological receptors is assessed as negligible for all features.

Significance of the effect

739. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be very low or low and impact magnitude is assessed to be negligible, the potential effect of direct effects on habitat within intertidal areas during the operation and maintenance phase is considered to be **Imperceptible** and **Not Significant** in EIA terms for both the PA and AAM scenarios (as shown in **Table 10-97**, below).

Table 10-97 Significance of the effects of direct effects on habitat to intertidal waterbirds during the construction phase

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Light-bellied Brent Goose	low	negligible	**Imperceptible**	**Not Significant**
Shelduck	very low	negligible	**Imperceptible**	**Not Significant**
Shoveler	very low	negligible	**Imperceptible**	**Not Significant**
Pintail	very low	negligible	**Imperceptible**	**Not Significant**
Teal	very low	negligible	**Imperceptible**	**Not Significant**
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	very low	negligible	**Imperceptible**	**Not Significant**
Great crested grebe	very low	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	very low	negligible	**Imperceptible**	**Not Significant**
Golden plover	very low	negligible	**Imperceptible**	**Not Significant**
Grey plover	very low	negligible	**Imperceptible**	**Not Significant**
Ringed plover	low	negligible	**Imperceptible**	**Not Significant**
Curlew	low	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Black-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Turnstone	low	negligible	**Imperceptible**	**Not Significant**
Knot	low	negligible	**Imperceptible**	**Not Significant**
Sanderling	low	negligible	**Imperceptible**	**Not Significant**
Dunlin	very low	negligible	**Imperceptible**	**Not Significant**
Redshank	low	negligible	**Imperceptible**	**Not Significant**
Greenshank	low	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	low	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Common gull	low	negligible	**Imperceptible**	**Not Significant**
Herring gull	low	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Common tern	low	negligible	**Imperceptible**	**Not Significant**

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Arctic tern	very low	negligible	**Imperceptible**	**Not Significant**
Roseate tern	low	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	low	negligible	**Imperceptible**	**Not Significant**
Black guillemot	very low	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	very low	negligible	**Imperceptible**	**Not Significant**
Shag	low	negligible	**Imperceptible**	**Not Significant**
Grey heron	low	negligible	**Imperceptible**	**Not Significant**
Little egret	low	negligible	**Imperceptible**	**Not Significant**
Wetland habitats	low	negligible	**Imperceptible**	**Not Significant**

740. The magnitude the of impact for all species is assessed as negligible. Therefore (as per the matrix in **Table 10-10**), any effects on intertidal ornithology as a result of temporary direct habitat loss is predicted to be **Imperceptible** and **Not Significant** for all species assessed in EIA terms. Where flexibility in the proposed design exists, there is **no other scenario which would lead to a more significant effect**.

741. Based on the predicted level of effect it is concluded that no additional mitigation is required beyond the primary mitigation described in **Section 10.9**.

Additional mitigation

742. As the impacts associated with Direct Effects on Habitat during operation and maintenance phase activities within intertidal areas are assessed to be **Imperceptible**, and **Not Significant** in EIA terms. No additional mitigation is necessary.

Residual effect

743. As no additional measures are required to mitigate Direct Effects on Habitat during operation and maintenance phase activities within intertidal areas, the residual effect is assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Offshore and intertidal – operation and maintenance: impact 2 – disturbance and displacement

Offshore – array site and OECC (below MLWS)

744. The presence of WTGs, OSSs and associated operational phase vessel activities within the array site has the potential to disturb and displace birds which would otherwise either:

- Directly utilise areas where the CWP array site is to be developed; or
- Pass through areas where the CWP array site is to be developed.

745. The displacement of individuals which would otherwise potentially utilise sea areas within or around the array site effectively equates to indirect habitat loss for those individuals. The displacement of

individuals which would otherwise potentially fly through areas within or around the array site effectively equates to a barrier to the movement (barrier effects) of those individuals.

746. Indirect habitat loss as a consequence of displacement reduces the potential spatial extent available to impacted ornithology receptors. Ornithology receptors utilising such areas of marine habitat are, by definition, seabird species, and this distributional response does not apply to migratory non-seabird species (which do not utilise marine habitats other than to overfly during migratory passage). Reductions in the areas available for seabirds to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

747. Barrier effects result in individuals altering flight pathways, which may increase energetic demands upon individuals where routes are altered to deviate around WTG arrays. This distributional response applies to both seabird species and migratory non-seabird species. Such increased energetic consequences may result in changes to key demographic rates (specifically reductions in productivity, or survival rates), which in turn may negatively impact populations. Increased energetic consequences may arise in relation to infrequent annual migration movements of migratory species, or more frequent movements of seabirds which utilise the array site and its vicinity to undertake key non-migratory behaviours (for example foraging by breeding seabirds).

Impact screening

Array site

748. Seabird species vary in their distributional responses to WTGs and operational phase vessel activity. The following studies, which have been widely applied in OWF EIAs, are referenced to characterise species-specific responses for the purpose of impact screening:

- Garthe and Hüppop (2004) – Initial scoring system for factors considered to contribute to species disturbance responses.
- Furness and Wade (2012) – For seabirds in Scottish waters, considers disturbance response ratings to wind farm structures and associated operational phase maintenance traffic alongside scores for habitat use flexibility and conservation importance.
- Bradbury et al., (2014) - Updates Furness and Wade (2012) to consider seabirds in English waters.
- Dierschke et al., (2016) – Meta-analysis of published avoidance or attraction responses by species in response to OWFs.
- Camphuysen, 1995; Hüppop and Wurm, 2000 – Attraction of particular species groups to vessels – specifically fulmar and gull species.

749. In addition to specific seabird species sensitivities to disturbance and displacement, the extent to which species utilise the array site and its surroundings is considered.

750. Seabird species which are insensitive to disturbance and displacement effects and / or make minimal use of areas within or surrounding the array site (i.e., where maximum mean peak bio-seasonal densities recorded within the array site or surrounding buffer are considered to be low or very low – i.e., <0.5 individuals per km^2) are not considered to be at risk of indirect habitat loss impacts above a significance level of imperceptible and therefore are not considered further in assessment in relation to such impacts from operation and maintenance phase activities within the array site.

Table 10-98 Screening of seabird species within CWP for risk of disturbance and displacement during operation

Species	Sensitivity to displacement (operational)	Maximum bio-season mean peak density (birds/km sq). Array Site + 2 km buffer (4 km buffer for divers)	Screened in or out
Kittiwake	very low	5.936 (high)	Out
Common gull	very low	0.231 (low)	Out
Black-headed gull	very low	0.051 (very low)	Out
Little gull	very low	0.255 (low)	Out
Great black-backed gull	very low	0.291 (low)	Out
Herring gull	very low	1.231 (medium)	Out
Lesser black-backed gull	very low	0.040 (very low)	Out
Roseate tern	very low	0.013 (very low)	Out
Common tern	very low	2.922 (medium)	Out
Arctic tern	very low	1.126 (medium)	Out
Sandwich tern	very low	0.035 (very low)	Out
Little tern	very low	0.025 (very low)	Out
Guillemot	medium	58.100 (very high)	In
Razorbill	medium	18.990 (very high)	In
Black guillemot	medium	0.076 (very low)	Out
Puffin	medium	0.408 (low)	In
Red-throated diver	high	0.577 (medium)	In
Great northern diver	high	0.051 (very low)	Out
Fulmar	very low	0.114 (low)	Out
Manx shearwater	medium	4.900 (medium)	In
Gannet	low to medium	0.457 (low)	In
Cormorant	low	0.055 (very low)	Out
Shag	low	0.190 (low)	Out

751. In relation to barrier effects to seabird species, only those species which demonstrate avoidance of offshore WTGs and would otherwise utilise or pass through the array site, i.e., those species screened in within **Table 10-98**, are considered susceptible and considered in subsequent assessment. As all other seabird species are either insensitive to operational phase displacement effects (i.e., do not demonstrate avoidance of offshore WTGs) or occur within the vicinity of the array site only in very low numbers (**Table 10-26**, **Section 10.7**), these species are screened out for further consideration in relation to barrier effects.

752. Should migrating non-seabirds fly around the array site rather than through it, those individuals may experience barrier effects associated with that single transit of the CWP Project. Although evidence demonstrating non-seabird migrant avoidance of offshore wind turbine array sites is limited, an assessment using Aumüller et al., 2013 has been undertaken for all on the conservative assumption that all migratory species do change their flight pathways in response to the presence of offshore WTGs and thus non-seabird migrant receptors are collectively screened in for further assessment in relation to barrier effects.

OECC

753. Potential for disturbance and displacement within the OECC during the operational phase of the project is limited to works associated with routine monitoring activity and potential maintenance or repair events over the operational lifetime of the project (**Section 10.8**).

754. Seabird species screened out in relation to disturbance and displacement impacts associated with construction phase activities within the OECC (**Table 10-38**), are also screened out in relation to potential operation and maintenance phase activities within the OECC.

755. As such, the following species are screened in in relation to potential operation and maintenance phase activities within the OECC:

- Guillemot;
- Razorbill;
- Puffin;
- Black guillemot;
- Red-throated diver;
- Great northern diver;
- Cormorant;
- Shag; and,
- Common scoter

Receptor sensitivity

Array site

Seabird species

Guillemot

756. On the basis of scientific literature (Bradbury et al., 2014; Dierschke et al., 2016; Garthe and Hüppop, 2004; Fliessbach et al., 2019) Guillemot are considered to have moderate inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

757. Although there is growing evidence of habituation to the presence of OWF infrastructure for this species (Vallejo et al., 2017, Trinder, 2021 and Trinder, 2023), the ubiquity of such responses remains to be demonstrated.

758. Guillemot forage over large areas during breeding (mean maximum foraging range + 1 SD = 153.7 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), but peak densities of Guillemot recorded within the array site and surrounding 2 km buffer area are considered to be very high. This indicates that although the location of potential disturbance and displacement inducing activities and infrastructure may correspond with areas of high importance to Guillemot, the receptor may have some ability to avoid such impacts due to the large spatial extent of its habitat use.

759. The tolerance of Guillemot to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be medium.

760. The conservation importance of Guillemot is assessed to be high (**Table 10-21**).

761. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Razorbill

762. On the basis of scientific literature (Bradbury et al., 2014; Dierschke et al., 2016; Garthe and Hüppop, 2004; Fliessbach et al., 2019) Razorbill are considered to have moderate inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

763. Although there is growing evidence of habituation to the presence of OWF infrastructure for this species (Vallejo et al., 2017, Trinder, 2021 and Trinder, 2023), the ubiquity of such responses remains to be demonstrated.

764. Razorbill forage over large areas during breeding (mean maximum foraging range + 1 SD = 164.6 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), but peak densities of Razorbill recorded within the array site and surrounding 2 km buffer area are considered to be very high. This indicates that although the location of potential disturbance and displacement inducing activities and infrastructure may correspond with areas of high importance to Razorbill, the receptor may have some ability to avoid such impacts due to the large spatial extent of its habitat use.

765. The tolerance of Razorbill to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be medium.

766. The conservation importance of Razorbill is assessed to be very high (**Table 10-21**).

767. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and very high importance).

Puffin

768. On the basis of scientific literature (Bradbury et al., 2014; Garthe and Hüppop, 2004) Puffin are considered to have moderately low inherent susceptibility to disturbance and displacement impacts in relation to vessel activity and the presence of OWF infrastructure.

769. Habituation to the presence of OWF infrastructure has not been documented for this receptor.

770. Puffin forage over large areas during breeding (mean maximum foraging range + 1 SD = 265.4 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), and peak densities of Puffin recorded within the array site and surrounding 2 km buffer area are considered to be low. This indicates that the location of potential disturbance and displacement inducing activities and infrastructure is unlikely to correspond with areas of high importance to Puffin and therefore that the receptor has considerable ability to avoid such impacts.

771. The tolerance of Puffin to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be high.

772. The conservation importance of Puffin is assessed to be very high (**Table 10-21**).

773. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as medium (i.e., high tolerance and very high importance).

Red-throated diver

774. On the basis of scientific literature (Garthe and Hüppop, 2004; Schwemmer et al., 2011; Furness and Wade 2012; Furness et al., 2013; Bradbury et al., 2014; Dierschke et al., 2016; Fliessbach et al., 2019;

Jarrett et al., 2022) Red-throated diver are considered to be highly or very highly susceptible to disturbance and displacement impacts in relation to vessel activity and widely recognised among seabird species as being particularly sensitive the presence of WTGs.

775. This receptor is assessed as having very limited ability to adapt behaviours or habitat use areas to avoid disturbance and displacement in relation to construction phase activities and infrastructure in the array site and may experience survival or productivity consequences resultant from potential displacement. Furthermore, non-habituation to the presence of vessel traffic (i.e., avoidance of regularly used shipping lanes – i.e., Burger et al., 2019) has been documented for this receptor.

776. Although peak densities of peak densities of Red-throated diver recorded within this area are relatively moderate, regional populations of this species are relatively low and, as such, the location of potential disturbance and displacement inducing activities and infrastructure may correspond with areas of high importance to Red-throated diver such that the receptor has limited ability to avoid such impacts.

777. The tolerance of Red-throated diver to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be low.

778. The conservation importance of Red-throated diver is assessed to be high (**Table 10-21**).

779. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as high (i.e., low tolerance and high importance).

<u>Manx shearwater</u>

780. Manx shearwater are considered to be relatively insusceptible to disturbance and displacement impacts in relation to vessel activity (Furness and Wade, 2012), but their likelihood of spatial response to the presence of WTG infrastructure is less well understood. Dierschke et al. (2016) classified the species' avoidance response to wind farms as weak, however noted indications of macro-avoidance of turbines from monitoring of the Robin Rigg OWF in the Solway Firth (Canning et al., 2013 a & b) and the instance of an apparent gap in distribution around another OWF within the Irish Sea (North Hoyle OWF).

781. Habituation to the presence of OWF infrastructure has not been documented for this receptor.

782. Manx shearwater forage over extremely large areas during breeding (mean maximum foraging range + 1 SD = 2,365.5 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), and peak densities of Manx shearwater recorded within the array site and surrounding 2 km buffer area are considered to be moderate. This indicates that the location of potential disturbance and displacement inducing activities and infrastructure is unlikely to correspond with areas of high importance to Manx shearwater and therefore that the receptor has considerable ability to avoid such impacts.

783. The tolerance of Manx shearwater to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be high.

784. The conservation importance of Manx shearwater is assessed to be high (**Table 10-21**).

785. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

<u>Gannet</u>

786. Gannet are considered to be relatively insusceptible to disturbance and displacement impacts in relation to vessel activity (Garthe and Hüppop, 2004; Fliessbach et al., 2019), but consistently have been demonstrated to completely or entirely avoid entering operational windfarms (Peschko et al., 2021, Trinder, 2023), and non-habituation to the presence of installed infrastructure has been documented (i.e., Vallejo et al., 2017; Trinder, 2021; Trinder, 2023).

787. Gannet forage over very large areas during breeding (mean maximum foraging range + 1 SD = 509.4 km, Woodward et al., 2019) and non-breeding periods (Furness, 2015), and peak densities of Gannet

recorded within the array site and surrounding 2 km buffer area are considered to be low. This indicates that the location of potential disturbance and displacement inducing activities and infrastructure is unlikely to correspond with areas of high importance to Gannet and therefore that the receptor has some ability to avoid such impacts.

788. The tolerance of Gannet to operation and maintenance phase disturbance and displacement impacts within the array site and surrounding area is therefore assessed to be medium.

789. The conservation importance of Gannet is assessed to be high (**Table 10-21**).

790. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Migratory species

791. Migratory species are considered to have very high tolerance to barrier effects associated with infrastructure within the array site during the operation and maintenance phase as:

- Migratory movements occur across broad geographic fronts, of which the project turbine array occupies a very small proportion. As such, the large majority of migrants will avoid impacts entirely, while those individuals which would otherwise pass through the array site may generally avoid doing so (should they choose to do so), though subtle alterations to flight trajectories or altitudes. Such changes (if any) to migratory flight paths may, at most, increase migratory energetic costs only negligibly and in such a way as to have no noticeable effect upon survival rates or future reproductive outputs (Masden et al., 2009).

792. Migratory species' receptor importances are assessed as low to very high (**Table 10-23**).

793. When receptor tolerances and importances are considered together to determine overall assessments of receptor sensitivities as per **Table 10-9**, receptor sensitivities are assessed as very low (i.e., very high tolerance and low / medium importance) or low (i.e., very high tolerance and high / very high importance) (**Table 10-99**).

Table 10-99 Determination of receptor sensitivity by consideration of conservation importance and tolerance to offshore disturbance and displacement effects during the operation and maintenance phase

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	very high	low
Greenland white-fronted Goose	medium		very low
Bewick's Swan	medium		very low
Whooper Swan	low		very low
Shelduck	medium		very low
Shoveler	medium		very low
Wigeon	low		very low
Mallard	low		very low
Pintail	medium		very low
Teal	medium		very low
Pochard	medium		very low

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Tufted Duck	low		very low
Scaup	medium		very low
Eider	medium		very low
Common scoter	high		low
Goldeneye	medium		very low
red-breasted merganser	low		very low
Corncrake	medium		very low
Great crested grebe	low		very low
Oystercatcher	very high		low
Lapwing	medium		very low
Golden plover	high		low
Grey plover	high		low
Ringed plover	high		low
Curlew	high		low
Bar-tailed godwit	very high		low
Black-tailed godwit	high		low
Turnstone	medium		very low
Knot	very high		low
Sanderling	high		low
Dunlin	very high		low
Snipe	medium		very low
Redshank	very high		low
Greenshank	low		very low
Red-throated diver	high		low
Great northern diver	high		low
Hen harrier	medium		very low
Merlin	medium		very low
All other migratory species	very low		very low

OECC

794. Receptor sensitivities to disturbance and displacement from operation and maintenance phase activities within the OECC are considered to be as per during the construction phase, as summarised in **Table 10-100**.

Table 10-100 Receptor sensitivities to disturbance and displacement from operational phase activities within the OECC

Species	Receptor sensitivity
Guillemot	medium
Razorbill	medium
Puffin	medium
Red-throated diver	high
Black guillemot	low
Great northern diver	medium
Cormorant	medium
Shag	medium
Common scoter	medium

Magnitude of impact

Array site

Indirect habitat loss and barrier effects to seabird species

795. Indirect habitat loss and barrier effect are considered collectively through application of displacement matrices – consistent with SNCB (2017) guidance.

796. The area of the array site is 125.12 km^2. For the majority of receptors potential disturbance and displacement is considered to occur within the array site and a 2 km surrounding buffer, which equates to a total area of 229.61 km^2. For the most sensitive receptors displacement is quantified in relation to the array site and a 4 km surrounding buffer, which equates to a total area of 358.63 km^2.

<u>Auk species</u>

797. Auk species, which for the purpose of this assessment are taken to include Guillemot, Razorbill and Puffin, are broadly considered to be moderately sensitive to disturbance and potential associated displacement resultant from vessel traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; Bradbury et al., 2014).

798. Although behavioural responses by auks to operational OWFs is varied, a general tendency to avoid WTG array sites has been noted. For example, in a review of displacement response studies from 12 European OWF sites which compare pre-construction baseline abundances with abundances from post-construction monitoring, Dierschke et al., 2016, note operational phase auk displacement rates ranging from 0% to 95%.

799. Variability in auk displacement response estimates between studies is likely a consequence of differing conditions between studies. These would include differences in baseline characterisation methods such as survey platform and programme duration and timings, as well as site conditions such as proximity to breeding colonies and array design. Where study conditions are different from conditions at CWP, those studies are less informative about potential displacement responses than for sites which are more directly comparable. For example, the high auk displacement rates reported in studies of OWFs outside UK and Irish waters (Bligh Bank, Thorntonbank, Prinses Amalia and Alpha Ventus – 55% to 75% displacement) and which have considerably smaller footprint sizes (<17 km^2), are

therefore not appropriate for consideration in relation to CWP, considering that their site configurations and ecology are not comparable to the location and configuration of the CWP array site.

800. Following reinterpretation of evidence considered by Dierschke et al., (2016), MacArthur Green (2019) determined appropriate displacement rates for Guillemot and Razorbill for Norfolk Vanguard OWF in the English Southern North Sea to be 50% from within the array site and 30% from a surrounding 1 km buffer.

801. Therefore, applying a single displacement rate across all bio-seasons of 50% within the CWP array site and out to a 2 km buffer would ensure a precautionary rate is used for the assessment of displacement.

802. Further evidence that an auk displacement rate of 50% is precautionary comes from studies that indicate auk habituation to OWFs. This was demonstrated at Thanet OWF in the English southern North Sea, where auk displacement was shown to be statistically significant, but only in the short term, with abundances increasing within the wind farm from year two post-construction suggesting some level of habituation after one year of operation. Indeed, year two and three displacement rates for auks fell from a range of 75% to 85% in the first year of operation to a low of 31% to 41% within year two and three of operations (Royal Haskoning, 2013). There is also further emerging evidence as additional post-construction monitoring of OWFs continues, with reports of auk numbers increasing and observations of foraging behaviour within the wind farm itself (Leopold & Verdaat 2018).

803. Therefore, in conclusion, there is good evidence to support an auk displacement rate of 50% within OWF array sites and out to a 2 km buffer, which would still be considered as precautionary.

804. For the purpose of this assessment, an evidence-led displacement and mortality rate of 50% and one % respectively was applied to each bio-season based on evaluation of the published literature and in line with values used by other OWF displacement assessments. Additional consideration is provided by reference to UK SNCBs preferred method of assessing potential impacts from displacement using a range of between 30% to 70% displacement and between 1% and 5% mortality rates.

805. However, it should be noted that due to the large expanse of available habitat outside of the array site, the mortality rate due to displacement could be as low as zero %, as the increase in density outside of the array site in comparison to the whole of the western Irish sea and UK Western Waters BDMPS region would be negligible.

806. A complete range of displacement matrices for all auk species for each of their relevant bio-seasons are presented in **Appendix 10.4 Offshore Ornithology Displacement**, whilst determination of impact magnitude for each species, using a 50% displacement rate and a 1% mortality rate is presented below.

<u>Guillemot</u>

807. For guillemot the annual estimated mortality rate as a consequence of displacement impacts from the array site and surrounding 2 km buffer is 84.82 birds. In **Table 10-101** this is presented as constituent estimated mortalities within relevant bio-seasons and magnitude of impact is estimated by calculating proportional increase in baseline mortality within each bio-season and annually with respect to regional and wider biogeographic populations. Regional and biogeographic baseline estimates are derived using overall baseline mortality rates calculated from age specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-101 Estimated bio-seasonal and annual changes in baseline mortality to guillemot from disturbance and displacement impacts

Bio-season (months)	Seasonal abundance (mean peak within array site plus 2 km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of individuals subject to mortality	Increase in baseline mortality (%)
		Population	Baseline mortality		
Breeding (Mar - Jul)	3,623.79	Method 1: 915,761	124,544	18.119 (10.871 – 126.833)	0.015 (0.009 – 0.102)
		Method 2: 319,052	43,391		0.042 (0.025 – 0.292)
Non-breeding (Aug - Feb)	13,340.164	1,567,398	213,166	66.701 (20.020 – 466.906)	0.031 (0.009 – 0.219)
Annual (BDMPS)	16,963.954	1,567,398	213,166	84.82 (30.891 – 593.739)	0.040 (0.014 – 0.279)
Annual (Biogeographic)	16,963.954	4,125,000	561,000		0.015 (0.006 – 0.106)

808. During the breeding bio-season, the mean peak abundance of Guillemot within the array site plus 2 km buffer is estimated to be 3,623.79 individuals. On the basis of displacement and mortality rates of 50% and one %, respectively, this equates to a predicted displacement mortality of 18.119 individuals.

809. The breeding season Guillemot regional baseline population is estimated to be 915,761 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 319,052 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

810. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (13.6%), the total number of regional Guillemot mortalities during each breeding season is estimated to be 124,544 individuals (using breeding season regional population estimation Method 1), or 43,391 individuals (using breeding season regional population estimation Method 2).

811. Additional mortality of 18.119 individuals, would therefore increase regional bio-seasonal mortality by 0.015 or 0.042% from baseline for breeding season regional population estimation Methods 1 and 2, respectively.

812. This level of impact during the breeding bio-season is considered to be of negligible magnitude.

813. During the non-breeding bio-season, the mean peak abundance of Guillemot within the array site plus 2 km buffer is estimated to be 13,340.164 individuals. On the basis of displacement and mortality rates of 50% one and one %, respectively, this equates to a predicted displacement mortality of 66.701 individuals. The non-breeding season Guillemot regional baseline population is estimated to be 1,567,398 individuals, and associated baseline mortality to be 213,166 individuals (from an average mortality rate of 13.6% – **Table 10-15**). Additional mortality of 66.701 individuals, would therefore increase regional bio-seasonal mortality by 0.031% from baseline.

814. This level of impact during the non-breeding bio-season is considered to be of negligible magnitude.

815. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 2 km buffer is 84.82 individuals. Using the largest regional bio-season population of 1,567,398 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 13.6% (**Table 10-15**), the predicted regional mortality across all seasons is estimated to be 213,166 individuals. Additional mortality of 84.82 individuals, would therefore increase regional annual mortality by 0.040% from baseline.

816. Similarly, for the estimated biogeographic population of 4,125,000 individuals (**Table 10-14**), using an average mortality rate of 13.6%, the predicted biogeographic mortality across all seasons is estimated to be 561,000 individuals. Additional mortality of 84.82 individuals, would therefore increase biogeographic annual mortality by 0.015% from baseline.

817. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude.

818. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Razorbill

819. For Razorbill the annual estimated mortality rate as a consequence of displacement impacts from the array site and surrounding 2 km buffer is 30.422 birds. In **Table 10-102** this is presented as constituent estimated mortalities within relevant bio-seasons and magnitude of impact is estimated by calculating proportional increase in baseline mortality within each bio-season and annually with respect to regional

and wider biogeographic populations. Regional and biogeographic baseline estimates are derived using overall baseline mortality rates calculated from age specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-102 Estimated bio-seasonal and annual changes in baseline mortality to Razorbill from disturbance and displacement impacts

Bio-season (months)	Seasonal abundance (mean peak within array site plus 2 km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of individuals subject to mortality	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return migration (Jan - Mar)	409.13	642,680	82,906	2.046 (1.227 – 14.320)	0.002 (0.001 – 0.017)
Migration-free breeding (Apr - Jul)	674.582	Method 1: 320,632	41,361	3.373 (2.024 – 23.610)	0.008 (0.005 – 0.057)
		Method 2: 38,462	4,962		0.068 (0.041 – 0.476)
Post-breeding migration (Aug - Oct)	4,360.134	642,680	82,906	21.801 (13.080 – 152.605)	0.026 (0.016 – 0.184)
Migration-free winter (Nov - Dec)	640.381	377,188	48,657	3.202 (1.921 – 22.413)	0.007 (0.004 – 0.046)
Annual (BDMPS)	6,084.227	642,680	82,906	30.422 (18.252 – 212.948)	0.037 (0.022 – 0.257)
Annual (Biogeographic)	6,084.227	1,707,000	220,203		0.014 (0.008 – 0.097)

820. During the return migration bio-season, the mean peak abundance of Razorbill within the array site plus 2 km buffer is estimated to be 409.13 individuals. On the basis of displacement and mortality rates of 50% and one %, respectively, this equates to a predicted displacement mortality of 2.046 individuals. The return migration bio-season Razorbill regional baseline population is estimated to be 642,680 individuals, and established baseline mortality to be 82,906 individuals (from an average mortality rate of 12.9% – **Table 10-15**). Additional mortality of 2.046 individuals, would therefore increase regional bio-seasonal mortality by 0.002% from baseline.

821. This level of impact during the return migration bio-season is considered to be of negligible magnitude.

822. The migration-free breeding season Razorbill regional baseline population is estimated to be 320,632 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 38,462 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

823. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (12.9%), the total number of regional baseline Razorbill mortalities during each migration-free breeding season is estimated to be 41,361 individuals (using breeding season regional population estimation Method 1), or 4,962 individuals (using breeding season regional population estimation Method 2).

824. Additional mortality of 3.373 individuals, would therefore increase regional bio-seasonal mortality by 0.008 or 0.068% from baseline for migration-free breeding season regional population estimation Methods 1 and 2, respectively.

825. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude.

826. During the post-breeding migration bio-season, the mean peak abundance of Razorbill within the array site plus 2 km buffer is estimated to be 4,360.134 individuals. On the basis of displacement and mortality rates of 50% and one %, respectively, this equates to a predicted displacement mortality of 21.801 individuals. The post-breeding migration bio-season Razorbill regional baseline population is estimated to be 642,680 individuals, and associated baseline mortality to be 82,906 individuals (from an average mortality rate of 12.9% – **Table 10-15**). Additional mortality of 21.801 individuals, would therefore increase regional bio-seasonal mortality by 0.026% from baseline.

827. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude.

828. During the migration-free non-breeding bio-season, the mean peak abundance of Razorbill within the array site plus 2 km buffer is estimated to be 640.381 individuals. On the basis of displacement and mortality rates of 50% and 1%, respectively, this equates to a predicted displacement mortality of 3.202 individuals. The migration-free non-breeding bio-season Razorbill regional baseline population is estimated to be 377,188 individuals, and established baseline mortality to be 48,657 individuals (from an average mortality rate of 12.9% – **Table 10-15**). Additional mortality of 3.202 individuals, would therefore increase regional bio-seasonal mortality by 0.007% from baseline.

829. This level of impact during the migration-free non-breeding bio-season is considered to be of negligible magnitude.

830. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 2 km buffer is 30.422 individuals. Using the largest regional bio-season population of 642,680 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 12.9% (**Table 10-102**), the predicted regional mortality across all

seasons is estimated to be 82,906 individuals. Additional mortality of 30.422 individuals, would therefore increase regional annual mortality by 0.037% from baseline.

831. Similarly, for the estimated biogeographic population of 1,707,000 individuals (**Table 10-14**), using an average mortality rate of 12.9% (**Table 10-15**), the predicted biogeographic mortality across all seasons is estimated to be 220,203 individuals. Additional mortality of 30.422 individuals, would therefore increase biogeographic annual mortality by 0.014% from baseline.

832. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude.

833. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Puffin

834. The annual estimated mortality rate for Puffin is 1.001 birds. In Table 10-103 Estimated bio-seasonal and annual changes in baseline **mortality** to Puffin from disturbance and displacement impacts

835. this is presented as constituent estimated mortalities within relevant bio-seasons and magnitude of impact is estimated by calculating proportional increase in baseline mortality within each bio-season and annually with respect to regional and wider biogeographic populations. Regional and biogeographic baseline estimates are derived using overall baseline mortality rates calculated from age specific demographic rates and age class proportions as presented in **Table 10-15**.

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Table 10-103 Estimated bio-seasonal and annual changes in baseline mortality to Puffin from disturbance and displacement impacts

Bio-season (months)	Seasonal abundance (mean peak within array site plus 2 km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of individuals subject to mortality	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return migration (Mar - Apr)	6.449	304,355	53,871	0.032 (0.019 – 0.226)	0.000 (0.000 – 0.000)
Migration-free breeding (May - Jul)	93.746	Method 1: 190,699	33,754	0.469 (0.281 – 3.281)	0.001 (0.001 – 0.010)
		Method 2: 95,044	16,823		0.003 (0.002 – 0.020)
Post-breeding migration (Aug)	55.306	304,355	53,871	0.277 (0.166 – 1.936)	0.001 (0.000 – 0.004)
Migration-free winter (Nov - Feb)	44.555	304,355	53,871	0.223 (0.134 – 1.559)	0.000 (0.000 – 0.003)
Annual (BDMPS)	200.056	304,355	53,871	1.001 (0.600 – 7.002)	0.002 (0.001 – 0.013)
Annual (Biogeographic)	200.056	11,840,000	2,616,640		0.000 (0.000 – 0.000)

836. During the return migration bio-season, the mean peak abundance of Puffin within the array site plus 2 km buffer is estimated to be 6.449 individuals. On the basis of displacement and mortality rates of 50% and 1%, respectively, this equates to a predicted displacement mortality of 0.032 individuals. The return migration bio-season Puffin regional baseline population is estimated to be 304,355 individuals, and associated baseline mortality to be 53,871 individuals (from an average mortality rate of 17.7% – **Table 10-15**). Additional mortality of 0.032 individuals, would therefore increase regional bio-seasonal mortality by <0.001% from baseline.

837. This level of impact during the return migration bio-season is considered to be of negligible magnitude.

838. The migration-free breeding season Puffin regional baseline population is estimated to be 190,699 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 95,044 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

839. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (17.7%), the total number of regional Puffin mortalities during each migration-free breeding season is estimated to be 33,754 individuals (using breeding season regional population estimation Method 1), or 16,823 individuals (using breeding season regional population estimation Method 2).

840. Additional mortality of 0.469 individuals, would therefore increase regional bio-seasonal mortality by 0.001 or 0.03% from baseline for migration-free breeding season regional population estimation Methods 1 and 2, respectively.

841. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude.

842. During the post-breeding migration bio-season, the mean peak abundance of Puffin within the array site plus 2 km buffer is estimated to be 55.306 individuals. On the basis of displacement and mortality rates of 50% and one %, respectively, this equates to a predicted displacement mortality of 0.277 individuals. The post-breeding migration bio-season Puffin regional baseline population is estimated to be 304,355 individuals, and associated baseline mortality to be 53,871 individuals (from an average mortality rate of 17.7% – **Table 10-15**). Additional mortality of 0.277 individuals, would therefore increase regional bio-seasonal mortality by 0.001% from baseline.

843. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude.

844. During the migration-free non-breeding bio-season, the mean peak abundance of Puffin within the array site plus two km buffer is estimated to be 44.555 individuals. On the basis of displacement and mortality rates of 50% and 1%, respectively, this equates to a predicted displacement mortality of 0.223 individuals. The migration-free non-breeding bio-season Puffin regional baseline population is estimated to be 304,355 individuals, and associated baseline mortality to be 53,871 individuals (from an average mortality rate of 17.7% – **Table 10-103**). Additional mortality of 0.223 individuals, would therefore increase regional bio-seasonal mortality by <0.001% from baseline.

845. This level of impact during the migration-free non-breeding bio-season is considered to be of negligible magnitude.

846. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 2 km buffer is 1.001 individuals. Using the largest regional bio-season population of 304,355 individuals **Table 10-103** as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 17.7% (**Table 10-15**), the predicted regional mortality across all

seasons is estimated to be 53,871 individuals. Additional mortality of 1.001 individuals, would therefore increase regional annual mortality by 0.002% from baseline.

847. Similarly, for the estimated biogeographic population of 11,840,000 individuals, using an average mortality rate of 17.7% (**Table 10-15**), the predicted biogeographic mortality across all seasons is estimated to be 2,616,640 individuals. Additional mortality of 1.001 individuals, would therefore increase biogeographic annual mortality by <0.001% from baseline.

848. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude.

849. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible, as it represents no discernible increase to baseline mortality levels as a result of displacement.

<u>Red-throated diver</u>

850. Red-throated diver is widely recognised as being particularly sensitive to human activities in marine areas, including through the disturbance effects of vessel traffic and the presence of WTGs (Garthe and Hüppop 2004; Schwemmer et al., 2011; Furness and Wade 2012; Furness et al., 2013; Bradbury et al., 2014); however, studies to quantify displacement rates, distances at which displacement occurs and consequences of displacement have documented a wide range of observed responses. A review from the English southern North Sea for the Norfolk Vanguard OWF examination found the strongest evidence-led position to be a displacement rate of 90% affecting the array site and a 2 km buffer and a 1% mortality rate of displaced birds (MacArthur Green, 2019). Similarly, analysis and interpretation of pre-, during- and post-construction survey results in the Irish Sea / Liverpool Bay area for the constructed Gwynt y Mor and Rhyl Flats OWFs enabled an assessment of any changes in the abundance and distribution of RTD throughout the Gwynt y Mor construction and operation. Operation of GyM currently appears to have had little influence on the presence of Red-throated diver in this area.

851. These rates are significantly lower than the preceding most precautionary rates recommended by UK SNCBs of 100% displacement to a 4 km buffer and 10% mortality (SNCBs, 2017). This lower mortality rate is, however, supported by a recent analysis of diver abundance in response to OWF development within the German North Sea (Vilela et al., 2020), where, despite regional scale expansion of OWFs, long-term population trends were assessed to be stable. By considering digital aerial survey data collected between 2001 and 2018, a period spanning prior to and during the expansion of OWFs within the German North Sea, the authors concluded that, despite notable distributional changes in response to OWF development, there was no significant trend in non-breeding population size of diver species (the large majority of which are Red-throated diver) over that period.

852. As Red-throated diver is a relatively long-lived species (where individuals typically breed for many seasons, while producing relatively few young in each season), substantial increases to mortality rates, particularly if they affect breeding adults, would be likely to result in population level effects. The absence of population change, derived from a large and long-term monitoring dataset, is therefore indicative that the probability of individuals experiencing mortality or fitness effects from displacement leading to demographic consequences is very low, and provides support for a very low (i.e., one %) displacement mortality rate to be used for OWF displacement impact assessment, rather than a high (i.e., 10%) displacement mortality rate.

853. This is consistent with the perception that, because Red-throated diver utilise a range of marine habitats and prey species, and do not typically aggregate in high densities within marine foraging areas, they are unlikely to experience significant levels of increased density-dependant competition or interference as a result of redistribution in avoidance of OWFs (Diershke et al., 2017).

854. ObSERVE visual aerial surveys of the western Irish Sea region in 2016 recorded divers in areas within the CWP array site and surrounding 4 km buffer; however, the CWP Project area did not correspond

with areas in which highest diver densities were observed within the region during the autumn and winter periods (Jessop et al., 2018). These surveys (Figure 78 within Jessop et al., 2018) show that during the autumn period of 2016, areas most used by divers occurred within the vicinity of Dundalk Bay to the north of the western Irish Sea area surveyed and did not overlap with the array site or OECC or associated buffers. Similarly, during the winter period, areas most utilised by divers also occurred within the vicinity of Dundalk Bay to the north of the western Irish Sea area surveyed; however, areas which were used by moderate densities of Red-throated Divers (50% utilisation distribution) did correspond with the array site, OECC and associated buffers.

855. In a UK Crown Estate (2019) commissioned plan level Habitats Regulations Assessment (HRA) for English waters, when considering potential impact of displacement to Red-throated Divers from Gwynt Y Mor OWF in the Welsh part of the Irish Sea, it is stated that: '*There is no evidence currently available that displacement will directly result in the mortality of individual birds. Mortality as a consequence of displacement is more likely to occur as a result of increased densities outside of the impacted area, which may lead to increased competition for resources. Displacement of birds from lower density areas, which are likely to be of lower habitat quality is less likely to result in mortality than would be the case in areas of high density and hence higher habitat quality. It is assumed that there are more opportunities for birds in lower quality habitats to relocate to habitats of similar quality. As such, the use of a one % mortality rate is considered appropriate for this assessment*.'

856. When this rationale is presented in the context of observed diver habitat use within the western Irish Sea (i.e., Figure 78 within Jessop et al., 2018), displacement of Red-throated diver from the CWP array site, which is not among the highest density areas within the region, may also be considered as displacement of birds from lower density, areas. Such displacement from relatively lower quality habitats, where there is a large amount of similar (or better) quality habitat within the western Irish Sea region is therefore unlikely to result in significant increases in intra-specific competition within the region and, as such, the use of a 1% mortality rate is further supported for this assessment.

857. On the basis of this evidence, a displacement rate of 100% within a 4 km buffer and mortality rate of 1% of displaced birds is put forward as the Applicant's evidence-led approach, whilst still retaining a significant degree of precaution. For comparison, the UK SNCB advocated minimum and maximum rates of 90% and 100% displacement to 4 km and 1-10% mortality of displaced birds is also presented.

858. The annual estimated mortality rate for Red-throated diver is 4.581 birds. In **Table 10-104** this is presented as constituent estimated mortalities within relevant bio-seasons and magnitude of impact is estimated by calculating proportional increase in baseline mortality within each bio-season and annually with respect to regional and wider biogeographic populations. Regional and biogeographic baseline estimates are derived using overall baseline mortality rates calculated from age specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-104 Estimated bio-seasonal and annual changes in baseline mortality to Red-throated diver from disturbance and displacement impacts

Bio-season (months)	Seasonal abundance (array site plus 4 km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of individuals subject to mortality	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return migration (Feb - Apr)	179.372	12,717	2,849	1.794 (1.614 – 17.937)	0.063 (0.057 – 0.630)
Migration-free breeding (May - Aug)	8.984	Method 1: 4,472	1,002	0.09 (0.081 – 0.898)	0.009 (0.008 – 0.090)
		Method 2: NA – no local breeders	NA		NA
Post-breeding migration (Sep - Nov)	63.092	12,717	2,849	0.631 (0.568 – 6.309)	0.022 (0.020 – 0.221)
Migration-free winter (Dec - Jan)	206.581	4,148	929	2.066 (1.859 – 20.658)	0.222 (0.200 – 2.224)
Annual (BDMPS)	458.029	12,717	2,849	4.581 (4.122 – 45.802)	0.161 (0.145 – 1.608)
Annual (Biogeographic)	458.029	27,000	6,048		0.076 (0.068 – 0.757)

859. During the return migration bio-season, the mean peak abundance of Red-throated diver within the array site plus 4 km buffer is estimated to be 179.372 individuals. On the basis of displacement and mortality rates of 100% and 1%, respectively, this equates to a predicted displacement mortality of 1.794 individuals. The return migration bio-season Red-throated diver regional baseline population is estimated to be 12,717 individuals, and associated baseline mortality to be 2,849 individuals (from an average mortality rate of 22.4% – **Table 10-15**). Additional mortality of 1.794 individuals, would therefore increase regional bio-seasonal mortality by 0.063% from baseline.

860. This level of impact during the return migration bio-season is considered to be of negligible magnitude.

861. The migration-free breeding season Red-throated diver regional baseline population is estimated to be 4,472 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season). As Red-throated diver do not breed in areas in which breeding adults may forage within the array site or surrounding areas, Method 2 for estimating regional breeding populations (where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults) was not used. Comparison with estimated summer abundances within the western Irish Sea region covered by ObSERVE surveys in 2016 (Jessopp et al., 2018), where a total of 47 individuals (of all diver species) was calculated. Indicates that the Method 1 migration-free breeding season estimate of 4,472 individuals is likely to be a considerable overestimation.

862. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (22.4%), the total number of regional Red-throated diver mortalities during each migration-free breeding season is estimated to be 1,002 individuals (using breeding season regional population estimation Method 1). However, as the migration-free breeding season Red-throated diver regional baseline population is considered likely to be overestimated, this regional seasonal mortality estimate is also, likely an overestimate.

863. Additional mortality of 0.09 individuals, would increase regional bio-seasonal mortality (as estimated by Method 1) by 0.009% from baseline for the migration-free breeding season regional population. Should this bio-seasonal population be overestimated by an order of magnitude (i.e., 447 individuals), this level of additional mortality would represent a 0.090% increase in regional bio-seasonal mortality. Should the migration-free breeding season only be considered to include the estimated western Irish Sea regional population of 47 individuals from Jessopp et al., 2018, this level of additional mortality would represent a 0.855% increase in regional bio-seasonal mortality.

864. This level of impact during the migration-free breeding bio-season is therefore conservatively considered to be of low magnitude, on the basis of there being a particularly high level of uncertainty in relation to regional migration-free breeding population estimates.

865. During the post-breeding migration bio-season, the mean peak abundance of Red-throated diver within the array site plus four km buffer is estimated to be 63.092 individuals. On the basis of displacement and mortality rates of 100% and 1%, respectively, this equates to a predicted displacement mortality of 0.631 individuals. The post-breeding migration bio-season Red-throated diver regional baseline population is estimated to be 12,717 individuals, and associated baseline mortality to be 2,849 individuals (from an average mortality rate of 22.4% – **Table 10-15**). Additional mortality of 0.631 individuals, would therefore increase regional bio-seasonal mortality by 0.022% from baseline.

866. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude.

867. During the migration-free non-breeding bio-season, the mean peak abundance of Red-throated diver within the array site plus 4 km buffer is estimated to be 206.581 individuals. On the basis of displacement and mortality rates of 100% and 1%, respectively, this equates to a predicted

displacement mortality of 2.066 individuals. The migration-free non-breeding bio-season Red-throated diver regional baseline population is estimated to be 4,148 individuals, and associated baseline mortality to be 929 individuals (from an average mortality rate of 22.4% – **Table 10-15**). Additional mortality of 2.066 individuals, would therefore increase regional bio-seasonal mortality by 0.222% from baseline.

868. This level of impact during the migration-free non-breeding bio-season is considered to be of low magnitude.

869. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 4 km buffer is 4.581 individuals. Using the largest regional bio-season population of 12,717 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.224 (**Table 10-15**), the natural predicted regional mortality across all seasons is estimated to be 2,849 individuals. Additional mortality of 4.581 individuals, would therefore increase regional annual mortality by 0.161% from baseline.

870. This level of annual impact to the regional population is considered to be of low magnitude.

871. For the estimated biogeographic population of 27,000 individuals (**Table 10-14**), using an average mortality rate of 0.224 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 6,048 individuals. Additional mortality of 4.581 individuals, would therefore increase biogeographic annual mortality by 0.076% from baseline.

872. This level of annual impact to the biogeographic population is considered to be of negligible magnitude.

873. Overall, the magnitude of this impact has been assessed as low. Despite absolute numbers of birds predicted to experience mortality being low or very low in all bio-seasons, regional populations of Red-throated diver are small and, particularly during the migration-free breeding season, the certainty associated with regional population estimates is low.

Manx shearwater

874. Although Manx shearwater are generally considered to demonstrate a low level of sensitivity to vessel activity (Furness and Wade, 2012, Furness et al., 2013, Bradbury et al., 2014, MMO, 2018, Rogerson et al., 2021), there is a lack of empirical evidence, and therefore high levels of uncertainty, relating to their vulnerability to disturbance and displacement from OWF infrastructure (Wade et al., 2016, Kelsey et al., 2018), with some evidence of the species avoiding operational WTGs.

875. A decline in Manx shearwater abundance detected in comparisons of pre- and post-construction data from Robin Rigg OWF, in the Scottish / English part of the northern Irish Sea (Canning et al., 2013a & b) was interpreted as suggesting a degree of avoidance of the array site. Similarly, from post-construction monitoring of North Hoyle OWF in the Welsh / English part of the southern Irish Sea, a notable gap in Manx shearwater distribution has been observed (Dierschke et al., 2016). These responses have resulted in the species being provisionally classified as weakly avoiding OWFs (Dierschke et al., 2016).

876. On the basis of described avoidance behaviours, a 30–70% displacement range, with a 50% central value for assessment, has been used to estimate numbers of Manx shearwater potentially displaced by the presence of operational WTGs within the CWP array site.

877. A mortality rate of 1% was selected for this assessment, based on expert judgement supported by evidence that Manx shearwater have a very large foraging range (mean max + 1 SD = 2,365.5 km; Woodward et al., 2019) and feed on a variety of different prey items across a wide range of habitats (i.e., Bradbury et al., 2014). On this basis it is considered that sufficient alternative foraging opportunities will be available despite the potential loss of habitat within the CWP array site and consequently displacement from this area is unlikely to translate to significant fitness reductions.

878. The annual estimated mortality rate for Manx shearwater is 10.428 birds, which is further broken down into relevant bio-seasons in **Table 10-105**. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-105 Estimated bio-seasonal and annual changes in baseline mortality to Manx shearwater from disturbance and displacement impacts

Bio-season (months)	Seasonal abundance (array site plus 2 km buffer)	Regional baseline populations and baseline mortality rates (individuals per annum)		Estimated number of individuals subject to mortality	Increase in baseline mortality (%)
		Population	Baseline mortality		
Return migration (Feb - Apr)	780.441	1,580,895	205,516	3.902 (2.341 – 5.463)	0.002 (0.001 – 0.003)
Migration-free breeding (May - Aug)	180.162	Method 1: 2,122,774	275,961	0.901 (0.540 – 1.261)	0.000 (0.000 – 0.000)
		Method 2: 2,736,288	355,717		0.000 (0.000 – 0.000)
Post-breeding migration (Sep - Nov)	1125.063	1,580,895	205,516	5.625 (3.375 – 7.875)	0.003 (0.002 – 0.004)
Migration-free winter (Dec - Jan)	0	0	0	0	NA
Annual (BDMPS)	2,085.666	2,736,288	355,717	10.428 (6.526 – 14.599)	0.003 (0.002 – 0.004)
Annual (Biogeographic)	2,085.666	2,736,288	355,717		0.003 (0.002 – 0.004)

879. During the return migration bio-season, the mean peak abundance of Manx shearwater within the array site plus 2 km buffer is estimated to be 780.441 individuals. On the basis of displacement and mortality rates of 50% and 1%, respectively, this equates to a predicted displacement mortality of 3.902 individuals. The return migration bio-season Manx shearwater regional baseline population is estimated to be 1,580,895 individuals, and associated baseline mortality to be 205,516 individuals (from an average mortality rate of 13.0% – **Table 10-15**). Additional mortality of 3.902 individuals, would therefore increase regional bio-seasonal mortality by 0.002% from baseline.

880. This level of impact during the return migration bio-season is considered to be of negligible magnitude.

881. The migration-free breeding season Manx shearwater regional baseline population is estimated to be 2,122,774 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 2,736,288 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-105**), multiplied by the number of breeding adults).

882. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (13.0%), the total number of regional Manx shearwater mortalities during each migration-free breeding season is estimated to be 275,961 individuals (using breeding season regional population estimation Method 1), or 355,717 individuals (using breeding season regional population estimation Method 2).

883. Additional mortality of 0.901 individuals, would therefore increase regional bio-seasonal mortality by <0.001% from baseline for both migration-free breeding season regional population estimation Methods 1 and 2.

884. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude.

885. During the post-breeding migration bio-season, the mean peak abundance of Manx shearwater within the array site plus 2 km buffer is estimated to be 1125.063 individuals. On the basis of displacement and mortality rates of 50% and one %, respectively, this equates to a predicted displacement mortality of 5.625 individuals. The post-breeding migration bio-season Manx shearwater regional baseline population is estimated to be 1,580,895 individuals, and associated baseline mortality to be 205,516 individuals (from an average mortality rate of 13.0% – **Table 10-15**). Additional mortality of 5.625 individuals, would therefore increase regional bio-seasonal mortality by 0.003% from baseline.

886. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude.

887. No Manx shearwater were observed during the migration-free non-breeding bio-season. The level of impact during the migration-free non-breeding bio-season is considered to be zero.

888. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 2 km buffer is 10.428 individuals. Using the largest regional bio-season population of 2,736,288 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.130 (**Table 10-15**), the natural predicted regional mortality across all seasons is estimated to be 355,717 individuals. Additional mortality of 10.428 individuals, would therefore increase regional annual mortality by 0.003% from baseline.

889. Similarly, for the estimated biogeographic population of 2,736,288 individuals (**Table 10-14**) considered to be the same as the maximum regional population), using an average mortality rate of 0.130 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 355,717 individuals. Additional mortality of 10.428 individuals, would therefore increase biogeographic annual mortality by 0.003% from baseline.

890. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude.

891. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Gannet

892. Although Gannet demonstrate a low level of sensitivity to vessel activity (Garthe and Hüppop, 2004; Furness and Wade, 2012), studies have demonstrated a consistent pattern of avoidance of areas in which operational WTGs are present. A recent review of Gannet displacement rates from 25 OWFs was undertaken by APEM Ltd., to inform assessment for Hornsea Project Four OWF in the English part of the southern North Sea (APEM, 2022). Key findings of this review include:

- Observed displacement rates vary over a greater range than the 60–80% range presently advocated by UK SNCBs. At only 26% of OWFs were displacement rates considered to fall into this advised range, while 32% of OWFs reported displacement rates above this range and 42% reported rates below.
- High displacement rates (>75%) are associated with four particular OWF design characteristics:
  - WTG densities exceeding 2.7 per km^2 (0.48-0.6 for the CWP Project).
  - Array site less than 2,500 ha (125 km^2 for the CWP Project).
  - Distance between WTGs less than 900 m (CWP project distances >900m).
  - Distance between array site and shore more than 19 km (11 km for the CWP Project).

893. As referenced above, none of these design characteristics are proposed in relation to the CWP Project.

894. As such the use of a 60–80% displacement range following precedence from recent UK OWFs as advocated by UK SNCBs (2022), with a 70% central value for assessment is considered conservative for the purpose of this assessment.

895. A mortality rate of 1% was selected for this assessment, based on expert judgement supported by evidence that Gannet have a very large foraging range (mean max + 1 SD = 509.4 km; Woodward et al., 2019) and feed on a variety of different prey items across a wide range of habitats (i.e., Bradbury et al., 2014). On this basis it is considered that sufficient alternative foraging opportunities will be available despite the potential loss of habitat within the CWP array site and consequently displacement from this area is unlikely to translate to significant fitness reductions.

896. Support that the use of a 1% mortality rate is conservative is also provided in the review to inform assessment for Hornsea Project Four OWF (APEM, 2022), which predicts an additional mortality for displaced birds of approximately 0.4%.

897. The annual estimated mortality rate for Gannet is 1.855 birds, which is further broken down into relevant bio-seasons in **Table 10-106**. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations. The overall baseline mortality rates are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-106 Estimated bio-seasonal and annual changes in baseline mortality to Gannet from disturbance and displacement impacts

Bio-season (months)	**Seasonal abundance (array site plus 2 km buffer)**	**Regional baseline populations and baseline mortality rates (individuals per annum)**		**Estimated number of individuals subject to mortality**	**Increase in baseline mortality (%)**
		Population	**Baseline mortality**		
Return migration (Dec - Mar)	104.876	644,739	116,698	0.734 (0.629 – 0.839)	0.001 (0.001 – 0.001)
Migration-free breeding (Apr - Aug)	104.876	Method 1: 517,233	93,619	0.734 (0.629 – 0.839)	0.001 (0.001 – 0.001)
		Method 2: 420,257	76,067		0.001 (0.001 – 0.001)
Post-breeding migration (Sep - Nov)	55.351	536,005	97,017	0.387 (0.332 – 0.443)	0.000 (0.000 – 0.000)
Annual (BDMPS)	265.103	644,739	116,698	1.855 (1.590 – 2.121)	0.002 (0.001 – 0.002)
Annual (Biogeographic)	265.103	1,180,000	213,580		0.001 (0.001 – 0.001)

898. During the return migration bio-season, the mean peak abundance of Gannet within the array site plus 2 km buffer is estimated to be 104.876 individuals. On the basis of displacement and mortality rates of 70% and 1%, respectively, this equates to a predicted displacement mortality of 0.734 individuals. The return migration bio-season Gannet regional baseline population is estimated to be 644,739 individuals, and associated baseline mortality to be 116,698 individuals (from an average mortality rate of 18.1% – **Table 10-14**). Additional mortality of 0.734 individuals, would therefore increase regional bio-seasonal mortality by 0.001% from baseline.

899. This level of impact during the return migration bio-season is considered to be of negligible magnitude.

900. The migration-free breeding season Gannet regional baseline population is estimated to be 517,233 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 420,257 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

901. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (18.1%), the total number of regional Gannet mortalities during each migration-free breeding season is estimated to be

93,619 individuals (using breeding season regional population estimation Method 1), or 76,067 individuals (using breeding season regional population estimation Method 2).

902. Additional mortality of 0.734 individuals, would therefore increase regional bio-seasonal mortality by 0.001% from baseline for migration-free breeding season regional population estimates derived using both Methods 1 and 2.

903. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude.

904. During the post-breeding migration bio-season, the mean peak abundance of Gannet within the array site plus 2 km buffer is estimated to be 55.351 individuals. On the basis of displacement and mortality rates of 70% and 1%, respectively, this equates to a predicted displacement mortality of 0.387 individuals. The post-breeding migration bio-season Gannet regional baseline population is estimated to be 536,005 individuals, and associated baseline mortality to be 97,017 individuals (from an average mortality rate of 18.1% – **Table 10-15**). Additional mortality of 0.387 individuals, would therefore increase regional bio-seasonal mortality by <0.001% from baseline.

905. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude.

906. Annual (all seasons combined) estimated mortality resulting from displacement from the array site plus 2 km buffer is 1.855 individuals. Using the largest regional bio-season population of 644,739 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 18.1% (**Table 10-15**), the predicted regional mortality across all seasons is estimated to be 116,698 individuals. Additional mortality of 1.855 individuals, would therefore increase regional annual mortality by 0.002% from baseline.

907. Similarly, for the estimated biogeographic population of 1,180,000 individuals (**Table 10-14**) considered to be the same as the maximum regional population), using an average mortality rate of 0.183 (**Table 10-15**), the predicted biogeographic mortality across all seasons is estimated to be 213,580 individuals. Additional mortality of 1.855 individuals, would therefore increase biogeographic annual mortality by 0.001% from baseline.

908. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude.

909. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible, as it represents no discernible increase to baseline mortality levels as a result of displacement.

Barrier effects to migratory species

910. For migratory species, one-off energetic costs associated with relatively small deviations during typically large migratory movements are considered to be inconsequential in relation to energy reserves recruited for migration (Masden et al., 2009).

911. Therefore, the potential magnitude of impacts on birds that only migrate through the array site (including waders and estuarine waterbirds, migratory terrestrial species and migratory seabirds) are considered negligible.

OECC

912. The potential for disturbance and displacement from operational phase activities within the OECC will be extremely limited, with activities limited to very low levels of vessel activity along monitoring routes and, potentially for rare occurrences, around locations where repair works are required. Such activities

within the OECC would also be temporally restricted to the time taken to undertake repairs or conduct routine monitoring.

913. The magnitude of disturbance and displacement impacts from operational activities within the OECC is therefore considered negligible for all receptors.

Significance of the effect

Array site

Indirect habitat loss and barrier effects to seabird species

Guillemot

914. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be negligible, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Guillemot is considered to be **Not Significant**, and **Not Significant** in EIA terms.

Razorbill

915. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be negligible, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Razorbill is considered to be **Not Significant**, and **Not Significant** in EIA terms.

Puffin

916. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be medium and impact magnitude is assessed to be negligible, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Puffin is considered to be **Imperceptible** and **Not Significant** in EIA terms.

Red-throated diver

917. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be low, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Red-throated diver is considered to be **Slight**, and **Not Significant** in EIA terms.

Manx shearwater

918. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be medium and impact magnitude is assessed to be negligible, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Manx shearwater is considered to be **Imperceptible**, and **Not Significant** in EIA terms.

Gannet

919. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be negligible, the potential effect of displacement and disturbance, through indirect habitat loss and barrier effects, during the operational phase upon Gannet is considered to be **Not Significant**, and **Not Significant** in EIA terms.

Barrier effects to migratory species

920. In **Table 10-107** in accordance with the matrix approach outlined to determine impact significance level in **Table 10-11** assessed sensitivities and magnitudes for each migratory species are considered in order to determine the potential effect of displacement and disturbance, through barrier effects, upon migratory species during the operational phase.

921. For all migratory species the potential effect of disturbance and displacement, through barrier effects, during the operational phase are considered to be **Imperceptible**, and **Not Significant** in EIA terms.

Table 10-107 Assessed sensitivities and magnitude for each migratory species

Receptor	Receptor sensitivity	Impact magnitude	Significance level	Significant / Not Significant
Light-bellied Brent Goose	low	Negligible	**Imperceptible**	**Not Significant**
Greenland white-fronted Goose	very low		**Imperceptible**	**Not Significant**
Bewick's Swan	very low		**Imperceptible**	**Not Significant**
Whooper Swan	very low		**Imperceptible**	**Not Significant**
Shelduck	very low		**Imperceptible**	**Not Significant**
Shoveler	very low		**Imperceptible**	**Not Significant**
Wigeon	very low		**Imperceptible**	**Not Significant**
Mallard	very low		**Imperceptible**	**Not Significant**
Pintail	very low		**Imperceptible**	**Not Significant**
Teal	very low		**Imperceptible**	**Not Significant**
Pochard	very low		**Imperceptible**	**Not Significant**
Tufted Duck	very low		**Imperceptible**	**Not Significant**
Scaup	very low		**Imperceptible**	**Not Significant**
Eider	very low		**Imperceptible**	**Not Significant**
Common scoter	low		**Imperceptible**	**Not Significant**
Goldeneye	very low		**Imperceptible**	**Not Significant**
red-breasted merganser	very low		**Imperceptible**	**Not Significant**
Corncrake	very low		**Imperceptible**	**Not Significant**
Great crested grebe	very low		**Imperceptible**	**Not Significant**
Oystercatcher	low		**Imperceptible**	**Not Significant**
Lapwing	very low		**Imperceptible**	**Not Significant**
Golden plover	low		**Imperceptible**	**Not Significant**
Grey plover	low		**Imperceptible**	**Not Significant**
Ringed plover	low		**Imperceptible**	**Not Significant**

Receptor	Receptor sensitivity	Impact magnitude	Significance level	Significant / Not Significant
Curlew	low		**Imperceptible**	**Not Significant**
Bar-tailed godwit	low		**Imperceptible**	**Not Significant**
Black-tailed godwit	low		**Imperceptible**	**Not Significant**
Turnstone	very low		**Imperceptible**	**Not Significant**
Knot	low		**Imperceptible**	**Not Significant**
Sanderling	low		**Imperceptible**	**Not Significant**
Dunlin	low		**Imperceptible**	**Not Significant**
Snipe	very low		**Imperceptible**	**Not Significant**
Redshank	low		**Imperceptible**	**Not Significant**
Greenshank	very low		**Imperceptible**	**Not Significant**
Red-throated diver	low		**Imperceptible**	**Not Significant**
Great northern diver	low		**Imperceptible**	**Not Significant**
Hen harrier	very low		**Imperceptible**	**Not Significant**
Merlin	very low		**Imperceptible**	**Not Significant**
All other migratory species	very low		**Imperceptible**	**Not Significant**

OECC

922. In **Table 10-108** in accordance with the matrix approach outlined to determine impact significance level in **Table 10-11** assessed sensitivities and magnitudes for each seabird species are considered in order to determine the potential effect of displacement and disturbance, during the operation and maintenance phase activities within the OECC.

923. For all species, with the exception of Red-throated diver, the potential effect of disturbance and displacement from operation and maintenance phase activities within the OECC are considered to be **Imperceptible**, and **Not Significant** in EIA terms. For Red-throated diver, this impact is assessed to be **Not Significant** and **Not Significant** in EIA terms.

Table 10-108 Assessed impact significance levels of seabird species from disturbance and displacement from operation and maintenance phase activities within the OECC

Receptor	Receptor sensitivity	Impact magnitude	Significance level	Significant / Not Significant
Guillemot	medium	Negligible	**Imperceptible**	**Not Significant**
Razorbill	medium		**Imperceptible**	**Not Significant**
Puffin	medium		**Imperceptible**	**Not Significant**
Black guillemot	low		**Imperceptible**	**Not Significant**
Red-throated diver	high		**Not Significant**	**Not Significant**
Great northern diver	medium		**Imperceptible**	**Not Significant**

Receptor	Receptor sensitivity	Impact magnitude	Significance level	Significant / Not Significant
Cormorant	medium		**Imperceptible**	**Not Significant**
Shag	medium		**Imperceptible**	**Not Significant**
Common scoter	medium		**Imperceptible**	**Not Significant**

Additional mitigation

924. As impacts associated with Disturbance and Displacement during the Operation and Maintenance phase within the array site and OECC are assessed to be **Imperceptible**, **Not Significant or Slight** and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

925. As no additional measures are required to mitigate the Operation and Maintenance phase disturbance and displacement impacts within the array site and OECC, the residual effects are assessed to be **Imperceptible**, **Not Significant or Slight** and **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

926. The occurrence of operational phase maintenance activities within the intertidal area has the potential to disturb and displace intertidal waterbirds which would otherwise utilise habitat areas which are subject to visual and / or acoustic disturbance at levels to which those species are sensitive.

927. The displacement of individuals which would otherwise potentially utilise intertidal areas within or around affected areas effectively equates to indirect habitat loss for those individuals.

928. Indirect habitat loss as a consequence of displacement reduces the potential spatial extent available to impacted receptors. Reductions in the areas available for intertidal waterbirds to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

929. Impact screening for operational phase disturbance and displacement impacts to ornithological receptors within intertidal areas is considered to be as per that outlined for the equivalent impact during the construction phase. See subsection **Impact Screening** in section **Construction: Disturbance and displacement – Intertidal**, above.

Receptor sensitivity

930. **Table 10-109** below summarises the impact screening of each intertidal ornithological receptor and, for those which are screened in for consideration in relation to operational phase disturbance and displacement impacts, considers their assessed conservation importance against their tolerance of operation phase disturbance and displacement impacts within the South Dublin Bay area in order to arrive at an assessment of receptor sensitivity as outlined in **Table 10-9** in **Section 10.4**.

931. Species conservation importances are taken from **Table 10-7** in **Section 10.6**.

932. The tolerance of all receptors to direct effects on habitat in intertidal areas during the operation and maintenance phase is considered to be very high. This is due to the fact that not only will intertidal infrastructure within the South Dublin Bay will be passive and buried, but maintenance activities on infrastructure are expected to be infrequent and localised, allowing intertidal waterbirds the capacity by which to be able to adapt their behaviours in order to avoid any effects on their survival and reproductive rates.

933. In all cases, receptors are considered to resume habitat use above buried infrastructure throughout the operational phase as before its installation and likely able to adapt behaviours to avoid localised impacts and reoccupy those areas shortly after cessation of any maintenance activities, such that the potential for effects upon reproduction or survival rates of regional populations would be negligible / imperceptible.

Table 10-109 Receptor screening and sensitivity in relation to disturbance and displacement of intertidal waterbirds during the operational phase

Species	Screened in or out	Conservation importance	Tolerance	Assessed receptor sensitivity
Light-bellied Brent Goose	In	high	very high	low
Pink-footed Goose	Out			-
Mute Swan	Out			-
Shelduck	In	medium	very high	very low
Wigeon	Out			-
Mallard	Out			-
Pintail	In	very high	very high	very low
Shoveler	In	medium	very high	very low
Eider	Out			-
Teal	In	medium	very high	very low
Common scoter	In	high	very high	low
Long-tailed Duck	Out			-
Goldeneye	Out			-
red-breasted merganser	In	low	very high	very low
Red-throated diver	In	high	very high	low
Great northern diver	Out			-
Manx shearwater	Out			-
Great crested grebe	In	low	very high	very low
Little Grebe	Out			-
Grey heron	In	very low	very high	very low
Gannet	Out			-
Little egret	In	low	very high	very low

Species	Screened in or out	Conservation importance	Tolerance	Assessed receptor sensitivity
Shag	In	high	very high	low
Cormorant	Out			-
Oystercatcher	In	very high	very high	low
Lapwing	Out			-
Golden plover	In	high	very high	low
Grey plover	In	high	very high	low
Ringed plover	In	high	very high	low
Ruff	Out			-
Whimbrel	Out			-
Curlew	In	high	very high	low
Bar-tailed godwit	In	very high	very high	low
Black-tailed godwit	In	high	very high	low
Common sandpiper	Out			-
Turnstone	In	medium	very high	very low
Curlew sandpiper	Out			-
Knot	In	very high	very high	low
Sanderling	In	high	very high	low
Dunlin	In	very high	very high	low
Purple sandpiper	Out			-
Little Stint	Out			-
Snipe	Out			-
Redshank	In	very high	very high	low
Greenshank	In	low	very high	very low
Lesser Yellowlegs	Out			-
Kittiwake	Out			-
Black-headed gull	In	high	very high	low
Little gull	Out			-
Mediterranean gull	In	medium	very high	very low
Common gull	In	high	very high	low
Great black-backed gull	In	medium	very high	very low
Herring gull	In	high	very high	low

Species	Screened in or out	Conservation importance	Tolerance	Assessed receptor sensitivity
Yellow-legged gull	Out			-
Lesser black-backed gull	In	high	very high	low
Sandwich tern	In	low	very high	very low
Sterna Terns	In	high	very high	low
Guillemot	Out			-
Razorbill	Out			-
Black guillemot	In	low	very high	very low
Kingfisher	Out			-
Hooded Crow	Out			-
Starling	Out			-
Wetland habitats	Out	no route to impact		

Magnitude of impact

934. Following installation of the OECC through the intertidal zone from the transition zone to the TJBs at the landfall location, the operational nature of any buried infrastructure within South Dublin Bay is passive. Any routine visual inspection of the OECC does not extend to buried infrastructure within South Dublin Bay.

935. It is possible that unplanned maintenance may be required on buried infrastructure within South Dublin Bay during the operational phase of the project. Any such unplanned maintenance activities have the potential to cause disturbance and displacement to intertidal waterbirds within the vicinity of the impacted area. It is considered, however, that any unplanned maintenance activities on buried infrastructure within South Dublin Bay during the operational phase of the project would be restricted in terms of their frequency, temporal duration and spatial scale.

936. When considering the PA and AAM scenarios (with the AAM scenario representing the maximum possible 'spread' of OECs buried within the intertidal zone), it is considered that neither scenario would represent a greater potential magnitude of impact than the other. This is due to the highly localised spatial extent and limited temporal duration and frequency of any potential maintenance works.

937. Although the AAM scenario may allow for maintenance works to take place in locations that the PA scenario would not, the relative spatial extent of remaining intertidal habitat available to waterbirds (there are 21.40 km^2 of intertidal habitat within the South Dublin Bay and Tolka Estuary SPA) would remain the same.

938. Given the extent of intertidal habitat available to intertidal waterbirds, the short temporal duration of any unplanned maintenance activities and the passive nature of the operation of buried infrastructure within South Dublin Bay, the tolerance of intertidal waterbirds to disturbance and displacement during the operational phase of the project is considered to be very high (**Table 10-8**). This is considered to translate into a negligible impact magnitude under both the PA and AAM scenarios (**Table 10-10**), as the impact is considered to be of very low consequence to the affected population.

Significance of the effect

939. **Table 10-110** below considers each species' assessed sensitivity against the predicted magnitude of impact in order to determine the level of significance of effects in EIA terms.

Table 10-110 Significance of the effects of disturbance and displacement to intertidal waterbirds during the operational phase

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance Level	Significant / Not Significant
Light-bellied Brent Goose	low	negligible	**Imperceptible**	**Not Significant**
Shelduck	very low	negligible	**Imperceptible**	**Not Significant**
Shoveler	very low	negligible	**Imperceptible**	**Not Significant**
Teal	very low	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	low	negligible	**Imperceptible**	**Not Significant**
Golden plover	low	negligible	**Imperceptible**	**Not Significant**
Grey plover	low	negligible	**Imperceptible**	**Not Significant**
Ringed plover	low	negligible	**Imperceptible**	**Not Significant**
Curlew	low	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Black-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Turnstone	very low	negligible	**Imperceptible**	**Not Significant**
Knot	low	negligible	**Imperceptible**	**Not Significant**
Sanderling	low	negligible	**Imperceptible**	**Not Significant**
Dunlin	low	negligible	**Imperceptible**	**Not Significant**
Redshank	low	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not Significant**
Sterna terns	low	negligible	**Imperceptible**	**Not Significant**
Great crested grebe	very low	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	very low	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	low	negligible	**Imperceptible**	**Not Significant**
Herring gull	low	negligible	**Imperceptible**	**Not Significant**
Little egret	low	negligible	**Imperceptible**	**Not Significant**
Greenshank	very low	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	very low	negligible	**Imperceptible**	**Not Significant**
Common gull	low	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	low	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	very low	negligible	**Imperceptible**	**Not Significant**
Shag	low	negligible	**Imperceptible**	**Not Significant**
Black guillemot	very low	negligible	**Imperceptible**	**Not Significant**
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Grey heron	very low	negligible	**Imperceptible**	**Not Significant**

940. The magnitude the of impact for all species is assessed as negligible. Therefore (as per the matrix in **Table 10-11**), any effects on intertidal ornithology as a result of disturbance and displacement during the operational phase is predicted to be Imperceptible and not significant for all species assessed in

EIA terms. Where flexibility in the proposed design exists there, is no other scenario which would lead to a more significant effect.

941. Based on the predicted level of effect it is concluded that no additional mitigation is required beyond the primary mitigation described in **Section 10.9**.

Additional mitigation

942. Given that it is considered that there will be no significant effects in relation to disturbance and displacement to intertidal waterbirds during the operational phase, no additional mitigation is considered to be required in order to address this impact.

Residual effect

943. The significance of any residual effect is predicted to remain as **Imperceptible**, and **Not Significant** in EIA terms.

Offshore and intertidal – operation and maintenance: impact 3 – changes in prey availability

Offshore – array site and OECC (below MLWS)

944. The presence of operational structures and their associated maintenance may impact the prey species of ornithological receptors within offshore areas in such a way as to alter their availability to those ornithological receptors. Potential impacts to fish and invertebrate species have been assessed in **Chapter 9 Fish, Shellfish and Turtle Ecology**, and conclusions of those assessments inform this assessment on changes in prey availability to ornithological receptors.

945. These impacts may arise through the alteration of seabed habitat which support seabed prey species (e.g., ongoing occupancy of areas of benthic habitat by infrastructure footprint, including associated reef effects as installed infrastructure is colonised by marine species).

946. Alteration of habitats which support seabird prey species may alter the capacity of those habitats to hold or produce seabird prey species, thereby altering the abundance of prey available to foraging seabirds within and around impacted areas. Where prey species habitats are removed or altered in such a way as to become less suitable for seabird prey species, this may result in displacement of prey species from those areas and a reduction in the availability of prey to seabirds foraging within operational areas. Conversely, where prey species habitats are introduced or altered in such a way as to make them more suitable for seabird prey species, this may result in an increase in the availability of seabird prey species.

947. As operational phase activities generally do not require disturbance of the seabed except in the instance that potential localised cable repairs are necessary, increased SSC levels, which occur during construction phase activities are not considered to occur during the operational phase and there is not pathway for this impact to have the potential to cause changes to prey availability during the operational phase in such a way that could impact seabird receptor populations.

948. Similarly, as operational phase activities do not include piling works, or any other very high energy underwater noise inducing activities, and operational noise impact magnitudes to all potential prey species are assessed to be very low, there is not considered to be a pathway for operation and maintenance phase underwater noise impacts to have the potential to cause changes to prey availability in such a way that could impact seabird receptor populations.

949. During the operation and maintenance phase one additional potential impact to seabird receptor prey species, which does not occur during the construction phase, is considered, namely the effects of

electromagnetic field (EMF) effects associated with electricity passing through infrastructure cables. As any effects on fish are anticipated only to occur within the immediate vicinity of the cable, and effect levels are likely to be low in relation to background levels associated with the Earth's magnetic field, the magnitude of such impacts to potentially sensitive fish species are assessed as very low. Consequently, there is not considered to be a pathway for operation and maintenance phase EMF impacts to have the potential to cause changes to prey availability in such a way that could impact seabird receptor populations.

Receptor sensitivity

950. Receptor tolerances to changes in prey availability during the operation and maintenance phase are conservatively assumed to be as per during the construction phase (**Table 10-60**); however, as the sensitivity of key prey species to underwater noise or increased SSC no longer factors into considerations of receptor tolerance, it should be noted that operational phase receptor sensitivities are likely to be somewhat lower than during construction. As per consideration of receptor sensitivity to effects to prey availability during the construction phase, seabird receptor importance is assessed as low to very high (**Table 10-21**, **Section 10.6**) and when receptor tolerances and importance are considered together to determine overall assessments of receptor sensitivities as per **Table 10-11**, receptor sensitivities are assessed as very low, or medium (**Table 10-111**).

Table 10-111 Determination of receptor sensitivity by consideration of conservation importance and tolerance to offshore changes in prey availability during the operation and maintenance phase

Species	Conservation importance	Tolerance	Receptor sensitivity
Common scoter	high	very high	low
Kittiwake	very high	high	medium
Black-headed gull	high	very high	low
Little gull	high	very high	low
Great black-backed gull	medium	very high	very low
Common gull	high	very high	low
Herring gull	high	very high	low
Lesser black-backed gull	high	very high	low
Sandwich tern	low	very high	very low
Roseate tern	high	very high	low
Common tern	high	high	medium
Arctic tern	high	high	medium
Little tern	low	very high	very low
Guillemot	high	high	medium
Razorbill	very high	high	medium
Black guillemot	low	very high	very low
Puffin	very high	high	medium
Red-throated diver	high	high	medium

Species	Conservation importance	Tolerance	Receptor sensitivity
Great northern diver	high	very high	low
Fulmar	high	very high	low
Manx shearwater	high	very high	low
Gannet	high	very high	low
Cormorant	medium	high	low
Shag	high	high	medium

Magnitude of impact

951. Key seabird prey species may experience the loss of up 0.49 km^2 of habitat within the array site and up 0.11 km^2 within the OECC. For all seabird receptors, areas which may experience long term alteration of benthic habitats which may support key prey species populations constitute only a very small proportion (<1%) of the extent of foraging areas. On this basis, and with consideration that the majority of seabird receptors consume a range of prey species, there is assessed to be very low potential for impacts from long-term, operational phase alteration of areas of benthic habitat to affect regional populations of any seabird receptor through impacts to the availability of prey species (i.e., any potential impacts to regional baseline population mortality rates would not exceed 0.1%). As such, impacts to prey availability are for all receptors assessed to be of negligible magnitude.

Significance of the effect

952. In accordance with the matrix approach outlined to determine impact significance level in Table **10-11**, as receptor sensitivities are assessed to be Low or Medium and impact magnitude is assessed to be low, the potential effect of changes in prey availability during the operation and maintenance phase within the array site and OECC, is considered to be **Imperceptible** and **Not Significant** in EIA terms (**Table 10-112**).

Table 10-112 Significance of changes to offshore prey species availability to during the operation and maintenance phase

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Kittiwake	medium		**Imperceptible**	**Not Significant**
Black-headed gull	low		**Imperceptible**	**Not Significant**
Little gull	low		**Imperceptible**	**Not Significant**
Great black-backed gull	very low		**Imperceptible**	**Not Significant**
Common gull	low		**Imperceptible**	**Not Significant**
Herring gull	low		**Imperceptible**	**Not Significant**
Lesser black-backed gull	low		**Imperceptible**	**Not Significant**
Sandwich tern	very low		**Imperceptible**	**Not Significant**
Roseate tern	low		**Imperceptible**	**Not Significant**
Common tern	medium		**Imperceptible**	**Not Significant**

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Arctic tern	medium		**Imperceptible**	**Not Significant**
Little tern	very low		**Imperceptible**	**Not Significant**
Guillemot	medium		**Imperceptible**	**Not Significant**
Razorbill	medium		**Imperceptible**	**Not Significant**
Black guillemot	very low		**Imperceptible**	**Not Significant**
Puffin	medium		**Imperceptible**	**Not Significant**
Red-throated diver	medium		**Imperceptible**	**Not Significant**
Great northern diver	low		**Imperceptible**	**Not Significant**
Fulmar	low		**Imperceptible**	**Not Significant**
Manx shearwater	low		**Imperceptible**	**Not Significant**
Gannet	low		**Imperceptible**	**Not Significant**
Cormorant	low		**Imperceptible**	**Not Significant**
Shag	medium		**Imperceptible**	**Not Significant**

Additional mitigation

953. As the impacts associated with changes in prey availability during the operation and maintenance phase within the array site and OECC are assessed to be **Imperceptible**, and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

954. As no additional measures are required to mitigate changes in prey availability during the operation and maintenance phase within the array site and OECC, residual effects are assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

955. Although export cable within the intertidal habitats of South Dublin Bay will be buried and passive, so as to be undetectable to ornithological receptors during the operational phase, any unplanned maintenance activities which may take place during the operational phase of the project have the potential to impact the prey species of intertidal waterbirds in such a way as to alter their availability to those ornithological receptors. These impacts have the potential to arise via the excavation of the intertidal habitat wherein such prey species are found.

956. Prey species upon which intertidal birds (primarily waders and gulls) include invertebrates such as molluscs (including bivalves) and annelids (including polychaetes). Some species (including terns, divers, grebes and auks) prey on fish species such as sandeels.

957. The disturbance of habitats which support intertidal waterbird prey species during any necessary excavation of the intertidal zone as a result of unplanned maintenance have the potential to change the distribution, behaviour or accessibility of prey species for intertidal waterbirds.

958. Increased suspended sediment levels may alter the distribution of fish and mobile invertebrate species should they respond to avoid areas of altered water column condition.

959. Disturbance of habitats which support seabird prey species may reduce the capacity of those habitats to hold or produce intertidal waterbird prey species, thereby reducing the abundance of prey available to foraging intertidal waterbirds within and around impacted areas.

960. These pathways may result in a reduction in the availability of prey to intertidal waterbirds foraging within areas that are subject to excavation as part of unplanned maintenance activities. Potential impacts to invertebrate and fish species have been assessed within chapters 8 and 9, and conclusions of those assessments inform this assessment on changes in prey availability to ornithological receptors.

961. For intertidal birds, key prey species are likely to be invertebrates such as catworm, and molluscs such as Baltic tellin living in the littoral mud and sand flats. Part of this habitat also includes seagrass beds. The primary impacts to these habitats and prey species will include disturbance of the littoral sandy mud within which invertebrate prey occur, as well as a temporary increase in suspended sediments arising as a result of unplanned maintenance activities during the operational phase of the project. Any such unplanned maintenance excavation activities are likely to occur at low tide and therefore will not have associated SSCs.

962. Intertidal waterbird prey species are not considered to be sensitive to sediment deposition, as the majority of species present are highly mobile and able to move away from areas affected by sediment deposition. The intertidal habitat in itself is subject to constant natural and anthropogenic disturbance, and as such the species present therein are adapted to this type of disturbance and can recover quickly.

Impact screening

963. The screening process in relation to changes in prey availability within the intertidal zone as an impact to intertidal waterbirds during the operation and maintenance phase is considered to be the same as that carried out in relation to disturbance and displacement of ornithological receptors during the construction phase. See subsection **Impact screening** in section **Construction: Disturbance and displacement – Intertidal**, above. This is due to the consideration that the changes in prey availability impact has the potential to affect the same suite of species (i.e., intertidal waterbirds) screened-in for assessment in relation to disturbance and displacement and that the thresholds for inclusion which form the basis for disturbance and displacement screening remain valid for the changes in prey availability impact (i.e., there are no characteristics of this impact that should warrant an alternative approach to screening).

Receptor sensitivity

964. Relative to the spatial extent of habitats within South Dublin Bay which are available to intertidal waterbirds for foraging behaviours (21.40 km^2 of intertidal habitat), and given that maintenance activities on passive buried infrastructure is expected to be infrequent and localised, the tolerance of all receptors to impacts upon prey availability in intertidal areas during the operation and maintenance phase is considered to be very high.

965. In all cases, receptors are considered likely able to adapt behaviours to avoid localised impacts and reoccupy those areas shortly after cessation of any maintenance activities, such that any effects upon reproduction or survival rates of regional populations would be negligible / imperceptible.

966. The receptor importance of species occurring within intertidal areas are assessed as low to very high (**Table 10-22**).

967. When receptor tolerances and importance are considered together in **Table 10-113**, to determine overall assessments of receptor sensitivities as per **Table 10-11**, **Section 10.4**, receptor sensitivities

are assessed as very low (i.e., very high tolerance and low / medium importance) or low (i.e., very high tolerance and high / very high importance).

Table 10-113 Assessment of sensitivities of receptors utilising intertidal habitat within South Dublin Bay

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	very high	low
Shelduck	medium		very low
Shoveler	medium		very low
Pintail	medium		very low
Teal	medium		very low
Common scoter	high		low
red-breasted merganser	low		very low
Red-throated diver	high		high
Great crested grebe	low		very low
Grey heron	low		very low
Little egret	low		very low
Oystercatcher	very high		low
Golden plover	high		low
Grey plover	high		low
Ringed plover	high		low
Curlew	high		low
Bar-tailed godwit	very high		low
Black-tailed godwit	high		low
Turnstone	medium		very low
Knot	very high		low
Sanderling	high		low
Dunlin	very high		low
Redshank	very high		low
Greenshank	low		very low
Black-headed gull	high		low
Shag	high		low
Mediterranean gull	medium		very low
Common gull	high		low

Species	Conservation importance	Receptor tolerance	Receptor sensitivity
Great black-backed gull	medium		very low
Herring gull	high		low
Lesser black-backed gull	high		low
Black guillemot	low		very low
Sandwich tern	low		very low
Common tern	high		low
Arctic tern	high		low
Roseate tern	high		low
Wetland habitats	very high		low

968. In addition to ornithological receptors, impacts to wetland habitat within the South Dublin Bay area are also considered. 'Wetland and waterbirds' [A999] is a feature of the South Dublin Bay and River Tolka Estuary SPA. This feature comprises the wetland habitats that support waterbirds within the SPA and is therefore considered as part of the ornithological assessment.

969. As intertidal habitats which support ornithological receptors are a designated feature of the South Dublin Bay and River Tolka Estuary SPA, the conservation importance of this feature is considered to be very high.

970. Given that intertidal habitats are expected to recover rapidly after any operational phase maintenance activities within the intertidal area, functioning again as areas which support waterbird prey species, the tolerance of this feature is considered to be very high.

971. When the conservation importance and tolerance of this feature are considered together to determine an overall assessment of receptor sensitivity (as per **Table 10-11**), receptor sensitivity is assessed as low.

Magnitude of impact

972. When considering the PA and AAM scenarios (with the AAM scenario representing the maximum possible 'spread' of OECs buried within the intertidal zone), it is considered that neither scenario would represent a greater potential magnitude of impact than the other. This is due to the highly localised spatial extent and limited temporal duration and frequency of any potential maintenance works.

973. Although the AAM scenario may allow for maintenance works to take place in locations that the PA scenario would not, the relative spatial extent of remaining intertidal habitat available to waterbirds (there are 21.40 km^2 of intertidal habitat within the South Dublin Bay and Tolka Estuary SPA) would remain the same.

974. Nevertheless, the magnitude of impacts upon prey species availability within the intertidal zone during the operation and maintenance phase to ornithological receptors is assessed as negligible for all features. This is due to, as per **Table 10-10**, the impact being predicted to be of very low consequence to the affected population (i.e., limited in spatial extent, short in duration and both unlikely and infrequent in terms of the likelihood of the occurrence of this impact).

Significance of the effect

975. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be very low or low and impact magnitude is assessed to be negligible, the potential effect of direct effects on habitat within intertidal areas during the operation and maintenance phase is considered to be **Imperceptible** and **Not Significant** in EIA terms for both the PA and AAM scenarios (as shown in **Table 10-114**).

Table 10-114 Significance of changes to prey species availability to intertidal waterbirds during the construction phase

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Light-bellied Brent Goose	low	negligible	**Imperceptible**	**Not Significant**
Shelduck	very low	negligible	**Imperceptible**	**Not Significant**
Shoveler	very low	negligible	**Imperceptible**	**Not Significant**
Pintail	very low	negligible	**Imperceptible**	**Not Significant**
Teal	very low	negligible	**Imperceptible**	**Not Significant**
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
red-breasted merganser	very low	negligible	**Imperceptible**	**Not Significant**
Great crested grebe	very low	negligible	**Imperceptible**	**Not Significant**
Oystercatcher	very low	negligible	**Imperceptible**	**Not Significant**
Golden plover	very low	negligible	**Imperceptible**	**Not Significant**
Grey plover	very low	negligible	**Imperceptible**	**Not Significant**
Ringed plover	low	negligible	**Imperceptible**	**Not Significant**
Curlew	low	negligible	**Imperceptible**	**Not Significant**
Bar-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Black-tailed godwit	low	negligible	**Imperceptible**	**Not Significant**
Turnstone	low	negligible	**Imperceptible**	**Not Significant**
Knot	low	negligible	**Imperceptible**	**Not Significant**
Sanderling	low	negligible	**Imperceptible**	**Not Significant**
Dunlin	very low	negligible	**Imperceptible**	**Not Significant**
Redshank	low	negligible	**Imperceptible**	**Not Significant**
Greenshank	low	negligible	**Imperceptible**	**Not Significant**
Black-headed gull	low	negligible	**Imperceptible**	**Not Significant**
Mediterranean gull	low	negligible	**Imperceptible**	**Not Significant**
Great black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Common gull	low	negligible	**Imperceptible**	**Not Significant**

Receptor	Assessed sensitivity	Assessed magnitude	Impact significance level	Significant / Not Significant
Herring gull	low	negligible	**Imperceptible**	**Not Significant**
Lesser black-backed gull	very low	negligible	**Imperceptible**	**Not Significant**
Common tern	low	negligible	**Imperceptible**	**Not Significant**
Arctic tern	very low	negligible	**Imperceptible**	**Not Significant**
Roseate tern	low	negligible	**Imperceptible**	**Not Significant**
Sandwich tern	low	negligible	**Imperceptible**	**Not Significant**
Black guillemot	very low	negligible	**Imperceptible**	**Not Significant**
Red-throated diver	very low	negligible	**Imperceptible**	**Not Significant**
Shag	low	negligible	**Imperceptible**	**Not Significant**
Grey heron	low	negligible	**Imperceptible**	**Not Significant**
Little egret	low	negligible	**Imperceptible**	**Not Significant**
Wetland habitats	low	negligible	**Imperceptible**	**Not Significant**

976. The magnitude the of impact for all species is assessed as negligible. Therefore (as per the matrix in **Table 10-10**), any effects on intertidal ornithology as a result of changes in prey species availability is predicted to be **Imperceptible**, and **Not Significant** in EIA terms for all species assessed in EIA terms. Where flexibility in the proposed design exists, there is no other scenario which would lead to a more significant effect.

977. Based on the predicted level of effect it is concluded that no additional mitigation is required beyond the primary mitigation described in **Section 10.9**.

Additional mitigation

978. As the impacts associated with changes in prey availability during operation and maintenance phase activities within intertidal areas are assessed to be **Imperceptible**, and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

979. As no additional measures are required to mitigate changes in prey availability during operation and maintenance phase activities within intertidal areas, the residual effect is assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Offshore and intertidal – operation and maintenance: impact 4 – pollution

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

980. Accidental pollution events during the operation and maintenance phase have the potential to have a negative effect on ornithological receptors within offshore and intertidal areas. Potential pollutants are

outlined in the **Table 10-28** in **Section 10.8 Assessment parameters**, and are as follows: grease, hydraulic oil, gear oil, nitrogen, transformer silicon / ester oil, diesel fuel, SF6, glycol / coolants, drill fluid and batteries.

Receptor sensitivity

981. Ornithological receptors may be sensitive to direct effects (i.e., through the ingestion of toxic substances, or from fouling of plumage), or indirect effects (i.e., upon habitat and / or prey species) from the release of pollutants. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to pollution events (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Magnitude of impact

982. Although there is the potential for significant impacts to arise from accidental pollution events in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation outlined in **Section 10.9**, in the form of a CEMP. This will ensure that vessels follow best practice guidelines to prevent the pollution and that analogous protocols are adhered to minimise such risk associated with works in inter-tidal habitats. The final CEMP will follow IMO and OSPAR guidelines in relation to industry best practices regarding pollution management. As such, the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

983. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of pollution impacts during the operation and maintenance phase upon all offshore and intertidal ornithology receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

984. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

985. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Offshore and intertidal – operation and maintenance: impact 5 – introduction of invasive non-native species

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

986. The potential for INNS to be introduced during operational and maintenance related activities is considered to be far less than during the construction phase. Operational and maintenance related activities involve the use of fewer vessels than those during the construction phase, with up to 14 vessels, compared to up to 75 vessels (with up to 38 on site simultaneously) during construction, and 1,209 movements per annum compared to 2,406 movements during construction. Furthermore, those

vessels which are used during the operation and maintenance phase will generally come from a nearby Irish O&M base, rather than international ports where there is greater potential for biofouling or ballast water contamination etc., by marine species which are not native to Ireland.

987. Despite this, there remains a limited potential that INNS could be introduced by operation and maintenance-related activities and that the presence of INNS could result in negative effects to ornithological receptors within offshore and intertidal areas.

Receptor sensitivity

988. Ornithological receptors may be sensitive to direct effects (for example, invasive plant species over-growing nesting locations), or indirect effects (i.e., upon habitat and / or prey species) associated with the introduction or spread of INNS. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to invasive species impacts (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Magnitude of impact

989. Although there is the potential for significant impacts to arise from INNS in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation stemming from consideration of the mitigation and control of invasive species measures in line with International Maritime Organization guidance (IMO, 2019) which are secured through the implementation of the CEMP described in **Section 10.9**, specifically that all vessels working on the CWP Project will have a Biosecurity Plan in place. The associated standards and procedures will be incorporated by all vessels and as such the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

990. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of introduction or spread of INNS impacts during the operation and maintenance phase upon all receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

991. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

992. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Offshore – operation and maintenance: impact 6 – collision

Offshore – array site

993. Where birds fly through the array site there is the potential of collision with WTGs resulting in injury or fatality. Birds passing through the CWP array site may do so when foraging, commuting or during seasonal migrations.

994. CRM has been carried out for the CWP Project, with detailed methods and results presented in **Appendix 10.3 Collision Risk Modelling**, to provide information for seabird and migratory species of interest identified as potentially at risk and of interest for impact assessment.

Seabirds

Impact screening

995. In line with best practice a screening process was undertaken based on the density of flying birds recorded within the array site and consideration of their assessed risk from collision, relating to flight heights (identified from the published literature), with the results presented in **Table 10-115**. This screening process screened out those species for which the risk of collision is considered to be very low, such as Fulmar which fly very close to the sea surface so are unlikely to interact with WTGs (e.g., Furness and Wade, 2012; Wade et al., 2016). Species were also screened out if their densities in flight within the array site were very low (i.e., where estimated peak density in flight within the array site was less than 0.1 bird per km^2), as this also provides evidence of very low potential for collision events to occur. Where a species' risk of collision was assessed to be low and its estimated peak density in flight within the array site was also assessed to be low (i.e., <0.5 birds per km^2), these too were screened out.

996. Following this screening process, six species were identified as meeting the screening criteria for CRM assessment; Kittiwake, Common gull, Great black-backed gull, Herring gull, Common tern and Gannet.

997. For species screened out, the combination of low risk and / or density means that there is no potential for a likely significant effect, either on a project-alone or a cumulative basis, and so those species are not considered further in this section.

Table 10-115 Screening of key seabird species for risk of collision

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
Kittiwake	medium	1.72 (low)	3.773 (high)	in	Medium / low risk of collision and flying birds occurring at high peak density within array site. Potential for non-negligible collision mortality.
Common gull	medium	6.01 (high)	0.150 (low)	in	Medium / high risk of collision and flying birds occurring at low peak density within array site. Potential for non-negligible collision mortality.

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
Black-headed gull	medium (uses common gull and Kittiwake as a proxy, as most similar species)	4.29 (medium)	0.050 (very low)	out	Medium risk of collision but flying birds occurring at very low peak density within Array Site. No potential for non-negligible collision mortality.
Little gull	medium (uses common gull and Kittiwake as a proxy, as most similar species)	1.61 (low)	0.302 (low)	out	Medium / low risk of collision and flying birds occurring at low peak density within array site. No potential for non-negligible collision mortality.
Great black-backed gull	high	12.21 (very high)	0.192 (low)	in	High / very high risk of collision and flying birds occurring at low peak density within array site. Potential for non-negligible collision mortality.
Herring gull	high	10.93 (very high)	0.876 (medium)	in	High / very high risk of collision and flying birds occurring at medium peak density within array site. Potential for non-negligible collision mortality.
Lesser black-backed gull	high	8.88 (high)	0.033 (very low)	out	High risk of collision and flying birds occurring at very low peak density within array site. No potential for non-

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
					negligible collision mortality.
Roseate tern	low (uses common and Arctic tern as a proxy, as most similar species)	0.41-0.76 (low)	0	out	Low risk of collision and no flying birds observed within array site. No potential for non-negligible collision mortality.
Common tern	low	0.41 (low)	1.825 (medium)	in	Low risk of collision and flying birds occurring at medium peak density within array site. Potential for non-negligible collision mortality.
Arctic tern	low	0.76 (low)	0.489 (low)	out	Low risk of collision and flying birds occurring at low peak density within array site. No potential for non-negligible collision mortality.
Sandwich tern	low	1.65 (low)	0.029 (very low)	out	Low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-negligible collision mortality.
Little tern	low	No data – but other tern species have 0.41% to 1.65% of flight activity >36 m (low)	0.025 (very low)	out	Low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-negligible collision mortality.

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
Guillemot	very low	0 (very low)	2.252 (medium)	out	Flying birds occurring at medium peak density within array site but very low risk of collision. No potential for non-negligible collision mortality.
Razorbill	very low	0 (very low)	0.475 (low)	out	Very low risk of collision and flying birds occurring at low peak density within array site. No potential for non-negligible collision mortality.
Black guillemot	very low	Not available (very low, based on flight behaviours of other auk species)	0	out	Low risk of collision and no flying birds observed within array site. No potential for non-negligible collision mortality.
Puffin	very low	0.06 (very low)	0.276 (low)	out	Very low risk of collision and flying birds occurring at low peak density within array site. No potential for non-negligible collision mortality.
Red-throated diver (uses Black-throated diver as a proxy, as most similar species)	very low	0.05 (very low)	0	out	Very low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-negligible collision mortality.

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
Great northern diver (uses Black-throated diver as a proxy, as most similar species)	very low	0.05 (very low)	0	out	Very low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-negligible collision mortality.
Fulmar	very low	0.1 (very low)	0.075 (very low)	out	Very low risk of collision and flying birds occurring at low peak density within array site. No potential for non-negligible collision mortality.
Manx shearwater	very low	0.01 (very low)	1.725 (medium)	out	Flying birds occurring at medium peak density within array site but very low risk of collision. No potential for non-negligible collision mortality.
Gannet	medium	1.97 (low)	0.200 (low)	In	Medium / low risk of collision and flying birds occurring at low peak density within array site. Potential for non-negligible collision mortality.
Cormorant (uses Shag as a proxy, as most similar species)	very low	0.11 (very low)	0.025 (very low)	out	Very low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-

Species	Risk of collision		Estimated peak monthly density of birds in flight in array site (birds/km^2)	Screened in or out	Explanation
	Desk-based review (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016)	Percentage of flight activity at PCH (>36 m ASL per Johnston et al., 2014)			
					negligible collision mortality.
Shag	very low	0.11 (very low)	0.025 (very low)	out	Very low risk of collision and flying birds occurring at very low peak density within array site. No potential for non-negligible collision mortality.

Receptor sensitivity

998. For receptor tolerance assessments in relation to collision impacts it should be noted that criteria which are generally used to define tolerance, particularly the considered ability of a receptor to avoid impacts (see **Table 10-8**) are incorporated within models to determine the number of individuals experiencing collision, and in turn used to attribute impact magnitude values. Furthermore, at an individual level, as collision events are generally equated to the death of the individual involved, collision impacts cannot be habituated to. As such, to assess receptor tolerances in order to most closely align with the criteria outlined in **Table 10-8** and associated principles, the following aspects are considered:

- Desk-based general overviews of species-specific inherent sensitivity to collision risk (such as Garthe & Hüppop, 2004; Furness & Wade, 2012 and Wade et al., 2016);
- Peak baseline monthly flight densities within the array site to provide an indication of the importance of the impacted area to the receptor (on the rationale that highly used areas are more important to receptor populations and impacts in these areas more likely to result in demographic consequences to the receptor population.

999. For example, where published literature suggests a low inherent sensitivity to collision risk and peak levels of site use are low, the tolerance of a receptor is assessed as high, whereas, if inherent sensitivity and peak levels of site use are high, receptor tolerance is assessed as low.

Kittiwake

1000. Kittiwake is considered to have low tolerance to collision impacts within the array site during the operation and maintenance phase. This species is assessed to have moderate inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), but peak monthly density of Kittiwake in flight within the array site, where birds may experience collision with turbine blades, is assessed to be high (up to 3.773 birds per km^2), indicating that the array site location may correspond with an area of high importance for this receptor.

1001. The conservation importance of Kittiwake is assessed to be Very High (**Table 10-21**).

1002. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as very high (i.e., low tolerance and very high importance).

Common gull

1003. Common gull is considered to have high tolerance to collision impacts within the array site during the operation and maintenance phase. Although this species is assessed to have moderate inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), peak monthly density of Common gull in flight within the array site, where birds may experience collision with turbine blades, is assessed to be very low (up to 0.150 birds per km^2), indicating that the array site location does not correspond with an area of medium or high importance for this receptor.

1004. The conservation importance of Common gull is assessed to be high (**Table 10-21**).

1005. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., high tolerance and high importance).

Great black-backed gull

1006. Great black-backed gull is considered to have medium tolerance to collision impacts within the array site during the operation and maintenance phase. Although this species is assessed to have high inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), peak monthly density of Great black-backed gull in flight within the array site, where birds may experience collision with turbine blades, is assessed to be very low (up to 0.192 birds per km^2), indicating that the array site location does not correspond with an area of medium or high importance for this receptor.

1007. The conservation importance of Great black-backed gull is assessed to be medium (**Table 10-21**).

1008. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as medium (i.e., medium tolerance and medium importance).

Herring gull

1009. Herring gull is considered to have low tolerance to collision impacts within the array site during the operation and maintenance phase. This species is assessed to have high inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), but peak monthly density of Herring gull in flight within the array site, where birds may experience collision with turbine blades, is assessed to be medium (up to 0.876 birds per km^2), indicating that the array site location may correspond with an area of medium importance for this receptor.

1010. The conservation importance of Herring gull is assessed to be high (**Table 10-21**).

1011. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., low tolerance and high importance).

Common tern

1012. Common tern is considered to have moderate tolerance to collision impacts within the array site during the operation and maintenance phase. This species is assessed to have low inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), but peak monthly density of Common tern in flight within the array site, where birds may experience collision with turbine blades, is assessed to be moderate (up to 1.825 birds per km^2), indicating that the array site location may correspond with an area of medium importance for this receptor.

1013. The conservation importance of Common tern is assessed to be high (**Table 10-21**).

1014. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Gannet

1015. Gannet is considered to have medium tolerance to collision impacts within the array site during the operation and maintenance phase. Although this species is assessed to have moderate inherent susceptibility to collision mortality from a desk-based review of literature (Garthe & Hüppop, 2004; Furness & Wade, 2012; Wade et al., 2016), peak monthly density of Gannet in flight within the array site, where birds may experience collision with turbine blades, is assessed to be low (up to 0.200 birds per km^2), indicating that the array site location does not correspond with an area of moderate or high importance for this receptor.

1016. The conservation importance of Gannet is assessed to be high (**Table 10-21**).

1017. When receptor tolerance and importance are considered together as per **Table 10-9**, overall receptor sensitivity is assessed as high (i.e., medium tolerance and high importance).

Magnitude of impact

1018. Collision risk modelling was run for both OWF Design Options (A and B). The CRM parameters for both Design Options, including percentage of time turbines are predicted to be operational, are provided in **Appendix 10.3 Collision Risk Modelling**.

1019. Species biometric data and avoidance rates used for CRM are also presented in **Appendix 10.3 Collision Risk Modelling**. These parameters are those recommended in the most recent guidance issued by NatureScot (2023).

1020. Monthly collision rates and total annual collisions for Design Option A for all species assessed are shown in **Table 10-116**. Monthly collision rates and total annual collisions under both Design Options A and B are presented for Herring gull only. Monthly collision rates and total annual collisions under Design Option B for all other species are presented in **Appendix 10.3 Collision Risk Modelling**.

Table 10-116 Monthly and annual collision estimates for Design Option A for all species considered, and both Design Options A and B for Herring gull only, using the appropriate Band Option for each species. Collision estimates are central estimate (minimum–maximum).

Month	Kittiwake	Common gull	Great black-backed gull	Herring gull	Common tern	Gannet
	Band Option 1 Design Option A	Band Option 2 Design Option A	Band Option 2 Design Option A	Band Option 1 Design Options A and B	Band Option 2 Design Option A	Band Option 1 Design Option A
Jan	1.322 (0.603 – 2.579)	0.228 (0.127 – 0.406)	0 (0 – 0)	**Option A**: 0 (0 – 0) **Option B**: 0 (0 – 0)	0 (0 – 0)	0.102 (0.037 – 0.213)
Feb	1.099 (0.062 – 3.812)	0.912 (0.047 – 3.415)	0 (0 – 0)	**Option A**: 1.308 (0.113 – 4.219) **Option B**: 1.179 (0.11 – 3.68)	0 (0 – 0)	0.051 (0.003 – 0.18)
Mar	1.001 (0.346 – 2.374)	0.391 (0.029 – 1.237)	0 (0 – 0)	**Option A**: 0.586 (0.053 – 1.762)	0 (0 – 0)	0.031 (0.002 – 0.111)

Month	Kittiwake	Common gull	Great black-backed gull	Herring gull	Common tern	Gannet
	Band Option 1 Design Option A	Band Option 2 Design Option A	Band Option 2 Design Option A	Band Option 1 Design Options A and B	Band Option 2 Design Option A	Band Option 1 Design Option A
				Option B: 0.505 (0.042 – 1.641)		
Apr	0.761 (0.245 – 1.686)	0 (0 – 0)	0 (0 – 0)	**Option A**: 0.543 (0.041 – 1.833) **Option B**: 0.472 (0.034 – 1.681)	0 (0 – 0)	0.069 (0.01 – 0.207)
May	2.011 (0.846 – 4.188)	0 (0 – 0)	3.659 (0.383 – 11.04)	**Option A**: 20.339 (0.824 - 75.582) **Option B**: 17.27 (1.261 - 62.677)	0.147 (0.008 – 0.531)	0.258 (0.017 – 1.024)
Jun	0.996 (0.455 – 1.905)	0 (0 – 0)	0 (0 – 0)	**Option A**: 0 (0 – 0) **Option B**: 0 (0 – 0)	0.019 (0.001 – 0.062)	0.034 (0.002 – 0.145)
Jul	1.242 (0.514 – 2.589)	0 (0 – 0)	0 (0 – 0)	**Option A**: 0.622 (0.04 – 2.175) **Option B**: 0.516 (0.033 – 1.861)	0.072 (0.031 – 0.144)	0.037 (0.002 – 0.136)
Aug	1.567 (0.491 – 3.679)	0 (0 – 0)	0 (0 – 0)	**Option A**: 3.514 (0.234 - 12.604) **Option B**: 2.92 (0.145 - 10.624)	1.366 (0.151 – 3.936)	0.034 (0.002 – 0.128)
Sep	0.379 (0.023 – 1.523)	0.009 (0 – 0.031)	0 (0 – 0)	**Option A**: 0 (0 – 0) **Option B**: 0 (0 – 0)	0.669 (0.039 – 2.128)	0.062 (0.013 – 0.189)
Oct	1.191 (0.322 – 2.946)	0 (0 – 0)	0 (0 – 0)	**Option A**: 0 (0 – 0) **Option B**: 0 (0 – 0)	0 (0 – 0)	0.027 (0.002 – 0.109)

Month	Kittiwake	Common gull	Great black-backed gull	Herring gull	Common tern	Gannet
	Band Option 1 Design Option A	Band Option 2 Design Option A	Band Option 2 Design Option A	Band Option 1 Design Options A and B	Band Option 2 Design Option A	Band Option 1 Design Option A
Nov	2.372 (0.987 – 5.1)	0.345 (0.079 – 0.828)	0 (0 – 0)	**Option A**: 0.016 (0.001 – 0.055) **Option B**: 0.014 (0.001 – 0.045)	0 (0 – 0)	0.047 (0.009 – 0.139)
Dec	4.341 (0.787 – 11.099)	0.474 (0.045 – 1.453)	0.488 (0.028 – 1.453)	**Option A**: 0.483 (0.028 – 1.657) **Option B**: 0.407 (0.025 – 1.372)	0 (0 – 0)	0.142 (0.006 – 0.568)
Annual	**18.282 (5.681 – 43.48)**	**2.359 (0.327 – 7.37)**	**4.147 (0.411 – 12.493)**	Option A: **27.411 (1.334 - 99.887)** Option B: **23.283 (1.651 – 83.581)**	**2.273 (0.23 – 6.801)**	**0.894 (0.105 – 3.149)**

1021. For species where there is considered to be sufficient site-specific flight data from baseline datasets (as justified in **Section 2.1** of Technical **Appendix 10.3 Collision Risk Modelling**) Band Option 1 Collision Risk Models outputs are presented in this chapter (with Band Option 2 outputs also included within **Appendix 10.3 Collision Risk Modelling**). Band Option 2 Collision Risk Model outputs, which make use of generic flight height distributions from Johnston et al. (2014a, b), are presented for all other species. Where sufficiently robust site-specific data are available to permit Band Option 1 CRM, assessment conclusions have focused upon the use of these data, with Band Option 2 CRM outputs provided for comparative purposes; an approach consistent with advice received within the NPWS review of the east coast Phase 1 Projects Offshore Ornithology Assessment Method Statement (ABPmer, 2023).

Kittiwake

1022. Monthly estimated mortality rates associated with design A are presented in **Table 10-116**. For Band Option 1 models these vary from a minimum of 0.379 in September to a maximum of 4.341 in December. On an annual basis, with Band Option 1 models, the estimated mortality rate for collision risk from CWP is 18.282 individuals. Monthly estimated mortality rates associated with design B are presented in **Appendix 10.3 Collision Risk Modelling**.

1023. Monthly estimates for Design A Band Option 1 models are considered grouped into relevant bio-seasons in **Table 10-117 Kittiwake bio-season collision risk estimates**

1024. . The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.10**, which are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

1025. For Kittiwake, as site-specific flight height information is considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 1 CRM outputs are used to define collision mortality impact magnitude. Band Option 2 CRM outputs for Kittiwake are presented in **Appendix 10.3 Collision Risk Modelling**.

Table 10-117 Kittiwake bio-season collision risk estimates

Design	BO	Bio-season (months)	Regional baseline populations and baseline mortality rates (individuals per annum)		Collisions (min – max)	Increase in baseline mortality (%)
			Population	Baseline mortality		
A	1	Return migration (Jan – Apr)	708,147	110,471	4.183 (1.256 – 10.451)	0.004 (0.001 – 0.009)
		Migration-free breeding (May – Jul)	Method 1: 404,443	63,093	4.249 (1.815 – 8.682)	0.007 (0.003 – 0.014)
			Method 2: 131,860	20,570		0.021 (0.009 – 0.042)
		Post-breeding migration (Aug-Dec)	928,207	144,800	9.85 (2.61 – 24.347)	0.007 (0.002 – 0.017)
		Annual (BDMPS)	928,207	144,800	18.282 (5.681 – 43.48)	0.013 (0.004 – 0.030)
		Annual (Biogeographic)	5,100,000	795600	18.282 (5.681 – 43.48)	0.002 (0.001 – 0.005)

1026. For Band Option 1 models, during the return migration bio-season Kittiwake collision mortality was estimated to be 4.183 individuals for Design A. The return migration Kittiwake regional baseline population is estimated to be 708,147 individuals, and associated baseline mortality to be 110,471 individuals (from an average mortality rate of 0.156 – **Table 10-15**). Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.004% from baseline for Design Option A.

1027. This level of impact during the return migration bio-season is considered to be of negligible magnitude for Design A.

1028. The migration-free breeding Kittiwake regional baseline population is estimated to be 404,443 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 131,860 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1029. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (15.6%), the total number of regional Kittiwake mortalities during each migration-free breeding season is estimated to be 63,093 individuals (using breeding season regional population estimation Method 1), or 20,570 individuals (using breeding season regional population estimation Method 2).

1030. For Band Option 1 models, during the migration-free breeding bio-season Kittiwake collision mortality was estimated to be 4.249 individuals for Design A.

1031. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.007 or 0.021% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design A.

1032. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude for Design A.

1033. For Band Option 1 models, during the post-breeding migration bio-season Kittiwake collision mortality was estimated to be 9.850 individuals for Design A. The post-breeding migration Kittiwake regional baseline population is estimated to be 928,207 individuals, and associated baseline mortality to be 144,800 individuals (from an average mortality rate of 0.156 – **Table 10-15**). Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.007% from baseline for Design A.

1034. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude for Design A.

1035. For Band Option 1 models, annual (all seasons combined) estimated mortality resulting from collisions is 18.282 individuals for Design A. Using the largest regional bio-season population of 928,207 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.156 (**Table 10-15**), the predicted regional mortality across all seasons is estimated to be 144,800 individuals. Additional collision mortality would therefore increase regional annual mortality by 0.013% and from baseline for Design A.

1036. Similarly, for the estimated biogeographic population of 5,100,000 individuals (**Table 10-14**), using an average mortality rate of 0.156 (**Table 10-15**), the predicted biogeographic mortality across all seasons is estimated to be 795,600 individuals. Additional collision mortality would therefore increase biogeographic annual mortality by 0.002% from baseline for Design A.

1037. This level of annual impact to the regional and biogeographic populations is considered to be of **negligible** magnitude for Design A.

1038. For each bio-season and on an overall annual basis, the magnitude of the potential impact is therefore considered to be negligible for design A, as this represents no discernible increase to baseline mortality levels, and therefore present no potential for discernible change to regional population trends as a result of collision.

1039. In light of advice from NPWS (NPWS, 2023), CRMs were also run for Kittiwake using flight speed values from Skov et al., 2028; these are provided in **Appendix 10.7 Additional Collision Risk Modelling of Kittiwake**. The use of these alternative flight speed values results in reduced estimated mortality. For Band Option 1 models, annual (all seasons combined) estimated mortality resulting from collisions is 14.070 individuals for Design A.

Common gull

1040. Monthly estimated mortality rates associated with design A are presented in **Table 10-116**. For Band Option 2 models these vary from a minimum of zero in April to August and October to a maximum of 0.912 in February. On an annual basis, with Band Option 2 models, the estimated mortality rate for collision risk from CWP is 2.356 individuals. Monthly estimated mortality rates associated with design B are presented in **Appendix 10.3 Collision Risk Modelling**.

1041. Monthly estimates for Design A for Band Option 2 models are considered grouped into relevant bio-seasons in **Table 10-118** Common gull bio-season collision risk estimates

1042. . The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.10** which are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

1043. For Common gull, as site-specific flight height information is not considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 2 CRM outputs are used to define collision mortality impact magnitude.

Table 10-118 Common gull bio-season collision risk estimates

Design	BO	Bio-season (months) (uses Kittiwake as a proxy for bio-season definitions, as most similar species)	Regional baseline populations and baseline mortality rates (individuals per annum)		Collisions (min – max)	Increase in baseline mortality (%)
			Population	Baseline mortality		
A	2	Return migration (Jan – Apr)	67,500	17,078	1.531 (0.203 – 5.058)	0.009 (0.001 – 0.030)
		Migration-free breeding (May – Jul)	Method 1: 26,779	6,775	0 (0 – 0)	0.000 (0.000 – 0.000)
			Method 2: 5,657	1,431		0.000 (0.000 – 0.000)
		Post-breeding migration (Aug-Dec)	67,500	17,078	0.828 (0.124 – 2.312)	0.005 (0.001 – 0.014)
		Annual (BDMPS)	67,500	17,078	2.359 (0.327 – 7.37)	0.014 (0.002 – 0.043)
		Annual (Biogeographic)	1,725,000	436,425		0.001 (0.000 – 0.002)

1044. The return migration Common gull regional baseline population is estimated to be 67,500 individuals, with a baseline mortality of 17,078 individuals (from an average mortality rate of 0.253; **Table 10-118**). For Band Option 2 models, during the return migration bio-season Common gull collision mortality was estimated to be 1.531 individuals for Design A. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.009% from baseline for Design A.

1045. This level of impact during the return migration bio-season is considered to be of negligible magnitude for Design A.

1046. The migration-free breeding Common gull regional baseline population is estimated to be 26,779 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 5,657 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1047. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (25.3%), the total number of regional Common gull mortalities during each migration-free breeding season is estimated to be 17,078 individuals (using breeding season regional population estimation Method 1), or 6,775 individuals (using breeding season regional population estimation Method 2).

1048. For Band Option 2 models, during the migration-free breeding bio-season Common gull collision mortality was estimated to be zero individuals for Design A.

1049. Additional collision mortality would therefore not increase regional bio-seasonal mortality from baseline for breeding season regional population estimation Methods 1 and 2 for Design A.

1050. The level of impact during the migration-free breeding bio-season is considered to be zero for Design A.

1051. The post-breeding migration Common gull regional baseline population is estimated to be 67,500 individuals, with a baseline mortality of 17,078 individuals (from an average mortality rate of 0.253 – **Table 10-15**). For Band Option 2 models, during the post-breeding migration bio-season common gull collision mortality was estimated to be 0.828 individuals for Design A. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.005% from baseline for Design A.

1052. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude for Design A.

1053. Using the largest regional bio-season population of 67,500 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.253 (**Table 10-15**), the predicted regional mortality across all seasons is estimated to be 17,078 individuals. For Band Option 2 models, annual (all seasons combined) estimated mortality resulting from collisions is 2.359 individuals for Design A. Additional collision mortality would therefore increase regional annual mortality by 0.014% from baseline for Design A.

1054. Similarly, for the estimated biogeographic population of 1,725,000 individuals (**Table 10-14**) using an average mortality rate of 0.253 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 436,425 individuals. Additional collision mortality would therefore increase biogeographic annual mortality by 0.001% from baseline for Designs A.

1055. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude for Design A.

1056. For each bio-season and on an overall annual basis, the magnitude of the potential impact is therefore considered to be negligible for design A, as they represent no discernible increase to baseline mortality levels as a result of collision.

Great black-backed gull

1057. Monthly estimated mortality rates associated with design A are presented in **Table 10-116**. Design A: Monthly estimated mortality rates associated with design A are presented in **Table 10-119**. For Band Option 2 models these vary from a minimum of 0 (ten months) to a maximum of 3.659 in May. On an annual basis, with Band Option 2 models, the estimated mortality rate for collision risk from CWP is 4.147 individuals. Monthly estimated mortality rates associated with design B are presented in **Appendix 10.3 Collision Risk Modelling**.

1058. Monthly estimates for Design A for Band Option 2 models are considered grouped into relevant bio-seasons in **Table 10-15**. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.6**, which are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

1059. For Great black-backed gull, as site-specific flight height information is not considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 2 CRM outputs are used to define collision mortality impact magnitude.

Table 10-119 Great black-backed gull bio-season collision risk estimates

Design	BO	Bio-season (months)	Regional baseline populations and baseline mortality rates (individuals per annum)		Collisions (min – max)	Increase in baseline mortality (%)
			Population	Baseline mortality		
A	2	Breeding (Apr – Aug)	Method 1: 33,032	3,238	3.659 (0.383 – 11.04)	0.113 (0.012 – 0.341)
			Method 2: 2,041	194		1.886 (0.197 – 5.691)
		Non-breeding (Sep – Oct)	53,181	5,052	0.488 (0.028 – 1.453)	0.010 (0.001 – 0.029)
		Annual (BDMPS)	53,181	5,052	4.147 (0.411 – 12.493)	0.082 (0.008 – 0.247)
		Annual (Biogeographic)	440,000	42,180	4.147 (0.411 – 12.493)	0.010 (0.001 – 0.030)

1060. The breeding Great black-backed gull regional baseline population is estimated to be 33,032 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 2,041 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1061. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (9.5%), the total number of regional Great black-backed gull mortalities during each breeding season is estimated to be 3,138 individuals (using breeding season regional population estimation Method 1), or 194 individuals (using breeding season regional population estimation Method 2).

1062. For Band Option 2 models, during the breeding bio-season great black-backed gull collision mortality was estimated to be 3.659 individuals for Design A.

1063. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.113 or 1.886% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design A.

1064. Levels of impact during the breeding bio-season are considered to be of low magnitude for Design A where the breeding season regional population is determined using Method 1, but of medium magnitude for Designs A where the breeding season regional population is determined using Method 2. The level of impact during the breeding bio-season is therefore considered to be of low / medium magnitude for Design A.

1065. The non-breeding Great black-backed gull regional baseline population is estimated to be 53,181 individuals, with a baseline mortality of 5,052 individuals (from an average mortality rate of 0.095 – **Table 10-15**). For Band Option 2 models, during the non-breeding bio-season Great black-backed gull collision mortality was estimated to be 0.488 individuals for Design A. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.010% from baseline for Design A.

1066. This level of impact during the non-breeding bio-season is considered to be of negligible magnitude for Design A.

1067. For Band Option 2 models, annual (all seasons combines) estimated mortality resulting from collisions is 4.147 individuals for Design A. Using the largest regional bio-season population of 53,181 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.095 **Table 10-15**), the predicted regional mortality across all seasons is estimated to be 5,052 individuals. Additional collision mortality would therefore increase regional annual mortality by 0.00082% from baseline for Design A.

1068. Similarly, for the estimated biogeographic population of 440,000 individuals (**Table 10-14**), using an average mortality rate of 0.095 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 41,800 individuals. Additional collision mortality would therefore increase biogeographic annual mortality by 0.010% and from baseline for Design A.

1069. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude for Design A.

1070. Although impact magnitudes during the non-breeding bio-season and on an annual basis are assessed to be negligible, as the magnitude of impacts during the breeding bio-season is assessed to be low / medium, the overall potential impact magnitude is considered to be low for design A (i.e., 0.1% to 1% increase to regional baseline mortality rates).

Herring gull

1071. Design A: Monthly estimated mortality rates associated with design A are presented in **Table 10-116**. For Band Option 1 models these vary from a minimum of zero in January, June, September and October to a maximum of 20.339 in May. On an annual basis, with Band Option 1 models, the estimated mortality rate for collision risk from CWP is 27.411 individuals.

1072. Design B: Monthly estimated mortality rates associated with design B are presented in **Table 10-120**. For Band Option 1 models these vary from a minimum of 0 in January, June, September and October to a maximum of 17.270 in May. On an annual basis, with Band Option 1 models, the estimated mortality rate for collision risk from CWP is 23.283 individuals.

1073. Monthly estimates for Designs A and B under Band Option 1 models are considered grouped into relevant bio-seasons in **Table 10-120**. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.6**, which are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

1074. For Herring gull, as site-specific flight height information is considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 1 CRM outputs are used to define collision mortality impact magnitude (**Table 10-10**). Band Option 2 CRM outputs for Herring gull are presented in **Chapter 10 - Appendix 10.3 Collision Risk Modelling**.

Table 10-120 Herring gull bio-season collision risk estimates

Design	BO	Bio-season (months)	Regional baseline populations and baseline mortality rates (individuals per annum)		Collisions (min – max)	Increase in baseline mortality (%)
			Population	Baseline mortality		
A	1	Breeding (Apr – Aug)	Method 1: 122,755	21,114	25.018 (1.139 – 92.194)	0.118 (0.005 – 0.437)
			Method 2: 21,351	3,672		0.681 (0.031 – 2.511)
		Non-breeding (Sep – Mar)	196,791	33,848	2.393 (0.195 – 7.693)	0.007 (0.001 – 0.023)
		Annual (BDMPS)	196,791	33,848	27.411 (1.334 – 99.887)	0.081 (0.004 – 0.295)
		Annual (Biogeographic)	640,000	110080	27.411 (1.334 – 99.887)	0.025 (0.001 – 0.091)
B	1	Breeding (Apr – Aug)	Method 1: 122,755	21,114	21.178 (1.473 – 76.843)	0.089 (0.004 – 0.310)
			Method 2: 21,351	3,672		0.511 (0.024 – 1.783)
		Non-breeding (Sep – Mar)	196,791	33,848	2.105 (0.178 – 6.738)	0.006 (0.000 – 0.016)
		Annual (BDMPS)	196,791	33,848	23.283 (1.651 – 83.581)	0.061 (0.003 – 0.210)
		Annual (Biogeographic)	640,000	110080	23.283 (1.651 – 83.581)	0.019 (0.001 – 0.064)

1075. The breeding Herring gull regional baseline population is estimated to be 122,755 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 21,351 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1076. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (17.2%), the total number of regional Herring gull mortalities during each breeding season is estimated to be 21,114 individuals (using breeding season regional population estimation Method 1), or 3,672 individuals (using breeding season regional population estimation Method 2).

1077. For Band Option 1 models, during the breeding bio-season Herring gull collision mortality was estimated to be 25.018 individuals for Design A and 21.178 individuals for Design B.

1078. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.118 or 0.681% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design A and 0.089 or 0.511% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design B.

1079. Levels of impact during the breeding bio-season are considered to be of low magnitude for Design A where the breeding season regional population is determined using Methods 1 and 2, but of negligible magnitude for Design B where the breeding season regional population is determined using Method 1 and low magnitude where the breeding season regional population is determined using Method 1. The level of impact during the breeding bio-season is therefore considered to be of low magnitude for Design A and of negligible / low magnitude for Design B.

1080. For Band Option 1 models, during the non-breeding bio-season Herring gull collision mortality was estimated to be 2.393 individuals for Design A and 2.105 individuals for Design B. The non-breeding Herring gull regional baseline population is estimated to be 196,791 individuals, and associated baseline mortality to be 33,848 individuals (from an average mortality rate of 0.172 – **Table 10-15**). Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.007% and 0.006% from baseline for Designs A and B, respectively.

1081. This level of impact during the non-breeding bio-season is considered to be of negligible magnitude for Design A and of negligible magnitude for Design B.

1082. Using the largest regional bio-season population of 196,791 individuals as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.172 (**Table 10-15**), the natural predicted regional mortality across all seasons is estimated to be 33,848 individuals. For Band Option 1 models, annual (all seasons combined) estimated mortality resulting from collisions is 27.411 individuals for Design A and 23.283 individuals for Design B. Additional collision mortality would therefore increase regional annual mortality by 0.081% and 0.061% from baseline for Designs A and B, respectively.

1083. Similarly, for the estimated biogeographic population of 640,000 individuals (**Table 10-14**), using an average mortality rate of 0.172 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 110,080 individuals. Additional collision mortality would therefore increase biogeographic annual mortality by 0.025% and 0.019% from baseline for Designs A and B, respectively.

1084. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude for Design A and of negligible magnitude for Design B.

1085. Although impact magnitudes during the non-breeding bio-season and on an annual basis are assessed to be negligible, as the magnitude of impacts during the breeding bio-season is assessed to be low for

Design A and negligible / low for Design B, the overall potential impact magnitude is considered to be low for Designs A and B, as they represent a small potential increase to baseline mortality levels, and present minimal potential for discernible change to population trends as a result of collision

Common tern

1086. For Common tern, as site-specific flight height information is not considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 2 CRM outputs are used to define collision mortality impact magnitude (**Table 10-10**).

1087. Monthly estimated mortality rates associated with Design A are presented in **Table 10-116**. For Band Option 2 models these vary from a minimum of 0 in October to April to a maximum of 1.366 in August. On an annual basis, with Band Option 2 models, the estimated mortality rate for collision risk from CWP is 2.273 individuals. Monthly estimated mortality rates associated with design B are presented in **Appendix 10.3 Collision Risk Modelling**.

1088. Monthly estimates for Design A for Band Option 2 models are considered grouped into relevant bio-seasons in **Table 10-121**. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.6**, which are based on age-specific demographic rates and age class proportions as presented in **Table 10-15**.

Table 10-121 Common tern bio-season collision risk estimates

Design	BO	Bio-season (months)	Regional baseline populations and baseline mortality rates (individuals per annum)		Collisions (min – max)	Increase in baseline mortality (%)
			Population	Baseline mortality		
A	2	Return migration (Apr – May)	71,030	13,567	0.147 (0.008 – 0.531)	0.001 (0.000 – 0.004)
		Migration-free breeding (Jun)	Method 1: 30,254	5,779	0.019 (0.001 – 0.062)	0.000 (0.000 – 0.001)
			Method 2: 1,684	322		0.006 (0.000 – 0.019)
		Post-breeding migration (Jul – Sep)	71,030	13,567	2.107 (0.221 – 6.208)	0.016 (0.002 – 0.046)
		Annual (BDMPS)	71,030	13,567	2.273 (0.23 – 6.801)	0.017 (0.002 – 0.050)
		Annual (Biogeographic)	480,000	91,680	2.273 (0.23 – 6.801)	0.002 (0.000 – 0.007)

1089. The return migration Common tern regional baseline population is estimated to be 71,030 individuals, with a baseline mortality of 13,567 individuals (from an average mortality rate of 0.191 – **Table 10-15**). For Band Option 2 models, during the return migration bio-season Common tern collision mortality was estimated to be 0.147 individuals for Design A. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.001% from baseline for Design A.

1090. This level of impact during the return migration bio-season is considered to be of negligible magnitude for Design A.

1091. The migration-free breeding Common tern regional baseline population is estimated to be 30,254 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 1,684 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1092. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (19.1%), the total number of regional Common tern mortalities during each migration-free breeding season is estimated to be 5,779 individuals (using breeding season regional population estimation Method 1), or 322 individuals (using breeding season regional population estimation Method 2).

1093. For Band Option 2 models, during the migration-free breeding bio-season common tern collision mortality was estimated to be 0.019 individuals for Design A.

1094. Additional collision mortality would therefore increase regional bio-seasonal mortality by <0.001 or 0.006% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design A.

1095. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude for Design A.

1096. The post-breeding migration Common tern regional baseline population is estimated to be 71,030 individuals, with a baseline mortality of 13,567 individuals (from an average mortality rate of 0.191 – **Table 10-15**). For Band Option 2 models, during the post-breeding migration bio-season common tern collision mortality was estimated to be 2.107 individuals for Design A. Additional collision mortality would therefore increase regional bio-seasonal mortality by 0.016% from baseline for Design A.

1097. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude for Design A.

1098. Using the largest regional bio-season population of 71,030 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.191 (**Table 10-15**), the natural predicted regional mortality across all seasons is estimated to be 13,567 individuals. For Band Option 2 models, annual (all seasons combined) estimated mortality resulting from collisions is 2.273 individuals for Design A. Additional collision mortality of would therefore increase regional annual mortality by 0.017% from baseline for Design A.

1099. Similarly, for the estimated biogeographic population of 480,000 individuals (**Table 10-14**), using an average mortality rate of 0.191 (**Table 10-15**), the natural predicted biogeographic mortality across all seasons is estimated to be 91,680 individuals. Additional collision mortality would therefore increase biogeographic annual mortality by 0.002% from baseline for Design A.

1100. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude for Design A.

1101. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible for designs A, as this represents no discernible increase to baseline mortality levels as a result of collision.

Gannet

1102. Monthly estimated mortality rates associated with Design A are presented in **Table 10-116**. For Band Option 1 models these vary from a minimum of 0.036 in October to a maximum of 0.258 in May. On an annual basis, with Band Option 1 models, the estimated mortality rate for collision risk from CWP is 0.894 individuals. Monthly estimated mortality rates associated with design B are presented in **Appendix 10.3 Collision Risk Modelling**.

1103. Monthly estimates for Design A for Band Option 1 models are considered grouped into relevant bio-seasons in **Table 10-122**.

1104. The magnitude of impact is estimated by calculating the increase in baseline mortality within each bio-season with respect to the regional populations and their overall baseline mortality rates as described in **Section 10.6**, which are based on age specific demographic rates and age class proportions as presented in **Table 10-15**.

1105. Unlike the other receptors screened in for assessment in relation to collision mortality, Gannet are also considered to experience displacement from areas surrounding operational WTG turbines (**Section 10.10**). As birds which avoid turbine arrays cannot simultaneously potentially collide with turbines within those arrays, the proportion of individuals demonstrating macro-avoidance spatial responses (i.e., avoidance of the entire array site), may be used as a correction factor to refine collision mortality estimates for this species. As such, following precedence from recent UK OWFs as advocated by UK SNCBs (2022), and in line with central displacement proportions used for this species in the displacement assessment of this chapter (**Section 10.6**), bio-seasonal collision mortalities and their associated consequence upon regional mortality rates associated with a 70% macro avoidance rate are also provided in **Table 10-122**.

1106. For Gannet, as site-specific flight height information is considered suitably robust to inform CRM (**Appendix 10.3 Collision Risk Modelling**), Band Option 1 CRM outputs are used to define collision mortality impact magnitude (**Table 10-10**). Band Option 2 CRM outputs for Gannet are presented in **Appendix 10.3 Collision Risk Modelling.**

Table 10-122 Gannet bio-season collision risk estimates

Design	BO	Bio-season (months)	Regional baseline populations and baseline mortality rates (individuals per annum)		Gannet collision estimates and baseline mortality increases before consideration of macro avoidance		Gannet collision estimates and baseline mortality increases after correction for macro avoidance (assuming 70% macro avoidance rate)	
			Population	Baseline mortality	Collisions (95% CI)	Increase in baseline mortality (%)	Collisions (95% CI)	Increase in baseline mortality (%)
A	1	Return migration (Dec – Mar)	644,739	116,698	0.326 (0.048 – 1.072)	0.000 (0.000 – 0.001)	0.098 (0.014 – 0.322)	0.000 (0.000 – 0.001)
		Migration-free breeding (Apr – Aug)	517,233	93,619	0.432 (0.033 – 1.640)	0.000 (0.000 – 0.002)	0.130 (0.010 – 0.492)	0.000 (0.000 – 0.001)
			420,257	76,067		0.001 (0.000 – 0.002)		0.000 (0.000 – 0.001)
		Post-breeding migration (Sep – Nov)	536,005	97,017	0.136 (0.024 – 0.437)	0.000 (0.000 – 0.000)	0.041 (0.007 – 0.131)	0.000 (0.000 – 0.000)
		Annual (BDMPS)	644,739	116,698	0.894 (0.105 – 3.149)	0.001 (0.000 – 0.003)	0.268 (0.032 – 0.945)	0.000 (0.000 – 0.001)
		Annual (Biogeographic)	1,180,000	213,580		0.000 (0.000 – 0.001)		0.000 (0.000 – 0.000)

1107. For Band Option 1 models, excluding correction for macro avoidance, during the return migration bio-season Gannet collision mortality was estimated to be 0.326 individuals for Design A. When correction for a macro avoidance rate of 70% is applied, bio-seasonal collision mortality is estimated to be 0.098 for Design A. The return migration Gannet regional baseline population is estimated to be 644,739 individuals, and associated baseline mortality to be 116,698 individuals (from an average mortality rate of 0.181 – **Table 10-15**). Additional collision mortality, excluding or including corrections for macro avoidance, would therefore increase regional bio-seasonal mortality by <0.001% from baseline for Design A.

1108. This level of impact during the return migration bio-season is considered to be of negligible magnitude for Design A.

1109. The migration-free breeding Gannet regional baseline population is estimated to be 517,233 individuals (Method 1: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus the estimate of immature individuals present in the preceding bio-season), or 420,257 individuals (Method 2: where the seasonal population is considered to include breeding adults within mean maximum foraging range plus 1 SD of the array site, plus a number of immatures derived from the stable age ratio of adults to non-adults (**Table 10-15**), multiplied by the number of breeding adults).

1110. By multiplying seasonal abundance estimates by mortality rates from **Table 10-15** (18.1%), the total number of regional Gannet mortalities during each migration-free breeding season is estimated to be 93,619 individuals (using breeding season regional population estimation Method 1), or 76,067 individuals (using breeding season regional population estimation Method 2).

1111. For Band Option 1 models, during the migration-free breeding bio-season Gannet collision mortality was estimated to be 0.432 individuals for Design A.

1112. Additional collision mortality would therefore increase regional bio-seasonal mortality by <0.001 or 0.001% from baseline for breeding season regional population estimation Methods 1 and 2, respectively for Design A.

1113. This level of impact during the migration-free breeding bio-season is considered to be of negligible magnitude for Design A.

1114. For Band Option 1 models, excluding correction for macro avoidance, during the post-breeding migration bio-season Gannet collision mortality was estimated to be 0.136 individuals for Design A. When correction for a macro avoidance rate of 70% is applied, bio-seasonal collision mortalities are estimated to be 0.041 individuals for Design A. The post-breeding migration Gannet regional baseline population is estimated to be 536,005 individuals, and associated baseline mortality to be 97,017 individuals (from an average mortality rate of 0.181 – **Table 10-15**). Additional collision mortality, excluding or including corrections for macro avoidance, would therefore increase regional bio-seasonal mortality by <0.001% from baseline for Design A.

1115. This level of impact during the post-breeding migration bio-season is considered to be of negligible magnitude for Design A.

1116. Using the largest regional bio-season population of 644,739 individuals (**Table 10-14**) as a proxy for the maximum regional population across the year, and an average baseline mortality rate of 0.181 (**Table 10-15**), the predicted regional mortality across all seasons is estimated to be 116,698 individuals. For Band Option 1 models, annual (all seasons combined) estimated mortality resulting from collisions is 0.894 individuals for Design A. Additional collision mortality would therefore increase regional annual mortality by 0.001% from baseline for Design A.

1117. Similarly, for the estimated biogeographic population of 1,180,000 individuals (**Table 10-14**), using an average mortality rate of 0.181 (**Table 10-15**), the predicted biogeographic mortality across all seasons is estimated to be 213,580 individuals. Additional collision mortality would therefore increase biogeographic annual mortality < by 0.001% from baseline for Design A.

1118. This level of annual impact to the regional and biogeographic populations is considered to be of negligible magnitude for Design A.

1119. For each bio-season and on an annual basis, the magnitude of the potential impact is therefore considered to be negligible for design A, as they represent no discernible increase to baseline mortality levels as a result of collision.

Significance of the effect

Kittiwake

1120. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11** as receptor sensitivity is assessed to be very high and impact magnitude is assessed to be negligible in all bio-seasons and overall annually, the potential effect of collision during the operational phase upon Kittiwake is considered to be **Slight**, and **Not Significant** in EIA terms.

1121. The same conclusion is determined if the slightly lower collision estimates are taken into account that arise from using the flight speeds advised by NPWS (2023), as provided in **Appendix 10.7 Additional Collision Risk Modelling of Kittiwake**.

Common gull

1122. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be medium and impact magnitude is assessed to be negligible in all bio-seasons and overall annually, the potential effect of collision during the operational phase upon Common gull is considered to be **Imperceptible**, and **Not Significant** in EIA terms.

Great black-backed gull

1123. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be medium and impact magnitude is assessed to be negligible during the non-breeding season, low / medium during the breeding season and low overall annually, the potential effect of collision during the operational phase upon Great black-backed gull is considered to be **Slight**, and **Not Significant** in EIA terms.

Herring gull

1124. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be low, the potential effect of collision during the operational phase upon Herring gull is considered to be **Slight**, and **Not Significant** in EIA terms.

Common tern

1125. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivity is assessed to be high and impact magnitude is assessed to be negligible, the potential effect of collision during the operational phase upon Common tern is considered to be **Not Significant**, and **Not Significant** in EIA terms.

Gannet

1126. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11** as receptor sensitivity is assessed to be high and impact magnitude is assessed to be negligible, the potential effect of collision during the operational phase upon Gannet is considered to be **Not Significant**, and **Not Significant** in EIA terms.

Additional mitigation

1127. As impacts to seabird species associated with collision during the Operation and Maintenance phase are assessed to be **Not Significant** or **Slight**, and **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

1128. As no additional measures are required to mitigate the Operation and Maintenance phase collision impacts to seabird species, the residual effects are assessed to be **Not Significant** or **Slight**, and **Not Significant** in EIA terms.

Migratory seabirds and non-seabirds

1129. In addition to the seabirds considered individually above, migrant seabirds and non-seabirds flying through the array site during the operational phase are at risk of collision with WTGs. The result of such collisions may be fatal to the bird concerned. Migratory birds may not be reliably detected using aerial digital surveys or any other standard survey method. Migratory birds may move through in short pulses, in poor weather or at night (when no surveys take place), or at high altitudes, which makes recording their numbers extremely complex.

1130. To quantify this collision risk, the MS mCRM tool (Caneco 2022) has been used, with migratory population sizes for each species altered to reflect those potentially utilising migration flyways over the western Irish Sea (Burke et al., 2018). Detailed methods on the adaptation and application of the mCRM tool are provided in **Appendix 10.3 Collision Risk Modelling**.

Receptor sensitivity

1131. Migratory species are considered to have very high tolerance to collision impacts associated with infrastructure within the array site during the operation and maintenance phase as:

- Interpretation of ringing recovery data supports the assumption in the migratory collision risk assessment that migration corridors are fairly broad (Wright et al., 2012), Comparison of GPS tracking data (such as Griffin et al, 2011; Clewley et al., 2021; Green et al., 2021) with ringing recovery data, suggests that while, for some species, birds may migrate within narrower corridors than assumed by this approach, reliance on ringing data will not lead to gross over estimates of migration corridor widths (Woodward et al, 2023). If migratory movements are assumed to occur across broad geographic fronts, of which the project turbine array occupies a very small proportion within an area that is unlikely to correspond with areas of high importance for migratory species, the large majority of migrating individuals within flyway populations will avoid impacts entirely, while those individuals which would otherwise pass through the array site may generally avoid doing so (should they choose to do so), though subtle alterations to flight trajectories or altitudes. Due to the extremely low proportion of regional populations at risk of experiencing potential collision mortality, the potential for any migratory receptor to experience perceptible population level effects upon regional survival rates is therefore considered minimal (Woodward et al., 2023).

1132. Migratory receptor importances are assessed as low to very high (**Table 10-123**).

1133. When receptor tolerances and importances are considered together to determine overall assessments of receptor sensitivities as per **Table 10-9**, receptor sensitivities are assessed as very low (i.e., very high tolerance and low / medium importance) or low (i.e., very high tolerance and high / very high importance).

Table 10-123 Determination of receptor sensitivity by consideration of conservation importance and tolerance to collision risk for migratory species during the operation and maintenance phase

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Light-bellied Brent Goose	high	very high	low
Greenland white-fronted Goose	medium		very low
Bewick's Swan	medium		very low
Whooper Swan	low		very low
Shelduck	medium		very low
Shoveler	medium		very low
Wigeon	low		very low
Mallard	low		very low
Pintail	medium		very low
Teal	medium		very low
Pochard	medium		very low
Tufted Duck	low		very low
Scaup	medium		very low
Eider	medium		very low
Common scoter	high		low
Goldeneye	medium		very low
red-breasted merganser	low		very low
Corncrake	medium		very low
Great crested grebe	low		very low
Oystercatcher	very high		low
Lapwing	medium		very low
Golden plover	high		low
Grey plover	high		low
Ringed plover	high		low
Curlew	high		low
Bar-tailed godwit	very high		low
Black-tailed godwit	high		low

Species	Receptor conservation importance	Receptor tolerance	Receptor sensitivity
Turnstone	medium		very low
Knot	very high		low
Sanderling	high		low
Dunlin	very high		low
Snipe	medium		very low
Redshank	very high		low
Greenshank	low		very low
Red-throated diver	high		low
Great northern diver	high		low
Hen harrier	medium		very low
Merlin	medium		very low
All other migratory species	very low		very low

Magnitude of impact

1134. For migratory species, **Table 10-124** provides predicted collision mortalities for Designs A and B, considered in relation to estimated regional migratory population sizes and population sizes using the wider biogeographic flyway.

1135. For all migratory species, annual collision mortality estimates for Designs A and B equate to less than 0.01% of estimated regional migratory populations (greatest proportion for Common scoter, where collision mortality associated with Design A equates to 0.00872% of regional migratory population) and less than or equal to 0.001% of estimated biogeographic populations (greatest proportion for Bar-tailed godwit, where collision mortality associated with Design A equates to 0.001% of biogeographic migratory population). Therefore, as annual mortality rates to migratory species represent such small proportion of regional and biogeographic populations, for no receptors are increases to regional or biogeographic population mortality rates predicted to exceed 0.1%. For this reason, the magnitude of collision impacts to all migratory species is assessed to be negligible.

Table 10-124 Magnitude of impact

Species	Reference population		Design A			Design B			Assessed magnitude
	All Ireland (regional)	Flyway (biogeographic)	Impact	Proportional impact (%)		Impact	Proportional impact (%)		
				All Ireland	Flyway		All Ireland	Flyway	
Light-bellied Brent Goose	35150	36500	0.04 ± 0.013	0.00011	0.00011	0.035 ± 0.01	0.00010	0.00010	negligible
Greenland white-fronted Goose	9590	20529	0.023 ± 0.012	0.00024	0.00011	0.02 ± 0.01	0.00021	0.00010	negligible
Bewick's Swan	20	21000	0 ± 0	0	0	0 ± 0	0.00000	0.00000	negligible
Whooper Swan	15370	34000	0.195 ± 0.052	0.00127	0.00057	0.155 ± 0.04	0.00101	0.00046	negligible
Shelduck	10160	250000	0.159 ± 0.024	0.00156	0.00006	0.142 ± 0.022	0.00140	0.00006	negligible
Shoveler	2240	65000	0.067 ± 0.009	0.00299	0.00010	0.058 ± 0.009	0.00259	0.00009	negligible
Wigeon	55730	1400000	3.344 ± 0.503	0.00600	0.00024	2.9 ± 0.421	0.00520	0.00021	negligible
Mallard	28230	5450000	0.794 ± 0.105	0.00281	0.00001	0.683 ± 0.099	0.00242	0.00001	negligible
Pintail	1570	65000	0.124 ± 0.02	0.00790	0.00019	0.106 ± 0.018	0.00675	0.00016	negligible
Teal	35740	500000	2.792 ± 0.412	0.00781	0.00056	2.446 ± 0.354	0.00684	0.00049	negligible

Species	Reference population		Design A			Design B			Assessed magnitude
	All Ireland (regional)	Flyway (biogeographic)	Impact	Proportional impact (%)		Impact	Proportional impact (%)		
				All Ireland	Flyway		All Ireland	Flyway	
Pochard	11150	200000	0.197 ± 0.032	0.00177	0.00010	0.17 ± 0.025	0.00152	0.00009	negligible
Tufted Duck	27470	900000	1.032 ± 0.192	0.00376	0.00011	0.901 ± 0.172	0.00328	0.00010	negligible
Scaup	2485	212500	0.065 ± 0.008	0.00262	0.00003	0.057 ± 0.008	0.00229	0.00003	negligible
Eider	5660	930000	0.176 ± 0.026	0.00311	0.00002	0.152 ± 0.025	0.00269	0.00002	negligible
Common scoter	7500	751000	0.654 ± 0.118	0.00872	0.00009	0.544 ± 0.1	0.00725	0.00007	negligible
Goldeneye	3820	1150000	0.295 ± 0.042	0.00772	0.00003	0.256 ± 0.036	0.00670	0.00002	negligible
red-breasted merganser	2430	87500	0.109 ± 0.018	0.00449	0.00012	0.096 ± 0.016	0.00395	0.00011	negligible
Corncrake	16960	2120000	0.099 ± 0.014	0.00058	0.00000	0.088 ± 0.014	0.00052	0.00000	negligible
Great crested grebe	2930	638500	0.062 ± 0.005	0.00212	0.00001	0.055 ± 0.005	0.00188	0.00001	negligible
Oystercatcher	60540	900000	0.25 ± 0.042	0.00041	0.00003	0.217 ± 0.039	0.00036	0.00002	negligible

Species	Reference population		Design A			Design B			Assessed magnitude
	All Ireland (regional)	Flyway (biogeographic)	Impact	Proportional impact (%)		Impact	Proportional impact (%)		
				All Ireland	Flyway		All Ireland	Flyway	
Lapwing	84690	7500000	0.102 ± 0.018	0.00012	0.00000	0.09 ± 0.014	0.00011	0.00000	negligible
Golden plover	92060	930000	0.828 ± 0.134	0.00090	0.00009	0.731 ± 0.132	0.00079	0.00008	negligible
Grey plover	2940	200000	0.004 ± 0	0.00014	0.00000	0.004 ± 0	0.00014	0.00000	negligible
Ringed plover	11660	54500	0.061 ± 0.01	0.00052	0.00011	0.054 ± 0.008	0.00046	0.00010	negligible
Curlew	35240	756500	0.092 ± 0.016	0.00026	0.00001	0.08 ± 0.014	0.00023	0.00001	negligible
Bar-tailed godwit	16530	150000	0.01 ± 0.003	0.00006	0.00100	0.008 ± 0.001	0.00500	0.00100	negligible
Black-tailed godwit	19800	116000	0.19 ± 0.09	0.00096	0.00016	0.167 ± 0.074	0.00084	0.00014	negligible
Turnstone	9480	150000	0.105 ± 0.05	0.00111	0.00007	0.094 ± 0.048	0.00099	0.00006	negligible
Knot	16270	532300	0.109 ± 0.017	0.00067	0.00002	0.097 ± 0.013	0.00060	0.00002	negligible
Sanderling	8420	200000	0.055 ± 0.008	0.00065	0.00003	0.049 ± 0.008	0.00058	0.00002	negligible
Dunlin	45760	1330000	0.617 ± 0.093	0.00135	0.00005	0.549 ± 0.092	0.00120	0.00004	negligible

Species	Reference population		Design A			Design B			Assessed magnitude
	All Ireland (regional)	Flyway (biogeographic)	Impact	Proportional impact (%)		Impact	Proportional impact (%)		
				All Ireland	Flyway		All Ireland	Flyway	
Snipe	6105001	11100000	5.191 ± 0.669	0.00009	0.00005	4.603 ± 0.561	0.00008	0.00004	negligible
Redshank	23800	361500	0.147 ± 0.027	0.00062	0.00004	0.129 ± 0.024	0.00054	0.00004	negligible
Greenshank	1320	350000	0.002 ± 0	0.00015	0.00000	0.002 ± 0	0.00015	0.00000	negligible
Red-throated diver	770	322500	0.012 ± 0.001	0.00156	0.00000	0.011 ± 0.001	0.00143	0.00000	negligible
Great northern diver	2240	5700	0.008 ± 0.001	0.00036	0.00014	0.006 ± 0.001	0.00027	0.00011	negligible
Hen harrier	2176	108800	0.008 ± 0.001	0.00037	0.00001	0.008 ± 0.001	0.00037	0.00001	negligible
Merlin	8256	103200	0.072 ± 0.057	0.00087	0.00007	0.063 ± 0.049	0.00076	0.00006	negligible

Significance of the effect

1136. In **Table 10-125**, in accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, assessed sensitivities and magnitudes for each migratory species are considered in order to determine the potential effect of collision mortality during the operational phase.

1137. For all migratory species the potential effect of collision mortality during the operational phase are considered to be **Imperceptible**, and **Not Significant** in EIA terms.

Table 10-125 Significance of effect

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Light-bellied Brent Goose	low	negligible	**Imperceptible**	**Not Significant**
Greenland white-fronted Goose	very low		**Imperceptible**	**Not Significant**
Bewick's Swan	very low		**Imperceptible**	**Not Significant**
Whooper Swan	very low		**Imperceptible**	**Not Significant**
Shelduck	very low		**Imperceptible**	**Not Significant**
Shoveler	very low		**Imperceptible**	**Not Significant**
Wigeon	very low		**Imperceptible**	**Not Significant**
Mallard	very low		**Imperceptible**	**Not Significant**
Pintail	very low		**Imperceptible**	**Not Significant**
Teal	very low		**Imperceptible**	**Not Significant**
Pochard	very low		**Imperceptible**	**Not Significant**
Tufted Duck	very low		**Imperceptible**	**Not Significant**
Scaup	very low		**Imperceptible**	**Not Significant**
Eider	very low		**Imperceptible**	**Not Significant**
Common scoter	low		**Imperceptible**	**Not Significant**
Goldeneye	very low		**Imperceptible**	**Not Significant**
red-breasted merganser	very low		**Imperceptible**	**Not Significant**
Corncrake	very low		**Imperceptible**	**Not Significant**
Great crested grebe	very low		**Imperceptible**	**Not Significant**
Oystercatcher	low		**Imperceptible**	**Not Significant**
Lapwing	very low		**Imperceptible**	**Not Significant**
Golden plover	low		**Imperceptible**	**Not Significant**
Grey plover	low		**Imperceptible**	**Not Significant**
Ringed plover	low		**Imperceptible**	**Not Significant**
Curlew	low		**Imperceptible**	**Not Significant**

Species	Assessed sensitivity	Assessed magnitude	Significance level	Significant?
Bar-tailed godwit	low		**Imperceptible**	**Not Significant**
Black-tailed godwit	low		**Imperceptible**	**Not Significant**
Turnstone	very low		**Imperceptible**	**Not Significant**
Knot	low		**Imperceptible**	**Not Significant**
Sanderling	low		**Imperceptible**	**Not Significant**
Dunlin	low		**Imperceptible**	**Not Significant**
Snipe	very low		**Imperceptible**	**Not Significant**
Redshank	low		**Imperceptible**	**Not Significant**
Greenshank	very low		**Imperceptible**	**Not Significant**
Red-throated diver	low		**Imperceptible**	**Not Significant**
Great northern diver	low		**Imperceptible**	**Not Significant**
Hen harrier	very low		**Imperceptible**	**Not Significant**
Merlin	very low		**Imperceptible**	**Not Significant**
All other migratory species	very low		**Imperceptible**	**Not Significant**

Additional mitigation

1138. As impacts to migratory species associated with collision during the operation and maintenance phase are assessed to be Imperceptible, and Not Significant in EIA terms, no additional mitigation is necessary.

Residual effect

1139. As no additional measures are required to mitigate operation and maintenance phase collision impacts to migratory species, the residual effects are assessed to be **Imperceptible**, and **Not Significant** in EIA terms.

Estuarine / Liffey – operation and maintenance: impact – disturbance and displacement.

Estuarine / Liffey

1140. Operational and maintenance activities at the onshore substation have the potential to disturb and displace birds within the estuarine / Liffey study area which would otherwise directly utilise areas within and around the areas where these works are proposed to take place.

1141. The disturbance and resultant displacement of individuals which would otherwise potentially utilise estuarine / Liffey areas within or around the area of O&M works effectively equates to temporary indirect habitat loss for those individuals.

1142. Indirect habitat loss as consequence of disturbance and displacement reduces the potential spatial extent available to impacted receptors. Reductions in the areas available to estuarine / Liffey bird species to forage, roost and breed may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Impact screening

1143. An impact screening is conducted to determine if disturbance / displacement to protected bird species during O&M phase activities, at the estuarine / Liffey area is applicable to each of the identified IEF species listed in **Table 10-16**. Each IEF species is examined in **Table 10-126** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-126 Impact screening of IEF species

IEF species	Potential for impact	Rationale
Arctic tern	Yes	This species has been assessed as at risk to disturbance / displacement during O&M phase activities*.* One breeding colony for this species were recorded near to the onshore substation area on the CDL Dolphin during estuarine / Liffey surveys, which is approximately 25 m from the northern boundary of the onshore substation. **Therefore, Arctic tern is screened in and the significance of this impact and effects assessed.**
Common tern	No	This species have been assessed as not at risk to disturbance / displacement during O&M phase activities*.* One breeding colony for this species were recorded near to the onshore substation area during onshore survey at the ESB Dolphin, which is approximately 250 m from the onshore substation. Due to this distance, that maintenance activities during the O&M phase is expected to be low at the onshore substation and confined to a small number of areas. Disturbance events are expected to be brief, and noise not expected to be above current levels at the area. Therefore, this species can be screened out for this impact
Black guillemot	No	These species have been assessed as not at risk to disturbance / displacement during O&M activities*.* These species have a higher tolerance to disturbance effects. Maintenance activities during the O&M phase is expected to be low at the substation area and confined to a small number of areas. Disturbance events are expected to be brief, and noise not expected to be above current levels at the area. Therefore, these species can be screened out for this impact.
Black-headed gull	No	

Receptor sensitivity

1144. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-127**. The conservation importance of IEF species has been determined in **Table 10-128**, and tolerance to the impact discussed below.

1145. Arctic tern was regularly recorded at a breeding colony 25 m north of the onshore substation during the breeding season. According to Goodship and Furness (2022) the species is assessed to have a medium sensitivity to human disturbance at breeding colonies and suggest a 200 m buffer zone around colonies to protect the species from pedestrian disturbance, but that a large buffer may be required if terns are not habituated to disturbance or if there is likely to be aerial disturbance.

1146. The colony near the onshore substation area is located within Dublin port, which is a busy shipping and industrial area, a report prepared by ALCnature on behalf of CWP (see **Appendix 10.9**), was commissioned to determine the current and potential tolerance of breeding terns near the onshore substation. The results concluded that the terns within this study area are likely to have habituated and show low levels of disturbance to several current forms of disturbances (boats, traffic, predators, humans and aircraft) and experimental disturbances (in the form of personnel, machinery, light and noise).

1147. Based on above, the Arctic tern is considered to have high tolerance to potential disturbance and displacement impacts within the estuarine / Liffey area during the O&M phase. Foreseen effects related to disturbance and displacement are expected to be minimal, occurring at low levels and over brief time periods. The proximity of this colony and the potential for disturbance is expected to be at a low level, with no impacts to the reproduction and / or regional population survival rates.

Table 10-127 Receptor sensitivity of IEF species

IEF species	Conservation importance	Tolerance	Receptor sensitivity
Arctic tern	high	high	medium

Magnitude of impact

1148. The magnitude of the impact on each of the IEFs screened in for this impact can be seen in **Table 10-128** below along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters and the criteria listed in **Table 10-10**.

Table 10-128 Magnitude of impact on IEF species

IEF species	Magnitude	Rationale
Arctic tern	negligible	During the O&M phase of the onshore substitution, a low number of parameters were identified with the potential to cause disturbance to this species, including some noise, presence of personnel and lighting (**Table 10-26**).

IEF species	Magnitude	Rationale
		Presence of personnel O&M works at this location are expected to be associated with maintenance, repair and inspection activities and over short term periods. Apart from these activities, the onshore substation will be unmanned and monitored remotely during the O&M phase. The visits will be *c*. an average of one visit per week. *O&M phase lighting* External lighting of the onshore substation during the O&M phase will be only required for the following purposes: • access and egress; • security lighting; • car park lighting; and • repair / maintenance. At night substation lighting will be switched off as the substation will be unmanned. Lights will only be used during periods where and when work is to be carried out (i.e., maintenance) and lights will be positioned to suit the work. *O&M onshore substation noise* An environmental noise model for the onshore substation determined that the contribution to the existing baseline is low. The predicted levels from the operating onshore substation are at least 10dB below the existing baseline noise levels. Based on the above, the magnitude of impact is assessed to be negligible.

Significance of the effect

1149. The receptor sensitivity and magnitude of impact of the screened in IEF species, within the onshore study area, has been determined in **Table 10-127** Receptor sensitivity of IEF species and **Table 10-128** Magnitude of impact on IEF species. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined in **Table 10-129** below.

Table 10-129 Significance of the effect on IEF species

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Arctic tern	medium	negligible	In the absence of additional mitigation measures, the sensitivity of Arctic tern in the estuarine / Liffey area is considered to be medium and the magnitude the of impact is assessed as negligible. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **Imperceptible** and without significant consequences to Arctic tern.	**Not significant**

Additional mitigation

1150. As impacts to Arctic tern associated with the disturbance and displacement impact during the O&M phase are assessed to **Imperceptible**, and so considered **Not Significant** in EIA terms, no additional mitigation is necessary.

Residual effect

1151. As no additional measures are required to mitigate the disturbance and displacement impacts during the O&M phase to Arctic tern, the residual effects is assessed to be **Imperceptible**, and **not significant** in EIA terms.

Estuarine / Liffey – operation and maintenance: impact 4 – presence of buildings / infrastructure

Estuarine / Liffey

1152. The onshore substation will be in close proximity to breeding colonies of tern on the CDL and ESB dolphins (approximately 25 m and 250 m respectively), which is within the estuarine / Liffey study area. The presence of the buildings and infrastructure could cast a shadow on surrounding habitat which could potentially impact on the Artic tern breeding colony.

1153. Similarly, the presence of the buildings and infrastructure could also create perching opportunities for species such as Peregrine falcon or Hooded Crow, which may increase the actual or perceived, predator threat on the nesting colony.

Impact screening

1154. An impact screening is conducted to determine if the presence of buildings and infrastructure is applicable to each of the identified IEF species listed in **Table 10-25**. Each IEF species is examined in **Table 10-130** below and a rationale provided on whether to screen in or out the species and to assess the impact significance.

Table 10-130 Impact screening of IEF species

IEF species	Potential for impact	Rationale
Arctic tern	Yes	This species has been assessed as at risk to the presence of buildings and infrastructures. One breeding colony for this species was recorded near the onshore substation area during surveys, on the CDL Dolphin during estuarine / Liffey surveys, which is approximately 25m from the northern boundary of the onshore substation. The presence of a new building, which may cast a shadow onto the colony, along with the attendant perceived, or actual, predator risk, in close proximity to the CDL colony, presents a risk of colony desertion. tern colony desertion may be temporary, periodic or long term and there is evidence to show habituation to human activity and new structures is feasible in tern species. Once constructed, there is potential that the buildings and infrastructure may provide perching opportunities to avian predator species, such as Peregrine falcon and Hooded Crow, which may predate on the nearby tern colonies. **Therefore, can be screened in and the significance of this impact and effects assessed.**
Common tern	Yes	This species has been assessed as at risk to the presence of buildings and infrastructures. One breeding colony for this species was recorded near the onshore substation area during surveys, on the ESB Dolphin within the estuarine / Liffey study area, which is approximately 250 m from the north-eastern boundary of the onshore substation. The presence of a new building, with the attendant perceived, or actual, predator risk, in close proximity to this ESB Dolphin colony, presents a risk of colony desertion. tern colony desertion may be temporary, periodic or long term and there is evidence to show habituation to human activity and new structures is feasible in tern species. Due to the distance of the colony and the buildings, there is no potential for the structures to cast a shadow on the colony. Once constructed, there is potential that the buildings and infrastructure may provide perching opportunities to avian predator species, such as Peregrine falcon and Hooded Crow, which may predate on the nearby tern colonies. **Therefore, can be screened in and the significance of this impact and effects assessed.**
Black guillemot	No	These species have been assessed as not at risk to *Impact 2 – Presence of buildings and infrastructures.*
Black-headed gull	No	

IEF species	Potential for impact	Rationale
		These IEF species will not be impacted by the presence of a new building, as no attendant perceived, or actual, predator risk is present due to the low numbers of these species recorded, the ecology the species (i.e., Black guillemot are cavity nesting species and so are not as exposed to predation on nest sites) and the in the case of the Black-headed gull, only wintering and non-breeding activity was noted, therefore the species is not dependent on the potentially impacted areas. Therefore, these species can be screened out for this impact.

Receptor sensitivity

1155. Receptor sensitivity is determined by considering a combination of conservation importance, of populations potentially impacted and the tolerance of those populations to that impact. Each IEF species which has been screened in for this impact has been assigned a receptor sensitivity in **Table 10-131**. The conservation importance of IEF species has been determined in **Table 10-25**, and tolerance to the impact discussed below.

1156. The Arctic tern is considered to have low tolerance to the presence of building / infrastructure impacts within the estuarine / Liffey area during the O&M phase. This species was found to be breeding in close proximity to the onshore substation (the nearest colony being approximately 25 m). The number of breeding birds at this colony ranged from 0 to 105 nests, between the period of 2013 to 2022. The presence of building / infrastructure, may cast a shadow onto the colony, along with the attendant perceived, or actual, predator risk, in close proximity to the CDL colony. This presents a risk of colony desertion. tern colony desertion may be temporary, periodic or long term and there is evidence to show habituation to human activity and new structures is feasible in tern species.

1157. Common tern is considered to have medium tolerance to presence of building / infrastructure impacts at the estuarine / Liffey area during the O&M phase. This species was found to be breeding in close proximity to the onshore substation (the nearest colony being approximately 250 m). The number of breeding birds at this colony ranged from 138 to 427 nests, between the period of 2013 to 2022. Foreseen effects of the newly constructed buildings / infrastructure and the increased potential of predation from avian species could cause adverse effects on the breeding common tern colony, but due to the distance between the colony and proposed building and infrastructure, there is lower potential for shadow and predator impacts as a result of the building, so will have a slightly higher tolerance compared to Arctic tern.

Table 10-131 Receptor sensitivity of IEF species

IEF species	Importance	Tolerance	Receptor sensitivity
Arctic tern	high	low	high
Common tern	high	medium	high

Magnitude of impact

1158. The magnitude of the impact on each of the IEFs screened in for this impact can be seen **Table 10-132** below along with a rationale on this designation. The magnitude of the impact is based on the assessed parameters and the criteria listed in **Table 10-10**.

Table 10-132 Magnitude of impact on IEF species

IEF species	Magnitude	Rationale
Arctic tern	low	During the O&M of the onshore substation, the constructed infrastructure / buildings have the potential to provide perching points, which may be used by avian predator species. The close proximity to the known breeding sites for this species, may lead to increased levels and threat of predation which may impact the long-term viability of the colonies, due to reduced nesting and fledging rates and may cause the species to abandon colonies. However as outlined in **Section 10.9** primary mitigation, as part of the design for the façade of the buildings, bird of prey deterrents have been incorporated at 2 locations: 1. Creating a steep angle (+60°) to the band between the brick base and metal cladding of the façade; and 2. Raising of the metal cladding above roof parapet, impairing hunting birds' view of target platform. The potential for the onshore substation buildings to cast a shadow on the CDL dolphin was assessed using a detailed shadow assessment model (details of which can be seen in **Appendix 10.11**). The results from this model showed that there will be no shadow cast by the onshore substation buildings during the breeding tern period (May to August). Therefore, the magnitude of this is assessed as being negligible. Therefore, based on the above, including the proximity of the colony to the onshore substation, the design of the façade with bird of prey deterrents and the negligible effect of shadow, the overall magnitude of impact for this impact is assessed to be low.
Common tern	negligible	During the O&M of onshore substation, the constructed infrastructure / buildings have the potential to provide perching points, which may be used by avian predator species. The close proximity to the known breeding sites for this species and increased levels and threat of predation may impact the long-term viability of the colonies, due to reduced

IEF species	Magnitude	Rationale
		nesting and fledging rates and may cause the species to abandon colonies. However as outlined in **Section 10.9** primary mitigation, as part of the design for the façade of the buildings, bird of prey deterrents have been incorporated at 2 locations (see details above). The potential for the buildings and infrastructure to cast a shadow on the ESB dolphin is determined to be negligible due to the distance between the structure and the onshore substation (approximately 250 m). Therefore, based on the above and the distance of colony to the onshore substation the magnitude of impact for this is assessed to be negligible.

Significance of the effect

1159. The receptor sensitivity and magnitude of impact of the screened in IEF species, within the onshore study area at the landfall site, has been determined in **Table 10-131** and **Table 10-132**. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined in Table 10-133 Significance of the effect on IEF species

1160. below.

Table 10-133 Significance of the effect on IEF species

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Arctic tern	high	low	In the absence of mitigation measures, the sensitivity of Arctic tern in the onshore substation area is considered to be high and the magnitude the of impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effect is predicted to be **Slight** and could negatively alter the Arctic tern population near the onshore substation area.	**Not significant**
Common tern	high	Negligible	In the absence of mitigation measures, the sensitivity of Common tern in the onshore substation area is considered to be high and the magnitude the of impact is assessed as high. Therefore (as per the matrix in **Table 10-11**), the significance of effect is predicted to be **Not Significant** and could negatively	**Not significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			alter the Common tern population near the onshore substation area.	

Additional mitigation

1161. As impacts to Arctic tern and common tern associated with the presence of building / infrastructure during the Operation and Maintenance phase are assessed to be **Slight** and **Not Significant** respectively, and so considered **not significant** in EIA terms, no additional mitigation is necessary.

Residual effect

1162. As no additional measures are required to mitigate the presence of building / infrastructure impacts during the O&M phase to Arctic tern and common tern, the residual effects are assessed to be **Slight** and **Not Significant** respectively, and **not significant** in EIA terms.

10.10.4 Decommissioning phase

1163. For the purposes of the EIA, at the end of the operational lifetime of the CWP Project, all offshore infrastructure will be rehabilitated.

1164. The sensitivity of receptors during decommissioning would be as described above for the construction phase, and the level of interaction of receptors with the Development Area are, for the purposes of this assessment assumed to be equivalent to those described within the baseline above.

Offshore and intertidal – decommissioning: impact 1 – direct effects on habitat

Offshore – array site and OECC (below MLWS)

1165. Direct effects on habitat may occur during decommissioning which alter areas of habitat, principally impacting benthic habitats. Such impacts to benthic habitats translate to potential impacts upon seabird receptors as impacts to prey species. Such impacts are addressed within the assessment of changes in prey availability (Decommissioning Impact 3).

1166. Direct effects to sea-surface areas which may be utilised by seabirds for non-foraging behaviours are considered only to relate to the physical footprint of above water infrastructure (i.e., WTG towers and the OSS) that will be removed, and vessels associated with their removal.

Receptor sensitivity

1167. Receptor sensitivity during decommissioning is considered to be the same as during construction, and is assessed as very low or low for all receptors (**Table 10-28**).

Impact magnitude

1168. Relative to the spatial extent of habitats used by breeding and non-breeding seabirds, the sea surface footprint of decommissioning phase activities is negligible.

1169. The effect on birds from this impact is expected to be similar to that of the construction phase. Impact magnitude during the decommissioning phase for direct effects on habitat is therefore predicted to be no greater than those during the construction phase, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible.

Significance of the effect

1170. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-134**, as receptor sensitivities are assessed to be **very low** or **low** and impact magnitude is assessed to be negligible, the potential effect of direct effects on habitat for birds within the array site and OECC, during the decommissioning phase is considered to be **imperceptible**, and **not significant** in EIA terms **Table 10-134**).

Table 10-134 Determination of receptor sensitivity by consideration of conservation importance and tolerance to direct effects on habitat during the decommissioning phase

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Common scoter	low	negligible	**Imperceptible**	**Not Significant**
Kittiwake	low		**Imperceptible**	**Not Significant**
Black-headed gull	low		**Imperceptible**	**Not Significant**
Little gull	low		**Imperceptible**	**Not Significant**
Great black-backed gull	very low		**Imperceptible**	**Not Significant**
Common gull	low		**Imperceptible**	**Not Significant**
Herring gull	low		**Imperceptible**	**Not Significant**
Lesser black-backed gull	low		**Imperceptible**	**Not Significant**
Sandwich tern	very low		**Imperceptible**	**Not Significant**
Roseate tern	low		**Imperceptible**	**Not Significant**
Common tern	low		**Imperceptible**	**Not Significant**
Arctic tern	low		**Imperceptible**	**Not Significant**
Little tern	very low		**Imperceptible**	**Not Significant**
Guillemot	low		**Imperceptible**	**Not Significant**
Razorbill	low		**Imperceptible**	**Not Significant**
Black guillemot	very low		**Imperceptible**	**Not Significant**
Puffin	low		**Imperceptible**	**Not Significant**
Red-throated diver	low		**Imperceptible**	**Not Significant**
Great northern diver	low		**Imperceptible**	**Not Significant**
Fulmar	low		**Imperceptible**	**Not Significant**
Manx shearwater	low		**Imperceptible**	**Not Significant**
Gannet	low		**Imperceptible**	**Not Significant**
Cormorant	very low		**Imperceptible**	**Not Significant**

Species	Receptor sensitivity	Impact magnitude	Level of significance	Significant
Shag	low		**Imperceptible**	**Not Significant**

Additional mitigation

1171. As the impacts associated with direct effects on habitat during decommissioning within the array site and OECC are assessed to be **imperceptible**, and **not significant** in EIA terms, no additional mitigation is necessary.

Residual effect

1172. As no additional measures are required to mitigate direct effects on habitat during decommissioning within the array site and OECC, the residual effect is assessed to be **imperceptible**, and **not significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

1173. Impacts considered to be direct effects on intertidal habitat may arise as a consequence of activities which alter areas of intertidal habitat which are utilised by ornithological receptors and their prey species. Impacts to intertidal habitats translate into potential impacts upon ornithological receptors via impacts to prey species. These are addressed within the assessment of changes in prey availability (Decommissioning Impact 2).

1174. Direct effects to intertidal areas which may be utilised by birds for non-foraging behaviours (such as roosting, loafing and maintenance) are considered only to relate to the physical footprint of the proposed intertidal infrastructure and works (i.e., the intertidal cable route during decommissioning and any infrastructure at the proposed landfall location).

Receptor sensitivity

1175. Receptor sensitivity during decommissioning is considered to be the same as during construction, and are assessed as very low to very high (**Table 10-134**).

Magnitude of impact

1176. The effect on birds from this impact is expected to be similar to that of the construction phase. Impact magnitude during the decommissioning phase for direct effects on intertidal habitat is therefore predicted to be no greater than those during the construction phase, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible.

Significance of the effect

1177. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be **low** to **very high** and impact magnitude is assessed to be negligible, the potential effect of direct effects on intertidal habitat for birds within the OECC (MLWS to MHWS) during the decommissioning phase is considered to vary from **imperceptible** to **slight,** and **not significant** in EIA terms.

Additional mitigation

1178. Although additional mitigation will not be required specifically to address direct effects on habitat within intertidal areas during the decommissioning phase, the mitigation which will be required to address disturbance and displacement impacts within intertidal areas during the decommissioning phase will reduce impact magnitudes (negligible to all receptors) and receptor sensitivities (to very low to medium).

Residual effect

1179. As a consequence of additional mitigation to address disturbance and displacement impacts within intertidal areas during the decommissioning phase, the residual effect to all receptors is assessed to be **imperceptible**, and **not significant** in EIA terms.

Offshore and intertidal – decommissioning: impact 2 – disturbance and displacement

Offshore – array site and OECC (below MLWS)

1180. The decommissioning of WTGs and associated vessel activities within the array site has the potential to disturb and displace birds which would otherwise either directly utilise areas within and around the array site, or pass through the array site

1181. Similarly, the removal of export cables and associated vessel activities within the OECC has the potential to disturb and displace birds which would otherwise either directly utilise areas within and around the OECC.

1182. The displacement of individuals which would otherwise potentially utilise sea areas within or around the array site or OECC effectively equates to indirect habitat loss for those individuals. The displacement of individuals which would otherwise potentially fly through areas within or around the array site effectively equates to a barrier to the movement (barrier effects) of those individuals.

1183. Indirect habitat loss as consequence of displacement reduces the potential spatial extent available to impacted receptors. Receptors utilising such areas of marine habitat are, by definition, seabird species, and this distributional response does not apply to migratory non-seabird species. Reductions in the areas available for seabirds to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

1184. Barrier effects result in individuals altering flight pathways, which may increase energetic demands upon individuals where routes are altered to deviate around WTG arrays. This distributional response applies to both seabird species and migratory non-seabird species and such increased energetic consequences may result in changes to key demographic rates (specifically reductions in productivity, or survival rates), which in turn may negatively impact populations. Increased energetic consequences may arise in relation to infrequent annual migration movements of migratory species, or more frequent movements of seabirds which utilise the array site and its vicinity to undertake key non-migratory behaviours (for example foraging by breeding seabirds).

1185. Seabird species vary in their distributional responses to WTGs and decommissioning phase vessel activity within the array site. The same screening in process as used for Construction phase is used here, with the same species screened in (**Table 10-38**). The receptors screened in for impacts in the array site are Guillemot, Razorbill, Puffin, Red-throated diver, Manx shearwater and Gannet. The receptors screened in for impacts in the OECC are Common scoter, Guillemot, Razorbill, Black guillemot, Puffin, Red-throated diver, Great northern diver, Cormorant and Shag.

Receptor sensitivity

1186. Receptor sensitivities during decommissioning are considered to be the same as during construction and are assessed as medium to high for seabird species at the array site, low to very low for migratory species at the array site and low to high for seabird species within the OECC

Impact magnitude

1187. The effect of indirect habitat loss and barrier effects to seabird species in the array site is expected to be similar to that of the construction phase. Impact magnitudes during the decommissioning phase for this impact is therefore predicted to be no greater than those during the construction phase and decreasing throughout as infrastructure is removed from the array site, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible.

1188. The effect of barrier effects to migratory species in the array site is expected to be similar to that of the construction phase. Impact magnitudes during the decommissioning phase for this impact is therefore predicted to be no greater than those during the construction phase and decreasing throughout as infrastructure is removed from the array site, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible.

1189. The effect of indirect habitat loss to seabird species in the OECC (below MLWS) is expected to be similar to that of the construction phase. Impact magnitudes during the decommissioning phase for this impact is therefore predicted to be no greater than those during the construction phase, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible.

Significance of the effect

1190. Impact significance is determined in accordance with the matrix approach outlined to in **Table 10-11**.

1191. Impact significances during decommissioning are considered to be the same as during construction and are assessed as **imperceptible** to **not significant** for seabird species at the array site, imperceptible for migratory species at the array site and imperceptible to not for seabird species within the OECC

Additional mitigation

1192. As the impact significance associated with disturbance and displacement during decommissioning within the array site and OECC are assessed to range from **imperceptible** to **not significant,** and are assessed as **not significant** in EIA terms, no additional mitigation is necessary.

Residual effect

1193. As no additional measures are required to mitigate disturbance and displacement during decommissioning within the array site and OECC, the residual effect is assessed to be **imperceptible**, and **not significant** in EIA terms to **not significant**, and **not significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

1194. Cable landfall duct and cable removal activities within the South Dublin Bay intertidal area have the potential to disturb and displace birds which would otherwise directly utilise areas within and around the areas where these works are proposed to take place.

1195. The disturbance and resultant displacement of individuals which would otherwise potentially utilise intertidal areas within or around the area of intertidal landfall works effectively equates to temporary indirect habitat loss for those individuals.

1196. Indirect habitat loss as a consequence of disturbance and displacement reduces the potential spatial extent available to impacted receptors. Receptor species utilising such areas of intertidal habitat include waders, wildfowl, gulls, terns, seabirds and other waterbird species. Reductions in the areas available for these species to forage, roost, loaf and / or moult may result in adverse fitness consequences to impacted individuals, which at their most extreme may result in mortality.

Receptor sensitivity

1197. Species screened in for assessment in relation to intertidal disturbance and displacement impacts during decommissioning are those which are the same as those screened in during construction: see **Table 10-25**.

1198. Receptor sensitivities during decommissioning are considered to be the same as during construction and are assessed as very low to very high (**Table 10-39**).

Impact magnitude

1199. The effect on birds from this impact is expected to be similar to that of the construction phase. Impact magnitudes during the decommissioning phase for intertidal disturbance and displacement is therefore predicted to be no greater than that during the construction phase and is assessed as negligible to high (**Table 10-54**).

Significance of the effect

1200. Impact significance is determined in accordance with the matrix approach outlined to in **Table 10-11**.

1201. Impact significances during decommissioning are considered to be the same as during construction and are assessed as **imperceptible** to **significant**. **Moderate** (potentially significant in EIA terms) and **significant** (significant in EIA terms) are identified in relation to the following receptors:

- Knot;
- Dunlin (AAM intertidal cable route scenario only);
- *Sterna* terns; and
- Sandwich tern.

Additional mitigation

1202. Additional mitigation analogous to restrictions outlined in relation to construction phase activities will be implemented to reduce decommissioning phase disturbance and displacement impacts to all receptors to such levels that their residual significances will be considered not significant in EIA terms.

Residual effect

1203. As a consequence of additional mitigation to address impacts within intertidal areas during the decommissioning phase, the residual effect to all receptors is assessed to be **Imperceptible** to **Slight**, and **Not Significant** in EIA terms.

Offshore and intertidal – decommissioning: impact 3 – changes in prey availability

Offshore – array site and OECC (below MLWS)

1204. Decommissioning phase activities may impact the prey species of ornithological receptors within offshore areas in such a way as to alter the availability to those ornithological receptors. These impacts include those resulting from the production of underwater noise, the introduction of suspended sediments to the water column, and the alteration of habitats which support seabird prey species. Such activities may change the distribution or behaviour or accessibility of prey species for seabirds.

Receptor sensitivity

1205. Receptor sensitivity during decommissioning is considered to be the same as during construction, and are assessed as very low to medium (**Table 10-38**).

Impact magnitude

1206. Assessments on impact magnitude at made based on impacts from underwater noise, increased suspended sediment concentrations, and the alteration of areas of benthic habitat.

1207. The magnitude of this impact is expected to be similar to that of the construction phase. Impact magnitude during the decommissioning phase for prey effects is therefore predicted to be no greater than that during the construction phase, i.e., the impact is predicted to be of very low consequence to affected populations, therefore impact magnitude is assessed as negligible to low (**Table 10-64**).

Significance of the effect

1208. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11**, as receptor sensitivities are assessed to be **very low** to **medium** and impact magnitude is assessed to be negligible to low, the potential effect of changes in prey availability within the array site and OECC, during the decommissioning phase is considered to be **slight** or **not significant**, and **not significant** in EIA terms.

Additional mitigation

1209. As the impacts associated with prey effects during decommissioning within the array site and OECC are assessed to be not significant, no additional mitigation is necessary.

Residual effect

1210. As no additional measures are required to mitigate prey effects during decommissioning within the array site and OECC, the residual effect is assessed to be **slight** or **not significant**, and **not significant** in EIA terms.

Intertidal – OECC (MLWS to MHWS)

1211. Decommissioning activities may impact the prey species of intertidal birds in such a way as to alter their availability to those ornithological receptors. These impacts have the potential to arise via the disturbance of the intertidal habitat where such prey species are found.

Receptor sensitivity

1212. Receptor sensitivity during decommissioning is considered to be the same as during construction, and are assessed as very low to high (**Table 10-68**).

Impact magnitude

1213. For intertidal birds, key prey species are likely to be invertebrates such as catworm and molluscs such as Baltic tellin living in the littoral mud and sand flats. The primary impacts to these habitats and prey species will include disturbance of the littoral sandy mud within which invertebrate prey occurs, as well as a temporary increase in suspended sediments associated with cable removal activities. Components of the intertidal trenching are likely to occur at low tide and therefore will not have associated increased SSCs.

1214. Prey species are not considered to be sensitive to sediment deposition, as the majority of species present are highly mobile and able to move away from areas affected by sediment deposition. The intertidal habitat in itself is a dynamic habitat and is subject to constant natural disturbance. As such, the species present therein are adapted to this type of disturbance and can recover quickly (see **Chapter 9 Fish, Shellfish and Turtle Ecology; Section 9.10.1; paragraphs 232- 236**).

1215. As the intertidal habitat available to foraging bird species is considerably larger than the area which may experience changes in prey availability during decommissioning activities, there will be large amounts of unaffected habitat for birds to utilise. Furthermore, given the high rate of recoverability of the impacted habitat (and associated organisms) and the short-term nature of the trenching activity, the magnitude of an impact on foraging intertidal waterbirds is considered to be **negligible**.

Significance of the effect

1216. In accordance with the matrix approach outlined to determine impact significance level in **Table 10-11** as receptor sensitivities are assessed to be **very low** to **high** and impact magnitude is assessed to be negligible, the potential intertidal prey effects during the decommissioning phase is considered to be **imperceptible**, and **not significant** in EIA terms to **slight**, and **not significant** in EIA terms.

Additional mitigation

1217. Although additional mitigation will not be required specifically to address changes in prey availability within intertidal areas during the decommissioning phase, the mitigation which will be required to address disturbance and displacement impacts within intertidal areas during the decommissioning phase will reduce impact magnitudes (negligible to all receptors) and receptor sensitivities (to very low to medium).

Residual effect

1218. As a consequence of additional mitigation to address disturbance and displacement impacts within intertidal areas during the decommissioning phase, the residual effect to all receptors is assessed to be **imperceptible**, and **not significant** in EIA terms.

Offshore and intertidal – decommissioning: impact 4 – pollution

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

1219. Accidental pollution events during decommissioning have the potential to negatively affect ornithological receptors within offshore and intertidal study areas. Potential pollutants are outlined in the **Table 10-28** in **Section 10.8 Assessment parameters**, and are as follows: grease, hydraulic oil, gear oil, nitrogen, transformer silicon / ester oil, diesel fuel, SF6, glycol / coolants, drill fluid and batteries.

Receptor sensitivity

1220. Ornithological receptors may be sensitive to direct effects (i.e., through the ingestion of toxic substances, or from fouling of plumage), or indirect effects (i.e., upon habitat and / or prey species) from the release of pollutants. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to pollution events (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Impact magnitude

1221. Although there is the potential for significant impacts to arise from accidental pollution events in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation outlined in **Section 10.9**, in the form of a CEMP. This will ensure that vessels follow best practice guidelines to prevent the pollution and that analogous protocols are adhered to minimise such risk associated with works in inter-tidal habitats. The final CEMP will follow IMO and OSPAR guidelines in relation to industry best practices regarding pollution management. As such, the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

1222. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of pollution impacts during the decommissioning phase upon all offshore and intertidal ornithology receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

1223. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

1224. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Offshore and intertidal – decommissioning: impact 5 – introduction of invasive non-native species

Offshore and intertidal – array site, OECC (below MLWS) and OECC (MLWS to MHWS)

1225. There is the potential that INNS could be introduced by activities during decommissioning and that the presence of INNS could result in negative effects to ornithological receptors within offshore and intertidal areas.

Receptor sensitivity

1226. Ornithological receptors may be sensitive to direct effects (for example, invasive plant species over-growing nesting locations), or indirect effects (i.e., upon habitat and / or prey species) associated with the introduction or spread of INNS. For the purposes of assessment, it is assumed that ornithological receptors have a low tolerance to invasive species impacts (i.e., very limited ability to avoid or habituate to such impacts and potential that population level survival rates may be affected), with receptor importances assessed as low to very high, which can be concluded as a range of sensitivity from medium to very high as described in **Table 10-9**.

Impact magnitude

1227. Although there is the potential for significant impacts to arise from INNS in the absence of mitigation, the magnitude of this impact will be limited through primary mitigation stemming from consideration of the mitigation and control of invasive species measures in line with International Maritime Organization guidance (IMO, 2019) which are secured through the implementation of the CEMP described in **Section 10.9**, specifically that all vessels working on the CWP Project will have a Biosecurity Plan in place. The associated standards and procedures will be incorporated by all vessels and as such the potential magnitude of impact is reduced as far as is reasonably practicable to negligible.

Significance of the effect

1228. As impact magnitude is assessed to be negligible and receptor sensitivities to be medium to very high, the significance of introduction or spread of INNS impacts during the decommissioning phase upon all receptors is considered to be **Imperceptible to Slight**, and **Not Significant** in EIA terms.

Additional mitigation

1229. As likely effect in the absence of additional mitigation (beyond primary / designed in mitigation outlined in **Section 10.9**) is **Not Significant** in EIA terms, no additional mitigation is considered necessary.

Residual effect

1230. The significance of the residual effect is therefore predicted to be **Imperceptible to Slight**, which is **Not Significant** in EIA terms.

Onshore and estuarine / Liffey – decommissioning: impact 1 – direct effects on habitat

Onshore

Impact screening

1231. The IEFs which have been identified during the construction impacts screening for this impact will be the same for the decommissioning of the infrastructure at the onshore area (see **Table 10-69**).

Receptor sensitivity

1232. Receptor sensitivity of each IEFs during decommissioning is considered to be the same as during construction, and are assessed as low (see **Table 10-70**).

Magnitude of impact

1233. Magnitude of impact for each IEF (with the exception of sand martin) during decommissioning is considered to be the same as during construction, and are assessed as low (see **Table 10-71**).

1234. The magnitude of impact for sand martin during decommissioning is considered to be lower compared to during construction. There will be no removal of nesting or resting locations (including the constructed sand martin wall) for the species and so the magnitude will be assessed as low.

Significance of the effect

1235. The significance of effect for each IEF species, in the absence of mitigation determined during the construction stage for this impact will be the same or lower for the decommissioning of the infrastructure at the onshore area. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-135**below.

Table 10-135 Significance of the effect of impact 1 – direct effects on habitat for onshore IEF species during decommissioning

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Greenfinch	low	low	In the absence of additional mitigation measures, the sensitivity of Greenfinch in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **long term, not significant, negative effect** for Greenfinch.	**Not significant**
Linnet	low	low	In the absence of additional mitigation measures, the sensitivity of Linnet in the onshore development area is considered to be low and the magnitude of the impact is assessed as low.	**Not significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **long term, not significant, negative effect** for Linnet.	
sand martin	low	medium	In the absence of mitigation measures, the sensitivity of sand martin in the onshore development area is considered to be low and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, slight negative effect** for sand martin.	**Not significant**

Additional mitigation

1236. As the likely effect in the absence of additional mitigation (beyond primary / designed-in mitigation outlined) is assessed as not significant, no additional mitigation is considered necessary.

Residual effect

1237. The significance of the residual effect is therefore predicted to be slight, which is **not significant** in EIA terms.

Estuarine / Liffey

Impact screening

1238. The IEFs which have been identified during the construction impacts screening for this impact will be the same for the decommissioning of the infrastructure at the onshore development area (see **Table 10-74**).

Receptor sensitivity

1239. Receptor sensitivity of each IEFs during decommissioning is considered to be the same as during construction and are assessed as low (see **Table 10-75**).

Magnitude of impact

1240. Magnitude of impact for each IEF during decommissioning is considered to be the same as during construction, (see **Table 10-135**) however, will be shorter duration and as there will be no further removal of suitable habitat for this species the magnitude will be lower. Therefore, the magnitude for the IEFs is assessed as negligible.

Significance of the effect

1241. The significance of effect for each IEF species, in the absence of mitigation determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-136** below.

Table 10-136 Significance of the effect of impact 1 – direct effects on habitat for onshore IEF species during decommissioning

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Black guillemot	low	negligible	In the absence of mitigation measures, the sensitivity of Black guillemot in the onshore substation area is considered to be low and the magnitude of the impact is assessed as negligible. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, imperceptible negative effect** for Black guillemot.	**Not Significant**

Additional mitigation

1242. As the likely effect in the absence of additional mitigation (beyond primary / designed-in mitigation outlined) is assessed as not significant, no additional mitigation is considered necessary.

Residual effect

1243. The significance of the residual effect is therefore predicted to be imperceptible, which is **not significant** in EIA terms.

Onshore and estuarine / Liffey – decommissioning: impact 2 – disturbance and displacement

Onshore

Impact screening

1244. The IEFs which have been identified during the construction impacts screening for this impact will be the same for the decommissioning of the infrastructure at the onshore area (see **Table 10-79**).

Receptor sensitivity

1245. Receptor sensitivity of each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area and are assessed as low to medium (see **Table 10-80**).

Magnitude of impact

1246. Magnitude of impact for each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area and are assessed as low to medium (see**Table 10-81**).

Significance of the effect

1247. The significance of effect for each IEF species, in the absence of mitigation determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-137** below.

Table 10-137 Significance of the effect of impact 2 – disturbance and displacement for onshore IEF species during decommissioning

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Light-bellied Brent Goose	medium	medium	In the absence of additional mitigation measures, the sensitivity of Light-bellied Brent Goose in the onshore development area is considered to be medium and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, moderate, negative effect** for Light-bellied Brent Goose. This moderate determination has been considered as significant in EIA terms.	**Potentially Significant**
Greenfinch	low	low	In the absence of additional mitigation measures, the sensitivity of Greenfinch in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term,** n**ot significant, negative effect** for Greenfinch.	**Not Significant**
Linnet	low	low	In the absence of additional mitigation measures, the sensitivity of Linnet in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, not significant, negative effect** for Linnet.	**Not Significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Peregrine falcon	low	low	In the absence of mitigation measures, the sensitivity of Peregrine falcon in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is predicted to be a **short term, not significant, negative effect** for Peregrine falcon.	**Not Significant**
sand martin	low	low	In the absence of additional mitigation measures, the sensitivity of sand martin in the onshore development area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be **short term, not significant, negative effect** for sand martin.	

Additional mitigation

1248. Construction noise will be kept to a minimum, in accordance with British Standard BS 5228 1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise' to reduce the level of noise during the construction phase. The appointed Contractor will be obliged to take specific noise abatement measures and will comply with the best practice measures outlined in BS 5228 and the National Road Authority (NRA) guidelines 'Good practice Guideline for the Treatment of Noise during the Planning of National Road Schemes' (NRA, 2014).

1249. To reduce the level of artificial lighting, all temporary lighting associated with the construction works will be placed strategically by the appointed Contractor following consultation with the appointed ECoW. This will ensure that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light splay.

1250. To reduce noise and visual disturbance in the intertidal area, a number of robust mitigation measures have been proposed (see **Section 10.10.2 [Offshore and intertidal – Construction: Impact 2 – Disturbance and displacement**]), the effect of these mitigation measures will also contribute to mitigating disturbance and displacement effects at the onshore area, particularly at 'Goose Green' and on any potential Light-bellied Brent Goose within the onshore area. In addition to the mitigation proposed in the offshore / intertidal area, construction hoarding will be erected around the perimeter of construction compound A, further reducing potential noise and visual disturbance.

Residual effect

1251. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs during the decommissioning phase has been determined in **Table 10-138** below.

Table 10-138 Residual effect on onshore IEFs for impact 2 – disturbance and displacement during decommissioning, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Light-bellied Brent Goose	With the adoption of the mitigation measures the magnitude of effect on Light-bellied Brent Goose will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Light-bellied Brent Goose.	**Not Significant**
Greenfinch	With the adoption of the mitigation measures the magnitude of effect on Greenfinch will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Greenfinch	**Not Significant**
Linnet	With the adoption of the mitigation measures the magnitude of effect on Linnet will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Linnet.	**Not Significant**
Peregrine falcon	With the adoption of the mitigation measures the magnitude of effects on Peregrine falcon will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Peregrine falcon.	**Not Significant**
sand martin	With the adoption of the mitigation measures the magnitude of effect on sand martin will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to sand martin.	**Not Significant**

Estuarine / Liffey

Impact screening

1252. The IEFs which have been identified during the construction impacts screening for this impact will be the same for the decommissioning of the infrastructure at the estuarine / Liffey area (see **Table 10-84**).

Receptor sensitivity

1253. Receptor sensitivity of each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the estuarine / Liffey area and are assessed as low to high (see **Table 10-85**).

Magnitude of impact

1254. Magnitude of impact for each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the estuarine / Liffey area and are assessed as low to medium (see **Table 10-86**).

Significance of the effect

1255. The significance of effect for each IEF species, in the absence of mitigation determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area. Using the matrix detailed in and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-139** below.

Table 10-139 Significance of the effect of impact 2 – disturbance and displacement for estuarine / Liffey IEF species during decommissioning

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Arctic tern	high	medium	In the absence of mitigation measures, the sensitivity of Arctic tern in the onshore substation area is considered to be high and the magnitude of the impact is assessed as medium. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is predicted to be a **short term, Significant, negative effect** for Arctic tern.	**Significant**
Black guillemot	low	low	In the absence of mitigation measures, the sensitivity of Black guillemot in the onshore substation area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effects is predicted to be a **short term, Not Significant, negative effect** for Black guillemot.	**Not Significant**
Black-headed gull	low	low	In the absence of mitigation measures, the sensitivity of Black-headed gull in the onshore substation area is considered to be low and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effect is predicted to be a **short term, Not**	**Not Significant**

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
			Significant, negative effect for Black-headed gull.	
Common tern	high	low	In the absence of mitigation measures, the sensitivity of Common tern in the onshore substation area is considered to be medium and the magnitude of the impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of the effect is predicted to be a **short term, Slight, negative effect** for Common tern.	**Not Significant**

Additional mitigation

1256. Construction noise will be kept to a minimum, in accordance with British Standard BS 5228 1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites –Part 1: Noise' to reduce the level of noise during the construction phase. The appointed Contractor will be obliged to take specific noise abatement measures and will comply with the best practice outlined in BS 5228 and the NRA guidelines 'Good practice Guideline for the Treatment of Noise during the Planning of National Road Schemes' (NRA, 2014).

1257. To reduce the level of artificial lighting, all temporary lighting associated with the construction works will be placed strategically by the appointed Contractor following consultation with the appointed ECoW. This will ensure that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light splay.

1258. Mitigations applicable to terns include the following:

1259. To reduce the level of artificial lighting, all temporary lighting associated with the construction works will be placed strategically by the appointed Contractor following consultation with the appointed ECoW. This will ensure that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light splay.

1260. Mitigations applicable to terns have been detailed in a tern disturbance report prepared by ALCnature (**Appendix 10.9**) a summary of these mitigations include the following:

- General restrictions period:
    - The period from 1 May – 15 August will be defined as the tern breeding season and restrictions may apply as detailed below. The latter date may require amendment subject to progress of the breeding season and this should be monitored as the season progresses.
- Visual screening:
    - A solid screen (hoarding) of 2.5 m in height.
    - Erected and maintained to a height which hides / screens all activities, up to and including the maximum height extent of operating machinery within 75 m of the CDL tern colony.
    - Screening duration period 1 May – 15 August.

- Working (movement and noise of machinery or personnel) above hoarding height and within 40 metres, limited to periods of <5 minutes per hour.

- Construction sequencing:
  - A visualisation of the following proposed mitigation measures can be seen in **Figure 10-12** below.
  - All works out of line of sight and beyond 75 m of the CDL tern colony (except piling or works involving high intensity or long duration noise or vibration) may proceed at any time.
  - No works within line of sight of tern colony (or above hoarding height within 50 m), to proceed during 1 May – 15 August.
  - Works behind hoarding during 1 May – 15 August (except high noise / vibration activities, such as piling – restricted to outside 75 m buffer) are acceptable.
- Noise & lighting limits:
  - High noise & vibration activities (e.g., piling) restricted within 75 m buffer zone of tern colony 1 May – 15 August.
  - No lighting on exterior of hoarding in line of sight of tern colony 1 May – 15 August.
  - No works in hours of darkness 1 May – 15 August.
- Monitoring and response:
  - Monitoring of tern colony response to be carried out to structured plan throughout breeding season to enable response to disturbance events (enabling or restricting works subject to response observed).
- Special measures during fledging period.

1261. During the period when chicks are fledging and may leave the colony platform (typically July – mid Aug) they may move to shoreline areas to seek dry perches and there is risk of tern chicks entering the site and adults defending chicks on or close to the site by attacking personnel. The potential loss of chicks through exclusion of adults or through injury on site is apparent and during this period a trained ecologist should be on hand to locate and capture chicks in close proximity to the site and relocate them to suitable safe areas to avoid these issues.

Residual effect

1262. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs during the decommissioning phase has been determined in **Table 10-140** below.

Table 10-140 Residual effect on the onshore IEFs for impact 2 – disturbance and displacement during decommissioning, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Arctic tern	With the adoption of the mitigation measures the magnitude of effects on Arctic tern will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Arctic tern.	**Not Significant**

IEF species	Residual effect	Impact significance in EIA terms
Black guillemot	With the adoption of the mitigation measures the magnitude of effects on Black guillemot will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Black guillemot.	**Not Significant**
Black-headed gull	With the adoption of the mitigation measures the magnitude of effects on Black-headed gull will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Black-headed gull.	**Not Significant**
Common tern	With the adoption of the mitigation measures the magnitude of effects on Common tern will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Common tern.	**Not Significant**

Onshore– decommissioning: impact 3 – introduction / spread of non-native species

Impact screening

1263. The IEFs which have been identified during the construction impacts screening for this impact will be the same for the decommissioning of the infrastructure at the onshore development area (see **Table 10-89**).

Receptor sensitivity

1264. Receptor sensitivity of each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore development area and are assessed as low (see **Table 10-90**).

Magnitude of impact

1265. Magnitude of impact for each IEF species determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore development area and are assessed as low (see **Table 10-91**).

Significance of the effect

1266. The significance of effect for each IEF species, in the absence of mitigation determined during the construction stage for this impact will be the same for the decommissioning of the infrastructure at the onshore area. Using the matrix detailed in **Table 10-11** and in the absence of additional mitigation measures, the significance of the effect on the IEFs has been determined as set out in **Table 10-141** below.

Table 10-141 Significance of the effect for impact 3 - introduction / spread of non-native species for onshore IEF species during decommissioning

IEF species	Receptor sensitivity	Magnitude	Significance of the effect	Impact significance in EIA terms
Light-bellied Brent Goose	low	low	In the absence of additional mitigation measures, the sensitivity of Light-bellied Brent Goose in the onshore export cable area is considered to be low and the magnitude the of impact is assessed as low. Therefore (as per the matrix in **Table 10-11**), the significance of effects is predicted to be a **long term, Not Significant, negative effect** for Light-bellied Brent Goose, which will cause noticeable changes in the character of the environment but without significant consequences.	**Not significant**

Additional mitigation

1267. Impacts during the decommissioning phase are expected to be of a similar type and magnitude to those anticipated during the construction phase, but generally of a shorter duration. Therefore, the same mitigation measures implemented during the construction phase, will be applied during the decommissioning works.

Residual effect

1268. Using the matrix detailed in **Table 10-11** and with the adoption of additional mitigation measures, the significance of the effect on the IEFs during the decommissioning phase has been determined in **Table 10-142** below.

Table 10-142 Residual effect on IEFs for impact 3 – introduction / spread of non-native species during decommissioning, following the adoption of additional mitigation measures

IEF species	Residual effect	Impact significance in EIA terms
Light-bellied Brent Goose	With the adoption of the additional mitigation measures the magnitude of effect on Light-bellied Brent Goose will be Negligible. The significance of the residual effect is therefore predicted to be **Imperceptible** and without significant consequences to Light-bellied Brent Goose.	**Not significant**

10.11 Cumulative impacts

1269. A fundamental component of the EIA is to consider and assess the potential for cumulative effects of the CWP Project with other projects, plans and activities (hereafter referred to as 'other development').

1270. **Appendix 10.1 Ornithology Cumulative Effects Assessment** presents the findings of the CEA for ornithology which considers the residual effects presented in **Section 10.10** alongside the potential effects of other proposed and reasonably foreseeable developments.

1271. As the magnitude of impacts of introduction or spread of INNS and pollution events are assessed as negligible from CWP Project activities alone, it is considered that there is no potential for cumulative impacts with the other projects identified in **Appendix 10.1.**

1272. A summary of the CEA for ornithology is presented below. Cumulative effects are considered and presented in accordance with a tiered approach to the treatment of other existing, consented or foreseeable projects within appropriate zones of influence around the array site, intertidal and terrestrial proposed activities. Planned and operational projects were screened out of further consideration for potential cumulative effects based on there not being a potential impact-receptor-pathway across development phases for the following reasons:

- There is no potential impact-receptor-pathway due to the project being outside of the ZoI;
- There is no temporal overlap between plans / projects;
- The plan / project is ongoing and is part of the current baseline; or
- Data are not available.

1273. Cumulative effects on offshore ornithological receptors with schemes other than offshore renewables are considered to be unlikely given the scale and nature of such developments (e.g., aggregate dredging projects, dredging and disposal projects, cabling projects and coastal projects). Any potential cumulative effects are predicted not to be significant (e.g., potential disturbance and effects on prey availability are predicted to be highly localised and temporary). Furthermore, commercial fishing and shipping were screened out since they are considered to be captured as part of the baseline environment.

1274. The CEA is limited by the data available upon which to base the assessment. Due to the age of developments in the Irish Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, few have comparable datasets upon which to base an assessment. Many of the older developments did not address cumulative effects as fully (as is required presently) whilst those developments which are not fully realised have not released their data into the public domain. As such the CEA is carried out with the fullest dataset available whilst acknowledging that further cumulative effects may occur from existing or planned developments.

1275. To facilitate the presentation of consistent and comparable approaches to CEA for offshore ornithology between east coast Irish Phase 1 projects (namely: Codling Wind Park, Dublin Array, North Irish Sea Area [NISA], Oriel and Arklow), consultation was undertaken between these projects to identify a comprehensive suite of appropriate plans and projects within the Irish Sea and wider region for inclusion within CEA for offshore ornithological receptors. On this basis the following projects (and their allocated tier) were incorporated in CEA for impacts to offshore ornithological receptors:

Tier 1

- Awel-y-Mor;
- Gwynt y Mor;
- Rhyl Flats;
- Burbo Bank Extension;
- North Hoyle;
- Walney Extension 3 + 4;

- West of Duddon Sands;
- Walney 2;
- Walney 1;
- Burbo Bank;
- Ormonde;
- Barrow;
- Robin Rigg;
- Arklow Bank Phase 1;
- Twin Hub;
- Erebus;
- Morgan;
- Morecambe;
- Mona; and
- White Cross.

Tier 2a *(Note that CWP is classified as a Tier 2a project)*

- Dublin Array; and
- NISA.

Tier 2b

- Oriel; and
- Arklow.

1276. The following projects (and their allocated tier) were incorporated in CEA for impacts to offshore intertidal receptors within South Dublin Bay:

Tier 1

- Dublin Port Capital Dredging Project;
- Dublin Port Company MP2 Project;
- Grand Canal Storm Water Outfall Extension; and
- New Terminal building (St Michael's Pier).

Tier 2a

- Dublin Array (export cable corridor option through South Dublin Bay).

1277. Further information relating to other plans and projects considered, but not progressed through CEA screening for offshore and intertidal ornithological receptors is provided in **Appendix 10.1 Cumulative Effects Assessment.**

1278. The following projects (and their allocated tier) were incorporated in CEA for impacts to onshore and estuarine / Liffey receptors.

Tier 1

- Electricity Supply Board (ESB) - Dublin Bay Power Station / Open Cycle Gas Turbine (OCGT), (CEA-1327);
- ESB - Poolbeg Generating Station / OCGT and Substation (CEA-1338 & CEA-1346); and
- Pembroke Beach DAC / Becbay Ltd & Fabrizia Developments Ltd – Redevelopment of former glass bottle site (CEA- 0333, CEA-0339, CEA-0387 and CEA-1354).

Tier 3

- 3FM Dublin Port Development (CEA-1348).

1279. Further information relating to other plans and projects considered, but not progressed through CEA screening for onshore ornithological receptors is provided in **Appendix 10.1 Cumulative Effects Assessment**.

10.11.1 Impact screening

1280. Only potential impacts assessed as 'not significant' or above are included in the CEA (i.e., those assessed as 'imperceptible' are not taken forward as there is no potential for them to contribute to a cumulative effect).

1281. On this basis potential cumulative effects are identified for:

- Guillemot, Razorbill, Red-throated diver and Gannet as a result of disturbance and displacement in the form of indirect habitat loss within the array site and surrounding area during the construction phase.
- Red-throated diver as a result of disturbance and displacement in the form of indirect habitat loss within the offshore part (<MLWS) of the OECC during the construction phase.
- *Sterna* terns (common, Arctic and Roseate) and Sandwich tern as a result of disturbance and displacement in the form of indirect habitat loss within the intertidal part (MLWS to MHWS) of the OECC during the construction phase.
- Guillemot, Razorbill, Red-throated diver and Gannet as a result of disturbance and displacement in the form of indirect habitat loss within the array site and surrounding area during the operation and maintenance phase.
- Red-throated diver as a result of disturbance and displacement in the form of indirect habitat loss within the offshore part (<MLWS) of the OECC during the operation and maintenance phase.
- Kittiwake, Great black-backed gull, Herring gull, Common tern and Gannet as a result of collision within the array site during the operation and maintenance phase.
- sand martin and Black guillemot as a result of direct habitat loss within the onshore / estuarine / Liffey area during the construction phase.
- Arctic and Common tern as a result of presence of onshore building / infrastructure within the estuarine / Liffey area during the operation and maintenance phase.

1282. Other potential impacts, including direct effects on habitat, pollution and introduction of invasive non-native species were screened out of the CEA on the basis that project only residual impacts to all receptors were assessed to be imperceptible.

10.11.2 Construction phase

Onshore and estuarine / Liffey – construction: impact 1 – direct effects on habitat

Onshore

1283. The CWP Project will result in the loss of habitat within the onshore area, which in turn, will result in the loss of a breeding colony of sand martin recorded within a harbour wall adjacent to the proposed onshore substation. Approximately four sand martin nests will be permanently lost to facilitate this proposed infrastructure.

1284. The permanent loss of habitat at the CWP Project was considered a moderate negative effect in the absence of mitigation and has been determined as significant in EIA terms. Additional mitigation measures in the form of the provision of an artificial sand martin wall will mitigate against the loss of habitat and four sand martin nests (as well as increasing the number of nesting opportunities for the species i.e., the sand martin will with contain a minimum of 27 nesting cavities), thus reducing the impact significance to a slight negative effect making it not significant in EIA terms and removing the potential for cumulative impacts.

1285. The accumulative effect of habitat losses with nearby projects (listed in above and in **Appendix 10.1 Cumulative Effects Assessment**) will not increase the magnitude of this impact on this sand martin colony. None of the projects screened through for further assessment noted impacts on sand martin or identified suitable habitats for the species, at risk of being lost.

1286. Furthermore, the policies and objectives listed in the Dublin City Council Development Plan (2022-2028) and the Dublin City Biodiversity Action Plan (2021-2025) will moderate the impacts on onshore habitats and flora from future proposed projects.

Estuarine / Liffey

1287. The CWP Project will result in the loss of habitat within the estuarine / Liffey area, which in turn, will result in the loss of a confirmed breeding sites and potential breeding sites for Black guillemot recorded within a harbour wall adjacent to the onshore substation. At least two active and three potential nest sites will be permanently lost to facilitate this proposed infrastructure.

1288. The permanent loss of habitat at the CWP Project was considered to have a moderate negative effect in the absence of mitigation and has been determined as significant in EIA terms. Additional mitigation measures in the form of the provision of artificial nest boxes will mitigate against the loss of habitat and active nesting areas (as well as increasing the number of nesting opportunities for the species i.e., a minimum of four nest boxes will be erected), thus reducing the impact significance to a slight negative effect making it not significant in EIA terms and removing the potential for cumulative effects.

1289. The cumulative effect of habitat losses with nearby projects (listed in above and in **Appendix 10.1 Cumulative Effects Assessment**) will not increase the magnitude of this impact on the Black guillemot population. None of the screened in project listed above noted impacts on Black guillemot or identified suitable habitats at risk of being lost.

1290. Furthermore, the policies and objectives listed in the Dublin City Council Development Plan (2022-2028) and the Dublin City Biodiversity Action Plan (2021-2025) will moderate the impacts on onshore habitats and flora from future proposed projects.

Offshore and intertidal – construction: impact 2 – disturbance and displacement

Array site

1291. The derivation of impact significance levels for each receptor for the project only and cumulative scenarios are summarised in **Table 10-143**, below, with a full description in **Appendix 10.1 Ornithology Cumulative Effects Assessment, Section 5.1.1** For further information on the selection of species-specific evidence led displacement and mortality rates and displacement buffer sizes refer to **Section 10.10.2** (Offshore and intertidal – Construction: Impact 2 – Disturbance and displacement).

1292. For all receptors and for all scenarios cumulative construction phase disturbance and displacement impacts associated with activities within the array site are assessed to be not significant in EIA terms.

Table 10-143 Derivation of impact significance for cumulative scenarios relating to construction phase disturbance and displacement impacts within the array site and appropriate buffer for each ornithological receptor

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
Guillemot	High	Estimated displacement mortality	42.41	457.76	588.58	617.59	Assumes evidence led conservative displacement rates of 50% for operational projects (Tier 1) and 25% for construction phase projects (Tier 2). Assumes evidence led conservative displacement mortality rate of 1% (all projects). Assumes displacement within 2 km buffer area around array site.
		Proportional increase in regional annual mortality rate	0.023%	0.253%	0.325%	0.341%	
		Assessed impact magnitude	negligible	low	low	low	
		Assessed impact significance level	**Not Significant**	**Slight**	**Slight**	**Slight**	
Razorbill	High	Estimated displacement mortality	15.21	130.95	155.94	183.44	
		Proportional increase in regional annual mortality rate	0.019%	0.160%	0.191%	0.225%	
		Assessed impact magnitude	negligible	low	low	low	
		Assessed impact significance level	**Not Significant**	**Slight**	**Slight**	**Slight**	

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
Red-throated diver	High	Estimated displacement mortality	2.29	4.12	4.17	6.05	Assumes evidence led conservative displacement rates of 100% for operational projects (Tier 1) and 50% for construction phase projects (Tier 2). Assumes evidence led conservative displacement mortality rate of 1% (all projects) Assumes displacement within 2 km buffer area around array site
		Proportional increase in regional annual mortality rate	0.080%	0.145%	0.146%	0.212%	
		Assessed impact magnitude	negligible	low	low	low	
		Assessed impact significance level	**Not significant**	**Slight**	**Slight**	**Slight**	
Gannet	High	Estimated displacement mortality	0.93	36.08	40.86	43.67	Assumes evidence led conservative displacement rates of 70% for operational projects (Tier 1) and 35% for construction phase projects (Tier 2). Assumes evidence led conservative displacement mortality rate of 1% (all projects)
		Proportional increase in regional annual mortality rate	0.001%	0.017%	0.017%	0.017%	
		Assessed impact magnitude	negligible	negligible	negligible	negligible	
		Assessed impact significance level	**Not significant**	**Not significant**	**Not significant**	**Not significant**	

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
							Assumes displacement within 4km buffer area around array site

OECC (<MLWS)

1293. On the basis of the limited duration of construction phase activities within the OECC (below MLWS), their occurrence within an area where baseline levels of vessel activity are very high and the implementation of additional mitigation to minimise vessel related disturbance, the residual disturbance and displacement impacts to Red-throated diver within the OECC (>MLWS) during the construction phase is assessed to be **not significant**.

1294. There is an absence of information relating to potential displacement of Red-throated Divers from other projects within and around the OECC (specifically, associated with export cable installation of other Tier 2 projects). It is, however, assumed that other projects will appropriately mitigate project alone effects. The addition of negligible magnitude CWP Project only construction phase disturbance and displacement impacts within the OECC to cumulative disturbance and displacement impacts of other relevant plans and projects to regional Red-throated diver populations is not considered to have any potential to materially alter conclusions relating to consequences upon regional populations. As such, cumulative disturbance and displacement impacts to Red-throated diver associated with construction phase activities within the OECC are assessed to be **non-significant** in EIA terms.

Intertidal OECC (MLWS to MHWS)

1295. On the basis of the limited duration of construction phase activities within the intertidal landfall of the OECC (MLWS to MHWS), and the implementation of additional mitigation to exclude construction activities from occurring within intertidal areas at times of year (for wintering waterbirds) and times of day (for post-breeding roosting tern aggregations) when ornithological receptors may be particularly sensitive to potential disturbance and displacement impacts, residual disturbance and displacement impacts to *Sterna* terns (Common, Arctic and Roseate) and Sandwich tern, within South Dublin Bay during the construction phase is assessed to be **slight** and **non-significant**, respectively.

1296. There is an absence of information relating to potential displacement of these receptors by other projects within the area around the intertidal landfall of the OECC. Whilst it is acknowledged that projects such as the Dublin Port Master Plan 3FM and MP2 projects are earmarked for development in the vicinity of the CWP landfall; at the time of writing these projects are yet to proceed through planning, and it is assumed that they will have EIAs and appropriate mitigative measures employed.

1297. The addition of low magnitude CWP Project only construction phase disturbance and displacement impacts within the area around the intertidal landfall of the OECC to cumulative disturbance and displacement impacts of the small number of other relevant plans and projects to regional populations is not considered to have any potential to materially alter conclusions relating to consequences upon regional populations. As such, cumulative disturbance and displacement impacts to *Sterna* terns (Common, Arctic and Roseate) and Sandwich tern associated with construction phase activities at the intertidal landfall of the OECC are assessed to be **non-significant** in EIA terms.

10.11.3 Operation and maintenance phase

Offshore and intertidal – operation and maintenance: impact 2 – disturbance and displacement

Array site

1298. The derivation of impact significance levels for each receptor for the project only and cumulative scenarios are summarised in **Table 10-144**, below, with a full description provided in **Appendix 10.1**

Ornithology Cumulative Effects Assessment, Section 5.2.1. For further information on the selection of species-specific evidence led displacement on mortality rates and displacement buffer sizes refer to **Section 10.10.3** (Offshore and intertidal – Operation and maintenance: Impact 2 – Disturbance and displacement).

1299. For all receptors and for all scenarios cumulative operation and maintenance phase disturbance and displacement impacts associated with activities within the array site are assessed to be **not significant** in EIA terms.

Table 10-144 Derivation of impact significance for cumulative scenarios relating to operation and maintenance phase disturbance and displacement impacts within the array site and appropriate buffer for each ornithological receptor

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
Guillemot	High	Estimated displacement mortality	84.82	500.17	761.81	819.82	Assumes evidence led conservative displacement rates of 50% for operational projects (Tiers 1 and 2). Assumes evidence led conservative displacement mortality rate of 1% (all projects). Assumes displacement within 2 km buffer area around array site.
		Proportional increase in regional annual mortality rate	0.047%	0.276%	0.420%	0.452%	
		Assessed impact magnitude	negligible	low	low	low	
		Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Razorbill	High	Estimated displacement mortality	30.42	146.16	196.15	251.14	
		Proportional increase in regional annual mortality rate	0.037%	0.179%	0.240%	0.308%	
		Assessed impact magnitude	negligible	low	low	low	

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
		Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Red-throated diver	High	Estimated displacement mortality	4.58	6.41	6.51	10.26	Assumes evidence led conservative displacement rates of 100% for operational projects (Tiers 1 and 2). Assumes evidence led conservative displacement mortality rate of 1% (all projects). Assumes displacement within 4 km buffer area around array site.
		Proportional increase in regional annual mortality rate	0.161%	0.225%	0.229%	0.360%	
		Assessed impact magnitude	low	low	low	low	
		Assessed impact significance level	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Gannet	High	Estimated displacement mortality	1.86	37.01	46.57	52.19	Assumes evidence led conservative displacement rates of 70% for operational projects (Tiers 1 and 2). Assumes evidence led conservative displacement
		Proportional increase in regional annual mortality rate	0.002%	0.032%	0.040%	0.045%	
		Assessed impact magnitude	negligible	negligible	negligible	negligible	

Receptor	Receptor sensitivity	Assessment parameter	Cumulative scenario				Additional information
			CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
		Assessed impact significance level	**Not significant** (not significant)	**Not significant** (not significant)	**Not significant v**	**Not significant** (not significant)	mortality rate of 1% (all projects). Assumes displacement within 2 km buffer area around array site.

OECC (<MLWS)

1300. On the basis of the very low levels of additional vessel activity along monitoring routes within an area where baseline levels of vessel activity are very high and, potentially for rare occurrences, around locations where repair works are required within the OECC during the operation and maintenance phase, plus the implementation of additional mitigation to minimise vessel related disturbance, project-only disturbance and displacement impact magnitude to Red-throated diver is assessed as negligible and impact significance levels as **not-significant**.

1301. There is an absence of information relating to potential displacement of Red-throated Divers from other projects within and around the OECC. It is, however, assumed that other projects will appropriately mitigate project alone effects. The addition of negligible magnitude CWP Project only operation and maintenance phase disturbance and displacement impacts within the OECC to cumulative disturbance and displacement impacts of other relevant plans and projects to regional Red-throated diver populations is not considered to have any potential to materially alter conclusions relating to consequences upon regional populations. As such, cumulative disturbance and displacement impacts to Red-throated diver associated with operation and maintenance phase activities within the OECC are assessed to be **non-significant** in EIA terms.

Estuarine / Liffey – operation and maintenance: impact 4 – presence of buildings / infrastructures

Estuarine / Liffey

1302. The CWP project will result in permanent buildings / infrastructure at the onshore substation in proximity to the estuarine / Liffey area, which would increase the magnitude of the effect on Arctic tern and Common tern (which are breeding in close proximity to the onshore substation), due to potential shadow cast and the creation of perching opportunities for predators such as peregrine falcon or hooded crow.

1303. The presence of buildings / infrastructure from the CWP Project was considered to have a slight negative effect for Arctic tern and not significant negative effect for Common tern, in the absence of mitigation. Both of which has been determined as not significant in EIA terms. Therefore, additional mitigation is not required.

1304. The accumulative effect of the presence of buildings / infrastructure with nearby projects (listed in above and in **Appendix 10.1 Cumulative Effects Assessment**) will not increase the magnitude of this impact on the Arctic tern and common tern colonies. None of the projects screened through for further assessment noted impacts on Arctic or Common Terns or have buildings / structure or infrastructure within the vicinity of the estuarine / Liffey area.

Offshore – operation and maintenance: impact 6 – collision

Array site

1305. The derivation of impact significance levels for each receptor for the project only and cumulative scenarios is summarised in **Table 10-145**, below, with a full description provided in **Appendix 10.1 Ornithology Cumulative Effects Assessment, Section 5.2.2**.

1306. For all receptors and for all scenarios cumulative operation and maintenance phase collision impacts associated with activities within the array site are assessed to be **not significant** in EIA terms.

1307. It should be noted for CRMs undertaken for Kittiwake that a conservative approach was taken for flight speeds. Given NPWS (2023) advice that flight speeds from Skov et al., (2018) at recommended, this would reduce the impact collision estimates for the CEA as it did for the project-only impact assessment. This would not change the above conclusion, but rather emphasises the conclusion that this impact is **not significant** in EIA terms for this species.

Table 10-145 Derivation of impact significance for cumulative scenarios relating to operation and maintenance phase disturbance and displacement impacts within the array site and appropriate buffer for each ornithological receptor

Receptor	Receptor sensitivity	WTG Option	Assessment parameter	Cumulative scenario				Additional information
				CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
Kittiwake	Very high	A	Estimated collision mortality	18.28	461.87	523.61	787.76	Although maximum cumulative collision impact mortality values are not predicted to result in an increase to regional baseline mortality rates in excess of 1% (which is generally treated in assessment as the minimum level of impact necessitating the use of Population Viability Analyses (PVA) to support impact magnitude level attributions), as assessed impact significance levels are determined as moderate, and moderate may or may not be considered as significant in EIA terms, additional PVA modelling was used to determine that moderate significance level impacts are not significant in EIA terms. (i.e., PVA outputs such that cumulative impacts are considered to indicate no significant adverse effect to the regional Kittiwake population). PVA information provided in **Appendix 10.1: Ornithology Cumulative Effects Assessment, Section 5.2.2**.
			Proportional increase in regional annual mortality rate	0.013%	0.317%	0.360%	0.541%	
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Slight** (not significant)	**Moderate** (not significant)	**Moderate** (not significant)	**Moderate** (not significant)	
		B	Estimated collision mortality	15.91	459.5	521.24	785.39	
			Proportional increase in regional annual mortality rate	0.011%	0.316%	0.358%	0.540%	
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Slight** (not significant)	**Moderate** (not significant)	**Moderate** (not significant)	**Moderate** (not significant)	
Great black-backed gull	High	A	Estimated collision mortality	4.15	49.99	75.39	141.3	As maximum cumulative collision impact mortality values are predicted to result in an increase to regional baseline mortality rates in excess of 1% (which is generally treated in assessment as the minimum level of impact necessitating the use of PVA to support impact magnitude level attributions), PVA modelling was used to determine that proportional increases in regional mortality rates equate to low impact magnitudes and therefore that impacts are not significant in EIA terms. PVA information provided in **Appendix 10.1: Ornithology Cumulative Effects Assessment, Section 5.2.2**.
			Proportional increase in regional annual mortality rate	0.082%	0.985%	1.486%	2.785%	
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
		B	Estimated collision mortality	3.67	49.51	74.91	140.82	
			Proportional increase in regional annual mortality rate	0.072%	0.976%	1.476%	2.776%	
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Herring gull	High	A	Estimated collision mortality	27.41	134.95	228.92	322.21	

Receptor	Receptor sensitivity	WTG Option	Assessment parameter	Cumulative scenario				Additional information
				CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
			Proportional increase in regional annual mortality rate	0.085%	0.419%	0.711%	1.001%	As maximum cumulative collision impact mortality values are predicted to result in an increase to regional baseline mortality rates in excess of 1% (which is generally treated in assessment as the minimum level of impact necessitating the use of PVA to support impact magnitude level attributions), PVA modelling was used to determine that proportional increases in regional mortality rates equate to low impact magnitudes and therefore that impacts are not significant in EIA terms. PVA information provided in **Appendix 10.1: Ornithology Cumulative Effects Assessment, Section 5.2.2**.
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
		B	Estimated collision mortality	23.28	130.82	224.79	318.08	
			Proportional increase in regional annual mortality rate	0.072%	0.407%	0.699%	0.988%	
			Assessed impact magnitude	negligible	low	low	low	
			Assessed impact significance level	**Not Significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Common tern	High	A	Estimated collision mortality	2.27	11.64	15.34	23.94	
			Proportional increase in regional annual mortality rate	0.016%	0.082%	0.109%	0.169%	
			Assessed impact magnitude	negligible	negligible	low	low	
			Assessed impact significance level	**Not significant** (not significant)	**Not significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
		B	Estimated collision mortality	2.03	11.40	15.10	23.70	
			Proportional increase in regional annual mortality rate	0.014%	0.081%	0.107%	0.168%	
			Assessed impact magnitude	negligible	negligible	low	low	
			Assessed impact significance level	**Not significant** (not significant)	**Not significant** (not significant)	**Slight** (not significant)	**Slight** (not significant)	
Gannet	High	A	Estimated collision mortality	0.27	90.17	95.00	116.72	
			Proportional increase in regional annual mortality rate	0.000%	0.077%	0.082%	0.100%	

Receptor	Receptor sensitivity	WTG Option	Assessment parameter	Cumulative scenario				Additional information
				CWP project only	CWP + Tier 1 projects	CWP + Tier 1 + other Tier 2a projects	CWP + Tier 1 + other Tier 2a + Tier 2b projects	
			Assessed impact magnitude	negligible	negligible	negligible	low	
			Assessed impact significance level	**Not significant** (not significant)	**Not significant** (not significant)	**Not significant** (not significant)	**Slight** (not significant)	
		B	Estimated collision mortality	0.23	90.13	94.96	116.68	
			Proportional increase in regional annual mortality rate	0.000%	0.077%	0.082%	0.100%	
			Assessed impact magnitude	negligible	negligible	negligible	low	
			Assessed impact significance level	**Not significant** (not significant)	**Not significant** (not significant)	**Not significant** (not significant)	**Slight** (not significant)	

10.12 Transboundary impacts

1308. Transboundary impacts arise when impacts from a development within one European Economic Area (EEA) state affects the environment of another EEA state.

1309. Transboundary impacts to offshore and migratory ornithological receptors are possible due to the wide foraging ranges of seabird species within the Irish Sea and because flyways used by migrant species typically cover more than one EEA state.

1310. In particular, there is potential for transboundary collision and displacement impacts to seabird receptors with those offshore renewable energy projects present, or in planning, in UK waters. There will be temporal overlap within the operational phases of some of these UK offshore renewable energy projects. Relevant offshore renewable projects within UK waters are, however, fully incorporated into the CEA (**Section 10.11**) and impacts assessed (**Section 10.10**) against regional populations which include breeding populations from UK colonies and non-breeding individuals within western UK waters. Where potential impacts to UK SPAs are identified, these are addressed within AA Screening (CWP-CWP-CON-08-03-01-REP-0001) and the NIS (CWP-CWP-CON-08-03-02-REP-0001).

1311. Beyond identified potential transboundary impacts between Ireland and the UK, during the breeding bio-season, it is highly likely that the majority of breeding seabirds will utilise only Irish and UK waters for foraging. For those key receptors with relatively large mean-maximum foraging ranges such as Gannet, Manx shearwater and Fulmar (Woodward et al., 2019), although these species may travel further than the Irish and Celtic Seas, the proportion of potential foraging within the waters of other EEA states is likely to be extremely limited. Therefore, developments outside of Irish and UK waters will not contribute significantly to any transboundary effects.

1312. During non-breeding bio-seasons, key non-breeding seabird receptors no longer behave as central-place foragers and, consequently, may travel more widely within European and wider Atlantic waters. As such, during non-breeding bio-seasons, seabird receptors may come into contact with developments elsewhere in European waters such as those operational, under construction or in planning in the Channel and North Sea. Given this larger spatial scale, any potential transboundary effects would be in relation to much larger populations than those considered at the regional scale for the project's impact assessment. Therefore, it is apparent that the scale of impacts arising from developments within such a wide context would be relatively much smaller with respect to any potential impacts considered at the regional population scale.

1313. For seabird receptors consideration of additional OWFs (and other relevant offshore renewable energy projects) outside of Irish and UK waters is considered very unlikely to alter the conclusions of the CEA presented in **Section 10.11**.

1314. For migratory receptors, as all collision and barrier effect impact magnitudes are assessed to be negligible and resultant impact significances to be imperceptible, project impacts will not contribute significantly to potential transboundary effects.

1315. There are no transboundary impacts with regards to impacts to wintering intertidal ornithological receptors within the South Dublin Bay area as this area is not sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and are not considered further.

1316. There are no transboundary impacts with regards to onshore and estuarine / Liffey ornithology as the onshore and estuarine / Liffey development area is not sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and are not considered further.

10.13 Inter-relationships

1317. The inter-related effects assessment considers the potential for all relevant effects across multiple topics to interact, spatially and temporally, to create inter-related effects on a receptor group. This includes incorporating the findings of the individual assessment chapters to describe potential additional effects that may be of greater significance when compared to individual effects acting on a receptor group.

1318. The term 'receptor group' is used to highlight the fact that the proposed approach to the inter-relationships assessment has not assessed every individual receptor considered in this chapter, but instead focuses on groups of receptors that may be sensitive to inter-related effects.

1319. **Chapter 5 EIA Methodology** provides a matrix to show at a broad level where across the EIAR interactions between effects on different receptor groups have been identified.

1320. The potential inter-related effects that could arise in relation to Ornithology are presented in **Table 10-146**.

Table 10-146 Inter-related effects assessment for ornithology

Impact / Receptor	Related chapter	Phase assessment
Increased SSC effects upon key prey species availability to seabirds during the construction and decommissioning phases	**Chapter 9 Fish, Shellfish and Turtle Ecology** **Chapter 6 Marine Geology, Sediments and Coastal Processes.**	Construction, maintenance and decommissioning activities within the array site and OECC could affect prey resource availability for offshore ornithology receptors. This potential impact is addressed within this chapter.
Removal or alteration of benthic habitat effects upon key prey species availability to seabirds during the construction, operation and maintenance and decommissioning phases	**Chapter 9 Fish, Shellfish and Turtle Ecology** **Chapter 8 Subtidal and Intertidal Ecology**	
Underwater noise effects upon key prey species availability to seabirds during the construction and decommissioning phases	**Chapter 9 Fish, Shellfish and Turtle Ecology**	
Removal or alteration of onshore habitat effects on habitat usage of IEFs during the construction and decommissioning phases	**Chapter 21 Onshore Biodiversity**	Construction and decommissioning activities within the onshore area could effect suitable habitat availability for onshore IEF bird species. This potential impact is addressed within this chapter.

10.14 Potential monitoring requirements

10.14.1 Ornithological receptors using offshore and intertidal areas

1321. Monitoring requirements for the CWP Project will be described in the In Principle Project Environmental Monitoring Plan (IPPEMP) submitted alongside the EIAR and further developed and agreed with stakeholders prior to construction.

1322. Assessed project only and cumulative impacts on ornithological receptors as a result of the construction, operation and maintenance and decommissioning phases of the CWP Project are predicted to be not significant in EIA terms. Based on the assessed impacts it is concluded that no specific monitoring is required.

1323. There are however several monitoring options that could be considered by the project to address some of the key assumptions in this impact assessment. The proposed development is committed to participating in the 'East Coast Monitoring Group' (ECMG), to discuss and agree potential strategic monitoring initiatives in relation to offshore ornithology. The need for strategic monitoring, and the level of participation by individual projects, will be determined by the conclusions of the EIAR process, in consultation with statutory and technical stakeholders, and with a focus on validation and evidence gathering. These could include, for example:

- Monitoring of intertidal construction phase disturbance responses within the South Dublin Bay OECC landfall area.
- Seabird colony monitoring for key sites and receptors including colony size counts, breeding productivity monitoring and / or prey species provisioned to chicks to provide information in relation to population trends, demographic parameters and prey species.
- Seabird tracking from key sites to further inform about connectivity to, or avoidance of, the operational CWP array site.

10.14.2 Ornithological receptors using onshore areas and estuarine areas within the Liffey

Operation onshore

1324. Following construction of the onshore substation and the installation of the sand martin wall, a suitably qualified and experienced ornithologist, will monitor the sand martin wall to determine usage and breeding success.

1325. Monitoring will broadly follow the survey methodology set out in Gilbert et al., (1998). Two visits will be made in May and June, observing the entrances of the wall from a suitable location and distance, to not cause disturbance. Apparent occupied nests will be noted during the first visit in May and will be confirmed if active or not during the second visit in June. This monitoring will remain for the first 5 years, post construction to ensure occupancy by sand martin has been established.

Operation estuarine / Liffey

1326. Following construction of the onshore substation a suitably qualified and experienced ornithologist, area will monitor the Common and Arctic tern colonies as well as the Black guillemots nest boxes to determine population size, breeding success and potential avian predator usage, at the substation site.

1327. tern monitoring on the CDL and ESB mooring dolphins will follow the methods outlined in Walsh et al., (1995). tern population census will occur on a weekly basis from 1 May to mid-June, to determine occupancy and breeding status using suitable vantage points. These visits will look at breeding behaviour and record a count of individuals and apparently occupied nests (AONs). A productivity survey will them be conducted during one visit in late June / early July, the determine approximate numbers of chicks per pair. It is proposed to conduct this monitoring over a five-year period post construction and provide the collected data to relevant parties (such as the NPWS and BirdWatch Ireland).

1328. A survey of avian predator usage on constructed buildings, will be conducted in conjunction with tern monitoring. Timed surveys from a suitable vantage will be conducted over the survey period of breeding terns (1 May to late July). Should a building or structure be found to provide suitable perching or nesting opportunities for an avian predator, which may predate on terns from both colonies, retro fitting measures will be considered.

1329. Black guillemot monitoring at the onshore substation site will involve a re-survey of the estuarine / Liffey study area and the installed nest boxes, to determine population and occupancy. The monitoring will follow the methodology set out in **Section 10.4.2 (Estuarine / Liffey - Black guillemot survey).** This monitoring will remain for the first 3 years, post construction to ensure occupancy of nest boxes by Black guillemot has been established.

10.15 Impact assessment summary

1330. This chapter of the EIAR has assessed the potential environmental impacts on **ornithological receptors** from the construction, operation and maintenance and decommissioning phases of the CWP Project. Where significant impacts have been identified, additional mitigation has been considered and incorporated into the assessment.

1331. This section, including **Table 10-147**, summarises the impact assessment undertaken and confirms the significance of any residual effects, following the application of additional mitigation.

Table 10-147 Summary of potential impacts and residual effects

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
Construction							
Impact 1 - Direct effects on habitat	Array Site and OECC	All seabird species	very low to low	negligible	Imperceptible (Not significant)	None	No change
	Intertidal OECC landfall	Oystercatcher	high	negligible	Not significant (Not significant)	None specifically, but seasonal and temporal restrictions to address disturbance and displacement impacts also alter receptor sensitivity and impact magnitude in relation to direct effects on habitat	**Imperceptible** (Not significant)
		Bar-tailed godwit	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Knot	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Dunlin	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Arctic tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Roseate tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Other species	very low to medium	negligible	Imperceptible (Not significant)		**Imperceptible** (Not significant)
	Onshore	Greenfinch	low	low	Not Significant (Not significant)	Seasonal restrictions on site clearance works, appointment of an EcoW and implementation of landscape reinstatement plan	**Imperceptible** (Not significant)
		Linnet	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		sand martin	medium	medium	Moderate (significant)	Seasonal restrictions on the demolition of harbour wall / reclamation works, if not possible the Installation of nets to exclude nesting birds outside of the nesting period prior to demolition works. The installation of an artificial nesting colony within or adjacent to the onshore substation	**Not Significant** (Not significant)
	Estuarine / Liffey	Black guillemot	medium	medium	Moderate (significant)	Seasonal restrictions on the demolition of harbour wall / reclamation works, if not possible the Installation of nets outside of the nesting period to exclude nesting birds prior to demolition works. The installation of artificial nest boxes at on / within quay walls at the onshore substation area	**Not Significant** (Not significant)
Impact 2 - Disturbance and displacement	Array Site	Guillemot	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Razorbill	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Red-throated diver	high	negligible	Not significant (Not significant)	Vessel management plan	**No change** (Not significant)
		Manx shearwater	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Gannet	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Migratory species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Other seabird species	screened out				
	OECC	Guillemot	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Razorbill	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Red-throated diver	high	negligible	Not significant (Not significant)	Vessel management plan	**No change** (Not significant)
		Black guillemot	low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Great northern diver	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Cormorant	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Shag	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Common scoter	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				
	Intertidal OECC landfall	Light-bellied Brent Goose	medium	PA & AAM -low	PA & AAM - Slight (Not significant)	Seasonal restrictions (no construction activities within and otherwise potentially visually or acoustically impacting intertidal areas within South Dublin Bay between September and March, inclusive)	PA & AAM - **Imperceptible** (Not significant)
		Shelduck	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Pintail	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Shoveler	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Teal	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Oystercatcher	high	PA & AAM -low	PA & AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Golden plover	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Grey plover	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Ringed plover	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Curlew	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Bar-tailed godwit	high	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Black-tailed godwit	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Turnstone	very low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Knot	very high	PA & AAM - medium	PA & AAM - Significant (Significant)		PA & AAM - **Imperceptible** (Not significant)
		Sanderling	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Dunlin	high	PA - low / AAM - medium	PA - Slight (Not significant) / AAM - Significant (Significant)		PA & AAM - **Imperceptible** (Not significant)
		Redshank	high	PA & AAM -low	PA & AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Black-headed gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Great crested grebe	medium	PA -negligible / AAM - low	PA - Imperceptible (Not significant) / AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant
		red-breasted merganser	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Red-throated diver	medium	PA & AAM - negligible	PA & AAM - Imperceptible(Not significant)		PA & AAM - **Imperceptible** (Not significant
		Herring gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Little egret	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Greenshank	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Mediterranean gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Common gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Great black-backed gull	very low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Lesser black-backed gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Shag	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Black guillemot	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Common scoter	medium	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Grey heron	low	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Imperceptible** (Not significant

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Common tern	high	PA & AAM -high	PA & AAM - Significant (Significant)	Diurnal restrictions (no construction activities within and otherwise potentially visually or acoustically impacting intertidal areas within South Dublin Bay between one hour before sunset and sunrise during the period of 15th July - 31st August, inclusive)	PA & AAM - **Slight** (Not significant)
		Arctic tern	high	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Slight** (Not significant)
		Roseate tern	high	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Slight** (Not significant)
		Sandwich tern	medium	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Not significant** (Not significant)
		Other species	screened out				
	Onshore	Light-bellied Brent Goose	medium	medium	Moderate (Significant)	Seasonal restrictions on site clearance works, appointment of an EcoW, light and noise restrictions in line with best practice strategic placement and the erection of hoarding around construction compound A removing visual disturbance	**Imperceptible** (Not significant)
		Greenfinch	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Linnet	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Peregrine falcon	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		sand martin	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
	Estuarine / Liffey	Arctic tern	high	medium	Significant (Not significant)	Seasonal restrictions on site clearance works, appointment of an ECoW, light and noise restrictions in line with best practice and strategic placement of lighting	**Imperceptible** (Not significant)
		Black guillemot	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Black-headed gull	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	low	Slight (Not significant)		**Imperceptible** (Not significant)
Impact 3 - Changes in prey availability	Array Site and OECC	Little tern	very low	low	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other species	very low to medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Intertidal OECC landfall	Oystercatcher	high	negligible	Not significant (Not significant)	None specifically, but seasonal and temporal restrictions to address disturbance and displacement impacts also alter receptor sensitivity and impact magnitude in relation to direct effects on habitat	**Imperceptible** (Not significant)
		Bar-tailed godwit	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Knot	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Dunlin	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Arctic tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Roseate tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Other species	very low to medium	negligible	Imperceptible (Not significant)		**Imperceptible** (Not significant)
Impact 4 - Pollution	Array Site, OECC and intertidal OECC landfall	All species	N/A	negligible	Imperceptible to Slight (Not significant)	None	**No change** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
Impact 5 - Introduction of invasive non-native species	Array Site, OECC and intertidal OECC landfall	All species	N/A	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Onshore	Light-bellied Brent Goose	low	low	Not Significant	Implementation of an ISMP and strict biosecurity measures	**Imperceptible** (Not significant)
operation and maintenance							
Impact 1 - Direct effects on habitat	Array Site and OECC	All seabird species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Intertidal OECC landfall	All species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
Impact 2 - Disturbance and displacement	Array Site	Guillemot	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Razorbill	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Red-throated diver	high	low	Slight (Not significant)	Vessel management plan	**No change** (Not significant)
		Manx shearwater	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Gannet	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Migratory species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				**No change** (Not significant)
	OECC	Red-throated diver	high	negligible	Not significant (Not significant)	Vessel management plan	**No change** (Not significant)
		Guillemot	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Razorbill	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Black guillemot	low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Great northern diver	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Cormorant	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Shag	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Common scoter	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				
	Intertidal OECC landfall	All species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Onshore	All Species	screened out				
	Estuarine / Liffey	Arctic tern	low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Array Site and OECC	All seabird species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
Impact 3 -Changes in prey availability	Intertidal OECC landfall	All species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
Impact 4 - Pollution	Array Site, OECC and intertidal OECC landfall	All species	NA	negligible	Imperceptible to Slight(Not significant)	None	**No change** (Not significant)
Impact 5 - Introduction of invasive non-native species	Array Site, OECC and intertidal OECC landfall	All species	NA	negligible	Imperceptible to Slight (Not significant)	None	**No change** (Not significant)
Impact 6 - Collision	Array Site	Kittiwake	very high	negligible	Slight (Not significant)	None	**No change** (Not significant)
		Common gull	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Great black-backed gull	high	low	Slight (Not significant)	None	**No change** (Not significant)
		Herring gull	high	low	Slight (Not significant)	None	**No change** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Gannet	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Migratory species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				
Impact 2 - Presence of onshore buildings / infrastructure	Estuarine / Liffey	Arctic tern	high	low	Slight (Not significant)	None	**No change** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
Decommissioning							
Impact 1 - Direct effects on habitat	Array Site and OECC	All seabird species	very low to low	negligible	Imperceptible (Not significant)	None	No change
	Intertidal OECC landfall	Oystercatcher	high	negligible	Not significant (Not significant)	None specifically, but seasonal and temporal restrictions to address disturbance and displacement impacts also alter receptor sensitivity and impact magnitude in relation to direct effects on habitat	**Imperceptible** (Not significant)
		Bar-tailed godwit	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Knot	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Dunlin	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Arctic tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Roseate tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Other species	very low to medium	negligible	Imperceptible (Not significant)		**Imperceptible** (Not significant)
	Onshore	Greenfinch	low	low	Not Significant (Not significant)	None	**No change** (Not significant)
		Linnet	low	low	Not Significant (Not significant)		**No change** (Not significant)
		sand martin	low	medium	Not significant (Not significant)		**No change** (Not significant)
	Estuarine / Liffey	Black guillemot	low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
Impact 2 - Disturbance and displacement	Array Site	Guillemot	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Razorbill	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Red-throated diver	high	negligible	Not significant (Not significant)	Ecological Vessel Management Plan	**No change** (Not significant)
		Manx shearwater	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Gannet	high	negligible	Not significant (Not significant)	None	**No change** (Not significant)
		Migratory species	very low to low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				
	OECC	Guillemot	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Razorbill	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Puffin	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Red-throated diver	high	negligible	Not significant (Not significant)	Vessel management plan	**No change** (Not significant)
		Black guillemot	low	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Great northern diver	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Cormorant	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Shag	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Common scoter	medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other seabird species	screened out				
	Intertidal OECC landfall	Light-bellied Brent Goose	medium	PA & AAM -low	PA & AAM - Slight (Not significant)	Seasonal restrictions (no construction activities within and otherwise potentially visually or acoustically impacting intertidal areas within South Dublin Bay between September and March, inclusive)	PA & AAM - **Imperceptible** (Not significant)
		Shelduck	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Pintail	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Shoveler	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Teal	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Oystercatcher	high	PA & AAM -low	PA & AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Golden plover	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Grey plover	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Ringed plover	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Curlew	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Bar-tailed godwit	high	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Black-tailed godwit	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Turnstone	very low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Knot	very high	PA & AAM - medium	PA & AAM - Significant (Significant)		PA & AAM - **Imperceptible** (Not significant)
		Sanderling	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant)
		Dunlin	high	PA - low / AAM - medium	PA - Slight (Not significant) / AAM - Significant (Significant)		PA & AAM - **Imperceptible** (Not significant)
		Redshank	high	PA & AAM -low	PA & AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Black-headed gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Great crested grebe	medium	PA -negligible / AAM - low	PA - Imperceptible (Not significant) / AAM - Slight (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Red-breasted merganser	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Red-throated diver	medium	PA & AAM - negligible	PA & AAM - Imperceptible(Not significant)		PA & AAM - **Imperceptible** (Not significant
		Herring gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Little egret	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Greenshank	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Mediterranean gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Common gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Great black-backed gull	very low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Lesser black-backed gull	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Shag	medium	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Black guillemot	low	PA & AAM - negligible	PA & AAM - Imperceptible (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Common scoter	medium	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Imperceptible** (Not significant
		Grey heron	low	PA & AAM - negligible	PA & AAM - Not significant (Not significant)		PA & AAM - **Slight** (Not significant)
		Common tern	high	PA & AAM -high	PA & AAM - Significant (Significant)	Diurnal restrictions (no construction activities within and otherwise potentially visually or acoustically impacting intertidal areas within South Dublin Bay between one hour before sunset and sunrise during the period of 15th July - 31st August, inclusive)	PA & AAM - **Slight** (Not significant)
		Arctic tern	high	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Slight** (Not significant)
		Roseate tern	high	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Not significant** (Not significant)
		Sandwich tern	medium	PA & AAM -high	PA & AAM - Significant (Significant)		PA & AAM - **Slight** (Not significant)
		Other species	screened out				
	Onshore	Light-bellied Brent Goose	medium	medium	Moderate (Significant)	Seasonal restrictions on site clearance works, appointment of an ECoW, light and noise restrictions in line with best practice strategic placement and the erection of hoarding around construction compound A removing visual disturbance	**Imperceptible** (Not significant)
		Greenfinch	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Linnet	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Peregrine falcon	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		sand martin	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
	Estuarine / Liffey	Arctic tern	high	medium	Significant (Significant)	Seasonal restrictions on site clearance works, appointment of an ECoW, light and noise restrictions in line with best practice and strategic placement of lighting	**Imperceptible** (Not significant)
		Black guillemot	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Black-headed gull	low	low	Not Significant (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	low	Slight (Not significant)		**Imperceptible** (Not significant)
Impact 3 - Changes in prey availability	Array Site and OECC	Little tern	very low	low	Imperceptible (Not significant)	None	**No change** (Not significant)
		Other species	very low to medium	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Intertidal OECC landfall	Oystercatcher	high	negligible	Not significant (Not significant)	None specifically, but seasonal and temporal restrictions to address disturbance and displacement impacts also alter receptor sensitivity and impact magnitude in relation to direct effects on habitat	**Imperceptible** (Not significant)
		Bar-tailed godwit	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Knot	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Dunlin	very high	negligible	Slight (Not significant)		**Imperceptible** (Not significant)
		Common tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Arctic tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)
		Roseate tern	high	negligible	Not significant (Not significant)		**Imperceptible** (Not significant)

Potential impact	Impact area	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect	Additional mitigation	Residual effect
		Other species	very low to medium	negligible	Imperceptible (Not significant)		**Imperceptible** (Not significant)
Impact 4 - Pollution	Array Site, OECC and intertidal OECC landfall	All species	NA	negligible	Imperceptible to Slight (Not significant)	None	**No change** (Not significant)
Impact 5 - Introduction of invasive non-native species	Array Site, OECC and intertidal OECC landfall	All species	NA	negligible	Imperceptible (Not significant)	None	**No change** (Not significant)
	Onshore	Light-bellied Brent Goose	low	low	Not Significant	Implementation of an ISMP and strict biosecurity measures	**Imperceptible** (Not significant)

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